Министерство науки и высшего образования Российской Федерации

САНКТ-ПЕТЕРБУРГСКИЙ
ПОЛИТЕХНИЧЕСКИЙ УНИВЕРСИТЕТ ПЕТРА ВЕЛИКОГО

О.И. Беляева, С.А. Амахина, Н.В. Попова

SCIENCE AND TECHNOLOGY: BASIC WORDS AND STRUCTURES

Учебное пособие по английскому языку

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Рецензент – кандидат педагогических наук, доцент высшей школы лингводидактики и перевода СПбПУ А.В.Гаврилова

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Пособие по английскому языку является авторским курсом по дисциплине «иностранный язык» и включает аутентичные тексты общенаучного содержания, лексико-грамматические и коммуникативные упражнения, задания по видеоаудированию и письменной практике. В пособие также включены задания с применением инфографики для визуализации текстового материала, интегративные задания для тренировки устной и письменной речи студентов. Пособие предназначено для студентов бакалавриата и магистратуры естественно-научных и технических направлений.

СОДЕРЖАНИЕ

МЕТОДИЧЕСКАЯ ЗАПИСКА

Учебное пособие «Science and Technology: Basic Words and Structures» направлено на комплексное развитие коммуникативных и когнитивных навыков, необходимых будущему учёному или инженеру при использовании английского языка в его профессиональной деятельности. Каждый из 12 разделов первой части пособия содержит несколько текстов среднего уровня сложности для обсуждения и перевода, которые сопровождаются упражнениями, направленными на проверку понимания их содержания и работу над общенаучной и терминологической лексикой.

Целью пособия является развитие у студентов универсальных компетенций, предусмотренных Федеральными государственными образовательными стандартами (ФГОС 3++) по гуманитарным и техническим направлениям. Все тексты и упражнения пособия составлены на основе аутентичных материалов, касающихся, в основном, истории науки, университетов, научных обществ, лабораторий, специальных журналов или биографий знаменитых учёных. Междисциплинарный подход к выбору материала способствует развитию у студентов социокультурной компетенции, поскольку тексты коррелируют с курсами истории, естествознания, физики, философии.

Каждый раздел включает в себя упражнения по определённой грамматической теме, упражнения по усвоению общенаучной лексики и текстообразующих элементов (linking words). В пособие включены такие грамматические темы как основные времена английского языка в действительном и страдательном залоге, выражение количества, модальные глаголы, косвенная речь, неличные формы глагола, условные предложения. Студентам предоставляется также возможность повторить фонетику английского языка и обсудить оригинальные цитаты, связанные с именами великих ученых и мыслителей.

Помимо слов латинского и греческого происхождения, составляющих основу общенаучного словаря, объектом изучения является лексика, традиционно относящаяся к разговорному стилю (фразовые глаголы и производные от них существительные), которые часто используются в письменном и устном научном дискурсе. Одной из задач освоения иностранного языка является работа по предотвращению возможных ошибок. Этому посвящены упражнения под рубрикой *Confusables*, содержащие такие группы общенаучной лексики, как *ложные друзья переводчиков, паронимы* и *синонимы*.

Во второй части пособия представлены задания, связанные с тематикой текстов и выполняемые студентами самостоятельно в цифровой обучающей среде. Для первых четырех уроков пособия предлагаются задания, связанные с применением инфографики и ментальных карт, которые способствуют развитию коммуникативных навыков обучающихся. Для последующих уроков разработаны задания по визуализации контента посредством инфопостеров, а также интегративные задания по видеоаудированию, в которых задействованы все виды речевой деятельности: чтение, аудирование, письмо и говорение. Основной задачей интегративного задания является сопоставление текстового и видеоконтентов, которое может проводиться в устном или письменном форматах, с актуализацией в процессе говорения или написания эссе.

Инфографика, в частности, инфопостеры направляют обучающихся к размышлению в правильном направлении для решения поставленной перед ними коммуникативной задачи, способствуют активному и продуктивному поиску ответа. Задания по обсуждению инфопостеров и презентаций в рамках аудиторного занятия рекомендуется выполнять устно в парах или мини-группах. Инфопостеры используются для того, чтобы при обсуждении содержания текстового материала у студентов была информационная база, на основе которой будут строиться рассуждения. Это позволит избежать распространенной ситуации, когда студенты не участвуют в обсуждении друг с другом или с преподавателем, потому что им «нечего сказать по теме», т.е. они не обладают необходимым минимумом знаний по теме даже на родном языке. Постеры, аналогичные представленным в пособии, могут подготавливаться самими студентами для парной или групповой аудиторной работы. Самостоятельная работа обучающихся в цифровой среде повышает мотивацию и интерес студентов к иностранному языку.

Тематика текстов не ориентирована на конкретную специальность, поэтому пособие может быть использовано для занятий в группах бакалавров и магистрантов различных естественно-научных и технических направлений. Пособие снабжено ключами, аудиовизуальными материалами и скриптами видеофрагментов.

Авторы-составители пособия выражают благодарность магистрантам-лингвистам педагогического профиля Гуманитарного института СПбПУ за подготовку заданий по инфографике в рамках дисциплин «Междисциплинарные связи в высшей школе» и «Компьютерная лингводидактика».

Part 1. Texts & Linguistic Exercises

Unit 1

ADVANCE OF SCIENCE AND TECHNOLOGY

1. Read and discuss the text. Choose from the extracts (A-F) the one which fits each gap (1-5).

Origin of Science

(1) _____. Indeed, if one consults the archeological record, it seems clear that the Babylonian and Sumerian civilizations had rather more than rudimentary grasp of medicine, astronomy and applied mathematics, not to mention engineering.

From around the sixth century BC, however, we see signs in the ancient Greek world of what, perhaps, could be called scientific revolution. No longer satisfied with gods as the ultimate answer why the world is the way it is, Greek thinkers began to search for the underlying principles which would form the basis of a more satisfactory explanation.

The great Thales of Miletus proposed that the prime substance was water; Anaxagoras believed it to be air. **(2) _____**. Democritus, astonishingly, proposed the first atomic theory – the word *atom* comes from the Greek '*atomon'*, literally translated as '*indivisible'* (just how inappropriate the word was would not be recognized until demonstrated in spectacular fashion by Ernst Rutherford in the twentieth century).

(3) _____. But we see glimmerings of the scientific method in the rejection of 'truth by authority', and the search for causes and principles based on observation and reason, the truth as a province of thinkers, rather than priests. With advent of Euclid and Archimedes, whose monumental works on geometry and trigonometry – among others – are still required reading on mathematical courses today, we find ourselves on the *terra cognita* of recognizable science.

(4) _____. Science has often come into conflict with organized religion, and on those occasions, the practitioners of science generally seem to come off worst, not least because the practitioners of religion seem all too eager to resort to threats, intimidation and even assassination in order to avoid hearing opinions they do not agree with. At certain periods in history, established churches have been eager to detect the odor of heresy in scientific accounts of the cosmos, the origin and structure of the earth, and especially the scientific account of the origin of humanity.

However battered and bruised it may at times have been, at the end of the twentieth century science emerged as a victor, as the key intellectual discipline for the twenty first century and beyond. **(5) _____**. The whole laborious trial and error of the scientific process, the testing, revising and discarding of hypothesis; the diligent construction of theories which fit the known facts, and modification or abandonment of these as and when new facts emerge; in short, the scientific method, produces results, results which are testable, verifiable, falsifiable, and from which predictions can be made.

Astrology, chiromancy, divination, parapsychology, telepathy, UFO-logy, 'creation-science', forecasting the weather from the entrails of sacrificial animals produce no such results. As it has been remarked elsewhere, those societies that have actively embraced the scientific method flourished. **(6) _____**.

A. In contrast, those which relied on superstition, witchcraft and religion have failed.
B. The progress of science has not always been straightforward, however.
C. Xenophanes proposed the rather less glamorous option of mud.
D. Science has been around for a long time, at least since the days of the ancient Greeks.
E. The reason for this success can be stated in two words: science works.
F. What we read in the works of these pre-Socratic philosophers is not recognizable science.

2. Read the text and decide whether the following statements are true of false.

1. People have always been wondering why some events in history occurred the way they did.
2. Chinese contribution in science is comparable to that in engineering.
3. Romans deserve the reputation of great engineers and builders.
4. Ancient Greek thinkers were rediscovered in Europe due to medieval Arab scientists.
5. Both social and economical aspects encourage scientific advance
6. Flourishing of science in the Renaissance in fully explained by rediscovery of ancient knowledge.

What Makes Science Possible

Some things in history are so familiar that we never stop to ask ourselves why they happened when and where they did, rather than at some other time and in some other place. The history of science is one of these things we take for granted. But if we stop to think about it, there is a riddle at its heart.

Greek science was unique in the ancient world. The Chinese created a great civilization; and their technology was in many ways in advance of the rest of the world. Ships, weapons, and agriculture, roads, bridges and locks, paper and printing; the list of their technical innovations goes on and on. Nothing like it had been seen before; and nothing comparable would be seen until the agricultural and industrial revolutions in the early modern Europe. But the more one tries to make out the similar case for Chinese science, the clearer it becomes that, as scientists, the Chinese were just not in the same league. Even the historian Joseph Needham, who opened the world's eyes to Chinese achievements in technology, confessed himself puzzled by their failure to make comparable progress in science.

Now consider the Romans. They also created the great civilization. They too had magnificent technology. They did not get round to inventing paper or gunpowder, but when it came to roads and bridges, aqueducts and steam baths, communications, and the administration of a great empire they were easily the equal of the Chinese. But hundreds of years of the Roman civilization produced next to nothing worthy of being called scientific advance. They had Greek slaves, and the access to the whole of Greek science, and could have built on that, had they felt the urge. Yet, when the classics of Greek science came to be translated into Latin in the sixteenth century, it was to Arabic versions that the translators had to turn for the majority of their texts.

Science, as we understand it, has only happened twice in the history of the world. And between the twilight of the Greek world and the dawn of the modern scientific age there was an interval of a millennium and a half, during which little of any consequence was added to the world's stock of scientific knowledge. Why should that be?

It can't be in the genes. The Greeks were no cleverer than the Romans or the Chinese, nor the people of Great Zimbabwe. Perhaps the economy is the key: science can only prosper in societies rich enough to enable a lot of people to sit around thinking and talking. But wealth, and leisure, and urban living can't be the whole story, or ancient Rome and classical China would have been scientific powerhouses. The explanation must be cultural as well as economic.

Some societies are organized in ways – and develop habits of thought – that make science possible; others, equally prosperous, have social and political arrangements, codes of belief, and ways of thinking that stifle science. Societies with an exaggerated respect for the past cannot generate the challenging attitude to accepted ideas that produces new understanding. Societies in which priests have power are liable to imprison or otherwise suppress those who threaten their monopoly of explanation. Where free speech and free thought are constrained, minds, as well as bodies, rot in chains.

Science is a plant that needs favourable conditions. It cannot grow in a wilderness, nor does it thrive in darkened room. It grows best in towns (including those town-like places called universities), nurtured by people with means and the leisure to care for it. It needs light and air, and fertile soil. In Europe in the sixteenth and seventeenth centuries, the conditions were right, and science burst into luxuriant growth.

The expansion of scientific knowledge that occurred in the early seventeenth century is often attributed to the rediscovery of ancient learning that sparked the phenomenon of Renaissance. But the more one examines this explanation, the less adequate it is. Between Archimedes and Eratosthenes, there were 400 years of speculation about the natural world, by some of the best minds that science has known: but they can hardly be said to have accumulated a vast store of knowledge about how the natural world works. Had science between 1600 and 2000 moved at the same pace, starting from the knowledge the Greeks possessed, and using the tools the Greeks used, we would not have added much to the stock of knowledge we inherited from them.

The rediscovery of ancient learning certainly provided a launch pad. But it needed something from outside science to propel science into orbit: something neither the Greeks, nor the Arabs, nor the Chinese had. That something was the right technology.

Word Families

3. Fill in the gaps.

a) **conceive**	b) **concept**	c) **conception**	d) **deceived**	e) **imperceptibly**
f) **inconceivably**	g) **perceived**	h) **perception**	i) **perceptive**	j) **received**

1) Bohr applied his complementarity _____ both in science and in other spheres of life.
2) For the work in developing the CAT scanner the American physicist A. Cormack _____ a share of Noble Prize for physiology and medicine.
3) Biblical catastrophes were not required to transform the earth; _____ slow alterations would suffice.
4) Albert Einstein and Paul Dirac were especially_____ about the role of mathematics in science.
5) Science is littered with the remains of theories that were once _____ as beautiful but turned out to be wrong.
6) In a single blinding pulse the singularity assumed heavenly dimensions, space beyond _____.
7) Shakespeare could no more ____ the multiple meanings readers have seen in his poems than

Einstein could have predicted the myriad consequences of his equations of relativity.
8) Archimedes's law of water displacement proved that the goldsmith had _____ the king.
9) Supenovae are so _____ distant that their light reaches us as the faintest twinkle.
10) Modern advanced instruments can be described as extending our senses of _____.

Confusables

4. Choose the correct word.

Science and Technology: A Hen or an Egg

The technology is **defined/determined** (1) in many dictionaries as applied science, but it is no more **meaning/meaningful** (2) to define technology as applied science that it is to define a hen as an applied egg. Hens do **indeed /in deed** (3) come from eggs, but eggs also come from hens. It is true that much new technology has come from the **appliance/application** (4) of scientific discoveries, but it is **quite/quiet** (5) true that scientific discoveries have often been the result of the **exploitation/exploration** (6) of new technology.

Science and technology are simply two different **replies/responses** (7) to the forces of nature. Science is humanity's **attempt/effort** (8) to explain them while **technology/technique** (9) tries to exploit them. And progress in either can be the **source/resource** (10) of progress in the other.

Engineering stands somewhat in the same **relativity/relationship** (11) to physics as does physics to mathematics. Just as physics uses **mathematics/mathematicians** (12) to elucidate the physical universe, so engineering **applies/implies** (13) the laws and discoveries of physics to develop practical **devices/devises** (14) like automobiles, computers, electric generators, nuclear reactors, bridges, tunnels and space shuttles.

All **contemporary/modern** (15) engineering is rooted in the laws of physics, but **physicians/physicists** (16) are interested in discovering these laws, not applying them. Since technology is engineering applied to **large-scale/long-term** (17) production processes physics has essentially the same **association/connection** (18) to technology as it does to engineering. Physicists uncover the data and **develop/elaborate** (19) physical theories and laws which **technologists/technicians** (20) then apply to society's needs.

Phrasal Verbs

5. Choose the suitable verb, noun, adjective or phrasal verb.

end / end up

1. If you have collected the necessary amount of data you might ____ the experiment.
2. In 1854, German physicist Hermann von Helmholz (1821-1894) perceived the consequences of this inevitable dissipation: the universe will ____ as a uniform, tepid reservoir of heat.
3. If you don't follow the instructions carefully you might ____ damaging valuable equipment.

figure / figure out

4. The final inflation ____ was 6% for the year.
5. We had to ____ the connection between the two events.

head / head for

6. The consensus seems to ____ a figure of about 13.7 billion years as the age of the Earth, but these things are notoriously difficult to measure.
7. In his capacity as the ____ of Biological Faculty he managed to build a thriving department.

iron / iron out

8. Extensive usage of____ gave name to the whole period in human history.
9. Given time, the amateur chemist Newland might ____ the drawbacks of his method.

size / size up

10. Large Hadron Collider is the research machine of gargantuan ____ and enormous capacity.
11. People who have the ability to ____ the situation quickly are good decision-makers.

work / work out

12. ____ is an alternative name for energy, used particularly in discussing mechanical processes.
13. Participants of international research projects have ____ common guidelines.
14. R. Franklin worked slowly, determined to ____ the solution from photographs and calculations on her own.

round / round off

15. The agreement on non-proliferation of nuclear weapons will be discussed at the next____ of talks.
16. For demonstration of physical laws science teachers tend to____ actual physical values to ____ figures.

usher / usher in

17. Earth sciences stretch the boundaries of the disciplines, ____ international research enterprises to understand and preserve the environment.
18. An ____ is supposed to help spectators find their seats.

date / date back

19. Due to its long half-life carbon is used to ____ objects.
20. The concept of atomism ____to the ancient Greek thinkers.

Linking Words: while, still

6. Translate the following sentences.

functions of *while*

1. While the telephone had had much less effect on research than on other professions, electronic mail produced a sort of computer logorrhea. Everything from a result to a piece of gossip is passed through this ubiquitous, international rumor mill.
2. The alchemists still believed in the same four basic elements as the Greek philosophers, **while** the chemists leaned to the ideas of Robert Boyle.
3. In a famous and brilliant experiment, Lavoisier burned a piece of tin in a sealed container – and found that, contrary to phlogiston theory, the tin actually became heavier after burning, **while** the air became lighter.
4. While working at McGill University in Canada Rutherford together with Soddy concluded that radioactivity was a process in which the atoms of one element spontaneously changed into atoms of a different element, which was also radioactive.
5. Significantly, **while** Einstein's relativity had played a key role in both the 'Big Bang' and Black Boles theory, the other revolutionary idea, quantum physics, seemed almost to have been sidelined as irrelevant to cosmology.
6. The most famous story about Archimedes concerns a discovery he made **whilst** in the bath. King Heiron had given a goldsmith some gold and asked him to make a wreath from it.

functions of *still*

7. Many agree with the philosopher L.Wittgenstein's condemnation of worship of science and lionization of scientists, **still** there is a lot to admire in the scientific point of view and in the character of many leading scientists.
8. Physics is **still** trying to link electromagnetism and gravity and complete unified field theory.
9. Mendel's paper 'Experiments with plant Hybrates' was published in 186 and was sent to all major libraries in Europe and America. Despite a wider audience his work **still** had little impact.
10. Einstein realized that nothing can go faster than light, because at that speed an object would have infinite mass, no length, and time would stand **still**.

Grammar

Present Simple Present Continuous Present Perfect Present Perfect Continuous

7. Fill in the gaps using the verbs in Present Simple or Present Continuous.

Example:
A: I *am thinking* about buying a Suzuki SX4.
B: I *think* you might have problems with it. It doesn't hold the road well.

1. **A:** I _____ (have) a very efficient personal assistant.
   B: Lucky you are. I _____ (have) a lot of problems with mine.
2. **A:** Our new suppliers _____ (be) very helpful at the moment.
   B: No wonder. Everyone says they _____ (be) reliable.
3. **A:** I _____ (see) Ann tonight. It's ten years since our last meeting.
   B: I _____ (see) what you mean. You must be nervous.
4. **A:** Why _____ you _____ (smell) the cooker?
   B: Because it _____ (smell) of gas. I wonder if there are any leaks.
5. **A:** Why _____ you _____ (weigh) the envelope?
   B: I want to make sure that it _____ (weigh) under 100g. Otherwise I have to pay extra.
6. **A:** This board _____ (feel) very smooth.
   B: Be careful! You can scratch your hand while you _____ (feel) it.
7. **A:** What's wrong? Why _____ you _____ (look) at me?
   B: It _____ (look) as if you've put you T-shirt inside out.
8. **A:** Anna Netrebko _____ (appear) at the Mariynsky Theatre in May.
   B: It _____ (appear) all the tickets were sold two months in advance.
9. **A:** _____ you (feel) _____ like going out tonight?
   B: I'd rather not. I _____ (feel) tired.
10. **A:** John, your wedding suit _____ (fit) perfect. What about Mary's dress?
    B: I haven't seen it yet. The dressmaker _____ (fit) it at the moment.

8. Some of the sentences contain an error. Identify and correct it.

1. Who is this idea belonging to?
2. That's ridiculous – I am not believing it!
3. I'm sorry; I'm not following what you are saying.
4. Pardon, I'm not understanding what you are saying.
5. This building is getting old – we are planning to pull it down and construct a new one.
6. Who is driving the black Volvo that is parked outside?
7. How many chapters is this book containing?
8. At the moment I am having all the details of this case.
9. John is being irresponsible though normally he is a reliable person.
10. I'm thinking we owe them an apology.

9. Use the correct verb form.

Talk with the Tutor

Tutor: Well, Jones, the summer vacation is about to begin. I (*expect*) _____ **(1)** you will be taking all your books home with you.

Jones: (*think*) _____ **(2)** you that is necessary, sir? Actually, I (*think*) _____ **(3)** of spending the vacation at the seaside.

Tutor: Really? Well, I (*feel*) _____ **(4)** most strongly that you should do some work.

Jones: It (*depend*) _____ **(5)** on what you (*mean*) _____ **(6)** by 'work', sir. I (*not mind*) _____ **(7)** getting a vacation job, but I certainly (*not want*) _____ **(8)** to spend the

holiday studying.

Tutor: But surely you (*realize*) _____ **(9)** that you must do some studying?

Jones: I (*not see*) _____ **(10)** why, sir. I (*know*) _____ **(11)** I have to study during the term, but in the holidays I *(prefer)* _____ **(12)** to enjoy myself.

Tutor: Jones, I (*not believe*) _____ **(13)** that you (*understand*) _____ **(14)** what it (*mean*) _____ **(15)** to be a student. (*Not care*) _____ **(16)** you about your future in the college? I (*think*) _____ **(17)** you (*be*) _____ **(18)** most irresponsible.

Jones: I (*suppose*) _____ **(19)** so, sir.

Tutor: You (*not appear*) _____ **(20)** to be convinced. I (*see*) _____ **(21)** your Senior Tutor this afternoon; I (*hear*) _____ **(22)** he (*expect*) _____ **(23)** good results from you; I will ask him what he (*think*) _____ **(24)** about your present attitude. Also, I (*have*) _____ **(25)** drinks with the Principal this evening; I (*remember*)_____ **(26)** he was most annoyed with a student last year for the same reason.

Jones: If I may say so, sir, I (*think*) _____ **(27)** you (*be*) _____ **(28)** too strict about this. Surely it (*not matter*) _____ **(29)** what I do in the vacation as long as I (*keep*) _____ **(30)** passing my exams. And may I ask what you (*think*) _____ **(31)** of doing in the vacation?

Tutor: Me? Ah, well, yes, you see, I *(make)*_____ **(32)** arrangements for me to go to the South of France. On business, of course. Anyway, Jones, my holiday plans (*not concern*) _____ **(33)** you.

10. Use the suitable verb form.

1. I **write / am writing** in response to your advertisement in *the Milford Times*.
2. I am furious as they **never reply / are never replying** to my e-mails.
3. Normally many items **cost / are costing** much less in duty-free shops.
4. David **is speaking / speaks** on another line. He will call you back.
5. He **speaks / is speaking** three languages.
6. We **produce / are producing** a full range of consumer electronics, from TVs to cameras.
7. What a mess! What **is going on / goes on**?
8. Most of the time we **correspond / are corresponding** via e-mails.
9. I often **get / am** often **getting** junk e-mail from companies I haven't heard of.
10. I **delete / am deleting** my junk e-mail/spam about once a month.
11. We **deliver / are delivering** the equipment that you've ordered within two days.
12. We **deliver / are delivering** the equipment within two days.
13. Banks **make/ are making** decisions about loans depending on a customer's income.
14. The Bank **makes/ is making** a decision about a loan depending on his income.
15. Currently our R&D department **develops / is developing** a new computer model.
16. R&D departments **develop / are developing** new products.

11. Fill in the gaps using Present Simple or Present Continuous.

Example: Where_____ you _____ **(go)** to? → Where ***are*** you ***going*** to?

Two passengers on the plane to St. Petersburg are talking about their visit to the trade fair.

1. A: What _____ you _____ **(do)**?

B: I _____ **(work)** as a civil engineer for *Strabag*.

2. A: What _____ this company _____ **(produce)**?

B: It's a construction company which _____ **(design)** and _____ **(construct)** residential and industrial buildings across Europe.

3. A: I know it's an Austrian company. _____ you _____ **(come)** from Austria?

B: Actually, at the moment I _____ **(come)** from Austria, but in fact, I am Swiss, I _____ **(come)** from Switzerland.

4. A: _____ you _____ **(attend)** the trade fair held by *Peter Expo* this week?

B: Yes**,** I _____ . I always _____ **(try)** to attend fairs and exhibitions held in St. Petersburg. Especially during the so-called *White Nights* period.

5. A: _____ you _____ **(mean)** *Midnight Sun* period?

B: Exactly, but *White Nights* _____ **(sound)** more romantic.

6. A: _____ you _____ **(speak)** Russian?

B: Just what you _____ **(call)** 'survival' Russian.

7. A: What hotel _____ you _____ **(stay)** at?

B: At the Astoria. I always **_____ (book)** there when I **_____ (come)** to St. Petersburg.

8. A: What a coincidence! I _____ **(stay)** at the Astoria too. I _____ **(like)** service there.

B: So _____ I. Many new hotels _____ **(not / justify)** their 5-star status, but it does.

12. Match sentences from column A describing the process with sentences from column B describing the result/consequence (Present Perfect / Present Perfect Continuous).

A	**B**
1. ***He has been working in a night shift. (c)***	**a)** The streets are covered with snow.
2. She has been working here for ten years.	**b)** She has lost six kilos.
3. They have been waiting for us for two hours.	**c)** ***He feels sleepy.***
4. He has been living abroad for the last three years.	**d)** They are tired and hungry.
5. She been keeping the diet for three months.	**e)** They are going to buy a flat.
6. He has been earning a lot recently.	**f)** She is rather experienced.
7. They have been doing sightseeing the whole day.	**g)** They are going to get married.
8. They have been saving for the last two years.	**h)** He has put aside some money.
9. They have been dating for a year.	**i)** They are irritated.
10. It has been snowing the whole night.	**j)** He is home-sick.

13. Complete the dialogue using the verbs in different Present tenses forms.

come	**do**	**earn**	**enjoy**	**have**	**see**	**stay**	**study**	**visit**	**work**

1. A: Where____ you____ from?

B: ……

2. A: What ____ you ____ for living?

B: …….

3. **A:** How long ____ you ____ for this company?
   B: …….
4. **A:** How much ____ you ____ in this job?
   B: …….
5. **A:** How long ____ you ____ English?
   B: …….
6. **A:** What hotel ____ you ____ at?
   B: …….
7. **A:** Is it the first time you ____ London?
   B: …….
8. **A:** What famous landmarks ____ you already ____?
   B: …….
9. **A:** Is it a tourist trip or ____ you ____ business meetings here?
   B: …….
10. **A:** ____ you ____ your stay in London?
    B: …….

14. Use one of Present Tenses forms.

1. This month, we **(examine)** the accounts of a large manufacturing company.
2. I **(analyze)** the figures from the different departments, so now I can make decisions about our future activities.
3. Small companies often **(try)** to get bank loans when they need to borrow money.
4. We **(raise)** € 50,000 which we are going to spend on charity for the homeless.
5. We **(have)** sufficient funds to build a completely new factory.
6. Since I was promoted, I **(do)** a lot of overtime.
7. Nearly 40 % of everything I earn normally **(go)** to the government as tax.
8. The landlord just **(increase)** the rent on our flat by 15 %.
9. I think this is a good investment: it **(pay)** 8 % interest.
10. We have to give up our project. The bank **(refuse)** to lend us any more money.
11. Many European countries now **(have)** the single currency, the euro.
12. We keep opening new stores in Germany, so our revenues steadily **(go up).**

15. Use the verbs in brackets in one of Present Tenses.

Global Environmental Issues

We **(spend)** (1) thousands of years fighting for our survival. Yet, now we **(discover)** (2) that our planet is under threat. The air is being polluted, rainforests **(die)** (3), rare plant and animal species **(disappear)** (4), rivers and seas are being contaminated and crops are failing to grow.

According to environmental scientists, the global climate **(change)** (5) in the past few decades. Partly it **(result)** (6) from the destruction of rainforests (deforestation) in South America, which **(bring about)** (7) occasional flooding, drought and heat waves across the globe.

Factories continuously **(pollute)** (8) our rivers and lakes with dangerous chemicals. Oil tankers often **(release)** (9) thick, black oil into our seas and oceans; these oil spills already **(cause)** (10) irreparable damage to sealife and coastal nature. In the past few years, more and more people **(develop)** (11) various allergies and breathing problems. Fortunately, an increasing number of people already **(become)** (12) aware of these problems and started repairing the damage. The idea

of sustainability **(get)** (13) more and more popular not only with ecologists and environmentalists but also with ecologically aware manufacturers who **(produce)** (14) environmentally friendly goods. Now, that people at least in the developed countries **(come)** (15) to realize environmental hazards, there is more chance that our planet is going to be saved.

Phonetics

***Choose the correct pronunciation*.**

	[k]	**[ʧ]**	**[ʃ]**	
1) chemistry	**5)** arch	**9)** technical	**13)** cholera	**17)** ochre
2) characteristic	**6)** chance	**10)** machine	**14)** cholesterol	**18)** anchor
3) mechanical	**7)** chief	**11)** chore	**15)** choir	**19)** oligarchy
4) chaos	**8)** chef	**12)** ache	**16)** chorus	**20)** hierarchy

Words of Wit and Wisdom

1. *Equipped with his five senses, man explores the universe around him and calls this adventure science.*

Edwin Hubble

2. *The highest wisdom has but one science – the science of the whole – the science explaining the whole creation and man's place in it.*

Leo Tolstoy

3. *Even when all the questions posed by science have been answered, the problems of human life will remain untouched.*

Ludwig Wittgenstein

4*. If my theory of relativity is proven correct, Germany will claim me as a German and France will declare that I am a citizen of the world. Should my theory prove untrue, France will say that I am a German and Germany will declare that I am a Jew.*

Albert Einstein

5. *Modern science kills God and takes his place on the vacant throne. Science is the sole legitimate arbiter of all relevant truth.*

Vaclav Havel

6. *Plato is dear to me, but dearer still is truth.*

Aristotle

Unit 2

BREAKTHROUGHS AND DEADENDS IN SCIENCE

1. Read and discuss the text. Fill in the gaps (1-10) with extracts (A-I).

Defunct Science, Bad Science, Pseudoscience, Anti-science

Some hypotheses − indeed fully fledged theories − are simply defunct science: in their day they represented the cutting edge of theoretical science but they have since been superseded by other versions that accord more accurately with reality, or they been realized to be totally at odds with reality and been replaced wholesale by something _____ **(1)**. As science slowly evolves − as our knowledge of the universe slowly progresses in the direction of completeness, even if as yet maybe nowhere approaching that ideal closely − ideas and hypotheses from seemingly different disciplines suddenly take on a new relationships: it can be seen as the myriad pieces of a single, very large jigsaw**.** Those pieces that simply will not fit _____ **(2)** naturally come under greatest scrutiny. Perhaps, just perhaps, getting them to fit will involve a paradigm shift − the removal of all the other pieces of the jigsaw in order to start afresh. More likely, they are from the wrong puzzle and should never have got into this one box in the first place.

Some jigsaw pieces very obviously do not belong to the puzzle at all. We should in theory look at them closely, of course, _____ **(3)**; but the chances of this being so are slender. There have been instances where "manifestly wrong" pieces have turned out to fit into the larger puzzles after all: for a single example, we can think of Alfred Wegener's hypothesis of continental drift, _____ **(4)**. Most of those misshapen incongruously coloured hypotheses are rightly discarded on sight as pseudoscience.

Examples of politically motivated science _____ **(5)** are the Nazi promotion of "non-Jewish science', or the Stalinist suppression of honest genetics in the USSR in favour of the populist, "peasant" pseudo-genetics propounded by T.D. Lysenko (1898-1976). The ideological corruption of science blends naturally into antiscience, the emotional rejection of all scientific conclusions, often because those conclusions have been reached by "them" and must therefore be antithetical to "us" – i.e. must be false.

There is a strange form of inverse snobbery _____ **(6)**. Here antiscience shades into the conspiracy – worldview theory whereby the clever are inferior to the stupid and thus must be plotting to the detriment of the latter. Conspiracy theories abound, manifestly, among the adherents of the pseudosciences.

Yet another contributor to the corruption of science is fraud. Fraud by the layman usually described as hoaxing is most frequently done for profit, and is perhaps best described as deliberate pseudoscience; at least some pseudoscientists are anyway spurred solely by the profit motive − just go browsing on the Internet and see _____ **(7)** − and therefore are really fraudsters in all but name**.**

But the more serious issue is fraud perpetrated by scientists themselves, perhaps in the pursuit of career advancement, perhaps in the hopes of fame and glory. Scientists like to pretend _____ **(8)** thanks to the scientific process itself − the process of peer review, attempted replication of experiments, and so on − not to mention the inherent honesty of scientists. Yet the frequency of

such frauds seems to have been steadily increasing: there have been several spectacular cases since the start of the 21st century.

There is of course overlap between all these categories of motivations for producing or subscribing to bad science. For example, Creationism is at one and the same time defunct science and "democratic" pseudoscience, it is corrupted (in this instance) by religious ideology, is sustained in large part by antiscience prejudices, is riddled by fraud – particularly in the guise of Intelligent Design. The Creationist selectivity in the insistence on a literal reading of the Bible is itself fraudulent and is fuelled to a great extent by the conspiracy theory _____ **(9)**. In November 1755 the most devastating earthquake ever to strike the northwestern US hit at Cape Ann some 50 km south of Boston. The reverend Thomas Prince, of South Church, Boston, knew at once who was to blame: Benjamin Franklin (1706-1790), for having invented the lightning conductor. Before Franklin's scheme of putting pointed metal rods on tall buildings had been universally adopted, God had been able to express His Wrath by blasting something with lightning. Now the presumptuous Franklin had taken that option away from Him, _____ **(10)**.

A. that "materialists" will do just about anything in their relentless quest to undermine society's morals and deprave us all.
B. that is at least, so far as we can establish, closer to the truth.
C. so He had to use earthquakes instead.
D. that spring at once to mind
E. that the fraud in the scientific establishment is rare and anyway is rapidly detected,
F. just in case our first impressions might have misled us
G. how many sham astrologists ask for your money in the first five minutes
H. in which the highly educated are somehow regarded as less well informed than the uneducated.
I. no matter how much we manipulate them,
J. which for decades was ridiculed by Earth scientists.

2. Arrange the numbered paragraphs in the correct order. The first one is done for you.

Philosopher's stone

1. a. In their search for gold alchemists did sterling service in the development of chemistry. They did, in fact, make it in the figurative sense, but gold in literal sense continued to elude them, since they started from quite incorrect premises.

b. Ether appeared not to exist, – and subsequently it also proved to be quite unnecessary that it should. Light certainly behaved as a wave, but also as a stream of particles. The results of the experiment discredited the ether theory; in 1908, Michelson was awarded the Nobel Prize for physics and became the first US Nobel prize winner.

c. Lavoisier's experiment was a turning point in our understanding of matter for three reasons. Firstly, it put accurate scientific measurement firmly at the heart of chemistry. Secondly, it demolished the phlogiston theory and showed that burning is a process involving oxygen. Thirdly, it showed that substances do not change or vanish even in as a dramatic process as burning; they swap places.

d. The debate between alchemists and chemists became centered on phlogiston theory, which said

that anything burnable contained a special active substance called phlogiston that dissolved into the air when burned. Therefore anything that burned must become lighter because it loses phlogiston.

e. It was Lord Rutherford who was the first man to succeed in making one element from another and who was the finder of 'philosopher's stone,' a 'stone' which turned out to be quite different from what all the medieval alchemists had imagined even in their most audacious dreams. It was, however, the means by which artificial gold could be made if desired.

Phlogiston

f. The *phlogiston* debate was quite literally the burning scientific issue of the eighteenth century. It was the focus of the battle between old ideas, which owed much to alchemy**,** and the new science of chemistry, – and in particular the idea of elements.

g. In a famous and brilliant experiment, he burned a piece of tin in a sealed container – and found that, contrary to phlogiston theory, the tin actually became heavier after burning, while the air became lighter. There was no change in mass at all. The substances were simply changing places. It was also clear that rather than losing something (phlogiston) to the air, the tin was taking something from it. Later, Lavoisier realized that this something was oxygen.

h. 'The philosopher's stone' did exist after all! It was discovered in the twentieth century. Its finder was not alchemist mumbling incantations, but a sober modern scientist. The discovery did not take place in a smoky den full of strange equipment but in a modern laboratory.

i. At first this theory had seemed sound to everybody and had become established as scientific orthodoxy. Later it began to be challenged, and it was Lavoisier who realized that the way to test if it was true was to weigh substances carefully before and after burning.

j. The question of ether was decided by an historical experiment by the American scientist A.A. Michelson. He had designed an apparatus for seeking out ether.

k. The alchemists still believed in the same four basic elements as the Greek philosophers, while the chemists leaned to the ideas of Robert Boyle. Boyle suggested the idea of chemical elements. If Boyle was right, then elements could only be mixed together, not changed – and the idea of the four elements might have to be abandoned.

Ether

l. In 1830 Thomas Young and Augustine Fresnel showed that light did not travel as particles, as Newton had said, but as waves or vibrations. But if it was so, what was vibrating? To answer this, scientists came up with the idea of a weightless matter called 'ether'. If this mysterious substance existed, the apparatus *interferometer* would certainly show it.

m. It is not for nothing that we continue to speak of 'the elements' when we talk about the

storm at sea in which ‘the elements are let loose’. According to alchemists, metals consisted of elements earth and fire. It must consequently have been possible in a metal such as copper to alter the proportion between the earth and fire, so that gold would be formed.

n. When Michelson was carrying out his experiment, in Chicago in 1887, all the streetcars in the city were stopped in order to avoid the slightest disturbance. An unambiguous question was put to nature – yes or no, – and the answer was no.

o. In common with Greek philosophers, the alchemists considered that all the matter was constructed from four different materials or elements, and that all substances known to them consisted of combinations of these elements in different proportions. Earth, air, fire and water, those were the basic materials or elements.

3. Fill in the gaps.

Twists and Turns of Science

a) **account**	b) **breakthroughs**	c) **complex**	d) **conclusions**	e) **correspond**
f) **considered**	g) **continuously**	h) **current**	i) **follow-up**	j) **frustrating**
k) **messy**	l) **obscuring**	m) **obtained**	n) **one-handed**	o) **persistent**
p) **striving**	q) **sturdiest**	r) **yield**		

What the world needs, say some people, is more _____ **(1)** scientists. That way, reports would have fewer sentences starting, ‘On the other hand…’Actually, scientists need all the hands they can get. Most of the phenomena they investigate are so _____ **(2)** that even carefully designed experiments cannot take into _____ **(3)** all possible influences on the results. Change one condition – a chemical concentration, a nutritional state – and an experiment can _____ **(4)** dramatically different data. Or worse, factors that scientists haven’t even _____ (**5)** turn out to be the main drivers. What scientists know for sure is that today’s _____ **(6)** may well be overturned by tomorrow’s data. That is a _____ (**7)** aspect of science.

Luckily, not every _____ (**8)** study contradicts earlier work, yet many of the scientific findings may challenge the results _____ **(9)** before. For example, Mars may not have had a _____ **(10)** warm, wet past. Neutrinos do have mass after all. Diamond is not in fact the _____ (**11)** material.

So, what we learned at school years ago – or what we you read just last year – doesn’t necessarily _____ **(12)** to today’s scientific conclusions. To keep _____ **(13)**, you will have to follow the twists and turns as researchers apply new technologies and carry out larger, longer, and smarter studies.

Anyone who understands science knows that it is often a _____ **(14)** complex business that can’t be conveniently packed into neat _____ **(15)**, despite what may appear in the daily headlines. Yet the _____ **(16)** of scientists to reach beyond the current limits of human learning is constant and unyielding, a _____ **(17)** tap, tap, tapping away at the _____ (**18)** shield that lies at the edge of the unknown.

4. Read the text. Match the words from column A with their definitions from column B.

Devotees of the paranormal disparage scientists as narrow-minded, unimaginative conformists who, having been taught a set of standard answers to the riddles of nature, thereafter turn a blind eye to evidence of extrasensory perception: flying saucers, reincarnation and other phenomena they can't explain. Yet without the unexplained, scientists soon would be out of job.

The real difference is that scientists enjoy a greater tolerance for ambiguity than pseudoscientists do. The scientist confronted with reports of lights in the sky or things go bump in the night, says, 'I don't know what they are.' The pseudoscientist cannot tolerate this state of affairs. He knows, all right: they are alien starships, or evidence of life after death. But it is useless to grasp at extreme hypothesis to explain any anecdotal report. As Newton wrote, 'To tell us that every species of things is endowed with an occult specific quality by which it acts and produces manifest effects, is to tell us nothing.'

Astrology, **chiromancy**, and **divination** date back to ancient times. Interestingly, every turn of the century is noted as the period of revival of these arts and crafts. The 21st century is no exception with its increasing fascination with all types of occult sciences. People especially willing to peep into their future search for all kinds of **sorcery**. They may turn to wizards, magicians and even 'specialists' who claim to be able to forecast the future from the entrails of sacrificial animals.

The 20th century witnessed the emergence of numerous alternative sciences – **parapsychology**, **telepathy, UFO-logy** – which are advocated even by serious scientists.

The members of the *UK Pagan* have given unfortunate impression that paganism is a new Age religion that will accept any **mumbo-jumbo**. The truth is that in fact this is **veneration** of nature and there are a large number of pagan scientists, engineers, teachers and health workers who embrace both real science and paganism.

Patients who have been used to modern medicine expect a pill for everything and doctors seem rather too willing to supply them. Perhaps if doctor had freedom to hand out crystals and **amulets** and **placebo** potions far less harm would be done. Regardless of the fact whether or not crystal treatment has any value in itself, belief can have a profound effect of its own. A placebo often achieves the results as good as 'real medicine'. Many survival manuals recommend administering anything that looks like a medicine to someone bitten by a snake if no **antivenin** is at hand.

A	B
1. astrology	**A.** the study of unidentified flying objects
2. chiromancy	**B.** communication by inexplicable means
3. divination	**C.** unintelligible incantation, obscure ritual
4. sorcery	**D.** a substance containing no medication, given to humor a patient
5. parapsychology	**E.** the art of foretelling a person's future by studying his palm
6. telepathy	**F.** antitoxin active against venom
7. UFO-logy	**G.** the study of heavenly for prediction of the future
8. mumbo-jumbo	**H.** an object serving as a charm against evil or injury
9. veneration	**I.** black magic, witchcraft
10. amulet	**J.** the study of phenomena not explainable by known natural laws
11. placebo	**K.** the act of foretelling future events
12. antivenin	**L.** profound respect or reverence

Word Families

5. Fill in the gaps using the words from the box.

a) **approved** b) **approval** c) **disapproved** d) **disapproval** e) **disproved** f) **improve** g) **improvements** h) **proved (2)** i) **proofs**

1.-2. It was Galileo's insistence on the importance of demonstration, observation and experiment that _____ Aristotle wrong, and led to insights and _____ of entirely new ideas.
3. -4. Charles Darwin's father _____ of his voyage, but despite his _____ Charles embarked on this exciting scholarly adventure that lasted for five years instead of the planned two.
5. -6. In the USA all gene modified foods are to be _____ by the National Food Agency. Yet, despite getting the _____ there is an increasing number of reported cases of substandard food.
7. Some breeds of carrot contain a protein that stops ice crystals growing. This natural carrot 'anti-freeze' can be extracted and used to preserve body tissues for medical use and _____ the shelf-life of frozen food.
8. A scientific theory is considered valid until it is _____ by a new one complying with more evidence.
9.-10. Computers have _____ adept at handling abstract challenges like flying spaceships, playing chess, and solving quadratic equations. They have also become indispensable in communication, but they failed to introduce notable _____ in housework as it was originally hoped.

Confusables

6. Fill in the gaps with some words from the box.

a) **advance** b) **advanced** c) **advantage** d) **advent** e) **adventure** f) **adventurous** g) **adverse** h) **adversary** i) **inadvertently** j) **advice**

1. M. Curie followed H. Becquerel's _____ to study the unusual properties of some elements emitting radiation, the term that she later coined.
2. "Equipped with his five senses, man explores the universe around him and calls this _____ science." *Edwin Hubble*
3. The Chinese created a great civilization; and their technology was in many ways in _____ of the rest of the world.
4. The sand castle view of science sees individual scientists, no matter how eminent and _____, as children digging on a beach, adding their contributions to the pile of sand, in this case knowledge, that has already been accumulated.
5. Leo Szilard (1898-1964), the peripatetic Hungarian physicist, who was the first to realize the importance of nuclear fission, departed from Berlin with the _____ of Hitler.
6. According to his principle of complementarity Bohr argued that peace among nations could be increased if each nation tried harder to appreciate both its own and its_____ points of view.
7. With the advent of _____ theories, such as sting theory, even concepts bordering on the impossible, such as time travel and parallel worlds are reevaluated by physicists.
8. Gold is highly valued for its property not to tarnish in any _____ environment.

9. While looking for the sauce of interference in a large communication antenna owned by Bell Laboratories Penzias and Wilson _____ discovered the remnants of the ancient Big Bang radiowaves.
10. Carrying out experiments resulting in his discovery of oxygen Lavoisier took _____ of the findings of the British chemist Priestley.

Phrasal Verbs

7. Insert the suitable verb from the box:

a) **came**	b) **do**	c) **done**	d) **drew**	e) **get**
f) **ironed**	g) **pointed**	h) **sort**	i) **spelling**	j) **turned**

1. It is Bacon writing in the first decades of the seventeenth century, who is usually credited with **…out** the principles of empirical science and the role that experiments should play in hypothesis testing.
2. When Newton made his theory of light and color known in 1672, Hooke… **out** that what was right in Newton's theory had been suggested by him seven years previously
3. Newland's system had its faults, but given time and encouragement he could have them **…out.**
4. In 1870, Julius Lothar Meyer (1830-1895), a German chemist, who independently from Mendeleev **… up** the periodic table, published his version.
5. The row over who had been the first to think of Calculus became so bitter that the Royal Society held an inquiry to **… out** the mess.
6. In 1755 Linnaeus **… down** the offer from the King of Spain to come and live at the Spanish court with a very handsome salary.
7. The occult qualities of late scholastic science were to be **… away with;** the only ideas which were clear and distinct were to be employed.
8. To answer the question about what transfers vibration, scientists **… up with** the idea of a weightless matter called 'ether'.
9. Romans did not **… round to** inventing paper or gunpowder, but when it came to technology and administration of a great empire they were equal to the Chinese.
10. For young Gauss whose inhuman memory enabled him to **… without** a table of logarithms, all the endless arithmetics was the sport of an infant.

Linking Words: once

8. Translate the following sentences paying attention to the linking words.

Functions of *once*

1. A problem **once** grasped was never released till Gauss had conquered it, although several other might be in the foreground of his attention simultaneously.
2. Picture the scientist. Now try again, **once** you erase the image of Einstein from your mental background.
3. Once in a while, "a new paradigm" – a revolutionary new model – is put forward, which offers a dramatically changed view of the underlying reality

4. Einstein **once** went so far as to say that 'the only physical theories that we are willing to accept are the beautiful ones" taking for granted that a good theory must concur with experiment.
5-6. Once Galileo directed his telescope at heavens he saw **at once** the Moon was not a perfect sphere it was supposed to be, but had mountains, valleys, cliffs, and maybe even seas.
7. "**Once** or twice I have been provoked to and have asked the company how many of them could describe the Second Law of Thermodynamics. The response was cold: it was also negative. Yet I was asking something which is about the scientific equivalent of: "Have you read a work of Shakespeare's?"
8. Over the next half a century, scientists began mathematically to wind back the clock of the expanding universe, and they realized that, although it is now big, it **once** must have been very small.
9. Where **once** research was done entirely in the lab (or in the wild) and then captured in a model, it often now begins in a predictive model, which then determines what might be explored in the real world.
10. The creationists believed, as many people still do, that every species was created by God **at once** – and that each was perfectly designed by him to suit the conditions in which it lived.

Grammar: Past Tenses

9. Use the verbs in brackets in Present Simple, Present Perfect Progressive, Past Simple, Past Progressive.

Science and Universe

Ever since humankind first (look) **(1)** at the stars moving about the sky, they (wonder) **(2)** how and why they (do) **(3)** that. People (always/ ask) **(4)** why things (behave) **(5)** the way they do. For thousands of years people (put) **(6)** questions like why things (fall) **(7)** to the ground, not away from it? Why the Sun (come up) **(8)** in the east and go down in the west? Early thinkers (answer) **(9)** these questions in philosophical ways.

It was Galileo who (lay) **(10)** the foundations of modern science. Nicolas Copernicus and Johannes Kepler (describe) **(11)** the solar system that (have) **(12)** the sun in its centre, not the Earth. James Clerk Maxwell (come up) **(13)** with the equations that (be) **(14)** later the starting point for Einstein and his relativity theory. At the same time, other scientists (work) **(15)** on thermodynamics. Scientists like Max Planck (look) **(16)** at the relationships between matter and wave motion and (originate) **(17)** quantum mechanics which (explain) **(18)** not only how atomic particles (move) **(19),** but also how the universe (do) **(20)**.

10. Use the verbs in the brackets in appropriate forms.

***Example**: I **used to get up** early when I was a school student.*
*He **used** this time to walk his dog.*
*He **isn't used to working** at weekends.*
*He could hardly **get used to driving**.*

In ancient times, people **(use/ believe 1)** that the Earth was the center of the solar system and **(use 2)** this idea to explain the movement of the Sun, the Moon, the stars and the planets around the Earth.

Nicolas Copernicus put forward heliocentric theory, according to which the earth was just another planet revolving around the Sun, which itself never moved. The terms *heliocentric* and *geocentric* still **(use 3)** to refer to these two opposing theories. The Dane Tycho Brahe and Galileo made accurate measurements of the heavens, which later scientists **(use 4)** for new theories.

It took ordinary people some time **(get/ use 5)** to this new world order, especially because the church **(use/ oppose 6)** it. Johannes Kepler, an assistant to Brahe, **(use 7)** his measurements to support Copernicus' heliocentric theory and postulate three laws relating to planetary movement. In his turn, Newton **(use 8)** Kepler's findings to put forward his historic law of universal gravitation and laws of motion.

Both scientists and laymen **(get /so /use 9)** to Newtonian physics that when in the early twentieth century Albert Einstein came up with his relativity theory many people did not understand it. Einstein's cosmology **(not/ use/ become 10)** part of modern common sense for many decades, but people gradually **(get/ use 11)** to it and now it **(use 12)** to explain many phenomena that **(use/ be 13)** mysterious before.

11. Open the brackets using the verbs in Past Simple and Past Continuous.

a) While I **(negotiate)** the contract, my boss **(phone)** me to say that he **(want)** completely different conditions.
b) Max **(explain)** his proposal when John **(interrupt)** him.
c) While the police **(investigate)** the accident they **(ask)** for soil samples.
d) When he **(read)** the draft of his article he **(decide)** to rewrite the conclusion.
e) Everyone **(wait)** for the meeting to begin when he **(call)** to say that he was stuck in a traffic jam.
f) When the lab assistant **(clean)** the piece he **(drop)** it and it broke.
g) The secretary **(find)** the missing file while she **(look for)** some other documents.
h) When the fire brigade **(arrive)** the staff **(try)** to put out the fire and evacuate the valuables.

12. Use the verbs in Past Simple, Past Continuous, Past Perfect.

The Origins of Photography

A Frenchman called Niepce **(take 1)** the world's first surviving photograph in 1827. Up to that point, it **(be 2)** impossible to capture permanently a living image, except in a painting or drawing. Niepce **(point 3)** his early camera at the window of his country home and he **(shoot 4)** a picture for eight hours. The image wasn't very clear, but it still **(survive 5)** to this day.

Another Frenchman, Daguerre, **(hear 6)** about work Niepce **(produce 7)** and contacted him. They became partners and **(work 8)** together to create a new photographic process. It **(become 9)** very popular and soon people round the world **(take 10)** daguerreotypes, as they were known.

In England, William Henry Fox Talbot **(develop 11)** his own process by about the same time. His method **(allow 12)** more than one copy to be made, whereas the daguerreotype could not be reproduced.

By the 1880s, when American George Eastman **(design 13)** the first Kodak camera, the world was ready for mass photography. The Kodak camera had a roll of film inside and **(be 14)** easier to use than any previous camera. It was an instant success and soon people **(take 15)** pictures as if it were the most ordinary thing in the world.

13. Use the verbs in Past Simple, Past Continuous, Past Perfect, Past Perfect Continuous.

Polar Exploration

The American explorer Robert Peary **(discover 1)** the North Pole in 1909, reaching the actual spot by sledge. A short while afterwards, Amundsen, who **(not hear 2)** of Peary's success, **(start 3)** to look for the Pole. But on the way he **(find out 4)** that Peary **(get 5)** there. So he **(decide 6)** to search for the South pole instead, which he **(discover 7)** in December 1911. Strangely enough he **(do 8)** it a few weeks before Britain's Captain Robert Scott who **(race 9)** to get there. Captain Scott **(get 10)** to the South Pole in January 1912 only to discover that Amundsen **(beat 11)** him to it. On the return journey, Scott and his four colleagues were overcome by the violent weather and **(die 12)**.

☺ ☺ ☺ ☺ ☺

14. Translate the following sentences paying attention to functions of used to and would.

1. Progress is the continuous effort to make things we eat and wear as good as they ***used to be.***
2. I ***used to*** snore so loudly I ***would*** wake myself up. I am cured now. I sleep in the next room.
3. Our parents ***used to*** tell us that money is not everything. Now we tell our children that money isn't anything.
4. My uncle ***used to*** be a train driver but he got the sack − for overtaking.
5. Things were so bad that at lunch time the family ***would*** fight over who got the middle part of the sardine.
6. He turned his life around. He ***used to*** be depressed and miserable. Now he is miserable and depressed.
7. Now women have to be elected to parliament, get CEO jobs and so on instead of ruling the earth by batting their eyelashes the way they ***used to***.
8. The penalty of success is to be honored by the people who ***used to*** snub you.

Phonetics

***Choose the correct pronunciation*.**

[k] **[s]** **[ʃ]** **[ʒ]**

1) academician	**5)** partial	**9)** cautious	**13)** society	**17)** ocean
2) concentrate	**6)** particular	**10)** occasion	**14)** social	**18)** measure
3) mathematician	**7)** issue	**11)** species	**15)** precede	**19)** precision
4) particle	**8)** soldier	**12)** racial	**16)** procedure	**20)** procedure

Words of Wit and Wisdom

1. *Man is a credulous animal, and must believe something; in the absence of good grounds for belief, he will be satisfied with bad ones.*

Bertrand Russell

2. *There is the greatest practical benefit in making a few failures early in life.*

3. *A man should never be ashamed to own that he has been wrong, which is but saying in other words that he is wiser today than he was yesterday.*

A. Pope

4. *There are defeats more triumphant than victories.*

M. Montaigne

5. *Failure is not falling down, it is not getting up again to continue life's journey.*

R. Nixon

6. *I am not ashamed to confess that I am ignorant of what I don't know.*

Cicero

7. *As for me, I know that I know nothing.*

Socrates

Unit 3
VISION IN SCIENCE AND TECHNOLOGY

1. Read and discuss the text. Fill in the gaps (1-5) with extracts (A-E).

Visionary Scientists and Inventors

Leonardo

On the surviving thousands of pages containing Leonardo's scientific ideas, there are scores of inventions of machines and devices, some just tentative ideas, some fully worked out with detailed drawings. What is astonishing is not just the sheer range of problems that Leonardo put his mind to, from war machines to water supply, **(1) ____** Helicopters, tanks, cars, aero planes, bicycles, and parachutes – all appear on Leonardo's pages, 500 years before they became a reality. It seems unlikely, though, that Leonardo tried out many of these amazing ideas. It seems unlikely, too, that anyone else even knew about them except the few who acquired his notebooks.

Ten years before his death he designed a glider that had a genuine control system not unlike modern hang gliders. Recently, experts have built a machine based exactly on his design using only materials and tools that would be available then, and proved that it would not only have been able to fly, **(2) ____**

He also designed a helicopter to climb vertically into the air carrying men on a platform beneath it. Unlike modern helicopters, it did not have rotor blades, but a spiral screw. Helicopter toys had actually been around for centuries, but Leonardo was the first – and perhaps the last for another 500 years – to try and design one as a means for lifting people.

Hooke

Among Hooke's many inventions were the ear trumpet, the first practical spirit level, sash windows, the anemometer (for measuring wind speed), the hydrometer (for measuring humidity), the cross-hair (for sights in telescopes and, later, gun sights), the iris diaphragm (later the aperture in the camera), respirators for easing breathing, a diving bell, an air pump, the universal joint (now widely used as a car drive shaft), a self- stabilizing keel for boats, mercury amalgam (later used for dental fillings), the micrometer, an air gun – the list goes on and on.

And like Leonardo, Hooke worked on flying machines and even anticipated the coming of the steam engine. Not for nothing did his friend, the famous diarist John Aubrey, described Hooke as 'certainly the greatest mechanic this day in the world', **(3) ____** He was also a visionary scientist. While studying fossil shells and living wood and shells, Hook made the first description of fossilization, in which minerals gradually replace living tissues to turn dead organisms to stone.

He later went even further, suggesting that seashell fossils found in high mountains indicate that in the past the world was subjected to massive earthquakes which threw up ancient seabeds to form mountains. Hooke even thought that some fossils might be species of creatures that no longer existed. Such ideas were way ahead of their time, and only came to prominence in the great revolution which transformed geology and formed the basis of Darwin's theory of evolution almost 200 years later.

Babbage

Charles Babbage (1792-1871) began his lifelong quest to create a mechanical calculating engine one evening in 1821. That night the young Babbage and his friend John Herschel were pouring over manuscripts of some mathematical tables they were preparing for the Astronomical society, painstakingly checking the tens of thousands of entries one by one. As they did, they came across error after error made by the 'computers', the poorly paid human calculators who worked out such figures. Finally, in exasperation, Babbage exclaimed, 'I wish to god these calculations had been executed by steam.'

Babbage's frustration was not simply at the mind-numbing tedious task of computing tables, **(4) ____** Yet at the time such tables were vital in many spheres of life – science, taxation, engineering, surveying, insurance, banking, and more. When a ship set sail, for instance, the navigator's cabin was lined with volume after volume of tables to help him pinpoint the ship's position at sea.

Babbage's Difference Machine No.1 was a tremendously ambitious project. No calculator had ever worked with numbers bigger than four digits, yet Babbage planned to build a machine that could handle numbers of up to fifty.

The Difference Engine was essentially just a clever mechanical calculator, though it incorporated such sophisticated ideas as automatic printing of results. But experts who have studied Babbage's papers believe the Analytical Engine could have truly been what we now call a computer – a machine that could 'think', responding to new problems and devising its own way of solving them without human intervention. In working out his ideas for the Analytical Engine, Babbage anticipated virtually all the key design elements of the modern computer, including the central processing unit and different kinds of memory.

Remarkably, Babbage's ideas were not just vague concepts, **(5) ____** that were simply beyond the technology of the day to build. Later in life Babbage designed a simpler version of the Difference Engine. His drawings for Difference Engine No. 2 were so thorough that in 1991, after 150 years, London's Science Museum researchers were able to use them to build a full-scale version – and show that it really worked. The chances are that the Analytical Engine would have worked, too, had it been built, and the era of Charles Dickens would have computers, the situation desribed in a retrofuturistic novel "*The Difference Engine"***.**

A. but he was by no means just an ingenious technician.

B. but thoroughly practical idea

C. but how many of his ideas are almost unnervingly ahead of time

D. but the high chance of mistakes.

E. but also be controlled in flight, something not achieved until the Wright brothers' famous flight in 1903.

2. Form a suitable word for every line.

Einstein and Modern Technology

Scientists in many realms of physics and **(1) ____**	**engineer**
spent the 20th century testing, realizing and **(2) ____**	**apply**
the **(3) ____** of Einstein's work. As everybody knows	**imply**
his formula $E = mc^2$ was the key to the **(4) ____** bomb –	**atom**
and all the history that sprang from it. Einstein's **(5) ____**	**explain**
of the photoelectric **(6) ____** underpinned technology	**affect**
(7) ____ from photodiodes to television camera tubes.	**range**
A hundred years later, **(8) ____** are still finding	**technology**
new ways to harvest novel **(9) ____** from	**invent**
Einstein's theoretical **(10) ____**.	**find**

3. Fill in the gaps with the words from the box.

Zwicky – the Unsung Genius

a) **abstract**	b) **bonus**	c) **brevity**	d) **concise**	e) **confirmed**	f) **insights**
g) **least**	h) **phenomenon**	i) **reference**	j) **scale**	k) **universe**	l) **verified**

A Bulgarian-born Swiss-American maverick genius Zwicky was capable of striking **(1) ____** most of which he could not substantiate scientifically.

On January 15, 1934, the journal *Physical Review* published a very **(2) ____** abstract of a presentation that had been conducted by Zwicky and Baade at Stanford University. Despite its extreme **(3) ____** − one paragraph of twenty-four lines − the **(4) ____** contained an enormous amount of new science: it provided the first **(5) ____** to supernovae and to neutron stars; explained their method of formation; calculated the **(6) ____** of their explosiveness; and, as a kind of concluding **(7) ____**, connected supernova explosions to the production of a mysterious new **(8) ____** called cosmic rays, which had been found swarming through the **(9) ____**.

These ideas were revolutionary, to say the **(10) ____**. Neutron stars wouldn't be **(11) ____** for thirty-four years. The cosmic rays notion, though considered plausible, was **(12) ____** only in 2015.

Word Families

4. Fill in the gaps with the words from the box.

a) **attain**	b) **contained**	c) **detained**	d) **entertaining**	e) **maintain**
f) **obtained**	g) **pertaining**	h) **retain**	i) **sustained**	j) **sustainability**

1. It would be nearly impossible to overstate Lyell's influence. *The Principles of Geology* went

through twelve editions in Lyell's lifetime and ____ notions that shaped geological thinking far into the twentieth century.
2. Researchers can estimate the amount of green algae and following from this, the type of population that could be ____.
3. In 1900, three European botanists, each working independently, ____ results that showed how plant heredity was governed by a set of basic laws.
4. The cactus growing in very arid areas has an ability to ____ a lot of moisture in its thick leaves.
5. The most extreme tornados can ____ the speed of 300mph, stretch more than 2miles across and stay on the ground for dozens of miles.
6. Ecologists are people who study the problems ____ the environment, while environmentalists are those involved is social activities concerning environmental protection.
7. International space stations are very expensive to ____, thus this enterprise requires joint effort of several nations.
8. Linus Pauling was not able to receive his Nobel Prize because he was ____ in the USA due to his anti-war activities.
9. Nobel Prize winners are to deliver a speech that is normally both serious and ____.
10. ____ is the key aspect of modern economic development

Phrasal Verbs

5. Replace the words in italics with phrasal verbs in the box.

Sci-Fi and Science
Herbert Wells and Leo Szilard

a) **broken through** b) **brought about** c) **came across** d) **came up with** e) **set off** f) **set up** g) **thought up**

Atomic physicist Leo Szilard remembered reading the 1914 H.G. Wells novel, *The World Set Free*, in which Wells **predicted (1)** the development of the atomic bomb. In the novel he stated that the secret of the atomic bomb would be **solved** (**2)** by a physicist by 1933. By chance Szilard **stumbled upon (3)** this book in 1932. Spurred on by the novel, in 1933, precisely as predicted by Wells some decades earlier, he **conceived (4)** the idea of magnifying the power of a single atom via a chain reaction. It **initiated (5)** splitting so that the emerging single uranium atom could be magnified by many trillions. Szilard's idea then **set into motion (6)** a series of key experiments and secret negotiations between Einstein and President F. Roosevelt. As a consequence the Manhattan Project was **started (7)**, whose outcome was the construction of the atomic bomb.

Jules Verne and Edwin Hubble

a) **come up**	b) **come up with**	c) **came across**	d) **came out**
e) **carried away**	f) **gave up**	g) **set off**	h) **turn up**

Jules Verne made his stunning predictions because he closely followed the break-throughs of science. He would often **suggest (8)** ideas and technology which would **appear (9)** as late as in the 20th century. One of his amazing novels *Paris in the Twentieth Century* written in 1863 describes with great accuracy what Paris might look like in the year 1960 including fax machines, glass sky scrapers, high-speed elevated trains, world-wide communication networks, etc. His great-grandson **accidentally discovered (10)** the manuscript and it **was published (11)** for the first time in 1994. Among outstanding scientists who were affected by Verne's futuristic visions was the great astronomer Edwin Hubble who was **captivated (12)** by his works and **abandoned (13)** a promising career in law to **start (14)** on a career in science.

Confusables

6. Decide which answer A, B, or C best fits each space.

Science in the Twenty-first Century

Science promises to change our lives in many ways in the twenty-first century. Most people probably (1) ____future scientific (2) ____ with traveling to distant planets. Or with the host of (3) ____ available in twenty-first century homes. However, it is probably in the (4) ____ of medicine that science will have the greatest (5) ____ on people's lives. (6) ____ is going on to find the ways to immunize people (7) ____ AIDS which is known to have claimed the lives of so many young people, and to discover (8) ____ for terrible diseases like cancer. Of course, before any of these are made (9) ____ to the public they will have been (10) ____ tested.

1.	a) join	b) connect	c) link
2.	a) improvements	b) progresses	c) advance
3.	a) mechanism	b) devices	c) instrument
4.	a) field	b) region	c) subject
5.	a) affect	b) impact	c) alteration
6.	a) Exploration	b) Analysis	c) Research
7.	a) for	b) against	c) to
8.	a) cures	b) injections	c) vaccination
9.	a) valuable	b) worth	c) available
10.	a) through	b) though	c) thoroughly

Linking Words
Functions of *as*

7. Translate the following sentences paying attention to the linking words.

1. Galileo showed that things accelerate at an even pace **as** they fall towards the ground.
2. The story about the falling apple is often dismissed **as** a legend but Newton claimed it was so.
3 - 4. In 1916, the German astronomer Karl Schwarzschild concluded that, **as** the star contracts, its gravity grows so powerful that nothing, not even light can escape. He also introduced the notion now **referred to as** Schwarzschild radius.
5. In 1830 Thomas Young and Augustine Fresnel showed that light did not travel **as** particles, **as** Newton had said, but **as** waves or vibrations.
6. Drexler argued that if biology works **as well as** it does, researchers ought to be able to do much better.
7. By space-time Einstein meant that space and time, which we regard **as** separate things, are actually one four-dimensional continuum.
8. As science slowly evolves − **as** our knowledge of the universe slowly progresses in the direction of completeness, even if **as yet** maybe nowhere approaching that ideal closely − ideas and hypotheses from seemingly different disciplines suddenly take on a new relationships: it can be seen **as** the myriad pieces of a single, very large jigsaw**.**
9. To make sense of this seeming paradox, Bohr – who like Einstein was a philosopher **as well as** a scientist – developed a view he called "complementarity".
10. Early Greek thinkers were not preoccupied with physics **as such** considering it a component of knowledge and philosophy in general, this attitude reflected in the name natural philosophy

Grammar: Future Tenses

8. Choose the correct verb form.

1. We **will be moving/will have moved** to our new premise in August.
2. We **will be moving/will have moved** to our new premise by August.
3. What time **does /will** your train **leave**?
4. Don't forget to turn off the lights before you **leave/will leave**.
5. We will not send the spare parts until we**'ve received/will receive** the payment.
6. We will **repay/will have repaid** the bank loan by December.
7. Unless they **are/will be** more reasonable, we'll break off the negotiations.
8. Our visitors are due **to arrive/to be arriving** at 10 a.m.
9. I'm afraid I **will arrive/will have arrived** a bit late.
10. I can't talk now. I **am/will be** about to leave for the airport.
11. I've been working for about three hours. **Shall/Will** we break for coffee?
12. I wonder when he **gets/will get used** to our requirements.

9. Write a letter using expressions:

I hope / hopefully, I expect, I'm afraid, I wonder, I don't think, I doubt;
In case, If you wish/ intend/ choose, Let me know (in advance), I would like to remind that

The first one is done for you.

Conference preparation. Anticipating Problems

A Research Institute of Solar Energy is planning a big international conference. The organizing committee is analyzing the list of things that might go wrong during the event.

Discuss the action plan in case of emergencies and arising problems.

Example: *I hope you will take part in the conference to be held in May. I do not think you will have problems getting a visa. I suppose it is a good idea to check up whether there are some extra days off due to the national holidays. If there are any, you will have to submit your documents in advance.*

Problems **Cause** **Solution**

1. Getting a Russian visa: national holidays in May
2. Delayed arrivals to St. Petersburg: emergency situation
3. Accommodation: shortage of hotels with central location at reasonable price.
4. Catering: welcome buffet, coffee breaks, lunch,
special dietary requirements of the participants.
5. Venue of the conference: provision of shuttle
6. Required equipment: OHPs, whiteboard
7. Translation: reports to be published in the Proceedings, simultaneous translation
8. Cultural program: sightseeing, theatre
9. Gala party: venue, dress code
10. Participant's kit with a logo: content
11. Participants' departure: bus schedule, ordering a taxi
12. Further information: organizing committee

10. Match the two parts of the sentences.

A	B
1. Please take a seat until	**a)** you leave
2.They won't accept our order unless	**b)** Dr. Repin is ready to see you.
3. Ann wants to speak to you before	**c)** you'll have left.
4. You won't see Alex. By the time he arrives	**d)** we give a bank guarantee.
5. As soon as he comes	**e)** have finished and we can talk.
6. I can't wait. This time next week	**f)** I'll ask him to phone you.
7. Sorry about this. In a few moments I'll	**g)** the technical staff sort out the problem.
8. Sorry for the delay. We'll have to wait until	**h)** I'll be lying on the beach in Greece.

11. Use the suitable verb form.

PhD Exams

The PhD exams are to be held in June. You may **(take 1)** some training courses, either philosophy or English, or both after you **(come back 2)** from your summer holidays. There probably **(be 3)** no classes in December when we **(be 4)** really very busy preparing end-of- the-year reports.

I would like to get some feedback from you concerning PhD courses as the number of participants **(be 5)** limited. You need not apply for a place in the refreshment courses unless you **(take 6)** an English or philosophy exam this year. You **(have 7)** four hours of English every week. If your classes **(coincide 8)** with public holidays the teacher **(cancel 9)** them and **(make 10)** it up for you in May. By May it is expected you **(read 11)** 100 pages of technical articles in your field. Make sure they are written by English-speaking authors, otherwise you **(have 12)** problems at the exams. The exam **(proceed 13)** as follows: while the examiner **(listen 14)** to the first examinee, the other applicants **(have 15)** time to get ready with their texts.

12. Choose the right verb form.

Economic Forecast

The Central Bank ____ **(1)** interest rates low in order to stimulate economic growth. So we expect the economy ____ **(2)** growing at the rate of about 4%. This means unemployment ____ **(3)** in most sectors of economy next year. Exchange rates are very difficult to predict, but hopefully the currency ____ **(4)** more or less stable. However, if oil prices ____ **(5)** dropping the situation may further deteriorate. Normally economic embargo ____ **(6)** domestic producers, it is widely expected this country ____ **(7)** no exception. By 2020 all formerly imported goods ____ **(8)** by domestic produce. However, these plans probably ____ **(9)** unless the international political situation ____ **(10)**.

1.	a) will keep	b) is going to keep	c) will be keeping
2.	a) will continue	b) will be continuing	c) is continuing
3.	a) will reduce	b) will be reducing	c) are reducing
4.	a) will remain	b) will remaining	c) is remaining
5.	a) will go on	b) go on	c) is going
6.	a) stimulates	b) will be stimulating	c) will stimulate
7.	a) will be	b) is going to be	c) will go
8.	a) will replace	b) will have been replaced	c) will have replaced
9.	a) won't materialize	b) don't materialize	c) will materialize
10.	a) will improve	b) will have improved	c) improves

13. Use the verbs in the brackets in the appropriate future or present form.

The End of the Universe

Man has always been wondering when and how the universe **(end 1)**.
The poet Eliot asked the question "Will the universe **(die 2)** with a bang or a whimper?"
Robert Frost asked: "Will we all **(perish** 3) in fire or ice?" The latest evidence points to the possibility that the universe **(die 4)** in a Big Freeze and all intelligent life **(wipe out 5)** when temperatures **(reach 6)** the absolute zero. But we don't know when the ultimate end of the universe **(occur 7).** Everyone realizes that this event **(take 8)** place trillions upon trillions years in the future. Scientists **(believe 9)** that the "dark energy" or the energy of vacuum **(push 10)** galaxies apart at an ever increasing rate. If such an expansion **(cool 11)** the universe it ultimately **(lead 12)** to the Big Freeze. Some scientists doubt whether this expansion **(be 13)** temporary or irreversible. Is it possible that it **(reverse 14)** itself in the future?

German physicist Hermann von Helmholz (1821-1894) perceived the consequences of this inevitable heat dissipation: the universe **(end up 15)** as a uniform, tepid reservoir of heat. No further change then will be possible when there **(be 16)** nowhere colder for the heat to flow. "Thus, he said, the universe ultimately **(die 17)** a "heat death". In a Big Splat scenario, in which two membranes collide and create the universe, it appears as if the membranes **(collide 18)** periodically. If such a scenario **(materialize 19)** in the future, the expansion that appears to lead to the Big Freeze is only a temporary state that **(reverse 20)** itself.

14. Use the suitable verb form.

Professional Development

The Human Resources Manager of a large company **is explaining/explains** (1) the appraisal system to a group of new employees. "Your appraisal interviews **will be taking/take** (2) place in March. During February your line managers **will have collected/will collect** (3) all the information they need from you. And by the time you **will meet/meet** (4) for an interview, they **will be producing/will have produced** (5) all the checkpoints to discuss.

In the interview you **are discussing/are going to discuss** (6) your performance during the past year and any issues relating to your future needs, such as training. By the end of the interview I hope that you and your line managers **will be agreeing/will have agreed** (7) upon your personal objectives for next year, both in terms of your tasks within the project and your personal development. Of course there is some flexibility in the deadlines in case something **happens/will happen** (8) that we can't predict.

The company **is going to offer/ will be offering** (9) a choice of courses in August before the work **will get/gets** (10) really busy in September. The next time we **will meet/meet** (11) will be October. By that time your courses you **will be finishing/will have finished** (12) and I will expect some feedback from you on your training.

Unless you **have/will have** (13) any questions I say that will do for today. I will also appreciate if you **e-mail/will e-mail** (14) your suggestions about your training courses as soon as you **have made up/will have made up** (15) your mind."

Phonetics

***Choose the correct pronunciation*.**

[s] **[ʃ]**

1) crucial	**2)** special	**3)** specific	**4)** physicist	**5)** physician
6) initiate	**7)** ensure	**8)** pressure	**9)** society	1**0)** ancient
11) conscious	**12)** conscientious	**13)** sure	**14)** tradition	**15)** sugar
16) associate	**17)** social	**18)** artificial	**19)** efficient	**20)** efficacious

Words of Wit and Wisdom

Anecdotes

- When Alexander Graham Bell exhibited his first telephone Preece, Chief Engineer of the British Post Office, gave evidence before the committee of the House of Commons. His confident evaluation was: “Americans have need of this invention, but we do not. We have a plenty of messenger boys.” (Americans, by contrast, were on the whole cautiously enthusiastic. “One day”, said the Mayor of Chicago after witnessing a demonstration of the instrument, “there will be one in every city.” A Senator, on the other hand, when told that Maine would soon be able to speak to Texas, riposted: “What should Maine have to say to Texas?”

- Charles Darwin's father was strongly opposed to Charles going on *the Beagle* voyage. He thought that Charles was moving away from the Church, drifting irretrievably into a life of sport and idleness**.** In his turn, Robert Fitzroy Captain of *the Beagle* and Governor of New Zealand doubted whether Darwin would have the determination to survive a difficult journey of several years. Thomas Bell, President of the Linnean Society, speaking of the year in which Darwin read his papers on the origin of species to the society said: “1858 has not, indeed, been marked by any of those discoveries which at once revolutionize, so to speak, the department of science in which they occur.”

Unit 4

INEVITABILITY OF SCIENTIFIC DISCOVERY

1. Read and discuss the text. Decide whether the following statements are true (T) or false (F).

Paradigm Shift

1. Science is an evolutionary process and relies on gradual accumulation of knowledge.
2. New ideas shock scientists who are reluctant to readjust.
3. A new paradigm provides a different perspective to the existing problems.
4. Paradigm shift does not necessarily lead to a number of ground-breaking discoveries.
5. Paradigm shift is usually opposed to the prevailing contemporary theory.
6. Only a few of the listed greatest paradigm shifts are the domain of physics.
7. Science seems to have reached its boundaries.
8. An increasing number of people are involved in research.

Many people think of scientific discovery as a process of gradual accumulation of new knowledge, which is added to a pile of the existing knowledge. This what one might call the sand castle view of science, which sees individual scientists, no matter how eminent and adventurous, as children digging on a beach, adding their contributions to the pile of sand that has already been accumulated. This might describe 98 per cent of what we call scientific advance. But we need another image to convey the nature of the other 1 or 2 per cent.

A recurring theme of the history of science has been the shock of new ideas, and the readjustment of scientific thought they bring about. This process of readjustment was the subject of the book published in 1962 entitled *The Structure of Scientific Revolution*, by Thomas S. Kuhn (1922-1996), professor of linguistics and philosophy at the Massachusetts Institute of Technology.

Kuhn's thesis was that scientific discovery is for most of the time a process of gradual accumulation of knowledge and understanding within the limits of what he called "normal science". But once in a while, "a new paradigm" – a revolutionary new model – is put forward, which offers a dramatically changed view of the underlying reality a particular science is trying to explain.

If the new model proves successful in explaining the hitherto mysterious phenomena, a period of upheaval follows, as scientists try to come to terms with its implications. This leads to a reorientation of the science in question, which Kuhn called "a paradigm shift". In due course the new paradigm meets with general acceptance, and there follows a period of exceptionally fruitful enquiry, which may last for two or three centuries, as scientists explore the territory the new field has opened up. Paradigm shifts need not be destructive. To return to the children on the beach, a major scientific breakthrough need not mean the flattening of the sand castle. It would be more like someone saying, "Why don't we build an ocean liner instead?" If it seems like a good idea, it generates a burst of enthusiasm that the original plain sand castle could never have produced.

The following is just a selection of some notable scientific revolutions of the past 600 years. All of them represent paradigm shifts of the kind Kuhn had in mind. And all of them were followed by a quickening of pace of scientific discovery that continued for a long time.

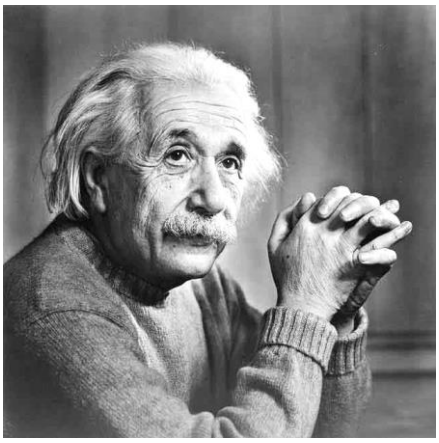
The Sun-centered Model of the Solar System	The Law of Universal Gravitation
Laws of Heredity	The Periodic Table of Elements
Evolution by Natural Selection	The Planetary Model of the Atom

Special and General Relativity — The Expanding Universe
The Structure of DNA — Plate Tectonics

The next 50 years in science will see a greater accumulation of scientific knowledge, further quickening of scientific advance pace than any half- century, and that there are still new paradigms to be constructed. We are better placed to seek out answers than ever in history. Whereas past ages had a handful of leisured gentlemen amateurs or academics, we have hundreds of thousands of full-time paid scientists.

As a result of recent developments in telecommunications – and above all, the Internet, – the opportunities for networking and the speed of new knowledge diffusion, far exceed anything known before. The technology available to us, especially in computing power, is immeasurably more powerful than that available to our predecessors. And, despite a few dark corners, the freedom to pursue enquiry, and the cultural imperative to do so, are built-in characteristics of our modern world. Of course, some people think most of what there is to be discovered has been discovered. But the history of science is littered with stories of eminent scientists who thought so. And how wrong they prove to be!

2. Fill in the gaps (1-6) with extracts (A-F).



Scientific vs. Artistic Genius

Would the world now be different if Albert Einstein had never lived? **(1) _____**. What is the relative impact of a legendary figure of science compared to a legendary figure of art or music?

Although both art and science are human activities, they are thought about in different ways. Monet's *Palazzo do Mula* and Mozart's *Die Zauberflote* are regarded as wondrous acts of creativity**.** Had Monet not lived, the world would be different because the *Palazzo do Mula* never would have been painted. Had Mozart not lived, the world would be different because the opera *Die Zauberflote* never would have been composed. **(2) _____**. His special theory of relativity, a response to the1905 intellectual environment, would have been eventually created by someone else.

Framed this way, art becomes a highly creative activity, with the fingerprints of an artist personalizing every painting and composition, and science becomes an intellectual activity driven by events. **(3) _____**. Framed this way, however, the natures of both art and science are obscured. Art is also driven by events external to the artist. Impressionist painters, who lived and worked during a culturally revolutionary period, at the turn of the twentieth century, influenced each other.

Mozart lived and worked during the late eighteenth century. **(4) _____**. Composers of this era were strongly influenced by the acoustical nature of the concert halls available for performances as well as by the musical range and mechanical efficiency of the musical instruments available to performers.

By the mid-nineteenth century, musicians threw off the constraints imposed by the classical period and composed more personal and emotional music. **(5) _____**. Einstein was influenced by his contemporaries as well as by the state of physics in 1905 and beyond.

It is indeed likely that if Einstein had not created the Special Theory of Relativity,

someone else would have created something equivalent to Einstein's theory. However, just as paintings by Claude Monet and Edouard Manet belong to the same genre and yet are unique, we can imagine a theory by Einstein and a similar theory by, say, Poincare, motivated by the same concerns. **(6) _____**. Einstein's theories would be distinguished from Poincare's theory by the starting point adopted, the conceptual path followed, the assumptions made, and the form of its final outcome. Each theory would be a unique product of human creativity.

A. These conditions are normally shared by the larger science community but they are external to the scientist.
B. The theories would have similarities, but each would be unique.
C. As in the visual arts and in music, science always has a context and a community.
D. Could we ask the same question with regard to Claude Monet or Wolfgang Amadeus Mozart?
E. By contrast, had Einstein not lived, the world would be no different.
F. His contemporaries included Franz Joseph Haydn and Ludwig van Beethoven.

Word Families

3. Fill in the gaps.

a) **consists**	b) **consistency**	c) **inconsistent**	d) **insisted**	e) **insistence**
f) **persisted**	g) **persistence**	h) **resisted**	i) **resistance**	j) **resistant**

1) It was Galileo's _____ on the importance of demonstration, observation and experiment that proved Aristotle wrong, and led to insights and proofs of entirely new ideas.
2) Perhaps because it was so strenuously _____ by Einstein, who was revered as both a scientist and a philosopher, the fall of the Newtonian clockwork model of nature is sometimes described in terms of lamentation more suitable to the end of the world.
3) From the time of Lord Bacon, well into the 20th century the myth _____ that science followed the particular method – Bacon's celebrated 'inductive method'.
4) Before Mendeleev there was no _____ in the symbols and abbreviations used in chemistry as well as arrangement of elements.
5) Mendeleev _____ that cobalt should be swapped with nickel that he believed to have been wrongly placed.
6) Mendeleev's _____ in looking for the ways to arrange the elements resulted in his creating the Periodic Table, whose outline he reportedly saw in his celebrated dream.
7-8) Noble gases group discovered long after Mendeleev's death_____ of gases such as argon and xenon that show_____ to chemical interactions.
9) The Catholic Church was stubbornly_____ to Copernicus' heliocentric theory.
10) Newtonian physics seems _____ with Einstein's relativity theory.

Confusables

4. Find the suitable word.

Who Strikes the Ball?

Objectivity, which is known to dominate science, may be **attributed/contributed (1)** to two reasons. First, experimental data must be analyzed with a reasonable **degree/extent (2)** of objectivity; a scientist cannot recklessly ignore everything that conflicts with a **favored/favourable (3)** hypothesis.

Second**,** the finished paper must **aspire/inspire (4)** to stand up to objective scrutiny; its **conclusions/inclusions (5)** should be judged as **supportable/portable (6)** by qualified researchers other than the author.

But subjectivity is important, too, for it is here that creativity is **introduced /induced (7)** in the picture, and good science is as creative as good art. Scientists in **designing/resigning (8)** an experiment or concocting a theory are not just weighing the **evidence/witness (9)**, but are trying to establish that nature in the way he or she thinks it is, or ought to be.

Objective criteria set the height of the net and **describe/ascribe (10)** the boundaries of the court, but it is the passion of the subjective idea that strikes the ball.

5. Fill in the gaps with the words from the box.

In my Humble Opinion

a) **complexity**	b) **criticism**	c) **dimension**	d) **evoked**	e) **considered**
f) **findings**	g) **modest**	h) **occasional**	i) **possess**	j) **recognize**
k) **response**	l) **self-confidence**	m) **subjected**	n) **support**	o) **undertake**

Of all technical talents, creativity is possibly the most important. In one survey the artists and scientists were **(1)** _____ to the same tests in which they were to choose the pictures they liked. The **(2)** _____ were surprising: both artists and Ph.Ds at the University of California showed **(3)** _____ preferences to pictures which looked chaotic or asymmetrical to other people.

Creative people were attracted by **(4)** _____ that looked to painters more "vital and dynamic" and scientists' creative **(5)** _____ to disorder was to find an elegant new order more satisfying than any that could be **(6)** _____ by simple configuration. Truly creative people must be sufficiently independent-minded to suffer personal discomfort and **(7)** _____ ridicule that often accompany new ideas.

It takes a high degree of **(8)** _____ to challenge the existing order and even more strength of character to risk **(9)** _____. Those who are timid rarely think up creative ideas, and when they do, they don't have the courage to **(10)** _____ them. W.O. Baker, who was president and then a chairman of Bell Laboratories before his retirement, adds an interesting **(11)**____findings: "Not only must technical people **(12)** _____ the ego that gives them the self-confidence necessary to **(13)** _____ a very difficult mission, but they must also have some humility, because nature will have the last laugh. They must, in short, **(14)** _____ the intrinsic difficulties of their task and be **(15)** _____ about the chance of success."

Phrasal verbs

☺ ☺ ☺ ☺ ☺

6. Translate the following sentences:

1. Always try to make the number of **landings** you make equal to the number of **take-offs** you make.
2. What he lacks in intelligence he **makes up for** in stupidity.
3./4. It's easier to rob by **setting up** a bank than by **holding up** a bank clerk.
5. The mind is like a TV set. When it goes blank, it's a good idea to **turn** the sound **off**.
6. A couple in Hollywood I know have just **ironed out** their divorce settlement. Now, at last, they can **go ahead** with the wedding.
7. Why is it that the man your wife **gave up** to marry you **turns out** to be more successful?
8. I was so long at writing my review that I never **got round to** reading the book.

Linking Words: yet, since

7. Translate the following sentences paying attention to the linking words.

Functions of *yet*

1. Scientists have not **yet** come up with the explanation why many physical laws hold.
2. In science Descartes is known for his celebrated, **yet** ultimately unsuccessful vortex theory of the solar system and statements of his principle of inertia and laws of ordinary refraction.
3. Chemistry made great advances in 18th century. **Yet for** all this progress, no one knew what an element was – and no one had thought to connect them with atoms in any way.
4. A popular explanation is that God is a mathematician, an idea that unhelpfully replaces profound questions with a doubly unverifiable proposition. **Yet** divine design has long been an explanation of the efficacy of equation in science.
5. It is perfectly possible to imagine a universe in which mathematical equations have nothing to do with the workings of nature. **Yet** the marvelous thing is that they do. Better **yet**, it seems to have held good since the beginning of time.
6. The table had gaps, but Mendeleyev predicted that these gaps would be filled by elements **yet** to be discovered.
7. Count von Rumford founded the Royal Institution, **yet another** of the many nineteenth centuries.
8. In November 1870, Mendeleev even **went so far as to** describe the properties of these **as yet** unknown elements, which he named eka-aluminum, eka-boron and eka-silicon.

Functions of *since*

9. The General Theory of Relativity stated that gravity is not a force – as physicists had believed **since** Newton – but a distortion in space-time, created by the presence of mass.
10 . There could of course be nothing on the plate examined by Becquerel, **since** the crystal had not been lying in the sun and could not therefore absorb energy to emit radiation.

11. Fleming's finding, which he called lysozyme, would prove to be a dead end in the search for efficacious antibiotic, **since** it typically destroyed nonpathogenic bacterial cells as well as harmful ones.
12. Perhaps the only thing lacking in the Nobel Prize routine is the drama. **Since** the winner are announced in mid October, the scope for on-screen gasps of joy, tears and mutual tearing of eyes is limited, (though do not believe that these emotions are completely absent).

Grammar: The Passive Voice

8. Find the 17 passive constructions in the text.

Drugs from the deep

Not much has been known about marine life until recently. Now, sea animals and plants that are shrouded in mystery excite attention of biologists. Knowledge which is gained by them raised new questions that made scientists turn their attention to the curative powers of sea animals and plants. The new science is called marine pharmacology. It is interested in discovering the pharmaceutical treasures that lie in the ocean. These treasures are the substances that can be extracted from various sea animals to improve the health of the human race.

Owing to the efforts of the pioneers in the field of marine pharmacology, a number of exciting new drugs which are believed to aid in the treatment of the ills of human beings have already been discovered. The sea urchin and sea worms investigated by the scientists are reported to have contributed a lot to the development of a venomous extract called *bonellinin*. Among other things it was found that bonellinin stops the growth of living cancer cells. It was also discovered that the snail-like gastropod produces a substance that relaxes muscles. This substance has been developed into an anticonvulsant drug.

Perhaps the most exciting discovery, however, is a compound from brown seaweed. Strontium-90, one of the most hazardous of nuclear fission products, can now be virtually eliminated from the body after this compound has been successfully developed into a new drug.

There seems to be no limit to the pharmaceutical treasures to be found in the ocean depths. Although only an estimated one percent of the thousands of sea organisms has been analyzed, it is quite clear to scientists that only time is needed to find and test the many opportunities that are offered by the new drugs from the ocean.

9. Transform the sentences using the Passive Voice.

***Example*:** The state funds most universities. → Most universities **are funded** by the state.

1. All universities charge tuition and students pay extra money for room and board.
2. School-leavers receive offers of a place at particular universities through UCAS.
3. Graduates may add letters BA (Bachelor of Arts) or BSc (Bachelor of Science) after their names.
4. Nowadays the University comprises over twenty faculties that provide instruction in science, engineering and humanities.
5. The University trains electrical and mechanical engineers, theoretical and experimental scientists, IT specialists and programmers, managers and PR specialists.

6. The dean's office coordinates the faculty's activities, issues matriculation books, and arranges the curricula.
7. School-leavers should achieve certain grades in their "A" levels.
8. Students choose their major at the end of their sophomore year.
9. Community colleges offer two-year courses leading to an associate's degree
10. The Department administration sets exam and credit schedule for every term.

10. Make up the dialogues using passive constructions.

1.− I've applied for several jobs.
 − How many…… ?
2. − I complained to the managing director about the poor service.
 − What …….. ?
3. − I hired the car from Hertz Rentals.
 − What company…… ?
4. − We are going to treat the patient with the most advanced medicine.
 − Which medicine ……. ?
5. − I have volunteered for the Ambulance Service.
 − Which service…… ?

11. Fill in the correct preposition.

of	**for**	**to** (x3)	**to as**	**with** (x2)	**on** (x2)

1. These phenomena **can be accounted** …… by Newtonian laws.
2. His proposal **was objected** …… by many scholars.
3. The conference website **is to be referred** …… for further information.
4. During the experiment the substance **was subjected** …… heating for 5 hours.
5. The subject **will** only **be touched** …… during the report at the conference.
6. All the problems arising during the conference **will be dealt** …… by the organizing committee.
7. This scientist **is** often **referred** …… the founder of this field.
8. The statement of the board of the directors **was not commented** …… .
9. The author **was accused** …… falsifying the facts.
10. A young scientist **was entrusted** …… a new task.

12. Translate from Russian into English using passive constructions.

1. О новом коллеге очень хорошо отзываются.
2. Можно ли положиться на эту информацию?
3. Решение, к которому, наконец, все пришли, было всеми одобрено.
4. Аспирантов тепло поблагодарили за помощь.
5. Надо положить конец этим бесполезным спорам.
6. Факты, на которые ссылались ученые, заинтересовали прессу.
7. За этой книгой можно послать в издательство.
8. Доклад слушали с большим интересом.

9. Кого обвиняют в утере документов?
10. Он был лишен возможности участвовать в новом проекте.

13. Convert the following sentences into passive and write questions to the subject and object of the sentences.

Physics before Newton

Example: **1. c. 400 BC** Democritus **put forward** the first atomic theory.
a) The first atomic theory was put forward by Democritus.
b) Who put forward the first atomic theory?
c) Who was the first atomic theory put forward by?
2. **c. 250 BC** Archimedes **proposed** the principle of buoyancy.
3. **c. 1610** Galileo **established** the principle of falling bodies.
4. **1643** Blaise Pascal **put forward** the principles of hydraulics.
5. **1656** Christian Huygens **invented** a pendulum clock.
6. **1662** Robert Boyle **formulated** the law describing the behavior of gases.
7. **1676** Roemer uses moons of Jupiter to measure the speed of light.
8. **1687** Newton's *Principia* make public his theory of universal gravitation.
9. **1690** Huygens' Treatise on Light describes his theory of light.
10. **1704** Newton's Optics presents his ideas on the nature and behavior of light.

14. Describe the events from the headlines.

***Example*: Union leader <u>gives</u> warning: pay more money or we <u>will declare</u> 3-day strike**
a) A warning…… → A warning has been given by the Union leader.
b) A 3-day strike…… → A 3-day strike will be declared otherwise.
1. Wimbledon, 12 June: Bjorn Borg <u>wins</u> final, business man <u>offers</u> £10,000 to advertise shaving cream
2. Queen <u>opens</u> bridge next week, police <u>expect</u> large crowds
3. Thieves <u>rob</u> Westland Bank, Middleford, <u>hit</u> cashier on head – second time this year
4. Prime Minister <u>makes</u> announcement: <u>pull down</u> Winfred Palace, <u>build</u> office block
5. Middleford, yesterday: police <u>arrest</u> man, cashier <u>identifies</u> Westland robber

1. a) The Wimbledon tennis final of 12 June……
   b) £10,000…….
2. a) A new bridge……
   b) Large crowds……
3. a) It's the second time Westland Bank…….
   b) The cashier……
4. a) An announcement……..
   b) Winfred Palace……..
   c) An office block …….
5. a) In Middleford yesterday a man ……
   b) The Westland robber……

Causation

15. Translate the sentences paying attention to the functions of 'make'.

1. An ink pen running at regular intervals over a paper chart was a hint leading Jocelyn Bell Burnell **to make** an astonishing discovery about the universe. Nobody yelled "eureka".
2. In the early 1920s, the British scientist Alexander Fleming reported that a product in human tears could **make** bacterial cells dissolve.
3. The telescope consisted of two lenses in a tube and could **make** a distant steeple look as if it was just across the street.
4. Unlike Brahe Kepler did accept Copernican model, and what is more, in a brilliant feat of mathematical inspiration, he found a way **to make** it fit the facts, using Brahe's observations.
5. Leonardo observed exactly what happened to muscles when they moved the body in different ways, how muscles in the face **made** people smile or frown, and much more.
6. An Italian anatomist Luigi Galvani (1737-1798) was using electricity **to make** the legs of the dead frog twitch.

16. Match the two parts of the sentences.

1. We had to check the device because …
2. We had checked it before the mechanic came,
3. We had the mechanic to check the device …
4. The device had to be removed and replaced…
5. We had the device replaced ….
6. We had to have it replaced …
7. We have had it replaced twice in the last two years by the manufactures and …

a) as we did not manage it on our own.
b) but could not identify the problem.
c) by the manufacturing company last week
d) it broke down.
e) by a new one as it was beyond repair.
f) each time it was free.
g) as it was not possible to repair it.

Causation

☺ ☺ ☺ ☺ ☺

17. Translate the sentences.

1. We all know art is not truth. Art is a lie that **makes us realize** truth, at least the truth that is given us to understand. *Pablo Picasso.*
2. Once you **get** people **laughing**, they are listening and you can tell them almost anything. Herbert Gardner
3. Think for yourself and **let** others **enjoy** the privilege **to do so,** too. *Voltaire*
4. Nothing soothes me more after a long and maddening course of piano forte recitals than to sit and **have my teeth drilled.** *G.B. Shaw*
5. I took my old car to the garage to **have oil changed.** The mechanic took one look and suggested I keep the oil and change the car.

6. The final test of fame to **have a crazy person imagine** that he is you.
7. To avoid delay please, have all your symptoms ready. *(notice in the doctor's waiting room)*
8. The farmer's new scarecrow is so intimidating that not only **has the crows stopped stealing** his corn, they are even bringing back the stuff they stole last year.

Phonetics

Choose the correct pronunciation.

	[s]	**[k]**	**[ks]**	**[sk]**
1) access	**5)** exceed	**9)** curtain	**13)** acid	**17)** science
2) decade	**6)** accent	**10)** certain	**14)** curve	**18)** scale
3) scatter	**7)** success	**11)** scene	**15)** score	**19)** scissors
4) cease	**8)** exhaust	**12)** scenery	**16)** fascinating	**20)** schedule

Words of Wit and Wisdom

1. *If a man will begin with certainties, he shall end in doubts; but if he will be content with doubts, he shall end in certainties.*

F. Bacon

2. *It is the customary fate of new truths to begin as heresies and to end as superstitions.*

T. H. Huxley

3. *Most human beings have an almost infinite capacity for taking things for granted.*

A. Huxley

4. *I think and think for years and years. Ninety-nine times the conclusion is false. The hundredth time I am right.*

A. Einstein

5. *No question is so difficult to answer as that to which the answer is obvious.*

G.B. Shaw

6. *The silly questions is the first intimation to some totally new developments.*

Alfred Whitehead

Unit 5
ACADEMIA AND ACADEMICS

1. Read and discuss the text, render it after updating information. Find equivalents to the Russian phrases:

Peter the Great Saint Petersburg Polytechnic University

Peter the Great Saint Petersburg Polytechnic University is one of the oldest and best-reputed technological universities of Russia. It was founded in 1899. Many outstanding scientists took part in its foundation. The University trains electrical and mechanical engineers, theoretical and experimental scientists, IT specialists and programmers, managers and PR specialists and many other academics and professionals.

Saint Petersburg Polytechnic University not only rates as one of Russia's best educational institutions of science and technology but it is also a major research center. Many outstanding scientists with international reputation are among the graduates and the teaching staff of the university. A number of research institutes and centers work in close cooperation with the Polytechnic University. Among them one can name such major research centers as Vedeneyev Hydraulic Research Institute, Ioffe Research Institute of Physics and Technology, the Research and Development Center of Robotics.

The teaching staff of the university includes experienced lecturers, professors, associate professors, academicians. Most of them are also engaged in research in various fields of science. The university provides tuition in three forms: full-time, part-time and extra-mural instruction. Nowadays e-learning is getting more and more popular.

For most students the tuition is free and they receive a scholarship. Beside scholarship they enjoy various benefits: low hostel rent, discount on monthly transportation cards and entrance tickets to museums. For example, the entrance to the world's greatest museum the Hermitage is free for all students.

Students' curriculum includes both fundamental and applied sciences. In the first two years they study mathematics, calculus, physics, chemistry and a number of humanity subjects such as the history of Russia and English. Every term students are to write term papers in various subjects. Students' attendance and academic progress are main criteria for their assessment.

Each institute is headed by a director who is usually a prominent scholar. He/she is assisted by several deputy directors who are responsible for various aspects of university life: academic process, research, extracurricular activity, students' accommodation. The director's office coordinates the institute's activities, it issues matriculation books, arranges curriculum and syllabus, sets exam and credit schedule for every term.

After four years of tuition students are awarded their first scholarly degree: Bachelor of Science (B.Sc.) or Engineering (B. Eng.). If they continue their study they may get Master's degree (M. Sc.). There are a lot of opportunities for SPSPU graduates: they may join a research institute and fill a position of junior research associate or work at Research and Development (R&D) department of an industrial company. Those who are interested in research prefer to stay at SPSPU and take a post-graduate course.

A post-graduate has three years to do research on a particular subject under the guidance of a scientific supervisor. If he or she defends his/her PhD thesis they are addressed as Doctors. The university provides young scientists doing their PhD and post-doc research an opportunity to work

under the guidance of prominent scholars. The Polytechnic is involved in major Russian and international research programs including students and post-graduates' exchange programs.

A lot of conferences, seminars and symposia on various subjects are held here every year, which enables scientists to present their findings to the international scientific community, to share, exchange and discuss their views on vital problems of modern science with their colleagues from Russian and foreign universities.

The university has its own publishing house that prints books, professional journals and proceedings of conferences, which enables the Polytech scientists to have their findings regularly published.

a) младший/старший научный сотрудник **b)** учёный
c) преподаватель **d)** доцент **e)** академик
f) учебный процесс **g)** учебная программа
h) зачёт **i)** зачётка
j) аспирант **k)** аспирантура **l)** диссертация
m) бакалавр **n)** магистр **o)** кандидат технических наук
p) дневное обучение **q)** вечернее обучение **r)** заочное обучение
s) кафедра **t)** заведующий кафедрой
u) семестр **v)** курсовая работа
w) академическая успеваемость **x)** посещаемость

2. Read the text and compare the higher school systems in the two countries. Pay attention to the expressions in bold.

Going to University in Britain

The system of education is basically the same in most European countries, with division into primary, secondary and tertiary (higher) school. In Britain after getting General Certificate of Secondary Education (GCSE) school-leavers apply to several universities through UCAS (Universities and Colleges Admission Service) and receive offers of a place on condition that they achieve certain **grades** in their "A" **levels.** Most universities are state-funded and receive some money from the state. The oldest and the most famous are Oxford and Cambridge. Other much respected universities include London, Durham and St. Andrew's. Some universities such as Birmingham and Manchester are so-called **"red-brick" universities** because they were built in the 19th century with brick rather than stone. The newer universities have their buildings grouped together on a **campus**.

A first degree which is usually an honor's degree, generally takes three years. Most courses end with exams called finals. Results are given as classes: the first is the highest class, seconds are often split between upper second and lower second, and below that is a third. Graduates may add letters BA (Bachelor of Arts) or BSc (Bachelor of Science) after their names. Some students go on to study for a further degree, often a Master's (MSc/MA/MBA) or a doctorate (PhD).

Students in Britain formerly had their tuition fees paid by the state and received a government grant to help pay their living expenses. Now they get only a **loan** and have to pay 1000 pounds a year to cover their **tuition fees**.

Going to College in the USA

Americans talk about going to college even if the institution they attend is a university. Most colleges offer classes only for undergraduate students studying for bachelor's **degree**. Community college offers two-year courses leading to an associate's degree. Universities offer courses for graduate students who study in graduate schools, e.g. a medical school or a law school.

American high school students who want to **enroll** at a college or university have to take a standardized test, e.g. the SAT (Scholastic Aptitude Test) or the ACT (American College Test). Students from countries outside the USA who are not native speakers of English must take the TOEFL (Test of English as a Foreign Language), with each college deciding on the minimum **score**.

Students apply direct to between three and six colleges in their last year of high school. Each college has its own application form and most include a question for which the student must write an essay. The student has also to send a **script** (an official list of all the subjects studied and grades received) and **letters of reference**.

All universities charge tuition and students pay extra for **boarding.** Students whose families cannot afford to pay a full amount apply for **allowance**. Many students receive a financial aid package which may be a combination of **grants** from the government, a **scholarship**, a student loan and work-study (a part-time job at a college). The most famous American universities are those in the "Ivy League", including Harvard and Yale, Caltech, Princeton and MIT are among the most renowned centers of education and research.

The US academic year may be divided into two semesters of about 15 weeks or three quarters of about 10 weeks each. Students take courses in a variety of **liberal arts curriculum** regardless of their main subject **(major).** They choose their major at the end of their **sophomore** year and sometimes take a minor which they study for two years. Students' academic progress is assessed in grades, from A to F, F meaning that a student failed the course and will not be given **credit** for it. To check a student's overall progress the university calculates a **grade point average (GPA).** Graduates with the best GPA are awarded **Latin honours**, of which the highest is ***summa cum laude***.

3. Match the words from column A with the synonym and definitions from column B.

A	**B**
1. ***grades*** ***(c)***	**a)** university area
2. "A" level	**b)** certificate of higher education
3. "red-brick" universities	**c)** ***marks***
4. campus	**d)** official list of subjects
5. tuition fees	**e)** food and accommodation
6. degree	**f)** humanities
7. enroll	**g)** advanced level
8. score	**h)** money provided by the government for research projects
9. script	**i)** ranks awarded for proficiency
10. letter of reference	**j)** monthly allowance for students on the basis of their academic progress
11. boarding	
12. allowance	
13. grants	

14. scholarship
15. liberal arts
16. curriculum
17. major
18. sophomore
19. credit
20. grade point average (GPA)
21. Latin honours
22. *summa cum laude*

k) the highest degree at a US university
l) money charged for instruction
m) a pass, recorded acknowledgment of the work of a student in a course
n) appraisal of a former student
o) subjects studied at a university
p) the number of points
q) average academic score for a student in a US high school
r) second-year student
s) financial aid
t) enter
u) Victorian time universities
v) main subject

4. Word Formation: Suffixes of agents /people *–er/or, -cian, -ic, -ist*

People in Science and Technology

Example: astronomy -- astronomer

a) academia –	b) academy –	c) analysis –	d) architecture –
e) biology –	f) botany –	g) education –	h) chemistry –
i) experiment –	j) exploration –	k) design –	l) industry –
m) investigation –	n) lecture –	o) mathematics –	p) mechanics –
q) philosophy –	r) physics –	s) psychology –	t) physiology –
u) research –	v) science –	w) technology –	x) theory –

Word Families

5. Fill in the gaps with the words from the box.

a) **components**	b) **deposits**	c) **disposable**	d) **disposal**	e) **disposed**
f) **exponent**	g) **exposed**	h) **exposure** (x2)	i) **imposes**	j) **opposed** k) **pose**
l) **position**	m) **postpone**	n) **proponents (**x2)	o) **proposed**	p) **supposed**

1-2. Drexler's alternative approach - based on mechanical devices made from rigid materials - fundamentally contradicts any physical laws, but its ____ underestimate the problems that certain features of the nanoworld will ____ for it.
3. Nuclear waste ____ and storage is one of the main problems of the nuclear power industry.

4. Uranium must have emitted radiation of its own accord, as Becquerel had not laid the plate in the sun and it had not been ____.
5. Workers who had experienced ____ to radiation during nuclear plants' disasters might be in the risk of developing cancers for the rest of their lives (which nevertheless can be long).
6-7. Marie Skladovskaya nearly missed out on the Nobel Prize altogether, because many of the judges_____ awarding the prize to a woman and ____ giving it to Pierre.
8. Soon after her husband's death Marie Skladovskaya was offered his ____ as professor of physics at the Sorbonne.
9-10. ____ syringes and nappies that are designed to be ____ of after use have greatly facilitated child-and healthcare.
11-12. Work with radioactive materials ____ a lot of restrictions and safety measures.
However, in the early years of radiation, research physicists were ignorant of adverse effects of long ____ to radioactivity.
13. Scientific findings are ____ to be rectifiable, verifiable, replica table and free available to other researchers.
14. Recently Russian geologists have discovered vast oil ____ in permafrost beyond the Polar Circle.
15. Tycho Brahe who was the most notable ____ of the naked eye astronomy was the opponent of Copernican heliocentric system.
16. The basic ____ of the computer hardware tend to get increasingly small.

Confusables

6. Correct the mistakes.

1. There are both theoretical and practical subjects on our schedule.
2. I have lost my credit book and I have a problem with the director's office.
3. In four years we will have practice and then we will write our diplomas.
4. Academic Alferov is to give a lecture at our department next week.
5. In five years we will be rewarded Magistrates' degrees.
6. After I finish university in five years I plan to be an aspirant.
7. After the university I would like to enter a scientific research institute.
8. My brother works as a junior research collaborator.
9. My scientific councilor is Mr. Petrov. He is a candidate of technical sciences.
10. The thesis of my report for the conference is too long.

7. Choose the correct word

1. Students who have poor **attendance/attention** may be summoned to the deputy dean.
2. At the end of the term we usually **take/pass** five exams.
3. The **theme/subject** of today's lecture is very important.
4. My **purpose/ambition** is to work at the Polytechnic University.
5. The institute was **funded/founded** in 1899 by some prominent Russian scientists.
6. The standards of university **education/allowance** have been raised recently.
7. When J. Bell discovered pulsars she was a 24-year-old **PhD/R&D** student at Cambridge.
8. I am a first **course/year** student.

9. Every student is to have **internship/ practice** after the fourth year.
10. I got good **marks/grades** at my final exams.

Translator's False Friends

8. Choose the suitable word.

University and Education

1. In 1867 Mendeleyev was made a professor of general chemistry at St. Petersburg University – the **institution/institute** that had rejected him 17 years before.
2. At the age of 20, Copernicus went to the University of Krakow to study the **liberal/human** arts, including astrology and astronomy.
3. Plank returned to Munich and obtained his **doctoral/candidate** degree in 1879 at the age of 21 with the thesis on the second law of thermodynamics.
4. Mm Curie's membership issue caused a stir in the press and in high society, and the academy meeting was attended by 162 **academics/academicians**, about twice the usual number.
5. A wet plate in Becquerel's hands was one of the proofs that nature did not behave at all in the way in which **physicians/physicists** had worked out in minute detail.
6. A common thread through Lavoisier's life was his interest in public works, and when he was admitted to the **academy /academia** at the young age of 23, it was partly for a brilliant paper of the way to light the streets of Paris.
7. As a pure **mathematician/mathematics** Newton reached his climax in the invention of the calculus, an invention also made independently by Leibniz.
8. Bohr's **academic/academician** promise was evident early in his life.
9. In 1905, a paper was published in a German scientific **journal/magazine**, describing the Special Theory of Relativity.
10. The university provides training in many branches of **physics/physique.**

Phrasal Verbs

9. Fill in the correct preposition.

after	**aside**	**back**	**for**	**down** (x2)	**up** (x3)	**on**	**out**

1. The falling cost of disk meant that system administrators could **set** _____ storage to host repositories that could be accessed globally.
2. Lord Kelvin was a prime mover in the **laying** _____ of the first trans-Atlantic submarine cable.
3. The eighteenth century represented a **catching** _____, as science in general came to terms with the way Newton had codified physics and demonstrated the lawful, orderly nature of the Universe.
4. In 1616, 73 years after its first publication, the cardinals banned *De Revolutionbus*, summoned Galileo to Rome and forbade him to talk about Copernicanism. Galileo persisted, and in the end the cardinals had to threaten him with torture to **shut** him _____.

5. Yet neither the electric motor nor the principle of electric induction is perhaps Faraday's greatest achievements. He **went** _____ to demonstrate the ultimate unity between all forces, including electricity, magnetism, light and even gravity, and to develop the idea of fields of force.
6. Armies of thinkers have been defeated by the enigma of why most fundamental laws of nature can be **written** _____ so conveniently as equations.
7. Newlands was so disheartened by his reception by chemical community that he **gave** _____ the idea and retired from chemistry for good.
8. After Leonardo's death his young companion, Francesco Melzi, was grief- stricken and stayed in the house for months before finally packing up all belongings, including 13,000 priceless pages of his notes, and **heading** _____ Italy. There after Melzi's death the notes were left to his son Orazio **to look** _____.
9. The idea that alcohol destroys brain cells **dates** _____ **to** the temperance campaigners of the early nineteenth century, who wanted all alcoholic drinks banned. It has no basis in scientific fact.
10. The fossil originally misidentified as an ancient fish **turned** _____ to be the nearly intact remains of a four-limbed creature that lived during a period that left few fossils of land animals.

Linking Words: Cause /Effect

10. Fill in the gaps with suitable words.

a) **as** (x2)	b) **because**	c) **because of** (x2)	d) **for** (x2)	
e) **since**	f) **so** (x3)	g) **so that**	h) **therefore**	i) **thus**

1. The Nobel Prize awarding ceremonies (white ties and tails, of course, tuxedoes are so *declasses*) are occasions for ladies to show off their finery. And they had better. _____ the television broadcast includes the fashion commentary, and woe betide the lady, whose *couture* is not haute enough.
2. What Copernicus thought about the publication of his famous book no one quite knows, _____ **(2)** he died of a stroke shortly after publication of the new book in 1543.
3-4. Becquerel took a plate, wrapped it up _____ light could not get to it, and fixed the uranium crystal on it. Then he put a small metal plate shaped as a cross between the photographic plate and the crystal. He opened the shutters of his laboratory windows. There was sun, but fog. _____ he pushed the plate with the crystal into a drawer.
5. Some scientists think that equations underlying the workings of the universe are in some sense "out there", independent of human existence, _____ scientists are cosmic archeologists, trying to unearth laws that have lain hidden _____ time began.
6. _____ lifespan increases, _____ will our expectations. In another ten years people might think it normal for a woman of fifty to be having her first child.
7. For a time The Royal Society was almost the only institution to actively promote the young science of chemistry, and that was almost entirely_____ the brilliant young man Humphry Davy.
8. Sophie Germain (1776-1831) who worked under the name of M. Leblanc _____ **(10)** prejudice against women mathematicians made the first significant breakthrough in the 19th century, proving a theorem which went a long way towards solving Fermat's last theorem.

9. _____ a woman, Mari Curie was barred from higher education in her native Poland, and _____ she planned to go to the Sorbonne in Paris.
10. Irene Joliot-Curie (1897-1956) shared the Nobel Prize for Chemistry for their discovery of artificial radioactivity with her husband Jean Frederick Joliot. Both also played a major role in the formation of the French atomic energy commission but _____ their communism, were removed from positions of responsibility.

Grammar: Reported Speech

11. Use Sequence of Tenses where it is necessary.

1. Lavoisier also showed that air has a mass and _____ **(may be)** a mixture of gasses (oxygen and nitrogen, which he called azote). He showered that water _____ **(be)** a compound of two gases. He also proved that the phlogiston idea of burning, which dominated at that time _____ **(be)** and gave us modern theory of combustion.
2. According to alchemists, metals _____ **(consist)** of elements earth and fire. It must consequently have been possible in a metal such as copper to alter the proportion between the earth and fire, so that gold would be formed.
3. The debate between alchemists and chemists became centered on phlogiston theory, which said that anything burnable _____ **(contain)** a special active substance called phlogiston that _____ **(dissolve)** into the air when burned.
4. Crucially, Lavoisier suggested that each of these 'chemical elements _____ **(have)** its own unique characteristics and that each could exist as a solid, liquid or gas. Boyle even suggested that matter might consist of atoms after all.
5. Dalton suggested that all the atoms of an element _____ **(be)** identical – different from every other element. He also argued that compounds _____ **(be formed)** by the joining of an atom of one element with an atom of another. Although theories of elements and compounds have developed since Dalton's time, the essentials of his ideas are all still there.
6. In 1980 the psychologist William James proposed a Darwinian model of thought origination. "New conceptions, emotions, and active tendencies which _____ **(evolve)**," he wrote, "_____ **(be)** originally produced in the shape of random images, fancies, accidental outbursts of spontaneous variation in the functional activity of the excessively unstable human brain."
7. Thomas Alva Edison one of the great inventors of all time and holder of more than 1000 patents wrote: "It _____ **(be)** apparent to me that the possibilities of the aeroplane _____ **(exhaust)**.
8. Addressing *Niagara Falls Power Company* Lord Kelvin wrote: "_____ **(Trust)** you will avoid the gigantic mistake of alternating current".
9. The Greek philosopher Aristotle whose writings influenced European thought for many centuries said: "The heavier a stone _____ **(be)**, the faster it _____ **(fall)**".
10. Isaac Newton stated: "Light _____ **(travel)** through water faster than through empty space."

12. Fill in the gaps using verbs of reporting.

a) **argued**	b) **challenged**	c) **concluded**	d) **deny**	e) **denying**
f) **discussed**	g) **explained**	h) **muttered**	i) **remarked**	j) **urged** (x2)

1. After doing calculations Rutherford _____ that the atom's nucleus is about 8000 times smaller than the entire atom
2. This appeared to be an inexplicable result, for radium had a smaller nucleus than uranium and Lise Meitner _____ Hahn to make absolutely sure he had got it right before publishing such an unaccountable anomaly.
3. In science, Descartes, _____ the possibility of vacuum, _____ everything in terms of motion in a plenum of particles whose sole property was extension.
4. Goethe did not care for the world *motor,* and was even more incensed by the Latin-Greek hybrid, *automotor* (an early form, perhaps, of automobile). They should be replaced, he _____, by *kion* and *autokion*.
5. An Oxford historian was supposed to have _____ when television arrived that no good would ever come of an invention the name of which was half Latin and half Greek.
6. Galeleo was forced by the papal authorities to _____ – may be under the threat of torture – that the Earth moves around the Sun, and was sent away to be imprisoned in his own house for the rest of his life. Legend has it that as he was led away, he _____ '*eppir si muove*'.
7. At one point in the debate, Wilbeforce _____ Huxley to say whether it was on his grandfather's or grandmother's side that he descended from an ape. But this cheap jibe cost Wilbeforce victory. Turning it neatly round, Huxley_____ persuasively and seriously enough to carry the day.
8. When he passed his school-leaving exams in July 1874, aged 16, Max Plank still had no clear idea of what he wanted to do with his life. The three options seemed to be music, mathematics and physics. He _____ the possibility of a musical career with a musician who told him that if he needed to ask the question, he'd better do something else.

13. Ann went for a job interview last week. Report HR manager's questions.

1. When did you graduate?
2. What university did you graduate from?
3. What was your previous employment?
4. What were your responsibilities there?
5. Why did you leave your previous employment?
6. Are you familiar with CAD/CAM?
7. What salary do you expect to receive?
8. Can you speak French?
9. Would you be willing to move to Morocco?
10. May I see your references?

14. Use verbs of reporting in the indirect speech.

a) ***apologized***	b) ***admitted***	c) ***agreed***	d) ***approved***	e) ***congratulated***
f) ***denied***	g) ***insisted***	h) ***permitted***	i) ***warned***	j) ***wished***

1. Happy birthday!
2. Congratulations on passing the exam!
3. Sorry. I was late.
4. Yes, I was wrong.
5. No, I didn't do that.
6. Of course, I will pick you up.
7. Yes, you may use my car.
8. You should not rely on them.
9. I will pay. Don't worry.
10. It's a good idea to invite them.

15. Transfer the following sentences into the indirect speech. Use Sequence of Tenses, where it is necessary.

Quotations

Example: I am strongly opposed to Charles going on this *Beagle* voyage. He is moving away from the Church, drifting irretrievably into a life of sport and idleness.

Robert Waring Darwin (1766-1848), Charles Darwin's father

Charles Darwin's father was strongly opposed to Charles going on this *Beagle* voyage. He thought that Charles was moving away from the Church, drifting irretrievably into a life of sport and idleness.

1. There is not the slightest indication that energy will ever be obtainable from the atom.

Albert Einstein (1879-1952)

2. I can accept the theory of relativity as little as I can accept the existence of atoms.

Ernst Mach (1838-19 Ui). Austrian physicist after whom Mach numbers are named.

3. 1858 has not, indeed, been marked by any of those discoveries which at once revolutionize, so to speak, the department of science in which they occur.

Thomas Bell (1792-1880), President of the Linnean Society, speaking of the year in which Darwin read his papers on the origin of species to the society.

4. All this talk about space travel is utter bilge, really. Richard Wooley, *British Astronomer Royal, 1956 (five years before Yuri Gagarin made the first space trip).*

5. I doubt whether Darwin will have the determination to survive a difficult journey of several years. My studies of physiognomy indicate that people with a broad, squat nose like his don't have the character. *Robert Fitzroy (1805-65), Captain of the* Beagle *and Governor of New Zealand*

6. The ape is a degraded form that has descended from man. The donkey has descended from the horse. *George de Button (1707-88), the greatest naturalist of his day and author of a 44-volume account of natural science*

7. Benjamin Franklin's lightning conductor is a sacrilege that tries to avert the wrath of God. The destruction of Lisbon by the earthquake and tidal wave is God's punishment of man for this sacrilege. *From a sermon by a Boston minister in 175*

8. In animals, there is a gap between species which Nature cannot bridge. The Creator has dictated simple but beautiful laws that impress upon each species its immutable characters.

The French naturalist *George Leclerc Button (1707-88), denying the possibility of evolution*

9. There is an ethereal medium pervading all bodies. The parts of this medium are capable of being set in motion by electric currents and magnets.

James Clerk Maxwell (1831-79), the greatest theoretical physicist of his time, whose equations established the theoretical foundations of electromagnetism.

10. Modem science kills God and takes his place on the vacant throne. Science is the sole legitimate arbiter of all relevant truth. *Vaclav Havel (1936* -2011)

Phonetics

***Choose the correct pronunciation*.**

[g]	**[dg]**	**[gju]**		
1) guinea	**5)** ambiguity	**9)** genius	**13)** gigantic	**17)** prolongation
2) analogy	**6)** ambiguous	**10)** colleague	**14)** gauge	**18)** belongings
3) analogous	**7)** guide	**11)** college	**15)** gear	**19)** longing
4) target	**8)** genie	**12)** giant	**16)** longitude	**20)** huge

Words of Wit and Wisdom

Translate the following quotations.

1. *Anyone who stops learning is old, whether at twenty or eighty. Anyone who keeps learning stays young.*

H. Ford

2. *Everywhere we learn from those whom we love.*

J. W. Goethe

3. *Education, beyond all other devices of human origin, is the great equalizer of the conditions of men – the balance wheel of the social machinery.*

H. Mann

4. *One exclusive sign of thorough knowledge is the power of teaching.*

Aristotle

5. *What we have to learn to do we learn by doing.*

Aristotle

6. *Setting the example is not the main means of influencing another; it is the only means.*

A. Einstein

☺ ☺ ☺ ☺ ☺

- He’s got a BA, a MA and a PhD. The only thing he does not have is a JOB.
- The graduate with a science degree asks, “Why does it work?” The graduate with an Engineering degree asks, “How does it work?” The graduate with an Accounting degree asks, “How much will it cost?” And the graduate with a Liberal arts degree asks, “Do you want fries with that?”
- One of the major embarrassments to which the lecturers are submitted is the audience’s looking at their watches. A famous scientist when asked if he finds this particularly annoying replied: “No, not until they start shaking them.”
- Good teachers cost a lot, but bad teachers cost a lot more.
- Teaching is the fine art of imparting knowledge without possessing it.
- On having been asked for two reasons to choose this profession a young teacher answered: “June and August”.
- I thought about declining standards of young people enrolling in our university when I saw in an application form the line “sign” completed as “Aquarius”.

Unit 6
LANGUAGE OF SCIENCE AND TECHNOLOGY

1. Read and discuss the text. Give headings to the numbered paragraphs.

A. Scientific Vocabulary and Politics
B. Greek and Latin as a Conventional Basis for Scientific Neologisms
C. An anecdote in the Spirit of Time
D. You should stick either to Latin or to Greek

The Language of Science

1. _____ Science has generated its own vocabulary, loosely rooted in the classical languages. But neologisms today are less scrupulously coined than in the era when the ancient languages were universally taught. J.Barzun, the American scholar, has recalled the lament of a university president, deploring the introduction of the Bachelor's degree: it would not, he said, ensure that the students knew science, but it would certainly ensure that they knew no Latin. Mixed derivations, in those more learned days, were an anathema. An Oxford historian was supposed to have remarked when television arrived that no good would ever come of an invention the name of which was half Latin and half in Greek.

2. _____ In the old age Johann Wolfgang von Goethe (1749-1832), who wrote and theorized widely about science, and is now remembered for his elaborate, but incorrect theory of color vision, was reported to have had the following illuminating exchange with his disciple, Johann Peter Eckermann: the latter related to his master one day that he had been present at the demonstration of a remarkable new invention. It was a steam carriage, or automobile, which could propel itself without horses. Goethe pondered long over this remarkable apparition, and presently summoned Eckermann again. It was surely, he pronounced, Eckermann's little joke, for if such contrivance had been ever invented it could not have been given so grotesque a name: it would have been called an autokineticon, or otherwise perhaps an ipsomobile.

3. _____ An echo of these purist scruples found its way into the columns of *Nature* 70 years after Goethe's death, when one sir Courtney Boyle was reported to have deplored in an article in Macmillan magazine that barbarous usages had crept into the language; he did not care for the world *motor,* and was even more incensed by the Latin-Greek hybrid, *automotor* (an early form, perhaps, of automobile). They should be replaced, he urged by *kion* and *autokion*.

4. _____ There have been occasional assaults on scientific vocabulary from altogether less fastidious motives than respect for the classical niceties.

German nationalism, for instance, spawned a movement to expunge all but Germanic stems from the language. And so a telephone became a Fernsprecher, and during the Third Reich there was a movement to construct a wholly Teutonic vocabulary for the physical sciences. This included such risible compounds as a Haarroehrchenkraft, or hair-tubule-power, for capillarity, Verschlukung –engulfment or swallowing – for absorption; and so on. Chemistry itself was to be Scheidekunst, or separation-craft. The biologists of the time also brought forward their own abortions – Umweltlehre, or whole-world teaching, for ecology; and many more. As may be supposed, they found little favor even in the inflamed humor of the time and place.

2. Fill in the gaps using the words in the box.
Scientific Word Building

a) **affixation**	b) **affixes**	c) **combinations**	d) **complex**	e) **compound**
f) **derived**	g) **meaningful**	h) **permissible**	i) **simple**	j) **terms**

Words in science as in other branches of human knowledge are either simple e.g. *carry* or *cold* or (1) ____. Complex words are either composite or **(2)** ____. A complex word is formed from a simple word with one or more **(3)** ____, e.g. *crystallize*, *superconductivity*. Compound words are either **(4)** ____ words joined together, e.g. *test tube*, or they are formed from one, two or more **(5)** ____ segments that do not themselves exist as simple words. These segments are mainly **(6)** ____ from Greek or Latin words. They are used in certain **(7)** ____ for special science terms. The knowledge of these segments is useful to understand the meaning of
(**8)** ____, but they can't be normally used to build a new word as only certain combinations are **(9)** ____. Composite words undergo **(10)** ____ to convey new meanings.

3. Choose the correct word.

Definition, classification, description

Nearly half the mail that authors of scientific journals ____ **(1)** has to do, not with something they wrote, but with something the correspondent thinks they wrote, so strong is our tendency to read our own thoughts on the printed page.

In this respect ____ **(2)** are essential for science as scientifically speaking, *to define* means *to state*, in known terms, a clear ____ **(3)** or a concept or the limits of a concept, or to give a new ____ **(4)** of a specific term, which allows the members of the scientific group to discuss the concept without misunderstanding. Definitions, together with classifications and descriptions can be____ (**5)** to as basic types of statements in science.

Mathematicians are fond of saying that mathematics is the key to it all. "God is a mathematician," ____ (**6)** the mathematician Gottfried Wilhelm von Leibniz. But while it is unquestionably true that mathematics works, it ____ (**7)** a mystery just why this should be so. ____ (**8)** is the curious fact that rules of number developed here on Earth – in the work of ancient Egyptian rope-stretchers surveying the Nile, and those of college professors today who use computers to ____ (**9)** theorems beyond the reach of human calculation – should also enable us to generate nuclear power and calculate the mass of the Magellanic Clouds. As the Hungarian mathematician Eugene Paul Wigner wrote, "The miracle of the appropriateness of the language of mathematics for the formulation of the laws of physics is a wonderful gift, which we neither understand nor ____ (**10)**."

1. a) deceive	b) conceive	c) perceive	d) receive
2. a) definitions	b) determination	c) identification	d) specification
3. a) ascription	b) description	c) prescription	d) subscription
4. a) concept	b) conception	c) deception	d) perception
5 a) conferred	b) inferred	c) preferred	d) referred
6. a) explained	b) declared	c) proclaimed	d) exclaimed
7. a) reminds	b) retains	c) retains	d) remains
8. a) Unobvious	b) Inexplicable	c) Unacceptable	d) Unperceivable

9. a) disprove b) approve c) improve d) prove
10. a) serve b) preserve c) reserve d) deserve

4. *Find the English words corresponding to the given Greek elements.*

Example: 1- e)- (2) (chron time chronological)

1. *chron*	**a)** earth	(1) prognosis
2. chrom	**b)** speech	(2) ***chronological***
3. gnos	**c)** heat	(3) biology
4. log	**d)** know	(4) hydrothermal
5. geo	**e) *time***	(5) monochromatic
6. therm.	**f)** colour	(6) geologist
7. loc	**g)** write	(7) amorphous
8. gram, graph	**h)** poison	(8) location
9. morph	**i)** far	(9) television
10. phil	**j)** place	(10) grammar
11. tele	**k)** shape	(11) toxin
12. tox	**l)** love	(12) philology

5. Find the English words corresponding to the given Greek and Latin elements.

Example: 9. n (Euphoria – a feeling of extreme well-being)

1. Antecedent	a) a review of things that have already occurred
2. Decelerate	b) pretending to have qualities that one does not possess
3. Retrospect	c) a combining of diverse elements into one entity
4. Hypocritical	d) a clever and deceitful double-dealing
5. Synthesis	e) to slow down
6. Duplicity	f) involving two sides, parties or opinions
7. Bilateral	g) occurring or existing prior to something else
8. Antagonistic	h) a-yet-to-be-proved assumption
9. ***Euphoria***	i) senseless or absurd
10. Hyperactive	j) a choice between two equally bad or good alternatives
11. Irrational	k) actively in opposition to
12. Dilemma	l) an area of study that is questionably scientific
13. Pseudoscience	m) unable to remain stationary
14. Hypothesis	n) ***a feeling of extreme well-being***

6. Find the English words corresponding to the given Latin elements.

Example: 2 d) (4) (labor – work – elaborate)

1. doc	a) law	(1) interrupt
2. ***labor***	b) break	(2) conscience
3. leg	c) teach	(3) construction
4. rupt	d) ***work***	(4) ***elaborate***

5. sci	e) empty	(5) doctrine
6. struct	f) know	(6) evacuate
7. vac	g) build	(7) illegitimate
8. medi	h) carry	(8) effortlessly
9. liber	i) strong	(9) submit
10. port	j) middle	(10) intermediate
11. fort	k) give	(11) transport
12. mit	l) free	(12) immobilize
13. mob	m) move	(13) liberalize

7. Translate the following sentences.

1. Many bird species including flamingoes and swans are monogamous.

2. "Cavemen" isn't a good description of Stone Age or Paleolithic people, as they didn't use caves as permanent dwelling-places.

3. Bananas are extremely susceptible to disease. Many species have already succumbed to fungal infections which are resistant to fungicides. Unless a genetically modified (GM) version can be developed soon, all bananas may become extinct.

4. Most bananas come from hot countries, but Europe's largest producer is Iceland. The bananas are grown in large greenhouses heated by geothermal water, just two degrees below the Arctic Circle.

5. *Fyffe's,* the banana multinational that buys the entire crop Belize banana each year, is Irish.

6. Some breeds of carrot contain a protein that stops ice crystals growing. This natural carrot 'anti-freeze' can be extracted and used to preserve body tissues for medical use and improve the shelf-life of frozen food.

7. In medieval heraldry, the panther was portrayed as a gentle, multicoloured beast that had a very sweet smell.

8. Wegener suggested that, originally, there had been only one landmass - which he called 'Pangaea' (literally 'all-mother earth') surrounded by a single large ocean 'Pantalassa'.

9. Now we have reached this stage of extraordinary sophistication in cosmology, yet we can't congratulate ourselves that we have explained the origin of the universe.

10. At the time, and for a long time afterwards, there was a general belief among scientists in what they called a Vital principle' that made the difference between inanimate and animate matter. If the *vis vitalis* (vital force) was present the thing was living; if it was absent, the thing was dead.

Word Families

8. Fill in the gaps with the words from the box.

a) **assume**	b) **assumed**	c) **assumption**	d) **consume**	e) **consumer**
f) **consuming**	g) **consumption**	h) **presumably**	i) **presumption**	j) **resumed**

1. It might be refreshing to **____** a similar attitude towards science and religion – to let them go their separate ways, rather than to bring them together under the roof of single, monolithic structure.

2. A lot of spin-offs in space research resulted in new _____ products.

3. Gene modified foods that are____ safe cause a lot of discussion in mass media.

4. Guinea pigs, or cavies, are almost never used for vivisection these days, but Peruvians _____ an estimated 65 million of them each year. They are also eaten in Colombia, Bolivia and Ecuador.
5. In scientific studies _____, reasoning and estimations are normally complemented by evidence from controlled experiments..
6. Three Rs of the green technology and waste management include reduction of all types of_____.
7. The_____ of innocence implies that a person is not considered guilty unless proved to be so.
8. Back when computers first came on the scene, scientists and sci-fi writers alike_____ that they would soon be put to work as the electronic brains of household robots. It did not work out that way.
9-10. Challenger" exploded in midair a few seconds after having been launched, _____ eight members of its crew. The flights much later were _____ with the redesigned engine.

Confusables: Translator's False Friends

9. Translate the following sentences

1. Light was believed to be made up of **minute** particles called corpuscles.
2. Sometime in the summer of 1609, Galileo visited Venice and became intrigued by a novelty called a *perscillium,* made by a **Dutch spectacle** maker.
3. Ada Lovelace wrote a **pamphlet** in Italian about the Analytical Engine developed by Babbage, to which she added extensive explanatory notes.
4. An enzyme works by coming in contact with particular **substances**, combining with it them and changing them.
5. In the cold fission scandal when the scientists attempting to **reproduce** the alleged results asked to be provided with essential details of the experiment, the chemists refused, **citing** the advice of their patent attorney.
6.. Most of the **phenomena** scientists investigate are so complex that even carefully **designed** experiments cannot take into account all possible influences on the results.
7. As a pure mathematician Newton reached his **climax** in the invention of the **calculus**, an invention also made independently by Leibniz.
8. Bacon writing in the first **decades** of the seventeenth century is usually **credited** with proposing the principles of empirical science and the role of experiments.
9. Before and after the war, E. Hubble played a central role in the **design** and **construction** of Mt. Wilson and Palomar Observatories in California.
10. It is not for nothing that in modern English we use the word **'elements'** when we talk about the storm at sea in which 'the *elements* are let loose'.

Phrasal Verbs

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10. Translate the following sentences.

1. We have made a deal with our next door neighbours. We'll stop trying to keep up with them if they stop trying to **keep up with** us.
2. They have recently improved my old neighborhood. They **tore** it **down** and **put up** a slum.
3. Happiness is a **by-product** in the process of making something else. *A.Huxley*
4. There was a smash-and-grab raid in Glasgow. The robbers would have **got away with it** but they went back for the brick.
5. I'll have to do something about my procrastination – just as soon as I can **get round to** it.
6. Never **put off** until tomorrow what you can **put off** for good.
7. Get in, **sit down, shut up and hold on**. *Bumper sticker*
8. Living up to the ideals is like doing everyday work with your Sunday clothes **on**.
9. The greatest problem about old age is the fear that it may **go on** too long.
10. Hard work **pays off** in the future while laziness **pays off** now.

Linking words (Latin)

11. Replace the italized Latin linking words with their equivalents.

a) **against**	b) **and others**	c) **and so on**	d) **for example**	
e) **for this**	f) **in itself**	g) **that is**		

E-publishing *vs.* (1) Paper Publishing

With the advent of the Internet the world of the conventional publishing has been changing. Nowadays e-publishing, ***i.e.*** **(2)** Desk Top Publishing enables an average person to publish his or her own books, **e.g. (3)** travelogues, textbooks, fiction or sci-fi. It can be a single author or a group of people like Jackson, Johnson ***et al*** **(4)**, who join their forces (sometimes without having any contact outside the Internet) to produce a book. To create DTP document the designer begins by selecting the settings of the new document including the page size, margins, font, paragraph size, ***etc*** (**5)**. Images for illustrations can be created ***ad hoc*** **(6)** or downloaded from the Internet. The edited file is taken to the publishers who deal with the publishing process ***per se*** **(7)**.

Grammar: Modality

12. Choose the correct modal verb.

a) **can**	b) **cannot**	c) **could**	d) **had**	e) **may**
f) **must**	g) **need**	h) **needed**	i) **ought**	j) **was**

1. Bacon simply set the scene from his armchair and told scientists how they _____ **to proceed.**
2. Einstein would _____ **to provide** some physical proof before the world would be ready to accept General Relativity.
3. Gauss finally decided for mathematics; the study of languages _____ **to remain** his lifelong hobby.

4. As his mother brought up her three children on her own Pauling _____ **to work** from the age of 13 to help support his family.
5. Scientists in the field of bioengineering _____ **sense** that solutions to major problems, from starvation to crippling birth defects, lie almost within their grasp.
6. About one person in every thousand _____ **have** the complaint diabetes caused by a malfunction in the pancreas gland – the gland producing the enzyme insulin.
7. Mathematics had just entered its modern phase with Descartes' publication of *Analytical Geometry* in 1647, and was still for many years to be of such modest extent that a gifted man _____ reasonably **hope** to do good work in both the pure and applied divisions.
8. With mathematical proofs, Newton showed that this force _____ **be** the same everywhere, and that the pull between two things depends on their mass (the amount of matter in them) and the square of distance between them.
9. After a series ofexperiments – many involving rolling balls down slopes – Galileo realized that force was **not** _____ to keep something moving.
10. Fermat's marvelous work in the theory of numbers and in mathematics generally _____ **be traced** to his schooling.

13. Fill in the table

Adjective	**Negative adjective**	**Noun**	**Negative noun**	**Verb**	**Negative verb**
				manage	fail
able	unable	ability			disable
capable(of)		capability	incapability		
possible	impossible	possibility			
certain	uncertain				
probable	improbable				
necessary					
		obligation			
compelling					

14. **Choose the suitable word.**

1. Zwicky was **able / capable** of startling insights.
2. He used the **possibility / opportunity** to work in the USA.
3. He was **incapable / unable** to provide scientific basis for his insights.
4. There is **opportunity / possibility** that Zwicky was right about cosmic rays.
5. Zwicky was **able / capable** to realize the **possibility / probability** of dark matter.
6. Unfortunately, some of Zwicky's ideas **failed / managed** to attract attention for several decades.
7. Zwicky's **inability / incapability** to get on with his colleagues had negative effect on his career.
8-9. It seems **improbable / impossible** that Oppenheimer did not discuss science with Zwicky as they worked in the same building. Somehow Oppenheimer **failed / managed** to mention it.
10. A very short report was **able / possible** to convey Zwicky's main ideas.

15. Use suffixes -able/-ible *(smth. that can be done) and* ***prefixes un-/in- + suffixes -able/-ible*** *(smth. that cannot be done)* ***to form an adjective.***

Example : *Something that can be predicted is predictable.*

1. Something that can be observed is … .
2. Something that can be recovered is … .
3. Something that can be understood is … .
4. Something that cannot be divided is … .
5. Something that cannot be violated is … .
6. Something that can be compared is … .
7. Something that can be managed is … .
8. Something that can be recycled is … .
9. Something that can be disposed of is … .
10. Something that can be questioned is … .

16. Fill in the gaps with the words from exercise 15.

1. Even the historian Joseph Needham, who admired Chinese achievements in technology, confessed himself puzzled by their failure to make _____ progress in science.
2. Material atoms are the smallest _____ units of chemical compounds;
3. A principle becomes a law if what before could not be observed becomes _____ by the virtue of some advance in experimental technique.
4. Television is the device which has changed a generation of children from an_____ force into immovable objects.
5. Scientists do not worry whether what they find is 'logical' and _____ or 'possible'.
6. For decades Hawking had debated with other scientists over the 'information paradox', the question of whether or not data might be _____ from the black holes.
7. We can break society's laws if we dare, but the laws of physics do not need enforcing, for they are _____
8. Most of household waste is either biodegradable or _____.
9. When you have doubts about something it is _____.
10. The LHC trigger system reduces this flood of data to _____ proportions.

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17. Fill in the gaps with modal verbs.

1. When you put down the good things you _____ have done and leave out the bad things you did do, that's memoirs.
2. I never _____ to be radical when I was young for the fear it would make me conservative when old.
3. You _____ help liking the chairman. If you don't, he fires you.
4. Those who _____, do; those who could but don't, consult.
5. Exercise is bunk. If you are healthy, you _____ it. If you are sick you should not take it.

6. You know you are getting old when you bend down to tie your shoelaces and try to think of other things you _____ do while you are down there.
7. A bargain is something you cannot see at a price you _____ resist.
8. Once women made it public they _____ do things better than men they are forced to do them.
9. The illiterate of the 21th century will be not those who____ read or write but those who cannot learn, unlearn, and relearn. *Alvin Toffler*
10. Who____ to teach must never cease to learn. *John Cotton Dana*

Phonetics

***Choose the correct pronunciation*.**

[ʌ] **[ɔ]** **[u]**

1) thus	2) through	3) routine	4) router	5) rough
6) enough	7) laugh	8) company	9) govern	10) move
11) flood	12) blood	13) woman	14) prove	15) above
16) among	17) thorough	18) cover	19) poverty	20) improve

Words of Wit and Wisdom

1. *Science is nothing more than a trained and organized common sense.* ***T. H. Huxley***
2. *A little nonsense now and then is relished by the wisest men.* ***R. Dahl***
3. *Common sense is not so common.* ***Voltaire***
4. *Good sense is a thing all need, few have, and none think they want.* ***B. Franklin***
5. *Genius is one per inspiration, ninety-nine per cent perspiration.* ***T.A. Edison***
6. *It is not that I am so smart, it is just that I stay with problems longer.* ***A. Einstein***
7. *When a distinguished but elderly scientist states that something is possible, he is almost certainly right. When he states that something is impossible, he is very probably wrong.* ***Arthur C. Clarke***

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- Normally a man is more pleased when he has a good dinner on the table than when his wife can read Greek philosophers in the original.
- Winston Churchill is supposed to have said that every person has the right to pronounce foreign words as he likes.
- It is not a trivial matter that science came to use legal terminology to describe regularities in nature. “I am arresting you for breaking the laws of physics. “, says the policeman to the levitating man in a cartoon. Like many good jokes, this one reveals the snares that language sets. We can break society’s laws if we dare, but the laws of physics do not need enforcing, for they are inviolable.

Unit 7
MATHEMATICS – THE LANGUAGE OF SCIENCE

1. Read and discuss the text. Say if the following statements are true (T) or false (F). Choose the correct adverb for your rendering.

1. In all modern science the discovered laws are written in the form of mathematical formulae.
2. Physicists believe that there is an equation underlying every fundamental law of nature.
3. Equations are part of every modern science.
4. Physics heavily relies on equations as its tool.
5. Physicists try to reduce complex things to their simple underlying structures.
6. The importance of equations varies in different sciences.

Equations in Science

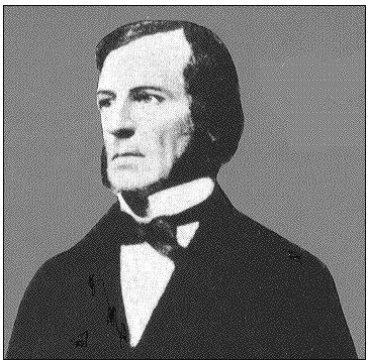
The idea that science advances **basically/fundamentally** (1) through a combination of experiment and mathematically based theory is **relatively/irrelevantly** (2) new. Science became more mathematical since Galileo's time. Equations are now a **hugely/largely** (3) important scientific tool and it is **virtually/invariably** (4) an a article of faith for most theoreticians – **certainly/likely** (5) for most physicists – that there exists a fundamental equation to describe the phenomenon they are studying or that someone some day will find a suitable equation. Yet, as Feynman was fond of speculating, it may **eventually/evenly** (6) turn out that fundamental laws of nature do not need to be stated **mathematically/numerically** (7) and that they are **better/bitterly** (8) expressed in other ways, like the rules governing a game of chess.

Since Galileo's time, physicists have flourished **mainly/entirely** (9) by keeping things simple, by breaking down the complexities of the everyday world into their simplest component parts. Such reductionism is not always an option for biologists, whose subject is the **absolutely/extremely** (10) complicated living world, with its interrelated communities of organisms, every one of which has **a very/the very** (11) complex structure in molecular terms.

And let us not forget that the unifying theory of biology is, **sufficiently/superficially** (12) at least, non-mathematical – *The Origin of Species*, Darwin's account of his theory of evolution by natural selection, does not contain a single equation. The same is true for geologists' theory of continental drift by Alfred Wegener, whose early papers (published soon after World War I) were **practically/feasibly** (13) an equation-free zone.

Mathematical equations are not the only type of equations used by scientists. Chemists, for example, use equations that are not written **solely/uniquely** (14) in terms of mathematical symbols but in terms of letters representing atoms, molecules and their subatomic relatives. A huge amount of industrial activity is based on chemical equations like this, each one describing an interaction whose details can be inferred but **practically/obviously** (15) never observed with a naked eye.

2. Fill in the gaps with the expressions from the box.



a) colossal superstructure
b) fundamental laws
c) human mind
d) mathematical doctrine
e) mathematical logic
f) pioneering work
g) probable suggestions

In 1854 George Boole wrote in his **(1)** _____ on algebra known as Boolean algebra, ' The design of this treatise is to investigate the **(2)**_____ those operations of mind by which reasoning is performed; to give expressions to them in the language of a Calculus, and upon this foundation to establish the science of logic and construct its method; to make that method itself the basis of a general method for application of the **(3)** _____ of probabilities; and, finally, to collect from the various elements of truth brought to the view in the course of these investigations some **(4)** _____ concerning the nature and constitution of the **(5)** _____'.

This programme was carried out in detail in his famous book. Boole reduced logic to an extremely easy and simple type of algebra. Thus logic itself was brought under the control of mathematics.

Since Boole's groundbreaking work his great invention has been improved, generalized, and extended in many directions. Today symbolic or **(6)** _____is indispensable in any serious attempt to understand the nature of mathematics and the state of its foundations on which the whole **(7)** _____ rests.

Mathematicians are fond of saying that mathematics is the key to it all. "God is a mathematician," declared the mathematician Gottfried Wilhelm von Leibniz. But while it is unquestionably true that mathematics works, it remains a mystery just why this should be so.

3. Fill in the gaps with the words from the box.

Complexity and Scientific Laws

a) **arbitrarily** b) **back** c) **complicated**
d) **conversely** e) **distinguish** f) **lawless** g) **measuring**
h) **notions** i) **otherwise** j) **random**

Modern research based on _____ **(1)** information shows that some mathematical facts cannot be compressed into theory because they are too _____ **(2)**. The relationship between complexity and scientific laws goes _____ **(3)** to the 17th century when G.W. Leibniz in his *Discourse on Metaphysics* argued that one could _____ **(4)** between facts that can be described by some laws and those that are _____ **(5)**, irregular facts. Leibniz states that theory has to be simpler than the data it explains, _____ **(6)** it does not describe anything. The concept of a law becomes vacuous if _____ **(7)** high mathematical complexity is permitted, because then one can always construct a law no matter how _____ **(8)** and patternless the data really are. _____ **(9)**, if the only law that

describes some data is an extremely complicated one, then the data are actually lawless. Today the _____ **(10)** of complexity and simplicity are put in precise quantitative terms by a modern branch of mathematics called algorithmic information theory.

4. Fill in the gaps with the words from the box.

I. The Dirac Equation

a) **accurately**	b) **compared**	c) **embody**	d) **known**	e) **minute**	f) **otherwise**
g) **prominent**	h) **physics**	i) **produce**	j) **uniquely**		

In early 1928 Paul Dirac produced a remarkable equation, for ever to be **(1)** _____ as the Dirac equation. Dirac's goal was quite concrete: he wanted to **(2)** _____ an equation that would describe the behavior of electron more **(3)** _____ than previous equations. Several other, more **(4)** _____ and experienced physicists were working at the same problem. Unlike these other physicists, and unlike the great classics of **(5)** _____, Newton and Maxwell Dirac did not proceed from a **(6)** _____ study of experimental facts. Instead, he guided his search using a few basic facts and perceived theoretical imperatives. Dirac sought to **(7)** _____ these principles in an economical, mathematically consistent scheme. By "playing with equations" he hit upon a **(8)** _____ simple, elegant solution. Some consequences of Dirac's equation could be **(9)** _____ with existing experimental observations. They worked quite well and explained results that were **(10)** _____ quite mysterious.

II. The Mollina Equation

a) **awareness**	b) **disciplines**	c) **Environmentally**	d) **equations**	e) **impact**
f) **order**	g) **owe**	h) **Politically**	i) **Scientifically**	j) **vulnerability**

During the awakening of environmental **(1)** _____, a few short lines were published that were to have a profound **(2)** _____ on our understanding of the Earth's environment. These lines were written in symbols of another language. These chemical **(3)** _____ described the destruction of the ozone layer. These lines **(4)** _____ their origin in part to the mood of the times. In turn, they shaped this mood. **(5)** _____, they began the era when people from around the Earth have been forced to negotiate with each other to defend their habitat. **(6)** _____, they have stretched the boundaries of the **(7)** _____, ushered in international research enterprises that mix dozens of approaches in **(8)** _____ to understand the most complex of the natural cycles.

(9) _____, they supplied us with the two symbols: of the Earth's **(10)** _____ under human stewardship and, conversely, of the human potential to avert technological catastrophe.

5. Form a suitable word for every line.

The Enigma of Scientific Laws

Armies of **(1)** ____ have been defeated by the enigma of	**think**
why most **(2)** ____ laws of nature can be written down	**science**
so **(3)** ____ as equations. Nor is it clear why	**convenience**
fundamental laws exist at all. A popular **(4)** ____	**explain**
that God is a **(5)** ____ replaces profound	**mathematics**
questions with a doubly **(6)** ____ proposition.	**verify**
Yet divine design has long been an **(7)** ____	**justify**
of the efficacy of equation in science. Witness the **(8)** ____	**quote**
on the **(9)** ____ bust of America's first	**memory**
professional woman **(10)** ____ Maria Mitchell	**astronomy**

in the Bronx Hall of Fame: "Every formula which expresses
a law of nature is a hymn of praise to God", words written by Mitchell in 1866.

Word Families

6. Fill in the gaps with suitable words.

a) **concluded**	b) **conclusion**	c) **conclusions**	d) **exclusion**	e) **exclusive**
f) **included**	g) **including**	h) **inclusions**	i) **reclusive**	j) **seclusion**

1. Many great scientists ____ Newton, Mendel and Einstein used to be poor students.
2. In 1902, Rutherford and Soddy ____ that radioactivity was a process in which the atoms of one element spontaneously changed into atoms of a different element, also radioactive.
3. 'I think and think for years and years. Ninety-nine times the ____ is false. The hundredth time I am right.' *A. Einstein*
4. What we learned at school years ago – or what we you read just last year – doesn't necessarily correspond to today's scientific ____.
5. The Oxford scholar R.C. Collingwood, who identified religion, history, philosophy, science and esthetic as the five essential but mutually ____ forms of human experience.
6. The Oort cloud of comets that forms the outer reaches of the solar system sends waves of them crashing periodically into planetary space and into planets, the earth ____.
7. Several decades after Chernobyl disaster the plant and animal life in the ____ zone are still heavily contaminated.
8. During the foundry process ____ known as impurities are removed from pig iron in the form of slag.
9. Newton spent several extremely fruitful months in ____ on his mother's farm, the period later known as *annus mirabilis.*
10. Maxwell greatly contributed to the history of physics by revealing that the shy and ____ Cavendish had been decades ahead of his time, particularly in his research.

Confusables

7. Choose the suitable word.

The Magic Mystery of Mathematics

Even more contentious than the provenance of scientific _____ **(1)** is the questions of whether they are _____ **(2)** or discovered. The Indian-American astrophysicist Subramayan Chandrasekhhar probably _____ **(3)** for most great theoreticians when he _____ **(4)** that when he found some new fact or insight, it appeared to him to be something "that had always been there and that I had _____ **(5)** to pick it up". According to this view, the equations that _____ **(6)** the workings of the universe are in the some sense "out there", _____ **(7)** of human existence, so scientists are cosmic archeologists, trying to _____ **(8)** laws that _____ **(9)** hidden since time began. The origin of the laws _____ **(10)** a complete mystery.

1.	**a)** equilibrium	**b)** equivalence	**c)** equality	**d)** equations
2.	**a)** invested	**b)** invented	**c)** invited	**d)** investigated
3.	**a)** spoke	**b**) told	**c)** said	**d)** talked
4.	**a)** remarked	**b)** noted	**c)** noticed	**d)** marked
5.	**a)** accidentally	**b)** chance	**c)** opportunity	**d)** chanced
6.	**a)** underline	**b)** undermine	**c)** underlie	**d)** understand
7.	**a)** irrelevant	**b)** independent	**c)** unrelated	**d)** regardless
8.	**a)** open	**b)** unearth	**c)** reveal	**d)** uncover
9.	**a)** laid	**b)** lied	**c)** have laid	**d)** have lain
10.	**a**) reminds	**b)** remains	**c)** retains	**d)** rests

8. Write a letter to a foreign colleague. Use the following phrasal verbs:

break down	***catch up with***	***carry out***	***check up***	
come up with	***fall behind***	***get round to***	***look forward to***	
pick up	***put off***	***put up***	***set back***	***worn out***

Writing an informal letter

Here is the plan of the letter.

1. apology for the delayed response to his previous letter
2. explanation for the delay
3. problems with the experiment
4. the schedule unfulfilled
5. cancelation of the planned meeting
6. information about the meeting date
7. discovery of a new approach
8. complaint about being tired
9. thanks for the offer to meet at the airport and provide accommodation
10. desire to see the friends soon

Linking words: neither…nor/ either…or/ both…and

9. Translate the following sentences paying attention to the linking words.

1) All things I really like to do are **either** immoral, illegal **or** fattening. *A. Woolcott*
2) It is the goodness of god that in our country we have those three unspeakably precious things: the freedom of speech, the freedom of conscience, and the prudence never to practice **either** of them. *M. Twain*
3) Learned conversation is **either** the affectation of the ignorant **or** the profession of the mentally unemployed. *Oscar Wilde*
4) All science is **either** physics **or** stamp collection. *Lord Rutherford*
5) Science and technology are simply two different responses to the forces of nature and progress in **either** can be the source of progress in the other.
6) Acclaimed as a genius and excoriated as an atheist, Darwin **neither** rested on his authority **nor** permitted himself to react angrily to attacks from the forces of religious fundamentalists. 'We are confessedly ignorant; **nor** do we know how ignorant we are,' he wrote.
7) Significantly, while Einstein's relativity had played a key role in **both** the 'Big Bang' **and** Black Boles theory, the other revolutionary idea, quantum physics, seemed almost to have been sidelined as irrelevant to cosmology.
8) Notable among these was the realization that matter and energy can be viewed as **both** particles **and** waves, even though particles and waves have mutually exclusive properties.
9) The rediscovery of ancient learning certainly provided a launch pad. But it needed something from outside science to propel science into orbit: something **neither** the Greeks, **nor** the Arabs, **nor** the Chinese had. That something was the right technology.
10) Newton and Einstein have much in common: **both** are the greatest scientists ever lived and both experienced an extremely fruitful creative period known as *annus mirabilis.*

Grammar: Participle I/ Participle II

10. Identify whether the words in bold are gerund, participle I/II, adjective, noun or verb.

Franklin's Daring Experiment

In 1752 Franklin conducted a **daring** experiment. By **flying** a kite **fitted** with a metal key into a storm cloud, he discovered that a **lightning** bolt is just a large electric spark. As everyone knows now, it is **caused** by the discharge of static electricity present in every storm cloud. Fortunately, Franklin was cautious enough in **performing** his experiment, whereas the first two men, **trying** to repeat it, were less so, and as the result were **electrocuted.**

Franklin **turned** his discovery into practical application and invented the lightning conductor**,** which was a thick metal wire **running** from the top of the **building** to the ground. If lightning struck the building, the electricity would travel down the wire to the ground, thus not **damaging** the building and the people inside.

This invention **amazed** his contemporaries so much that some priests even blamed **devastating** Lisbon earthquake on Franklin's invention. They said that he had deprived God of his usual means to express his wrath by **lightning**, therefore He had to use earthquakes instead.

11. Choose the suitable participle.

Example: *The lecture was dull and long. It was* ***boring*** *(оценка). I was* ***bored*** *(состояние).*

1. The task is very complicated but interesting. It is **challenging / challenged**.
2. Power supply failed during my experiment. I was **frustrating / frustrated.**
3. I've lost the point and can't follow the explanation. I am **confusing / confused.**
4. The food store falsified the validity dates on some cans. It is **disgusting / disgusted.**
5. I was carried away by this book. I am **fascinating / fascinated.**
6. His habit of speaking so loudly gets on my nerves. It is **irritating / irritated.**
7. John told very funny jokes at the party. I was **amusing / amused.**
8. I can't find the answer and have no clue to this problem. It is **puzzling / puzzled.**
9. We heard a loud explosion in the lab. Everyone was **scaring / scared**.
10. I met my teacher at the night club. It was **embarrassing / embarrassed** for both of us.

12. Complete the dialogue by using a participle with a stronger meaning.

a) **appalling**	b) **exhausted**	c) **fascinating**	d) **frustrated**
e) **infuriating**	f) **mortified**	g) **terrified**	h) **thrilled**

1. − Holidays is something that turns someone who's **tired** …
− … into someone who's _____.

2. − You look **disappointed**.
− Disappointed? I am _____.

3. − The situation is **humiliating**.
− Humiliating? I was _____.

4. − Are you **excited** about the trip?
− Excited? I am _____.

5. − It's an **annoying** habit.
− Annoying? It's_____.

6. − To tell the truth, I am **scared**.
− Scared? I am _____.

7. − It's an **entertaining** book.
− Entertaining? It's _____.

8. − There is nobody so **irritating** than someone with less intelligence and more sense that we have.
− Irritating? It's _____.

13. Match the phrase from column A with the reply from column B.

Example: 1. *I am* ***puzzled*** *by this problem.* ***c)*** *Ask Peter. He is likely to help you.*

A	B
1. *I am* ***puzzled*** *by this problem.*	**a) Amazingly**, I don't feel sleepy.
2. Pr. Brown's lectures are difficult.	**b)** But it is **embarrassing** to call at 1a.m.
3. It is difficult to combine work and study.	**c)** Ask Peter. He is likely to help you.
4. Ann is likely to have notes on Math.	**d)** Yes, his explanations are **confusing**.
5. You are **exhausted** after staying up all night**.**	**f) Thrilled**? I am **scared**!
6. I couldn't help laughing at his jokes.	**e)** I am **surprised** that I manage to cope.
7. I am **thrilled** about the exam.	**g) Shocking**, you mean.
8. The test results are rather **disappointing**.	**h)** Yes, his jokes are always **amusing**.

14. Form Participle I or Participle II.

Looking for a Job

With the rate of unemployment **ever increase** (1), it seems wise to follow some advice **concern** (2) job interviews. Those **seek** (3) job opportunities should check the advertisements for jobs **print** (4) in newspapers. They can also contact state or municipal agencies **deal** (5) with employment. The advent of computers produced many jobs suitable for the **disable** (6) or mothers **have** (7) young children. Many people **work** (8) from home like this flexitime arrangement. The ability to use the computer on an **advance** (9) level may definitely be regarded as an advantage. Candidates with the right qualifications are also **expect** (10) to have certain social skills.

15. Fill in the gaps with the words from the box. Pay attention to their functions.

a) **aged**	b) **depending**	c) **drawings**	d) **embedded**	e) **fossilized**	f) **gathering**
g) **held**	h) **named**	i) **spotting**	j) **unaided**	k) **unrivalled**	l**) untrained**

Mary Anning

In 1812, at Lyme Regis on the Dorset coast, an extraordinary child _____ **(1)** Mary Anning, _____ **(2)** eleven, twelve, or thirteen, _____ **(3)** on whose account you read, found a strange _____ **(4)** sea monster, seventeen feet long and now known as the ichthyosaurus, _____ **(5)** in the steep and dangerous cliffs along the English Channel. It was the start of a remarkable career. Anning would spend the next thirty-five years _____ **(6)** fossils, which she sold to visitors. (She is commonly _____ **(7)** to be the source for the famous tongue twister "She sells seashells on the seashore.") She would also find the first plesiosaurus, another marine monster, and one of the first pterodactyls. It wasn't simply that Anning was good at _____ **(8)** fossils − though she was _____ **(9)** at that − but that she could extract them with the greatest delicacy and without damage. It's hard to appreciate the scale and beauty of what this young woman achieved working virtually _____ **(10)** with the most basic tools in nearly impossible conditions. The plesiosaur alone took her ten years of patient excavation. Although _____ **(11)** Anning was also able to provide competent _____ **(12)** and descriptions for scholars.

16. Replace the clauses in bold with *compound* ***participles.***

Example: *Radiation* ***lasts so long*** *that the papers and clothing of Mme Curie from the 1890s are too dangerous to handle.* → *Radiation* was *so* ***long-lasting*** *that even now…*

1. Visions of nanomachines **that replicate themselves** that could devour the Earth in a "grey goo" are probably wide off the mark, but "radical nanotechnology" could still deliver great benefits to society.
2. Industry has shown extraordinary ingenuity in overcoming seemingly insurmountable barriers already − new ultraviolet light sources and masks **that shift phases** have made feature sizes below 100 nm a commercial reality.
3. Carbon nanotubes, like chrysotile, are the rolled-up version of a mineral **that forms sheets** that itself is not toxic − in this case, graphite.
4. Evolutionary nanotechnology is certainly going to lead to changes **that reach far** in society, which we should get to grips with now.
5. By replacing living parts of the body with artifacts **that are made by man**, are we blurring the line between man and machine?
6-7. Were the world just and **spoke Swedish**, Scheele would have enjoyed universal acclaim. As it is, the plaudits have tended to go to more celebrated chemists, mostly from the world **who speaks English**.
8. In the nineteenth century there was hardly a molecule that was uniformly represented everywhere. Chemists used a bewildering variety of symbols and abbreviations **that were often invented by themselves**.
9-10. Chinese economy that **grows very fast** is based on scientific and technological advances that are both imported and **grown at home**.

Phonetics

Are all the words pronounced with these sounds?

	[u]	**[u:]**	**[ju]**	
1) rheumatism	**2)** duration	**3)** pneumatic	**4)** euphoria	**5)** pneumonia
6) pseudoscience	**7)** fewer	**8)** pharmaceutical	**9)** therapeutic	**10)** routine
11) pure	**12)** poor	**13)** pull	**14)** put	**15)** threw
16) through	**17)** towards	**18)** drawer	**19)** dew	**20)** due

Words of Wit and Wisdom

1. *Mathematics may be defined as a subject in which we never know what we are talking about, nor whether what we are saying is true.* ***B. Russell***

2. *Although this may seem a paradox, all exact science is dominated by the idea of approximation.* ***B. Russell***

3. *Mathematics, rightly viewed, possesses not only truth, but the supreme beauty – a beauty cold and austere, like that of sculpture.* ***B. Russell***

4. *By the help of God and with his precious assistance, I say that algebra is a scientific art.* ***Omar Khayyam***

5. *To avoid tedious repetition of … 'is equal to', I will settle … on a pair of parallels of one length…* ***Robert Recorde***

Unit 8
INVENTION AND DISCOVERY: A NAME IN SCIENCE AND TECHNOLOGY

1. Read and discuss the text. Decide whether the following statements are true or false.

1. *Scientific American* was founded to provide technical help and legal advice to inventors.
2. It reported the hallmarks of science and technology during the Industrial Revolution.
3. Many of the would-be Nobel Prize winners were among its contributors.
4. The journal has a limited edition due to its highly professional nature.
5. *Scientific American* focuses on practical applications of science.

Scientific American

Scientific American, the oldest continuously published magazine in the U.S., has been bringing its readers unique insights about developments in science and technology for more than 170 years. In 1845 Rufus Porter founded the publication as a weekly broadsheet subtitled "The Advocate of Industry and Enterprise, and Journal of Mechanical and Other Improvements." A restless inventor, Porter soon turned to other ventures, and after 10 months sold Scientific American − for the sum of $800 − to Orson Desaix Munn and Alfred Ely Beach.

In an era of rapid innovation *Scientific American* founded the first branch of the U.S. Patent Agency to provide technical help and legal advice to inventors. A Washington, D.C. branch was added in 1859. By 1900 more than 100,000 inventions had been patented thanks to *Scientific American*.

For a century, Munn & Company retained ownership of the journal, which chronicled the major discoveries and inventions of the Industrial Revolution, including the Bessemer steel converter, the telephone and the incandescent lightbulb. Edison presented the prototype of the phonograph for inspection by the editors, and Samuel Morse, father of the telegraph, and Elias Howe, inventor of the sewing machine, were frequent visitors to the offices in downtown New York City.

By 1904 journal had established its hallmark for pinpointing emerging trends before news of them reached the general population. Articles on Marconi's experiments appeared two decades before the advent of radio. With ahead-of-the-curve reporting, *Scientific American* continued to cover groundbreaking events in science and technology. More than 120 Nobel laureates have written for *Scientific American*, most of whom wrote about their prize-winning works years before being recognized by the Nobel Committee. In addition to the likes of Albert Einstein, Francis Crick, Jonas Salk and Linus Pauling, *Scientific American* continues to attract esteemed authors from many fields.

Scientific American is a truly global enterprise. The journal publishes 15 foreign language editions and has a total of more than 1,000,000 copies in circulation worldwide. Scientific American understood early on the importance of the Internet, so in March 1996, it launched its own Web site at www.SciAm.com. *Scientific American* has distinguished itself by looking ahead for more than 150 years. More relevant and topical than ever, it is a powerful tool for forward-thinking readers.

2. Put the paragraphs in the correct order.

Popov, Marconi et al. A Sense of Urgency

Guglielmo Marconi

a) The story of radio begins with James Clerk Maxwell, professor of experimental physics at Cambridge University. In 1864, Maxwell proved mathematically that an electrical disturbance was capable of producing a remote effect by electromagnetic propagation. His calculations, which concluded that these radio waves move at the same speed as visible light, were put to test in 1888 by Heinrich Hertz, a German physicist. However, he said that he did not see any useful purpose for this mysterious, invisible electromagnetic energy.

b) Popov thoroughly enjoyed his research but he did not approach it with a sense of urgency. Marconi, in contrast, was determined to develop wireless telegraph into a profitable technology, lest someone else achieve it first. When an Italian government showed no interest in his apparatus, Marconi set sail for England, where he was granted a patent for "a system of telegraphy using Hertzian waves, dating June 2 1896. From that point on, the future of the early radio belonged to Marconi.

Alexander S. Popov

c) The birth of radio communication came in 1895, when Alexander Stepanovich Popov, a Russian, and Guglielmo Marconi, whose father was an Italian nobleman and his mother Irish, separately sent and received radio signals over distance.

d) Two years after, Edouard Branly, a French scientist, noticed that the electrical resistance of a tube of fine metal particles decreased dramatically when a spark discharged nearby, but the particles had to be shaken loose after each discharge in order to detect the next spark.

e) Both men used similar equipment, including an antenna, and both had studied the work of Hertz. Popov had read Lodge's work in scientific journals, and he further improved the sensitivity of the coherer.

f) Then, in 1892 Oliver Lodge, an English physicist, noticed that when a spark discharged near two barely touching metal spheres, the spheres fused together and current would flow easily through the junction. Lodge called this phenomenon "coherer" and realized that it could be used to detect electromagnetic waves produced by a distant spark discharge.

g) Marconi's experiments became increasingly successful. In 1897, the Wireless Telegraph and Signal Company was formed with Marconi as its major shareholder. A year later, the Italian navy adopted Marconi's wireless, the press used wireless, Queen Victoria communicated with the Prince of Wales on board the Royal yacht, and Lord Kelvin sent the first telegram by wireless.

h) Popov felt no personal resentment towards Marconi. In 1902 when Marconi visited Kronstadt, Popov met him and the two had a cordial discussion. Marconi later received a silver samovar and a sealskin coat from Popov as a wedding present. Popov's work won him a Grand Gold medal at the Paris International Exhibition of 1900. (Marconi's gained him a share of the 1909 Nobel Prize for physics.

i) In 1902, Valdemar Poulse, a Dane, invented the first high-frequency generator without moving parts. By generating continuous waves, it enabled transmitters to be fine tuned and minimized signal disturbance between stations. Radio came of age.

3. Fill the gaps using the word from the box.

a) **ampere**	b) **colt**	c) **daguerreotype**	d) **edison**	e) **mackintosh**
f) **maxim**	g) **ohm**	h) **remington**	i) **sandwich**	j) **watt**

Many trades use the inventor's name. The name typically becomes an adjective, then, ideally, (if not to the maker), the generic noun: a **(1)** _____ gun or a Ford hoover. The last word (say, levis) as here may be used without a capital. About 80 years ago they had already gone the further step into use as verbs. However, you should be careful about some of them; for example, *hooversize* does not mean *to vacuum clean* but *to economise* (after the American president who in 1917-1919 had been America's food administrator). Many such words die with the technology, for example, *victorola* (an old fashioned for *phonograph* is gone). However, you can still take off your **(2)** _____ and be brought a **(3)** _____ like the 18th century earl did, who could thus go on gambling uninterrupted.

Science has honoured its heroes with the names like **(4)** _____ (a unit of electric current), **(5)** _____ (a unit of electric resistance) and **(6**) _____ (power). So when you buy an electric bulb, actually designed by Edison and inquire about its voltage, you may as well wonder why the goods you are buying are not referred to as an **(7)** _____.

Some names that used to commemorate the names of their inventors are no longer used. This happened, for example with **(8)** _____, the original name for the photograph. *Remington* is another case. The gunmaker E. Remington started manufacturing typewriters, **(9)** _____ being at that time the synonym for the device, because his company had spare capacity as following the Civil War there was a catastrophic drop in the demand for guns. The Remington had been one of the most successful guns ever made, rivaled in sale volume only by the **(10)** _____. In his turn Colt had to make revolvers because his mines failed him. This may have been because in 1844, after his mining a ship, he was unwilling to give his secret to the navy, so they did not pay him the money.

4. Fill the gaps using the word from the box.

Serendipity

a) **chemist**	b) **development**	c) **impression**	d) **misheard**
e) **oddest**	f) **property**	g) **referred**	h) **replace**
i) **scientific**	j) **tasted**	k) **technologists**	l) **test**

When you read magazine articles about (**1)** _____ discoveries or technological advances, you can get a false **(2)** _____ of the way scientists and **(3)** _____ work. Of course their research solves problems or leads to the **(4)** _____ of new theories. But it is not all as carefully planned as we might imagine. A lot of the important discoveries were made by chance.

A **(5)** _____ might mix some substances and produce a new substance with unexpected **(6)** _____. Such faculty of making fortunate and unexpected discoveries, **(7)** _____ to as serendipity, is not unusual in the history of science.

The **(8)** _____ manner in which a new sweetener came to light was when Shashkant Phadnis, a foreign research student at King's College in London **(9)** _____ the instructions of his supervisor, professor L. Hough. Hough asked him to **(10)** _____ the substance, but his ear being imperfectly attuned to the language, Phadnis instead **(11)** _____ it. The resulting artificial sweetener, sucralose, as it became known, can **(12)** _____ sucrose at less than one-thousandth of the concentration.

5. Read the text match the units with their definitions

Units Named after Scientists

As the nineteenth century drew to a close, scientists could reflect with satisfaction that they had pinned down most of the mysteries of the physical world: electricity, magnetism, gases, optics, acoustics, kinetics, to name just a few, all had fallen into order before them. They had discovered the X- ray, the cathode ray, the electron, and radioactivity, invented the ohm, the watt, the Kelvin, the joule, the amp, and the little erg.

If a thing could be oscillated, accelerated, distilled, combined, weighed, scientists had done it, and in the process produced a body of universal laws so weighty and majestic that we still tend to write them out in capitals: the Electromagnetic Field Theory of Light, Richter's Law of Reciprocal Proportions, Charles's Law of Gases, the Law of Combining Volumes, the Valence Concept, the Laws of Mass Actions, and others beyond counting. The whole world clanged and chuffed with the machinery and instruments that their ingenuity had produced. Many wise people believed that there was nothing much left for science to do.

1. Ampere **(A)**	**a)** a unit of force
2. Becquerel (Bq)	**b)** a unit of pressure, stress
3. Coulobm (C)	**c)** a unit of frequency
4. Farad (F)	**d)** unit of energy, work, quantity of heat
5. Joul (J)	**e)** a unit of electric capacitance
6. Herzt (Hz)	**f)** a unit of electric charge, quantity of electricity
7. Kelvin (K)	**g)** unit of power
8. Newton (N)	**h)** a unit of electrical current
9. Pascal (Pa)	**i)** a unit of activity of a radionuclide
10. Watt (W)	**j)** unit of thermodynamic temperature

6. Fill in the gaps with the words from the box.

I.

a) **architecture**	b) **cycle**	c) **effect**	d) **machine**
e) **modulus**	f) **pendulum**	g) **screw**	h) **test**

- One of Archimedes' inventions a special kind of the water pump also known as **Archimedes _____ (1)** is still used today.
- Interference of light was discovered by Thomas Young (1773-1829), a British linguist, physician and physicist. His most significant achievement was to resurrect the wave theory of light which had been occulted by Newton's particle theory. He also suggested the eye responded to mixture of primary three colours and proposed modulus of elasticity known as **Young's _____ (2)**.
- Thermodynamics as a branch of physics was proposed by Sadi Carnot. **Carnot _____ (3)** postulates that the efficiency of a heat engine does not depend on its mode of operation but only of the temperature at which it accepts and discards heat energy.

Thomas Young

- The rotation of Earth was demonstrated by Jean Foucault. The **Foucault _____ (4)** used to be fixed on top of the tallest St. Petersburg's cathedral – St. Isaac's as the replication of the famous experiment.
- Christian Doppler (1803-1853) (Austria) enunciated the so-called "**Doppler _____ (5)"**, which explains frequency variations observed when a vibrating source of waves approach or recede from one another. Nowadays it is used in routine medical examination.
- **Turing _____ (6)** is a virtual computer that can perform all possible operations. **Turing _____ (7)** is test to see whether a human being can realize that he is talking with a computer after a five minutes' talk.
- Newman realized that computer programs could be stored in memory instead of being fed in every time the computer was switched on. This development became known as "**von Newman _____ (8)**" or the "stored-program".

Christian Doppler

II. Fill in the gaps with the words from the box.

Cat	**Dog**	**Demon**	**Goldilocks**

- Ivan Pavlov (1849-1936), Russian physiologist, (the 1904 Nobel Prize winner) is best known for his work on the conditioned reflex. Regularly, over long periods, hearing a bell just to feed dogs, and found eventually they produced saliva on hearing the bell, even when there was no food forthcoming. In modern English **Pavlov's _____ (9)** is used to describe a person doing something out of habit**.**
- The "**_____ zone (10)**" is a term that refers to the habitable zone which is the region surrounding a star in which an orbiting planet could maintain liquid water. It would be not too hot or cold. It would be "just right".

- **Maxwell' s _____ (11**) is an imaginary creature to whom he assigned the task of opening a door in a partition dividing a volume containing gas at a uniform temperature. This enabled molecules to move, say, from left to right, making one part of the gas volume hotter than the other.
- **Schrödinger's _____ (12)** is an imaginary character placed in a dark chamber. The outside observers wondering whether it is dead or alive cannot prove either.

7. Use the italicized proper name to form a suitable adjective.

- *Tycho Brahe* (1546-1601) was a Danish astronomer, the greatest exponent of naked eye positional astronomy. Brahe is remembered for the **_____ (1) system**, in which planets circled the sun, which in turn cycled the stationary earth.
- **_____ coordinates (2)** is the most commonly used system of rectangular coordinates employed in analytical geometry. The term is used after *Rene Descartes* (1596-1650), a French mathematician, physicist and philosopher.
- *Alexandro Volta* invented the source of direct electricity known as the **_____ pile (3)**.
- **_____ movement (4)** resulting from vibrations was observed by *Robert Brown*.
- *George Boole* (1815-1864) was a British mathematician and logician, chiefly remembered for devising **_____ (5) algebra,** which allowed mathematical methods to be applied to nonquantifiable entities such as logical propositions. In the 20th century it became important in the design of telecommunications systems and logic circuits, and hence in computer technology.
- The existence of radio waves was predicted by *Heinrich Hertz* in 1887. The research of **_____ waves (6)** by other scientists culminated in invention of the modern radio.

8. Who of the following scientists defined these notions or described the phenomena and coined the corresponding words?

Coining and Naming

a) **Curie** b) **Fourier** c) **Lavoisier**
d) **Leibnitz** e) **Bodestein**

- Secrecy caused Newton great problems; it took him 30 years to publish his work on calculus, for instance. In the intervening period, the German philosopher (**1) _____** had published his own independently discovered method and given it the name *calculus*, which is still used nowadays. Even after his death the infuriated Newton continued to condemn the German philosopher as a plagiarist.
- **(2) _____** coined the term *'radioactivity'* to describe the elements that gave off the mysterious rays. In spring 1898 she and her husband discovered polonium, an extraordinary element that glowed in the dark when mixed with water. She named it after her native country. Poland. In 1911, she was awarded the Nobel Prize for Chemistry for her work on *polonium* and *radium.*

- The term “greenhouse effect” has a modern ring, yet in fact it is nearly 200 years old. It was coined by **(3) _____**, who proposed was that the Earth’s atmosphere acted as an insulating blanket, slowing down the rate at which heat was radiated into the space during the night and therefore reducing the difference between daytime and night-time temperatures. It also had a similar effect in reducing the range of summer and winter temperatures. This was what he called the “greenhouse effect’.
- The founder of modern chemistry **(4) _____** was not above laying his claim to the work of others and he seldom acknowledged the efforts of his contemporaries. He shared with Priestly the discovery of the significance of oxygen -- which he named from the Greek, meaning *"acid generator”* (a misnomer, of course, perpetuated in current German usage as *suerstoff*, or sour substance).
- The concept of a chain reaction – a process that gathers pace by multiplying the reactive entities as it progresses – entered chemistry in 1913 and physics some 20 years later. As **(5) _____** in 1913 pondered about the phenomenon, he undid his gold watch-chain and asked his assistant to hold one end, while he himself twirled the other. “If we give this chain an impulse it will propagate through its whole length.” So they dubbed this phenomenon chain reaction.

Confusables: False Friends

9. Choose the correct word.

1. The **terrain / territory** of Antarctica, which is nearly one and a half times as big as the United States is amazingly varied.
2. A **desert / dessert** is described as a region in which an average of less than ten inches of rain falls in a year.
3. To travel in space a **racket / rocket** is to be powerful enough to break out of the pull of the earth’s gravity.
4. Regarded as one of the greatest **physicists / physicians**, Isaac Newton was the first to express the relationship between force and motion.
5. The Kodak was the1st camera **designed / projected** both for mass production and amateur use.
6. Whenever a mosquito bites a **human / humane** being or animal suffering from a certain disease, it carries off the disease germs in its saliva.
7. Morse **code / codex** was an important way to send messages before the telephone and radio were invented.
8./9./10. A. G. Bell who was an **immigrant / emigrant** of **Scottish / Scotch** origin worked with the deaf before **constructing / designing** the first telephone in 1876.

Phrasal Verbs

☺ ☺ ☺ ☺ ☺

10. Match responses from column B to the phases from column A.

A	B
1. You say you've **run out of** petrol.	**A)** That will certainly **cheer** him **up**.
2. Before we were married you told me that we were **well-off.**	**B)** Sleep nearer the edge of the bed. You'll soon **drop off**.
3. I'm afraid, Mrs. Smith, that your husband will never work again.	**C)** That's right. Will it damage the car if I drive on an empty tank?
4. Doctor, I don't seem to be able to sleep at night. What shall I do?	**D)** The stock-broker who jumped out of the window on the twelfth floor saw a computer screen on the seventh floor and did a U-jump.
5. There was a tremendous **turn-around** in the market today.	**E)** They lost their seats on the bus.
6. What happened when women **stood up for** their rights?	**F)** Yes, but I didn't know how **well off**.
7. Every day I **get up** and **look through** the Forbes list of the richest people of America.	**G)** When a woman gets up, people look, then if they like what they see, they listen.
8. When a man **gets up** to speak, people listen then look.	**H)** If I am not there, I go to work.

Word Families

11. Fill in the gaps with suitable words.

a) **conducted**	b) **conductor**	c) **deduction**	d) **deduce**	e) **introduced**
f) **induction**	g) **produce**	h) **reduces**	i) **reproduce**	j) **reproducible**

1. The most probable speed is the average speed. Maxwell felt a certain uneasiness about his kinetic theory, acknowledging that it broke with the mechanistic tradition of using Newtonian laws of motion to _____ the exact trajectories of a system's components, as one does for example to explain planetary motions.

2. If we are asking about, say, the behavior of lump of matter you can hold in your hand, we are typically dealing with billions and billions of molecules, and the statistical behavior is utterly _____ from one experiment to another.

3. Fruit flies are a lab favourite. Three-quarters of known human disease genes have a match in the genetic code of fruit flies. They also go to sleep every night, react in a similar way to general anaesthetics and, best of all, _____ very quickly. You can have a whole new generation in a fortnight.

4. Gold has very high electric conductivity, but can't be widely used as a _____ because of its price.

5. Einstein _____ an anti-gravity force into his equations, which he called the cosmological constant.

6. The Second Law of Thermodynamics _____ to the statement that in all processes of spontaneous change (such as heat flowing from hot to cold), enthropy increases.
7. In recent years much of physics has separated further from chemistry by devoting its attention chiefly to the reactions which occur at very high energies and which _____ particles that play no role in chemical reactions
8. Alfred Wegener (1880-1930) is one of the unsung heroes of science who first put forward the theory of the continent drift found his tragic and heroic end in the icy wilderness of Iceland where he _____ his explorations.
9. The expression "_____ method" was wrongly used by Conan Doyle's Sherlock Holmes, for in fact he used the induction method.
10. Neither the electric motor nor the principle of eclectic _____ are perhaps Faraday's greatest achievements. He went on not just to demonstrate the principle of electrolysis – the way chemicals are broken down by electricity – but to demonstrate the ultimate unity between all forces, including electricity, magnetism, light and even gravity, and to develop the idea of fields of force.

Linking Words: Concession / Contrast

12. Fill in the gaps with suitable words.

a) **although** (x2)	b) **as** (x2)	c) **despite**	d) **however**	e) **nevertheless**
f) **still**	g) **though**	h) **unless**	i) **yet** (x2)	j) **yet for**

1. Robert Oppenheimer did not make any reference to Zwicky's work _____ Zwicky had been working for years on the same problem in the same building.
2. Babbage's Difference machine No.1 was a tremendously ambitious project. No calculator had ever worked with numbers bigger than four digits; _____, Babbage planned to build a machine that could handle numbers of up to fifty.
3. Scientists have not _____ come up with the explanation why many laws hold, _____ they do.
4. _____ his friends petitioned for him Lavoisier was guillotined on 8 May 1794.
5. _____ the great progress in chemistry, no one knew just what an element was – and no one had thought to connect them with atoms in any way.
6. We may find much to agree with the philosopher Ludwig Wittgenstein's condemnation of the worship of science and the lionization of scientists, _____ there is a lot to admire in the scientific point of view and in the character of many leading scientists.
7. Mendel received a polite hearing from the audience, _____ no one present appeared to acknowledge that his discoveries broke a new ground.
8. _____ the society published Mendel's paper 'Experiments with plant Hybrates' in 1866 and sent it to all major libraries in Europe and America, hardly any scientist wrote to him.
9. ____ a wider audience, Mendel's work had little impact.
10. Man is not free _____ government is limited. There is a clear cause and effect here that is _____ neat and predictable as laws of physics: ____ government expands, the liberty contracts.

Ronald Reagan

Grammar: Functions of Verbals

13. Translate the sentences. Identify the functions of the words in bold.

1. What **distinguished** Rutherford from his colleagues – and the reason why he is remembered today as one of the greatest experimental physicists of all time – was his special qualities as a scientist.
A distinguished professor is givin lecture today.
He made a **distinguished** career in the diplomatic service.
The professor distinguished by his discoveries in physics is giving a lecture today.

2. Kekule was a **noted** teacher, but is now mainly remembered for his **celebrated** dreams, in which came to him the two inspirations that changed the face of chemistry.
Kekule **noted** the resemblance of the molecular structure to the snake biting its own tail.
The periodicity of elements first **noted by** Newlands was used by Mendeleyev in his Periodic Table.
Last year the scientific community **celebrated** the 200 anniversary of this scientist.

3. In 1636, Hobbes **traveled** to Florence to meet Galileo and became **convinced** that the law of inertia was the axiom he had been seeking.
Galileo **convinced** Hobbes that the law of inertia was the axiom he had been seeking.
Convinced by his scientific supervisor the post graduate revised chapter I of his thesis.
He was a **convinced** advocate of political reforms.

4. It was while studying for his Ph.D. at Indiana University that Watson became **interested** in genetics.
John **interested** in physics decided to enter the Polytechnic University.
The **interested** audience of 100 students listened attentively to the lecturer.

5. Scornful of tradition, Babbage **infuriated** and **irritated** his elders.
Noise **annoyed** Babbage and he campaigned against organ grinders.
Neighbors were **annoyed** by Babbage and his strange ways.
Irritated neighbors responded by paying street musicians to play outside his window.
Irritated by noise Babbage could not concentrate on his studies.

14. Identify the function of –ing form (Gerund or Participle)

1. The natural philosophers of the Enlightenment frequently sought to safeguard their claims to a discovery, **while minimizing** the risk of public error, by **depositing** their dated observations in an archive or **by concealing** them in a cipher.
2. By connecting thermodynamics with the properties of atoms in motion, statistical mechanics describes the behavior of matter from bottom up.
3. Lisa Meitner was a skilled mathematician with a good grasp of nuclear physics, she realized that Hahn was splitting uranium nuclei, **thus producing** barium and **releasing** energy.

4. All the day he sat in his laboratory, vainly **hoping** that the sight of all the familiar apparatus would stimulate his memory, and **trying** without success to understand the scribbled note of the night before.
5. In 1939 Einstein alerted President Roosevelt to the danger of Germany's development of an atomic bomb (A-bomb), **thus contributing** to **setting up** of the Manhattan project.
6. Twentieth century astronomy had been dominated by professionals. **Using** giant telescopes that cost millions they studied distant galaxies, while amateurs were to be content with **charting** the brightness of variable stars and **making** drawings of the Moon, Mars, and Saturn rings.
7. Mendeleyev's **being** the first in his class brought him a gold medal when he qualified as a teacher in 1855.
8. Working closely with radioactive materials without realizing the dangers involved was typical of the Curies' practices.
9. **Gathering** of scientists in the form of workshops and symposia provide them an opportunity to exchange ideas.
10. Glass **making** at his mother's glass factory fascinated young Dmitri Mendeleyev as his first encounter with practical chemistry.

15. Transform the clauses in bold into participial clauses with function of adverbial modifiers.

Example**:** *One day,* ***while he was thinking over the problem in the bath****, Archimedes suddenly noticed how the water rose as he sank deeper into the bath.* → *One day,* ***while thinking over the problem in the bath****, Archimedes suddenly noticed how the water rose as he sank deeper into the bath.*

1. The story goes that Archimedes leaped straight out of his bath and ran to the king; **he shouted at the top of his voice:** "Eureka! Eureka!"
2. After he realized that he had to get the names of the plants in place, Linnaeus gave a binomial label to every known animal species.
3. Pauli and Heisenberg claimed to have solved all the unsolved problems in elementary particle theory, after they **had reduced** everything to a single equation.
4. Scientists enjoy their 15 minutes of fame as much as everybody else. But next week the prize-winners will be back in their laboratories and offices **and will do** what they do best − **push out** the frontiers of human understanding.
5. In spring 1898 Marie and Pierre discovered polonium, an extraordinary element that glowed in the dark **when it was mixed with water**. She named it after her native country Poland.
6. Ernest Rutherford was an ebullient speaker, but would dissolve into incoherence when he was **forced** to manipulate algebraic equations.
7. Marie Curie coined the term *'radioactivity'* to describe the elements that gave off the mysterious rays. In spring 1898 Marie and Pierre discovered polonium, an extraordinary element that glowed in the dark **when it was mixed with water**. She named after her native county Poland.
8. When he was spurred into action, Darwin wrote his great book *On the Origin of Species,* in which he outlined his ideas and gave a wealth of supporting evidence gathered from *the Beagle* voyage and subsequent research.

16. Fill in the gaps using the words in the box.

a**) belongings**	b) **earnings**	c) **findings**	d) **footings**	e) **gatherings**
f) **proceedings**	g) **reasoning**	h) **shortcomings**	i) **teachings**	j) **workings**

It's worth examining the **____ (1)** of Drexler's original vision because this may give clues as to how we might make radical nanotechnology feasible.
The **____ (2)** of the world inspire curiosity of scientists.
The ____ **(3)** of Aristotle and his commentators were the basis of medieval science.
Fermat's **____ (4)** as a civil servant enabled him to pursue mathematics in his spare time.
Firmer **____ (5)** to Copernicus's ideas appeared only in Galileo's time.
The **____ (6)** of London Mathematical Society published a crucial article by Alan M. Turing.
Hubble's **____ (7)** attracted the attention of the famous physicist Albert Einstein.
So-called *a priori* **____ (8)** in science prevailed in medieval science.
The**____ (9)** of scientists, e.g. symposia provide them an opportunity to exchange ideas.
Leonardo's **____ (10)**, including his notes, were shipped to Italy after his death.

Absolute Participial Construction

17. Translate the following sentences.

1. By early summer Blondot published twenty papers, Charpantier twenty, Becquerel ten, **all describing new properties and sources of the rays.**
2. His mother living in poverty, Pauling had to work full time while studying. From 1919 to 1920 he taught the course in analysis that he had just finished taking, earning the epithet 'The boy professor'.
3. Plants grown in the dark are always colourless, **chlorophyll becoming green only when affected by light.**
4. This approach called "massively parallel processing**"** turns the computer into a factory, **with thousands of parallel assembly lines churning out calculations and swapping** results back and forth.
5. About 700 tons of graphite and 70 tons of uranium fuel from the core of the reactor, **all being lethally radioactive,** spewed onto the tarmac and the roof of the turbine hall in Chernobyl.
6. Ada (the daughter of the great short-lived Lord Byron) was fascinated with mathematics and is credited with writing the first computing programs, **the fact reflected in the first programming language being named *Ada* after her.**
7. Einstein identified two fundamental principles, the Principle of Relativity and the Principle of the Constancy of Light, **each founded on empirical observation**.
8. Taken together (along with a few other assumptions such as *isotropy* and *homogeneity* of space), these two postulates lead uniquely to the mathematics of Lorentz's electrodynamics and special relativity.

18. Convert the following complex sentences into simple ones using Absolute Participial Construction.

Example: It's easy to feel sad about the world, since a billion people are still poor, the earth's population is doubling, the environment is being damaged. →
It's easy to feel sad about the world, ***with a billion people still being poor, the earth's population doubling, the environment being damaged****.*

1. Up to 30 per cent of underground storage tanks and pipelines leak and one gallon of petrol contaminates millions of gallons of groundwater.
2. There are three Rs in environmental waste management – reduce, reuse and recycle; actually reuse and reduce are being neglected.
3. When Linnaeus completed his work on plant kingdom, he turned his attention to the animal kingdom.
4. There are thousands of cables required to carry all the channels of data from the detectors in the LHC and every cable is individually labeled and needs to be painstakingly matched up to the correct socket and tested.
5. Mendel's prediction came true in 1900**,** when three European botanists, each of whom worked independently, obtained results that showed how plant heredity was governed.
6. Physicists have devised several theories of quantum gravity and each theory applied quantum principles in a distinct way.

Phonetics

Choose the correct pronunciation.

[ɔ] [ɔ:] [ɔʊ]

1) launch	**2)** jaw	**3)** road	**4)** router	**5)** awful
6) owe	**7)** flaw	**8)** flow	**9)** floor	**10)** law
11) lower	**12)** lawyer	**13)** alter	**14)** clause	**15)** appalling
16) course	**17)** cause	**18)** coarse	**19)** paw	**20)** pour

Words of Wit and Wisdom

☺ ☺ ☺ ☺ ☺

Translate the following quotations

1. The easiest thing in the world is **to tell the truth**. Then you don't have to remember what you said. ***R. Evans***
2. Acquaintance is a person whom we know well enough **to borrow from**, but not well **enough to lend to**. ***A. Bierce***
3. Some see private enterprise as predatory target **to be shot**, others as a cow **to be milked**, but few are those who see it as a sturdy horse **pulling** the wagon. ***W. Churchill***
4. There is much pleasure to be enjoyed from useless knowledge. ***B. Russell***

5. One of the first duties of a physician is **to educate** people not to take medicine. ***William Osler***

6. Politics is too serious a matter to be left to the politicians. ***Ch. de Gaulle***

7. I am always ready to learn, but I do not always l**ike being taught**. ***W. Churchill***

8. If a thing is worth doing it is **worth doing** badly. ***G. Chesterton***

9. Man, **biologically considered/speaking,** and whatever he may be into the bargain, is simply the most formidable of all the beasts of prey, and indeed, the only one that preys systematically on its own species. ***William James***

10. Mathematics **rightly viewed,** possesses not only truth, but also supreme beauty_ a beauty cold and austere, like that of a sculpture. ***B. Russell***

11. Life is a tragedy **when seen in close-up**, but comedy in long-shot. ***Charlie Chaplin***

12. **When asked** the difference between a tax collector and a taxidermist: "The taxidermist takes only your skin". ***M. Twain***

13. **Generally speaking**, it takes people a lot of **thinking** and hard work, even with the aid of a teacher, to get anything **worth having**. ***P. J. Macdonal***

14. For every person **wishing** to teach there are thirty not **wanting** to be taught. ***W. Sellerd***

Unit 9

IMPORTANCE OF MEASUREMENTS IN SCIENCE AND TECHNOLOGY

1. Read and discuss the text. Decide whether the following statements are true or false.

1. The accuracy of measurements tends to be greater with advent of new technology.
2. Measurements are indispensable for physical experiments.
3. Values needn't be expressed by units.
4. The level of measurement accuracy is determined by the skill of the experimenter.
5. Uncertainties are similar to reading errors.

Measurement is central to the development of any science. The importance of measurement was apparent to ancient civilizations. Throughout history the accuracy with which measurements could be made has been improved by the use of more and more sophisticated instruments. At almost every stage, improved measuring techniques have resulted in new concepts and ideas.

The science of physics, like all other sciences, is based on reliable measurements. All scientific laws and theorems must be tested experimentally, and all experiments necessitate making measurements. One of the reasons for the development of physics as a science is that the measurements that are made in physics are usually more sophisticated than the measurements made in other sciences.

Physical quantity is the term that is used to include measurable features of many different items. The area of a playing field, the mass of a bag of sugar and the speed of an airplane are all physical quantities.

In quoting any measurement of a physical quantity, two items need to be stated. The first is the numerical value of the quantity, sometimes called the magnitude, and the second is its unit. It is important at all times to think of and to write the value and the unit of any quantity together. Apart from technical accuracy of writing in this way, it will also help you to acquire mental appreciation of the size of the quantity you are considering.

For instance, if the diameter of the wire is found to be 1,46 meters, then something is wrong. A value stated as simply 1,46 is meaningless. Realizing if the particular value is possible or not is something that comes with experience, but it is only by thinking about the sizes of physical quantities that this experience is gained.

Whenever a measurement of a physical quantity is made, some measuring instrument has to be used. The instrument may be as ordinary as a ruler or as sophisticated as a modern mass spectrometer.

In using the instrument an experimenter has to make use of his or her own skills to obtain as accurate reading as possible. Built-in to the instrument however is a limit of accuracy. The result of this is that the experimenter takes has a degree of uncertainty. The size of uncertainty needs to be considered together with the size of the quantity being measured. Uncertainties can be described as absolute, fractional and percentage uncertainties.

2. Complete the table.

Dimensions and Parameters

verb	***noun***	***adjective***
	magnitude	
measure		
	length	
	longitude	
prolong		
	extent	
		broad
		wide
expand		
	latitude	
deepen		
		high
	elevation	
	altitude	
	strength	
	force, fortitude,	reinforced
	weight	
		large
		warm
		hot

3. Use the words from the table to fill in the gaps.

1. ____ concrete is widely used in construction of engineering structures.
2. A massive earthquake occurred in Los Angeles in 1994, its ____ measuring 6,7 on the Richter scale.
3. The occurrence of glaciers depends on the ____ and local topography.
4. Accumulated carbon dioxide forms a cover over the earth keeping the ____ of the sun close to the earth surface.
5. During a tsunami the entire ____ of water is involved in the wave motion forming successive waves.
6. The friction of tides causes the day to ____ 0,001 seconds per century.
7. Tidal bores are phenomena which occur on rivers that ____ gradually toward broad mouths and are subject to high tides.
8. River floods can be prevented by broadening and ____ river channels or construction of suitably positioned dams.
9. The Dead Sea is actually a salt lake lying on record low ____.
10. Galileo constructed a telescope with ten times more ____ and used it to watch the sky.
11. Every quotation contributes something to the stability or ____ of the language. *S.Johnson*

4. Read the text. Match the names of the scientists with units named after them.

As the nineteenth century drew to a close, scientists could reflect with satisfaction that they had pinned down most of the mysteries of the physical world: electricity, magnetism, gases, optics, acoustics, kinetics, and statistical mechanics, to name just a few, all had fallen into order before them. They had discovered the X- ray, the cathode ray, the electron, and radioactivity, invented the ohm, the watt, the Kelvin, the joule, the amp, and the little erg.

If a thing could be oscillated, accelerated, perturbed, distilled, combined, weighed, or made gaseous scientists had done it, and in the process produced a body of universal laws so weighty and majestic that we still tend to write them out in capitals: the Electromagnetic Field Theory of Light, Richter's Law of Reciprocal Proportions, Charles's Law of Gases, the Law of Combining Volumes, the Zeroth Law, the Valence Concept, the Laws of Mass Actions, and others beyond counting. The whole world clanged and chuffed with the machinery and instruments that their ingenuity had produced. Many wise people believed that there was nothing much left for science to do.

Units named after scientists

1. Ampere (A)	**a)** a unit of force
2. Becquerel (Bq)	**b)** a unit of pressure, stress
3. Coulobm (C)	**c)** a unit of frequency
4. Farad (F)	**d)** unit of energy, work, quantity of heat
5. Joul (J)	**e)** a unit of electric capacitance
6. Herzt (Hz)	**f)** a unit of electric charge, quantity of electricity
7. Kelvin (K)	**g)** unit of power
8. Newton (N)	**h)** a unit of electrical current
9. Pascal (Pa)	**i)** a unit of activity of a radionuclide
10. Watt (W)	**j)** unit of thermodynamic temperature

5. Read the text. Match SI- prefixes to the corresponding numeric values.

Measures and Weights

Early peoples used measured that could be easily recognized using parts of their bodies. During and after the Middle Ages each region developed its own system of measurement. In the 19th century they were standardized on the national basis, to be superseded in turn by the Metric system. In the Western world only the British Empire and the USA retained their own systems well into the mid-20th century, with Imperial and US Customary systems respectively.

The Metric system is a system of weights and measures devised in revolutionary France that I based on a meter as a length unit. A meter was defined as a ten-millionth part of the distance from the equator to either geographic pole.

SI system is a modern form of metric system of measurements, commonly used in most countries. It consists of series of units of measurements built around seven interdependent base units of individual physical qualities. All other physical qualities are obtained from these units. The SI is an evolving system in which units are created and definitions are modified as the technology and precision of measurement improves. In addition to seven base units (a meter, a

kilogram, a second, an ampere, a kelvin, a candela, a mole) there are two supplementary units (radian and steradian) and many derived units (e.g. Tesla, Gray, Katal) .

Scientists use a number odf symbols to denote physical properties when writing formulae describing processes. Some symbols (of Latin and Greek origin) represent several properties P P w W v V density, pressure, momentum, mechanical power, velocity, volume, work, weight.

SI prefixes and symbols are used to indicate decimal multiples (prefixes of Greek origin) and submultiples (those of Latin origin) of SI units to avoid having to write either very large or extremely small numeric values, from 10 to 18.

SI Prefixes (order of magnitude)

Multiples: yotta (Y)	zeta (Z)	exa (E)	peta (P)	tera (T)
giga (G)	mega (M)	kilo (k)	hecto (h)	deca (da)
Submultiples: deci (d)	centi (c)	milli (m)	micro (μ)	nano (n)
pico (p)	femto (f)	atto (a)	zepto (z)	yocto (y)

Confusables

6. Choose the suitable word.

Instruments – Tools of Science

A brilliantly **creative / prolific (1)** man, Galileo Galilei, achieved many scientific firsts, each of which would have been enough to give him a place in history. For one thing, he was an **engineering / ingenious (2)** inventor, and among the most **notable / noticeable (3)** of his ideas was the value of the pendulum as a timekeeper, which led to the creation of the first **neat / accurate (4)** clocks.

Another his invention was a thermometer. He invented a sector too, the simple device for calculating the **projection / trajectory (5)** of a missile. Above all, he was a scientist, though. For example, he did not simply take the telescope and turn it into a **major / majestic (6)** scientific instrument. He had the **eyesight / insight (7)** to use it to look at the night sky and make **expressive / impressive (8)** discoveries there including the mountains on the Moon's surface; the moons of Jupiter; the fact that Venus has **periods / phases (9)** like the Moon; that the Sun has spots. It was these discoveries that **persuaded / pursued (10)** Galileo that Copernicus' view that the sun and not the Earth was at the center of the universe was **genuine / true (11).**

Some time in the summer of 1609, Galileo visited Venice and became intrigued by a **novel/novelty (12)** called a *perscillium*, made by a Dutch **spectacle / optician (13)** maker. It consisted of two lenses in a tube and could make a **distinct / distant (14)** steeple look as if it as just across the street. **Inspired / Aspired (15)** Galileo realized how it worked and immediately made one of his own with ten times more **magnificence / magnification (16).** He called it a *telescope* and it rapidly became famous **thorough / throughout (17)** Italy.

Among Hooke's many inventions were the anemometer (for measuring **wind / rain (18)** speed), the hydrometer (for measuring **humidity / wetness (19)**, the cross-hair (for sights in **microscopes / telescopes (20)** and, later, gun sights), the iris diaphragm (later the aperture in the camera).

Phrasal Nouns

***7. Find the corresponding Russian nouns*.**

a) **breakthrough** b) **black-out** c) **build-up** d) **downfall** e) **intake** f) **outcome** g) **pile-up** h) **spelling-out** i) **slow-down** j) **write-off**

1. (*Накопление*) of carbon dioxide in the atmosphere can be considered as a huge climatic experiment.
2. Research has shown that limiting calorie **(*потребление*)** has an effect on reducing the incidence of almost all diseases associated with aging.
3. The start of modern science dates back to Francis Bacon, who is credited with **(*формулировка*)** the experimental principles.
4. The **(*падение*)** of the ancient Rome resulted in the general decline of science and culture.
5. If the **(*результат*)** of one event is known, this affects the probability of another event occurring.
6. The solution they have come up with is considered an important **(*успех*)** in science.
7-8. My car is a complete **(*развалина*)** as result of yesterday's **(*столкновения множества машин*).**
9. Sino-American trade frictions cannot cause a **(*замедление*)** in the Chinese economy, nor change the good momentum in China's economic development.
10 (*отключение электричества*) caused by tornado resulted in multimillion material and financial loss.

Word Families

8. Fill in the gaps with the suitable words.

a) attracted b) attractiveness c) contract d) contracted e) contractions f) distract g) extract h) extraction i) subtract j) subtraction

1. Along with addition, multiplication and division **____** is one of the four basic arithmetic operations.
2. In order to get the amount of carbon dioxide saved by nuclear plants one should **____** it from the total emitted by fossil.
3. Invited by Queen Christina to be her personal tutor Descartes **____** pneumonia and died in Sweden.
4. Motion-impaired people, e.g. Steven Hawking, can control computer by their facial muscle**____**.
5. Fermat's reclusive way of life did not **____** from his mathematical studies, the theory of numbers being the most important among them.
6. Creative people are **____** by complexity that looks to painters more 'vital and dynamic" and scientists' creative response to disorder is to find an elegant new order more satisfying than any that could be achieved by simple configuration.
7-8. It took the determined pair (the Curies) four more years to **____** a tiny amount of radium a. Four years of persistent efforts involving health hazards resulted in **____** of fraction of a gram of

radium, as the element was named due to its high radioactivity.
9. To develop his argument, Carnot considered an engine in which heat flow allowed a gas to expand (when heated) and **____** (when cooled), driving a piston in a cyclic process now known as the Carnot cycle.
10. Much like the great work of art, a beautiful equation has among its attributes much more than mere **____** – it will have universality, simplicity, inevitability, and an elemental power.

Linking Words

9. Fill the gaps with the words from the box.

a) **however** b) **thereafter** c) **thereby** d) **therefore** e) **whatever** f) **whatsoever** g) **whereas** h) **wherein** i) **whoever** (x2)

1. **____** the scales balance weights, most equations balance other quantities.
2. **____** a man does a thoroughly stupid thing, it is always from the noblest of motives. *O. Wilde*
3. At the start of the 20th century Paul Wolfkehl, a German industrialist, bequeathed 100,000 marks to **____** could meet Fermat's challenge.
4. Mendeleev was said to have been inspired by the card game known as solitaire in North America and patience elsewhere, **____** cards are arranged by suit horizontally and by number vertically.
5. The only absolute, according to Einstein, is the speed of light, which is the same **____** and **____** it is measured.
6. He ____ can, does. He ____ cannot, teaches.
7. The fact that an opinion is widely held is no evidence **____** that it is not utterly absurd. *B. Russell*
8. Opponents fear that in tinkering with DNA, the coded essence of life, science may unleash dark forces that it cannot **____** contain.
9. Fake users tie themselves to legitimate users to boost their own profile, **____** damaging the legitimate users.
10. **____** women do, they must do it twice as well as men to be thought half as good. Luckily, this is not difficult.

Grammar: Infinitive Structures

10. Translate the sentences paying attention to the verbs in bold (Complex Subject).

Example: a) Great ideas seldom **appeared** in the history of science.
Великие идеи редко появлялись в истории науки.
b) At first revolutionary ideas **appear** to attract little attention.
Сначала революционные идеи, как кажется, привлекают мало внимания.

1. Like all great equations, $E = mc^2$ asserts a surprising equality between things that superficially **appear to be quite different** – energy, mass and speed of light in a vacuum.
2. 'I do not know what I **may appear** to the world; but to myself I **seem to have been** like a boy playing on the seashore, and diverting myself in now and then finding a smoother pebble or a prettier shell than ordinary, whilst the great ocean of truth lay all undiscovered before me'. *I.Newton*

3. In mathematics, too, something like this **happens** – mathematicians compress their computational experiments into mathematical axiom, and they then show how to deduce theorems from these axioms.
4. Newton died on 20 March 1723 and was buried with a grand funeral at Westminster Abbey. Voltaire who **happened to be visiting** London at that time, wrote: 'England honors a mathematician as other nations honor a king who has done well by his subjects.'
5. Once *Hubble* was in orbit and it became evident that the mirror had been ground incorrectly, they attempted to justify their prior oversights by **claiming** that to have tested the mirror in the first place would have cost millions of dollars.
6. No statement can be **proved** true but some statements can be proved false.
Science is defined by this falsifiability: it is the fact that they can be proved false, but have not been, which gives accepted scientific statements their value.
7. Sometimes factors that scientists haven't even considered **turn out to be** the main drivers.
8. Everyone was pleased with the way the apparatus **turned out.**
9. Some sciences, such as astronomy, **tend to concern** themselves more with observation than experiment as such.
10. Crick and Watson were asked to stop their study of the DNA structure. They **pretended to comply.**
11. The reliability people **have come to expect** from natural sciences comes, in large part, from experiments.
12. Einstein **came to see** Hubble personally in Mt. Wilson Observatory.

11. Translate the sentences paying attention to Complex Object.

1. The great Thales of Miletus proposed that the prime substance was water; Anaxagoras **believed it to be** air while Xenophanes proposed the rather less glamorous option of mud.
2. Newton **showed Kepler's laws to be a** consequence of the theory of universal gravitation.
3. Abbe George Lamaitre said that the investigations **revealed the age of the earth to be** about 4,5 billion years.
4. Only a few substances that we now **know to be elements**, twelve to be exact, were known in 1630.
5. Eco-friendly firms are willing to put themselves at the disadvantage by allowing their competitors to get away with environmental pollution. These firms are as keen as eco-cops **to see stiff anti-pollution laws approved and enforced.**
6. Examination with X-rays **shows halogens to possess diatomic molecules** even in the solid state.
7. We **can hardly expect the public to permit** many mistakes in a field that aims to alter the skein of life upon which our existence depends.
8. They **discovered phosphorus fumes to enter** the body, causing necrosis to develop in the lower jawbone.

12. ***Use the following verbs to complete the sentences.***

a) **to cool**	b) **to develop**	c) **to do**	d) **to exist**
e) **to hit**	f) **to progress**	g) **to revert**	h) **to survive**

1. If rationality were the criterion **for things ____**, the world would be one gigantic field of soya beans.
2. Among other consequences, the discovery of radioactivity unlocked puzzle that had been tormenting Charles Darwin in the last decades of his life: the age of the Earth, inferred from the fossil record, vastly exceeded the calculated time required **for earth ____** from its temperature (that of the Sun) when formed.
3. It's possible **for a camel ____** without drinking water for up to two weeks.
4. **For mathematics ____** you actually need new ideas and plenty of room for creativity.
5. By the end of the 19^{th} century many wise people believed that there was nothing much left **for science ____**.
6. It took twenty years **for physicists ____** a theory explaining atoms – namely, quantum mechanics, – and another 30 years for physicist Erwin Mueller to make the first microscopic images of them.
7. Rusting represents the natural tendency **for iron ____** from the unstable condition.
8. A slow molecule is a nearly stationary target **for other molecules ____**.

13. Use the correct verb form.

Example: *Hooke* ***is known (collaborate)*** *with most of the great scientists of his day – Boyle, Newton, Huygens, Leeuwenhoek.→ Hooke* ***is known to have collaborated*** *with most of the great scientists of his day – Boyle, Newton, Huygens, Leeuwenhoek.*

1. Now a twentieth century icon $E=mc^2$ is one of the few things about science that every TV quiz participant **(expect) to know**.
2. The famous Monument of the Fire in London, the world's tallest Greek-style column, **is thought (design)** by Hooke.
3. Linus Pauling **(consider) to be** the most influential chemist since Lavoisier and the founding father of molecular biology.
4. Owing to Werner Heisenberg's uncertainty principle, all observations **are seen (affect)** with a small but irreducible degree of imprecision.
5. Lavoisier was tried and found guilty, and when his achievements were brought to the attention of the judge in an attempt of his friends to save him, the judge **is said (reply)** 'The Republic has no need for scientists.'
6. Western style development **is known (bring)** the third world accelerated depletion of natural resources.
7. Scientists **(know) to complain** of a want of candor in their confreres, in pursuit of patents or merely priority.
8. Only a few substances that now (**know) to be elements**, 12 to be exact, were known in 1630.
9. For economists, the world **seems (to get)** better while many environmentalists **tend (believe**) that, ecologically speaking, things are getting worse and worse.

10. Most forms of environmental pollution either **appear (to exaggerate)**, or are transient – associated with the early phases of industrializing and therefore best cured not by restricting economic growth, but by accelerating it.
11-13. One form of pollution – the release of greenhouse gases that causes global warming – **(not appear) (be)** a long-term phenomenon, but its total impact **is unlikely (pose)** a devastating problem for the future of humanity. A bigger problem **may well turn out (be)** an inappropriate response to it.

14. Transform the sentences using Complex Object.

1. Newton showed that Kepler's laws were the consequence of the theory of universal gravitation.
2. Examination with x-rays shows that halogens even in the solid state possess diatomic molecules.
3. They expected that acceleration was different for different weights but that was not the case.
4. We can hardly expect that the public will permit many mistakes in a field that aims to alter the skein of life upon which our existence depends.
5. Investigations revealed that the age of the earth is about 4,5 billion years.

15. Transform the sentences using Complex Object.

1. It is **known** that Hooke **collaborated** with most of the great scientists of his day – Boyle, Newton, Huygens, and Leeuwenhoek.
2. Now a twentieth century's icon $E = mc^2$ is one of the few things about science that any TV quiz participants are **expected to know**.
3. It is thought that the famous Monument of the Fire in London, the world's tallest Greek-style column, **was designed** by Hooke.
4. It is considered that Linus Pauling was the most influential chemist since Lavoisier and the founding father of molecular biology.
5. Lavoisier was tried and found guilty, and when his achievements were brought to the attention of the judge in an attempt of his friends to save him, they say the judge **replied**, 'The Republic has no need for scientists'
6. It was rumored that Georg von Hevesy, the pioneer of radioactive tracers **laced** the left-overs with radioactive salt and detected radioactivity in the soup with a Geiger counter suspecting the landlady of recycling the left-overs. His suspicion was confirmed.
7. It is known that Western style development **has brought** the third world accelerated depletion of natural resources.
8. Everyone knows that scientists **complain** of a want of candor in their confreres, in pursuit of patents or merely priority.
9. They heard that Sergei Gaposchkin, who was never in truth much more than the assistant of his wife, Cecilia Payne-Gaposchkin, an astronomer of great luster, **once said** with apparently unconscious hyperbole, "Cecilia is an even greater scientist than I am".
10. Power planners **expect** that the share of hydropower **will increase** about 3.1% each year for the next 25 years.

Phonetics

Choose the correct pronunciation.

[ɔ:] [a]

1) automatic	**2**) half	**3)** authorize	**4)** astronaut	**5)** aeronautic
6) authentic	**7)** audio	**8)** auction	**9)** alternative	**10)** altitude
11) audition	**12)** audience	**13)** hydraulic	**14)** also	**15)** already
16) always	**17)** although	**18)** dawn	**19)** drawer	**20)** exhaust

Words of Wit and Wisdom

1. Moderation is a virtue only in those *known to have* an alternative. ***Henry Kissinger***

2. One problem with people who have no vice is that they *are pretty sure to have* some annoying habits. ***Elizabeth Taylor***

3. Gossip is what no one *claims to like*, but everybody enjoys. ***Joseph Conrad***

4. If you want a *speech to be made* ask a man, if you *want something done* ask a woman. ***Margaret Thatcher***

5. Politics *is supposed to be* the second oldest profession. I *have come to realize* that it bears a very close resemblance to the first. ***Ronald Reagan***

6. The secret of teaching is to *appear to have known* all your life what you learned this afternoon.

7. What really flatters a man is that *you think him worth flattering.* ***Bernard Shaw***

8. The fundamental defect of fathers is that they want their children *to be credit* to them. ***Bertrand Russell***

9. If allowed to survive this grass will produce enough oxygen *for two students to breathe* for one semester. ***(A sign on the lawn. University of Iowa)***

10. Although Nature commences with reason and ends in experience, it is necessary *for us to do* the opposite. ***Leonardo da Vinci***

Unit 10

ENGINEERS AND SCIENTISTS

1. ***Read and discuss the text. Identify true and false statements.***

1. The definition of the word “engineer” is quite straightforward.
2. The now outdated division of engineering referred only to two aspects.
3. The ancient wonders of the world included many works of engineering art.
4. All engineers work only in their narrow fields.
5. Every field of engineering uses its own scientific basis.
6. To reach a successful engineering solution an engineer should consider both technical and non-technical aspects.
7. Normally there is a single reasonable solution an engineer can come up with.
8. In this text *science* is used as a synonym of physics.

Engineering

The history of the concept of "engineering" stems from the earliest times when humans began to make clever inventions, such as the pulley, lever, or wheel, etc. The exact etymology of the word engineer, however, is a person occupationally connected with the study, design, and implementation of engines. The word "engine" derives from the Latin ingenium, meaning "innate quality, especially mental power, hence a clever invention." Hence, an engineer, essentially, is someone who makes useful or practical inventions.

From another perspective, a now obsolete meaning of engineer, dating from 1325, is "a constructor of military engines". Engineering was originally divided into military engineering, which included construction of fortifications as well as military engines, and civil engineering, involved in non-military projects, such as bridge construction. The Acropolis and the Parthenon in Greece, the Roman aquaducts, Via Appia and the Colosseum, the Hanging Gardens of Babylon, the Pharos of Alexandria, the pyramids in Egypt, Teotihuacan and the cities and pyramids of the Mayan, Inca and Aztec Empires, the Great Wall of China, among many others, stand as a testament to the ingenuity and skill of the ancient civil and military engineers.

With the rise of engineering as a profession in the nineteenth century the term became more narrowly applied to fields in which mathematics and science were applied to these ends. Similarly, in addition to military and civil engineering the fields then known as the mechanic arts became incorporated into engineering.

Engineering, much like science, is a broad discipline which is often broken down into several sub-disciplines. These disciplines concern themselves with various areas of engineering work. Although initially an engineer is trained in a specific discipline, throughout an engineer's career the engineer may become multi-disciplined, having worked in several of the outlined areas. Historically the main Branches of Engineering are categorized as follows: Aerospace Engineering, Chemical Engineering, Civil Engineering, Electrical Engineering, Mechanical Engineering.

With the rapid advancement of technology many new fields are gaining prominence and new branches are developing such as Computer Engineering, Software Engineering, Nanotechnology, Molecular Engineering, Mechatronics etc. These new specialties sometimes combine with the

traditional fields and form new branches such as Mechanical Engineering and Mechatronics and Electrical and Computer Engineering. For each of these fields there exists a considerable overlap, especially in the areas of the application of sciences to their disciplines such as physics, chemistry and mathematics.

Engineers borrow ideas from physics and mathematics to find suitable solutions to the problem at hand. They apply the scientific method in deriving their solutions. The crucial and unique task of the engineer is to identify, understand, and interpret the constraints on a design in order to produce a successful result. It is usually not enough to build a technically successful product; it must also meet further requirements. Constraints may include available resources, physical, imaginative or technical limitations, flexibility for future modifications and additions, and other factors, such as requirements for cost, safety, marketability, productibility, and serviceability. By understanding the constraints, engineers derive specifications for the limits within which a viable object or system may be produced and operated.

Engineers use their knowledge of science, mathematics, and appropriate experience to find suitable solutions to a problem. Engineering is considered a branch of applied mathematics and science. Creating an appropriate mathematical model of a problem allows them to analyse it (sometimes definitively), and to test potential solutions. Usually multiple reasonable solutions exist, so engineers must evaluate the different design choices on their merits and choose the solution that best meets their requirements.

2. Choose the right word.

Research in Science, Engineering and Technology

Research is the use of appropriate methods in attempting to discover new knowledge or to develop new applications of existing knowledge or to explore relationships between ideas or events. Scientific discoveries, **technical/ technological (1)** achievements and scholarly publications are all fruits of research. Every discipline develops tools and **technology/techniques (2)** appropriate to its subject matter, but whether undertaken by scholar, **technician/technologist (3)** or a scientist, research always involves three basic steps: the formulation of the problem, the collection of relevant information and a concerted attempt to discover a solution or otherwise resolve the problem in a manner dictated by the available evidence.

In the field of science and **technology/techniques (4)** fundamental (or properly scientific) research aims at enlarging man's understanding of observable phenomena; the search is for general explanatory principles. Unlike applied or **technological/technical (5)** research fundamental research is not explicitly directed to the solution of a practical problem, although its results may, and usually do, suggest new **technical /technological (6)** possibilities.

Knowledge of the atomic structure is a goal of fundamental research; possible applications of this knowledge − nuclear power plants and weapons − demand **technical /technological (7)** research and development. In practice, however, the distinction is less clear-cut: accidental scientific discoveries are often done by research workers pursuing a practical goal in industry, engineering and **technology/ techniques (8)**.

3. ***Fill in the gaps.***

Research and Technology Combined

a) **constructed**	b) **decades**	c) **decided**	d) **engaging**	e) **identified**	f) **invention**
g) **objectives**	h) **pursue**	i) **receive**	j) **suppressing**	k) **task**	l) **varying**

Bell Telephone Company in New Jersey has been for **1____** one of the world's foremost centers of discovery and **2____**, thanks to its enlightened practice of **3____** the best scientists and allowing them to follow their own ideas, even when these bore no evident relation to practical **4____**.

A discovery of momentous importance to astronomy had already been made at Bell, for in 1929 an engineer Karl Jansky, was entrusted with the **5____** of tracking down the sources of static in short-wave radio reception so that ways could be sought of **6____** it. Jansky built a sensitive antenna on the roof of the laboratory in Holmdel and soon **7____** thunderstorms, near and remote, as a major source, but after that there still remained a continuous hiss, **8____** in intensity on diurnal cycle. Eventually he found that the hiss came from the centre of the Milky Way, and so prefigured the science of radio astronomy. Bell did not **9____** the subject further, but 30 years later the thoughts of radio engineers turned to satellite communications, and to make a start, they **10____** to try bouncing microwave signals (that is to say radiation of wavelengths of a centimeter or so up to a meter) off a weather balloon. To **11____** the signals a giant horn antenna was **12____**, but it was agreed that when it had served its immediate purpose the Bell scientists could use it as a radio telescope for astronomical observations.

Confusables

I. Creativity in Science and Technology

Of all technical talents, **____ (1)** possibly the most important. In one survey the artists and scientists were **____ (2)** to the same tests in which they were to choose the pictures they liked. The **____ (3)** were surprising: both artists and PhDs at the University of California showed **____ (4)** preferences to pictures which looked chaotic or asymmetrical to other people. Creative people were attracted by **____ (5)** that looked to painters more "vital and dynamic" and scientists' creative **____ (6)** to disorder was to find an elegant new order more satisfying than any that could be evoked by simple configuration. **____ (7)** creative people must be sufficiently independent-minded to suffer personal discomfort and **____ (8)** ridicule that often accompany new ideas. It takes a high **____ (9)** of self-confidence to challenge the existing order and even more strength of character to risk **____ (10)**. Those who are timid rarely think up creative ideas, and when they do, they don't have the courage to support them.

1. a) creation b) creature c) creativity
2. a) injected b) objected c) subjected
3. a) finds b) findings c) foundations
4. a) analogous b) likely c) similar
5. a) complexion b) complexity c) complication

6. a) response b) respond c) reply
7. a) Actually b) Truthfully c) Truly
8. a)accidental b) occasional c) periodic
9. a) degree b) grade c) extend
10. a) critic b) criticism c) critique

II. Engineers and Scientists

There is an important____ **(1)** in attitudes of scientists and engineers working in large organizations. Engineers____ **(2)** to feel locals and regard their career as a ____ **(3)** of assignments where they edict themselves to____ **(4)** the organization's problems. Scientists, on the other hand, measure their success in ____ **(5)** of the boundaries of science and often become so engrossed that they ____ **(6)** the world around them. Scientists want to learn, to understand, and to teach. They____ **(7)** the company of their ____ **(8)** in seminars, technical meetings, and conferences, and their loyalties extend ____ **(9)** the confines of job and organization. The focus for the scientist's career is his or her special ____ **(10)** of interest; the current job is ____ **(11)** a convenience that permits the individual to ____ **(12)** it.

1. a) difference b) distinction c) variety
2. a) attend b) intend c) tend
3. a) succession b) success c) session
4. a) decision b) resolution c) solution
5. a) notions b) terms c) units
6. a) ignore b) neglect c) abandon
7. a) search b) sick c) seek
8. a) peers b) campaigners c) fellows
9. a) beyond b) below c) beside
10. a) aerial b) field c) region
11. a) merely b) merrily c)mostly
12. a) persuade b) pursue c) pursuit

Word Families

5. Fill in the gaps with the suitable words.

a) **aspire**	b) **aspirant**	c) **conspire**	d) **expired**	e) **inspiration**
f) **inspired**	g) **inspiring**	h) **perspiration** (x2)		i) **respiratory**

1. Faraday's force fields have been an ____ for physicists for a century and a half. Einstein was so inspired by them that he wrote his theory of gravity in terms of force fields.
2. In coming up with his Periodic Table, Mendeleev later said that he had been ____ by the card game called *patience* or *solitaire* in which cards are arranged horizontally by suite and vertically by number.
3. The finished paper must ____ to stand up to objective scrutiny; its conclusions should be

judged as supportable by qualified researchers other than the author.

4. In 1877 Max Plank completed his education at the University of Berlin, where he attended **____** lectures by H. von Helmholtz and G. Kirchhoff, both leading scientists of the generation.

5. In recent years many **____** researchers have made strides towards a Theory of Everything, which could someday wrap together the classical physics inspired by Isaac Newton with the rules that govern events on quantum scales**.**

6. As T.A. Edison once put it: "A genius is 1per inspiration and 99 per cent **____**".

7. Cold treatment and exercises reduce the occurrence of **____** diseases.

8. Before booking a flight and accommodation for a conference you should to make sure that your visa has not **____**.

9. Pseudoscience tends to feel that scientific community**____** against their unconventional theories.

10. Many anti- **____** aerosols contain substances harmful for the environment.

Phrasal verbs

6. Insert the suitable particles.

across	***in***	***on*** *(x2)*	***out*** *(x3)*	***round***	***through***	***up***

1. After finishing her degree, R. Franklin spent a year in research at Cambridge, but **gave** it **____** to work in industry studying the physical structure of coal.

2. It is in his biology that Aristotle's genius **shines** **____**.

3. Our lungs **take** **____** the oxygen we need from the air and expel carbon dioxide.

4. The first certitude Descartes discovered was his famous ***cogito ergo sum,*** and on the basis of this, the existence of everything, he **worked** **____** his philosophy.

5. I. Newton applied the laws of gravity to the Moon, showing that the Moon tries to **carry** **____** moving in a straight line, but gravity pulls it into an orbit.

6. When Michelson **carried** **____** his experiment, in Chicago in 1887, all the streetcars in the city were stopped in order to avoid the slightest disturbance.

7. Helicopter toys had actually **been** **____** for centuries, but Leonardo was the first to try and design one as a means for lifting people.

8. As Babbage was poring over statistic tables, he **came** **____** error after error made by the 'computers', the poorly paid human calculators who **worked out** such figures.

9. While electrical hysteria was **going** ____, rapid and serous advances were being made by experimental scientists towards understanding the true nature of electricity.

10. It **turned** **____** that Kelvin was mistaken about how fast the earth is cooling; further calculations showed that the world was over 4 billion years old.

Linking Words

if as long as in case provided unless

7. Translate the following sentences, paying attention to functions of 'if' and 'unless'.

1. Max Planck did not display an outstanding aptitude for science and math at the early age. **If anything,** he showed more promise in music. He was blessed with the gift of perfect pitch, and was a talented pianist and organist.
2. Despite the difficulties, nanotechnology will let us do some useful **- if crude -** things.
3. Scientists study the phenomena, dream up a hypothetical explanation, deduce some consequences of this explanation, and then devise experiments to see **if** these consequences are reflected in nature. **If** they are, scientists consider the theory (hypothesis) confirmed
4. Exactly the opposite is true: something will keep on moving at the same speed **unless** it down.
5. Prophesy, like poetry can teach us about ourselves **unless**, of course, we abandon the notion that it predicts anything.
6. The first law was the idea of inertia or momentum. It basically means that things keep moving at the same speed in a straight line **unless** something pushes on them – that is, a force.
7. In 1742 Leonard Euler, the greatest number theorist of the 18th century, became so frustrated by his inability to prove Fermat's last theorem, that he asked a friend to search Fermat's house in case some vital scrap of paper was left behind.
8. If you know how to spend less than you get, you have the philosophers' stone. *Franklin*
9. If Karl instead of writing a lot about capital had made a lot of it, it would have been much better. *Marx's mother*
10. Economy is going without something you do want **in case** you should, some day, want something you probably won't want. *Anthony Hope*

8. Match the two parts.

Unless/ provided

1. Please, understand it's only a suggestion. You don't have to do that
2. I've got enough money to last me for the rest of my life,
3. A friend is always delighted at your success
4. Democracy is the state of mind in which every man is equal to every other man
5. If nobody ever said anything
6. It is dangerous to be sincere
7. It's not the real job

a) provided it does not exceed his own.
b) unless I want to buy anything.
c) unless you want to keep your job.
d) provided he really is.
e) unless you are also stupid. *(B. Shaw)*
f) unless you would rather do something else.
g) unless he knew what he was talking about, a ghastly hush **would descend** upon the earth.

Grammar: Conditionals

9. Identify the type of the conditional clause.

1. If you want to make the world's most compact computer memory, perhaps the smallest thing you could use to represent a bit of information **would be** one electron.
2. Should the traces of life be found on the solar system planets, this will booster the investments in space research.
3. If spacetime atoms **exist**, it **will not take** centuries to find evidence, as it did for material atoms. With some luck, we may know within the coming decade.
4. In terms of science, to predict something means to give a description of future events in which certain principles and conditions are assumed to be valid. **If** these principles or conditions **are fulfilled** then the event **will** follow.
5. What **would happen** if you **travelled** out to the edge of the universe and put your head through the curtains? Where would your head be if it were no longer in the universe?
6. Had gravity **been** a trifle stronger, the universe itself **might have collapsed** like a badly erected tent, without precisely the right values to give it the right dimensions and density and component parts.
7. If the universe **had been formed** just a tiny bit differently − if gravity **were** fractionally stronger or weaker, if the expansion **had proceeded** just a little more slowly or swiftly − then there **might never have been** stable elements to make you and me and the ground we stand on.
8. Perhaps if doctor **had** freedom to hand out crystals and amulets and placebo potions, far less harm **would** be done. A placebo often achieves the results as good as 'real medicine'. Many survival manuals recommend administering anything that looks like a medicine to someone bitten by a snake **if no antivenin is** at hand.

10. Choose the right option.

1. What ____ if I hadn't been working?
a) you would have done b) would you have done c) did you do d) were you doing
2. If I'd done that, we'd never have met, ____?
a) would we b) had we c) didn't we d) hadn't it
3. If I ____ more responsibility, I would have been pleased.
a) was given b) had given c) would have been given d) had been given
4. If the man ____ the wrong way, he would have seen the car.
a) hasn't looked b) wasn't looking c) hadn't been looking d) wouldn't have looked
5. If you ____ on a regular salary, paying bills can be quite difficult.
a) were b) will be c) would be d) are
6. Unless we ____ payment within seven days, your telephone will be disconnected.
a) don't receive b) didn't receive c) receive d) received
7. If he had gone to the agency earlier, there ____ more choice.
a) may be b) might be c) might have been d) would be
8. If you ____ more copies, please let us know.
a) like b) liked c) will like d) would like

11. Form mixed conditional sentences.

A	B
1. If the company was more careful,	**a)** you would not have thrown the rubbish on the road.
2. If she had known about the conference,	**b)** a lot of valuable equipment would be damaged now.
3. If you were more environmentally aware,	**c)** it would not have polluted the area with toxic waste.
4. If the fire in the laboratory had not have been put out,	**d)** she would have sent her abstract.
5. If the volcano in Iceland had not erupted three days ago,	**e)** there would not be thousands of people waiting for their cancelled flights across Europe.

☺ ☺ ☺ ☺ ☺

12. Match the two parts.

A	B
1. If you can't get the lawyer who knows the law,	**a)** if only he knew how to pack his bag.
2. He is the world's worst businessman. If he were a florist,	**b)** if I could have spelt it.
3. I'm sure my husband would leave home	**c)** get one who knows the judge.
4. A man may be a fool and not know it,	**d)** if he'd stayed single.
5. We were shipwrecked. I would have sent a SOS	**e)** he'd close on Mother's day.
6. A wife is a woman who stands by her husband through all the trouble he would not have had	**f)** she conveniently symbolizes them at times.
7. If your wife does not cause all your troubles,	**g)** but not if he is married.
8. If you don't go to people's funerals,	**h)** make the best of what you have.
9. If you cannot have the best,	**i)** they won't come to yours.
10. If you steal from one author it is plagiarism, if you steal from many,	**j)** it's research.

13. Use the correct form of the verbs in brackets.

Art and Science. Subjectivity vs. Objectivity

Although both art and science are human activities, they are thought about in different ways. Monet's *Palazzo do Mula* and Mozart's *Die Zauberflote* are regarded as wondrous acts of creativity**.**

1. We value variety in, say, art or biology. Nobody thinks the world would be better if Eduard Manet ____ **(be)** more like Mark Chagall, or fish like fowl.

2. Would the world now be different if Albert Einstein never ____ **(live)**?
3. Had Monet not lived, the world **(be)** different because the *Palazzo do Mula* ____ never **(paint)**.
4. Had Mozart not ____ **(live)**, the world **(be)** different because the opera *Die Zauberflote* never ____ **(compose)**.
5. It is indeed likely that if Einstein not ____ **(create)** the Special Theory of Relativity, someone else would have created something equivalent to Einstein's theory.

Phonetics

How are the following words pronounced?

[e] [i] [ei] [i:]

1) gauge	**5)** either /ай/	**9)** receipt	**13)** steam	**17)** determine
2) height //ай/	**6)** neither	**10)** tiny	**14)** threat	**18)** engine
3) rather	**7)** ether	**11)** instead	**15)** legacy	**19)** consider
4) key	**8)** foreign	**12)** steady	**16)** treat	**20)** typical

Words of Wit and Wisdom

1. *Man is a tool-making animal.*

B.Franklin

2. *Science and technology are incomparably the most successful endeavors human beings have ever engaged upon.*

Peter Medawar

3. *Invention breeds invention.*

W. Emerson

4. *Any sufficiently advanced technology is indistinguishable from magic.*

A.Clarke

5. *Technology is a knack for so arranging the world so that we don't have to experience it.*

M. Frisch

6.*Technology means the systematic application of scientific or other organized knowledge to practical tasks.*

J.K. Galbraith

7. *Machines are worshipped because they are beautiful, and valued because they confer power; they are hated because they are hideous, and loathed because they impose slavery.*

Bertrand Russell

Unit 11

MODERN MATERIALS

1. Read and discuss the text. Decide whether the following statements are true or false.

Nanotechnology

1. Richard Feynman was the first to come up with the idea of nanotechnology.
2. Current definition of nanotechnology is confusing and incomplete.
3. Commercially produced nanosystems approach nanoscale.
4. Research in the conventional fields of science is often mistaken for nanotechnology.
5. Radical nanotechnology implies mechanical devices built with molecular precision.
6. Natural life forms cannot be regarded as nanomachines.
7. It is hard to predict the future progress of nanotechnology.

Back in December 1959, future Nobel laureate Richard Feynman gave a visionary and now oft-quoted talk entitled "There is a Plenty of Room at the Bottom". Although Feynman did not intend it, his 7000 words were a defining moment in nanotechnology, long before anything 'nano' appeared on the horizon.

Manipulating and controlling things on a small scale is what is now referred to as nanotechnology. The breadth of Feynman's vision is staggering. In that lecture about 60 years ago he anticipated a spectrum of scientific and technical fields that are now well established, among them electron – beam and ion-beam fabrication, nanoimprint lithography, projection electron microscopy, atom-by-atom manipulation, spin electronics.

Today there is a nanotechnology gold rush. Nearly every major funding agency for engineering and science has announced its own thrust into the field. But in all honesty, it should be admitted that much of what invokes the hallowed prefix 'nano' falls a bit short of Feynman's remark. We've only just begun to take the first steps towards his grand vision of assembling complex machines and circuits atom by atom. What can be done now is extremely rudimentary. We've certainly nowhere near being able to commercially mass-produce nanosystems – integrated multicomponent nanodevices that have the complexity and range of functions readily provided by modern microchips. This new science concerns the properties and behavior of aggregates of atoms and molecules at the scales not yet large enough to be considered macroscopic but far beyond that can be called microscopic. It is the science of the mesoscales, and until we understand it, practical devices will be difficult to realize.

Nanotechnology is slowly creeping into popular culture, but not in a way that most scientists will like. Scientists expect that nanotechnology will lead to tiny robotic submarines navigating our bloodstream is ubiquitous, and images like that are frequently used to illustrate stories about nanotechnology in the press. Yet today's products of nanotechnology are much more mundane − stain-resistant trousers, better sun creams and tennis rackets reinforced with carbon nanotubes. There is an almost surreal gap between what the technology is believed to promise and what it actually delivers.

The reason for this disparity is that most definitions of nanotechnology are impossibly broad. They assume that any branch of technology that results from our ability to control and manipulate matter on length scales of 1-100 nm can be counted as nanotechnology. However, many successes that are attributed to nanotechnology are merely the result of years of research into conventional fields like materials or colloid science. It is therefore helpful to break up the definition of nanotechnology a little.

What we could call "incremental nanotechnology" involves improving the properties of many materials by controlling their nano-scale structure. These are the sorts of commercially available products that are said to be based on nanotechnology. However, they do not really represent a decisive break from the past.

In "evolutionary nanotechnology" we move beyond simple materials that have been redesigned at the nano-scale to actual nano-scale devices that can, for example, sense the environment, process information or convert energy from one form to another. Taken together, incremental and evolutionary nanotechnology are driving the current excitement in industry and academia for all things nano-scale.

But where does this leave the original vision of nanotechnology as articulated by Eric Drexler? Back in 1986 Drexler published an influential book called *Engines of Creation: The Coming Era of Nanotechnology*, in which he imagined sophisticated nano-scale machines that could operate with atomic precision. We might call this goal "radical nanotechnology". Drexler envisaged a particular way of achieving radical nanotechnology, which involved using hard materials like diamond to fabricate complex nano-scale structures by moving reactive molecular fragments into position. His approach was essentially mechanical, whereby tiny cogs, gears and bearings are integrated to make tiny robot factories, probes and vehicles.

Drexler's most compelling argument that radical nanotechnology must be possible is that cell biology gives us endless examples of sophisticated nano-scale machines. Drexler argued that if biology works as well as it does, researchers ought to be able to do much better. Surely we can create what are, in effect, synthetic life forms that can reproduce and adapt to the environment and overcome "normal" life in the competition for resources.

Scientists almost always greatly overestimate how much can be done over a 10 year period, but underestimate what can be done in 50 years. Which design philosophy of radical nanotechnology will prevail − Drexler's original "diamondoid" visions or something closer to the marvelous creations of cell biology.

2. Read the text. Write a summary of the text.

Nanotechnology in space

Nanotechnology could lead to radical improvements for space exploration. When it comes to taking the next "giant leap" in space exploration, scientists are thinking small – really small.

In laboratories around the world, governments are supporting the burgeoning science of nanotechnology. The basic idea is to learn to deal with matter at the atomic scale – to be able to control individual atoms and molecules well enough to design molecule-size machines, advanced electronics and "smart" materials.

Nanotechnology could lead to robots you can hold on your fingertip, self-healing spacesuits, space elevators and other fantastic devices. Some of these things may take 20+ years to fully

develop; others are taking shape in the laboratory today. Nanotechnology could provide the very high-strength, low-weight fibers that would be needed to build the cable of a space elevator.

Simply making things smaller has its advantages. Imagine, for example, if the Mars rovers Spirit and Opportunity could have been made as small as a beetle, and could scurry over rocks and gravel as a beetle can, sampling minerals and searching for clues to the history of water on Mars. Hundreds or thousands of these diminutive robots could have been sent in the same capsules that carried the two desk-size rovers, enabling scientists to explore much more of the planet's surface - and increasing the odds of stumbling across a fossilized Martian bacterum!

But nanotech is about more than just shrinking things. When scientists can deliberately order and structure matter at the molecular level, amazing new properties sometimes emerge. An excellent example is that darling of the nanotech world, the carbon nanotube. Carbon occurs naturally as graphite – the soft, black material often used in pencil leads – and as diamond. The only difference between the two is the arrangement of the carbon atoms. When scientists arrange the same carbon atoms into a "chicken wire" pattern and roll them up into miniscule tubes only 10 atoms across, the resulting "nanotubes" acquire some rather extraordinary traits.

Nanotubes have 100 times the tensile strength of steel, but only 1/6 the weight; are 40 times stronger than graphite fibers; conduct electricity better than copper; can be either conductors or semiconductors (like computer chips), depending on the arrangement of atoms; and are excellent conductors of heat.

Much of current nanotechnology research worldwide focuses on these nanotubes. Scientists have proposed using them for a wide range of applications: in the high-strength, low-weight cable needed for a space elevator; as molecular wires for nano-scale electronics; embedded in microprocessors to help siphon off heat; and as tiny rods and gears in nano-scale machines, just to name a few. Scientists are looking at how nano-materials could be used for advanced life support, ultra-powerful computers, and tiny sensors for chemicals or even sensors for cancer."

Confusables

3. Fill the gaps using the words below.

Lavoisier - the father of experimental chemistry

Lavoisier realized that every substance can ____ **(1)** in three states- solid, liquid and gaseous. He also ____ **(2)** that the phlogiston theory of burning was wrong. He was also a meticulous experimenter who ____ **(3)** the notion of exact measurement. His idea of____ **(4)** of energy and matter ____ **(5)** that whatever changes the substances ____ **(6)** in an experiment no mass is ever lost. This crucial insight not only helped him prove that combustion is ____ **(7)** by oxygen but still ____ **(8)** all experiments with matter even today. Lavoisier learned that air ____ **(9)** of two gases: oxygen and nitrogen. He also showed that both burning and breathing involve oxygen. Our lungs take in oxygen and ____ **(10)** carbon dioxide.

1. a) persist	b) resist	c) exist	d) consist
2. a) proved	b) disproved	c) improved	d) approved
3. a) campaigned	b) pioneered	c) championed	d) advocated
4. a) reservation	b) conservation	c) preservation	d) observation
5. a) applied	b) supplied	c) replied	d) implied

6. a) undergo	b) underpin	c) underlie	d) underline
7. a) retained	b) contained	c) sustained	d) obtained
8. a) imports	b) exports	c) supports	d) reports
9. a) persists	b) resists	c) insists	d) consists
10. a) propel	b) compel	c) expel	d) repel

4. Fill the gaps with the following verbs.

Newlands and Mendeleyev

a) **arranged**	b) **concluded**	c) **christened**	d) **greeted**	
e) **ironed**	f) **noticed**	g) **presented**	h) **published**	i) **related**
j) **repeated**	k) **retired**	l) **tried**	m) **wondered**	n) **worked**

D.I.Mendeleyev

In March 1866, an English sugar refiner and amateur chemist named John Newlands presented a paper to the Chemical Society with his own idea for bringing order to the elements. He ____ **(1)** that when elements were arranged in order of increasing atomic weight, every eighth element was ____ **(2)** – or had properties similar to the first element in the group. Elements, he ____ **(3)**, were multiples of 8, like notes in an octave. He therefore ____**(4)** his system the 'Law of Octaves'.

Perhaps it was the manner of his presentation, or the fact that he was an amateur, but sadly for Newlands, his idea was ____ **(5)** with general derision and mockery. One chemist sarcastically commented that he might just as easily have ____ **(6)** the elements alphabetically – implying that his system was based on coincidence. His system had its faults, but given time and encouragement he could have ____ **(7)** them out. However, he was so disheartened by his reception that he gave up the idea and ____ **(8)** from chemistry for good. In 1867, as he ____ **(9)** on his ***Principles of Chemistry***, Mendeleyev was unaware of the efforts of Newlands. He simply was trying to solve the problem with the structure of his book. He ____ **(10)** if there might be a relationship between the atomic weights and the properties of elements.

He ____ **(11)** ordering them by atomic weights in groups of seven, and began to notice a pattern; he saw that the properties ____ **(12**) themselves periodically, which was how the Periodic Table got its name. In 1869, it was formally ____ **(13)** to the Russian Chemical Society.

In 1870, Julius Lothar Meyer (1830-1895), a German chemist, who independently from Mendeleev drew up the periodic table, ____ **(14)** his version, showing the periodicity of chemical properties.

5. Find correspondence between the names and symbols of the elements.

Elements

1) As 2) C 3) H 4) Hg 5) Fe 6) K 7) Mn 8) N
9) Na 10) Pb 11) Sb 12) S 13) Si 14) Sn

а) азот б) водород в) железо г) калий д) марганец е) мышьяк ё) натрий
ж) олово з) ртуть и) свинец к) сурьма л) углерод м) сера н) кремний

a) antimony b) arsenic c) carbon d) hydrogen f) iron g) lead h) manganese
i) mercury j) nitrogen k) potassium l) sodium m) sulfur n) tin o) silicon

6. Fill in the gaps with the names of the elements.

Example: (Carbon) *is non-metal. It is unique among elements because a whole branch of chemistry (organic chemistry) is devoted to it.*

1. The atoms of ____ make up 90% of the universe, on earth it occurs combined with oxygen as water or with carbon as hydrocarbons, e.g. petroleum.
2. Metallic ____ is the main constituent of the earth crust, but it is rarely found in its core. It is found in meteorites. Its deficiency in the human body causes anemia.
3. In the 19th century green wallpaper was prohibited to be used after it had been found that it caused poisoning due to …content.
4. ____ compounds are used in the manufacture of medicines, paints, explosives and fireproofing materials.
5. It is used in matches, gunpowder, as fungicide and to vulcanize rubber.
6. ____ is also known as quick silver. The metal is used to form amalgams, for electrodes, in barometers, thermometers.
7. The compound of ____ with oxygen referred to as laughing gas is used as a weak anesthetic, sometimes producing mild hysteria and as an aerosol propellant.
8. The salts of this element are essential to plant life (hence their use as fertilizers) and important for animals for the transmission of impulses through the nervous system.
9. ____ is the sixth most common element and occurs naturally in common salt and many other important minerals such as cryolite.
10. ____ is used as a protective coating for steel, and in alloys including solder, bronze, pewter, Babbitt metal.
11. The oxide of ____ is used as a bleach, disinfectant and powerful oxidizing agent.
12. The second most abundant element, occurring naturally as silica. It is widely used in semiconductors.
13. Its main uses include steel alloys for high temperature applications and filaments of incandescent lamps.
14. ____ is used in roofing, water pipes, radiation shields and alloys including solder. It is added to gasoline as antiknock agent.
15. It is used in rocket propulsion and uranium production while its compounds with carbon find numerous applications from nonstick pans to refrigerators.

7. Form the suitable word.

Alloys

Four millennia before Christ people learnt how to use metal, how to melt and anneal it and how to extract it from soil and combine it with other metals. Other techniques were to be added **success (1)** to this basic knowledge, which were sometimes **inspiration (2)** by the discovery of other metals.

One of the most **signify (3)** inventions during the fourth millennium was that of making alloys. An alloy is a **mix (4)** of two metals. The first to be made were gold-copper and lead-tin alloys. The latter is still used in soldering which is aimed at forming a strong **join (5)** to hold together different **metal (6)** parts.

Amaze (7) though it may seem, at the same time this discovery inspired another invention, a carbon-iron alloy, that is, steel. It is not known whether the invention took place in Mesopotamia or Egypt, but it is almost certainly derived from **observe (8)**.

The first blacksmiths must have noticed that when the iron was put with wood it became much harder; this was in fact carbon iron and it had the **add (9)** advantage that it could be tempered.

As metallurgy developed new alloys were produced to be later adjusted to specific purposes by **vary (10)** the proportions of their **constitute (11)**.

One alloy, which was common in the ancient world but is seldom used today – is *electrum*, the **mix (12)** of gold and silver. It was used for ornaments and in statues.

Among the most **family (13)** alloys are those of copper, i.e. *bronze*, which is a mixture of copper and tin, and *brass*, which is an alloy of copper and zinc. Bronze was **special (14)** important for the **evolve (15)** of human technology, hence the name of the early history period.

8. Choose the right word.

Most widely used Metals

Mercury is a **(1)** ____ metal, it is almost like a thing alive. Its common name is '*quick silver*'. Aristotle called mercury 'liquid silver'. The Romans **(2)** ____ their mercury by heating the ore until the metal became a gas. This was **(3)** ____ in vessels and chilled until it became a liquid. Pliny said that the making of mercury could be dangerous. Workers worked with their backs to the wind and wore **(4)** ____ masks.

In Rome lead was used by plumbers for water **(5)** ____ pipe lines, thus the Latin name of this element. In the Middle Ages it was used in warfare when great kettles of lead were boiled and **(6)** ____ upon the heads of the attackers by the castle **(7)** ____. After the invention of gunpowder lead **(8)** ____ for several centuries for bullets that were used in rifles.

Cobalt was **(9)** ____ evil metal in the Middle Ages (this word means *black devil*). When King Solomon wished to **(10)** ____ Hiram, the Phoenician king, for his help, he **(11)** ____ Hiram some gold and silver mines. But Hiram **(12)** ____ to accept the gift because after the inspection of the mines he found that they **(13)** ____ some cobalt, which was believed **(14)** ____.

Nickel, though known as early as ancient Greece and India, it did not come into **(15)** ____ use until the 16th century in Germany, where it got the name of nickel, which means 'old Nick', an euphemism to **(16)** ____ 'old devil' because smiths often **(17)** ____ its poor workability while dealing with it.

1	**A** particular	**B** curious	**C** weird
2	**A** obtained	**B** gained	**C** supplied
3	**A** captivated	**B** captured	**C** capsized
4	**A** protective	**B** preventing	**C** preserving
5	**A** delivery	**B** provision	**C** supply
6	**A** spilt	**B** poured	**C** spitted
7	**A** defenders	**B** defeaters	**C** protectors
8	**A** serviced	**B** served	**C** preserved
9	**A** regarded	**B** supposed	**C** considered
10	**A** award	**B** reward	**C** present
11	**A** suggested	**B** proposed	**C** offered
12	**A** refused	**B** rejected	**C** resented
13	**A** consisted	**B** contained	**C** comprised
14	**A** dangerous	**B** harmful	**C** hazardous
15	**A** entire	**B** total	**C** general
16	**A** displace	**B** replace	**C** misplace
17	**A** cursed	**B** caused	**C** coursed

Word Families

9. Fill in the gaps with the suitable words.

a) **admit**	b) **admission**	c) **emitted**	d) **emitting**	e) **emission**
f) **permit**	g) **permissions**	h) **submit**	i) **transmit**	j) **transmitters**

1. Carbon capture and storage equipment should be installed at fossil fuel plants to prevent carbon dioxide____.

2. Frisch traveled to Copenhagen to ____ their speculations – it wasn't really more at the time – to Bohr, who was just about to leave for the U.S.A.

3. G. Marconi was the first to____ trans-Atlantic radio signal.

4. In 1897 Marie Curie began her Ph. D. dissertation, an investigation of the properties of uranium. She also started her own research to determine elements ____ similar substances.

5. The Curies realized that there is another element that____ radioactive rays.

6. Scientists who strongly advocate the manned exploration of Mars ____ that, for the same amount of money, unmanned missions could probably find as much if not more.

7. In the 19th century women had no ____ to Russian universities, so Kovalevskaya had to leave Russia to study abroad. Later she went on to become the first female professor in Sweden.

8. Daily injections of insulin ____ diabetes patients to have practically normal life.

9. By generating continuous waves, the high-frequency generator invented by Valdemar Poulse, a Dane ,enabled ____ to be fine-tuned and minimized signal disturbance between stations.

10. In China approvals and ____ concerning nuclear plants don't have as much salience as in Europe.

Phrasal Nouns

10. Add the suitable particle to form nouns and fill in the gaps.

back	***by***	***down*** *(x2)*	***in***	***out*** *(x4)*	***through***

1. Tax farms was a sound financial investment and helped Lavoisier to get wealthy, but it would also prove in time to be his ____ **fall,** for the tax farmers were not popular with the people.
2. A major **set** ____ occurred in 1862, when the Scottish physicist W. Thomson, later Lord Kelvin, estimated the age of the Earth scientifically. Kelvin declared the Earth could be no older than 40 million years old and possibly only 20 million years old.
3. As a ____-**product** of his work, Rutherford had made a significant discovery in an entirely different field, and pioneered a new science – ***radiometric dating*.**
4. The ____**come** was the development of the first nuclear bomb, which, ironically, was detonated on Japan after the fall of Germany.
5. In 1514, Copernicus published a little handwritten book for his friends. Called *Commentariolus*, it gave the first ____ **line** of his revolutionary theory.
6. Fleming's discovery was one of the medicine's greatest break____.
7. The ____ **break** of the First World War prevented Bohr from taking up a professorship in theoretical physics in Copenhagen.
8. Darwin's ____ **sight** was to focus on individuals, not species and he showed how individuals evolve by natural selection.
9.-10. If the reaction in the heat-producing core of a nuclear power station goes out of control, there may be a **melt-** ____ causing a radioactive material to release into the environment radiation in the form of radioactivity and radioactive **fall-** ____.

Linking Words: *but / but for*

11. Translate the following sentences paying attention to functions of 'but/but for'.

1. If others **would but** reflect on mathematical truths as deeply and continuously as I have they would make my discoveries. *Einstein*
2. But for all its elegant simplicity, the double helix is only part of the story. The helix itself still holds a few surprises. The fact that it can conduct electricity means DNA has an in-built shield against gene mutations.
3. The highest wisdom has **but** one science – the science of the whole – the science explaining the whole creation and man's place in it. *Leo Tolstoy*
4. The lineage of Gauss, Prince of Mathematicians, is **anything but royal**. The son of poor parents, he was born in a miserable cottage at Brunswick (Braunschweig), Germany in 1777. His parental grandfather was a poor peasant.
5. German nationalism spawned a movement to expunge **all but** Germanic stems from the language.
6. It is hard to imagine anyone **but** Hooke being willing to fulfill such an arduous brief – or making such a success of it.

7. This crucial insight not only helped him prove the true nature of combustion, **but** still underpins all experiments with matter even today.
8. Feynman did not intend it, **but** his 7000 words were a defining moment in nanotechnology, long before anything 'nano' appeared on the horizon.
9. Nanotechnology is slowly creeping into popular culture, **but** not in a way that most scientists will like.

12. Translate the following sentences.

☺ ☺ ☺

But/ If … not for

1. My only regret is that I have but one wife to send to the country.
2. I am not saying he is ugly, but he looks good in anything but a mirror.
3. She would be a great dancer if it were not for two things – her feet.
4. If it were not for the last minute, nothing would ever get done.
5. But for Edison we would watch TV in complete darkness.
6. We should have had socialism already, **but for** the socialists. *B. Shaw*
7. We owe a lot to Thomas Edison – if it wasn't for him, we'd be watching television by candlelight.

GRAMMAR: Subjunctive Mood. Emphasis

13. Complete the sentences according to the pattern:

Going to an international scientific conference (Wishes and Regrets)

***Example A*:** It's time *I learned English properly*.
1. It's time …… **2.** It's time …… **3.** It's time ……

***Example B*:** I'd rather *stay downtown so that I could walk to most landmarks.*
4. I'd rather …… **5.** I'd rather …… **6.** I'd rather …… **7.** I'd rather ……

***Example C*:** I'd rather *they met me at the airport.*
8. I'd rather …… **9.** I'd rather …… **10.** I'd rather …… **11.** I'd rather ……

***Example D*:** I'd better *send my abstract today as the deadline is tomorrow.*
12. I'd better…… **13.** I'd better…… **14.** I'd better…… **15.** I'd better……

***Example E*: 16.** I wish *I had taken some formal clothes as there were some receptions.*
16. I wish …… **17.** I wish …… **18.** I wish ……

a) I booked plane tickets;
b) Peter did not share the room with me as he snores;
c) learn my report by heart as my English is not good enough;
d) the organizing committee sent us the conference program;

e) come on Saturday before the conference in order to see the city;
f) Kate flew with us as she speaks good English;
g) register for the cultural program otherwise it might be too late;
h) check up my credit card to make sure there is enough euros;
i) I had not left behind my laptop;
j) the organization fee were not so high;
k) I concentrated on my report;
l) I had made some animation in the Power Point;
m) I got a visa;
n) had not forgotten to take my French-Russian phrase book;

14. Translate the following sentences.

1. I **would rather be** an opportunist and float than go to the bottom with my principles round my neck. *Stanley Baldwin*
2. Men occasionally stumble over the truth, but most of them pick themselves up and hurry off as **if nothing had happened.** *Churchill*
3. He who sees the need and waits to be asked for help is as unkind as **if he had refused** it.*Dante*
4. **Whoever would overthrow** the liberty of a nation must begin by subduing the freeness of speech. *Franklin*
5. In nine cases out of ten, a woman **had better show** more affection than she feels. *Jane Austen*
6. Patience is the most necessary quality in business; many a man **would rather you heard** his story than grant his request. *Chesterfield*
7. Many a man has fallen in love with a girl in a light so dim he **would not have chosen** his suit by it. *Maurice Chevalier*
8. History is sum total of things that **could have been avoided.** *K. Adenauer*
9. **If it were not for** presents elopement **would be** preferable.
10. A gentleman is any man who would not hit a woman with his hat on. *Fred Allen*
11. To dream of the person you w**ould like to be** is to waste the person you are.
12. The overall impression from the German and British is that they love France itself but **would rather the French did not live** there. *(the results of a 1997 tourist survey)*
13. Every form of addiction is bad, no matter **whether** the narcotic **be** alcohol **or** morphine or idealism. *Carl Gustav Jung*
14. If people knew what they had to do to be successful they would not. *Roy Thomson*

GRAMMAR: Emphasis

15. Translate the following sentences.

1. Not only **did** Archimedes invent a lot of basic mechanical devices, but he built the first water pump, which is called Archimedes screw.
2. One of those who **did** understand Copernicus was the English astronomer Thomas Digges, who wrote the first explanation of the Copernican system in English in 1576.

3. Unlike Brahe Kepler **did** accept Copernican model, and in a brilliant feat of inspiration, he found a way to make it fit the facts, using Brahe's observations.
4. Some people condemned Darwin's idea as an affront to god, for **nowhere did** Darwin's ideas leave room for the biblical creation.
5. Although Galileo did not formulate his ideas with the same grand clarity and mathematical certainty of Newton, he **did lay the** foundations of our modern understanding of how things move.

16. Fill the gaps using the following words:

pulled	***realised***	***seen***	***shared***	***was***	***were***

1. It was Lavoisier **who** ____ existing knowledge all together and made all significant advances in his own right.
2. It was Lavoisier **who** ____ that every substance can exist in three states – solid, liquid and gaseous.
3. Although Archimedes did not hesitate to build machines and conduct practical experiments, **it is** his purely intellectual achievements **that** ____ his lasting legacy.
4. It was Lord Rutherford **who** ____ the first man to succeed in making one element from another and who was the founder of 'philosopher's stone'.
5. It **was not** until 17 years later **that** Eijkman and Gowland (Pekelharing being by then dead) ____ the Nobel Prize for their work.
6. It is perhaps in the study of muscles **where** Leonardo's blend of artistry and scientific analysis is ____ best.

Phonetics

In which words is the letter h not pronounced?

1) hour	**2)** honor	**3)** dishonest	**4)** whether	**5)** hair
6) exhaust	**7)** rhyme	**8)** while	**9)** whole	**10)** ohm
11) vehicle	**12)** exhibit	**13)** exhale	**14)** whale	**15)** mishap
16) threshold	**17)** wheel	**18)** khaki	**19)** forehead	**20)** whip

Words of Wit and Wisdom

1. *Now it is established in the sciences that no knowledge is acquired save through the study of its causes and beginnings.*

Ibn Sina (Avicenna), Arab polymath (980–1037)

2. *Experimental science is the queen of sciences and the goal of all speculation.*

Roger Bacon

3. *I much prefer the sharpest criticism of a single intelligent man to the thoughtless approval of the masses.*

Johannes Kepler

4. *In questions of science, the authority of a thousand is not worth the humble reasoning of a single individual.*

Galileo Galilei

5. *He that will not apply new remedies must expect new evils; for time is the greatest innovator.*

Francis Bacon

6. *Knowledge becomes wisdom only after it has been put to practical use. Knowledge must be gained by ourselves. Mankind may supply us with the facts; but the results, even if they agree with the previous ones, must be the work of our mind.*

Benjamin Disraeli

7. *A pessimist sees a difficulty in every opportunity; an optimist sees an opportunity in every difficulty.*

Winston Churchill

8. *We cannot command nature except by obeying her.*

Benjamin Franklin

Unit 12
CAREERS IN SCIENCE AND ENGINEERING

1. Read and discuss the text. Decide if the following statements are true or false.

1. The careers in physics are subject to variations due to general economic trends.

2. Science graduates have good chance to be hired in industry because they are prepared to accept a low salary.

3. Trained physicists often fill managerial positions because they lack talent to do proper science.

4. Science departments should change their programs to ensure better working life for their graduates.

5. Traditionally trained academics have certain drawbacks in their education.

6. Though science is an egalitarian activity there is some stratification in academia which has negative impact on science students' vision.

7. The science departments that fail to attract students tried to follow the example of their more successful colleagues.

Full Academic and Practical Toolkit

"It's déjà vu all over again". This expression aptly describes ups and down cycles of physics job market during the past century. The ups resulted from such stimuli as war needs, the invention of the sputnik, the transistor or the computer, as well as from the spark of strong economy. The downs have almost inevitably followed, as the supply of trained specialists has exceeded the demand or the economy faulted. During the down periods such as the job crunches of the early 1970s and 1990s, those hardest hit were the newly minted physicists and students caught in the pipeline. Although, historically few physicists go unemployed or underemployed for long, they nevertheless experienced great angst. Many enter "holding pattern", taking one postgraduate position after another; some drop out. As the word of the tight job market spread, physics major enrollments drop, recovering only slowly once the conditions improve.

Industry wants very bright problem solvers, having broad technical underpinning. Science graduates fill that part of the bill. Moreover, they are frequently hired because employers know that science majors effectively weed out all but most talented. For example, half of the new physics PhDs in the US have taken potentially permanent jobs in the industrial sector, doing applied physics, engineering, software development, and the like.

Aspects of management consulting certainly appeal to a number of physics doctorates. Management consulting involves many of the same skills as physics, such as problem solving and quantitative analysis, but offers rewards on a shorter time scale and allows participation in a greater variety of projects. Plus, the six-figure salaries are nice as well.

Right now the demand for scientists in the US is healthy, and more academic openings are available to scientists than have existed for many years. But how long will the boom last? Are science departments planning for the rainy day? Many physics departments are listening to their students and to a wide range of employers, taking an introspective look at their program, and introducing measures to increase the robustness and attractiveness of their major.

Traditionally trained academics are hired when specialized talent is scarce but they are at competitive disadvantage when demand wanes. Being smart is not enough; industry expects new hires to contribute from day to day. Industrial employers perceive academics to be at the periphery of the high-tech talent pool. They believe that scientists often lack social skills needed to work on a team or they are too narrowly focused on a topic or too easily diverted from practical goals by interesting science. As a prominent industrial physicist said that academic physicists are "utterly clueless about what it takes to survive in industrial world. They have no idea about customers, on-time on-target delivery of the results without excuses, or participation in teams. These stereotypical views have a grain of truth that needs to be recognized.

Many science faculty members don't have the background to prepare students for a career outside the world of academia. Moreover, there persist in academia the remnants of an elitist perception of what a proper science is and what one's best graduates should do. These days, elitism is decreasing and rarely expressed, but students are masters at reading subtle, subconscious signals from their advisors. With declining enrollment science departments are challenged either to excel at providing a traditional academic program or to adapt their programs to prepare their graduates better for a broader employment markets. Some science departments seem to fail to achieve this goal.

The losers cite a number of reasons for the drop in students' numbers, including increased competition from other programs, notably computer science and engineering, poor employment prospects, declining preparation of incoming students. The gainers had all taken some action to change their enrollments. Their efforts included a double major with a department like electrical engineering, transfer to engineering school after two years and increased research opportunities. Though the gainers do not have a single bullet, all remedies include visible and improved preparations other than research professorship.

2. ***Read the text and make up dialogues simulating job interviews.***

Job interview

While still being **undergraduates** students are provided an opportunity to work as **trainees** at various organizations including major research centers and **industrial** enterprises. Such **internship** is part of Bachelor's and Master's projects. Many students go on working for these **organizations** on a part-time basis. Some students take temporary jobs during summer vacations. It means that by the time they graduate from university most graduates have some **working** experience and know how to present themselves at job interviews.

At present many companies have adopted western style of **recruitment** which includes **advertising** of a vacant position in special journals, mass media or in the Internet, **shortlisting** of suitable applicants and their **further** interviewing.

People searching for a **suitable** position find a lot of vacancies and follow a standard procedure of sending an **application** accompanied by a covering letter; they also **enclose** their C.V. or resume. This document contains the **applicant's** personal data, details of his/her **educational** background and working experience, as well as skills and **qualifications**. It also provides the names and contact phones or addresses of people in **responsible** positions who have agreed to provide **references** for the applicant.

If an applicant is shortlisted he or she is notified by the **personnel** manager and invited to attend an interview. There are **various** types of interview depending on the company and position you apply for. An interview may include a **psychological** or professional test (paper-and-pencil tests), but above all it is a talk. The interviewer wants to see what kind of person you are and to form his/her impression of your **personality**. Sometimes **interviews** are conducted in several stages.

While getting ready for the interview try to get information about the company in question by looking through its **profile** or **fact sheet**. Try to anticipate the possible questions asked at the interview. Typical questions concern the description of the desired position, working conditions, **perks**, opportunities for career growth, salary.

Try to look your best for the interview, dress neatly and try to follow the required dress code, if there is any. Be punctual for your interview; be polite to both the staff and **fellow applicants**. During the interview try to behave naturally, be realistic, do not **exaggerate** your qualifications, abilities, skills and experience. Actually, most companies have special training programs both for young employees and experienced staff. The qualities the interviewer is sure to appreciate is your honesty, flexibility and the ability to learn.

3. Complete the given form and use it as a model to write a CV of your friend or member of your family.

CV (Curriculum Vitae)

Personal Details:
Date of Birth:
Marital Status: (single, married, separated, divorced, a widow/widower)
Address:
Phone:

Education:

2005	advanced IT course (Moscow State University)
1989	post-doc research program (Hannover University, Germany)
1978	Ph.D. (Physics) Saint Petersburg State Polytechnic University
1975-1978	Ph. D. studies Saint Petersburg State Polytechnic University
1970-1975	MSc (Physics), Saint Petersburg State Polytechnic University

Professional Experience:

1995 – present	head of the IT department (“Advantex”, plc.)
1983–1995	senior research associate (Vedeneyev Hydraulic Engineering Institute)
1978 – 1982	junior research associate (Direct Current Research Institute)
1975 – 1978	teaching assistant (Saint Petersburg State Polytechnic University)
1973 – 1975	technician (Ioffe Physics and Technology Institute)

Participation in Conferences, Publications:

2008 CTBTO Informal workshop on noble gases OSI (St. Petersburg)
2007 International Congress on Large Dams (St. Petersburg)
2004 International Ice Congress (St. Petersburg)
2002 CTBTO workshop (Tahiti)
2000 CTBTO workshop (Stockholm, Sweden)

Skills: fluent German, proficient English, driving license
Activities: outdoor sports, traveling

4. ***Read the text and discuss the opportunities of taking international student's program or doing post-doc research at McGill University.***

McGill University

McGill University is one of Canada's best-known institutions of higher learning and one of the leading research-intensive universities. With students coming to McGill from about 160 countries, its student body is the most internationally diverse of any medical-doctoral university in Canada.

The oldest university in Montreal, McGill was founded in 1821 from a generous bequest by James McGill, a prominent Scottish merchant. Since that time, McGill has grown from a small college to a bustling university with two campuses, 11 faculties, some 300 programs of study, and more than 34,000 students. McGill is recognized around the world for the excellence of its teaching and research programs.

Ernest Rutherford's Nobel Prize-winning research on the nature of radioactivity was conducted at McGill, part of a long tradition of innovation on our campuses which has included the invention of the artificial blood cell and Plexiglas. Today its professors are performing pioneering work in epigenetics, developing alternative energy sources from crop plants and using nanotechnology to repair damaged neurons.

In addition to a stellar faculty, McGill is known for attracting the brightest students from across Canada, the United States, and abroad. McGill students have the highest average entering grades in Canada, and its commitment to fostering the best has helped its students win more national and international awards on average than their peers at any other Canadian university. The prestigious Rhodes scholarship has gone to a nation-leading 130 McGill students.

The ability to balance academic excellence with the extracurricular is another hallmark of the McGill student. In addition to a rich athletic tradition that includes many Olympians, thousands of McGill students participate in the hundreds of clubs, associations and community groups that enrich Montreal and contribute to a vibrant campus life.

Its 200,000 graduates form a vast global network, with many of its alumni reaching the top of their professions as Supreme Court Justices, award-winning authors and musicians, astronauts and Nobel Prize winners.

5. Discuss the importance of the English language in your future profession. Add your own reasons for mastering English.

Academics and the English Language

- publications in international professional journals
- working language of international conferences
- the proceedings of conferences
- the Internet, e-mails
- foreign colleagues and counterparts
- joint ventures, multinational companies
- international fairs
- international scientific organizations
- grant proposals
- tender technical proposals, terms of reference
- international scientific exchange program
- traveling and tourism, personal contacts
- miscellaneous

6. Write a report based on your findings using the model.

A Model for a Report

Thank you, Mr X. I am happy to have this opportunity to present my paper at this workshop session. The purpose of this study was to understand the mechanism of …
It is well known that some interesting research has been done in this field in recent years. Yet, it is not clear why …
So the aim of this work was to find an explanation for the …
We suggest an explanation in terms of …, which is confirmed by a model calculation.
Now let me discuss in some detail the data we have obtained and the conclusions we have made.
I would like to start by …
I'm afraid we'll have to skip some details, because we're short of time.
Have a look at this diagram, please. It demonstrates the difference (You can see a good agreement) between the experimental data and the model calculations.
This enables us to make the following conclusion …
Experimental results agree with this theory and show that …
In contrast with a previous interpretation, we attribute the phenomenon to …
With this I would like to finish.
If there are any questions, I'll be glad to answer them. Thank you.

☺ ☺ ☺ ☺ ☺

7. Find corresponding sentences.

Scientific research phases explained

what is said or written	what is meant or implied
1. In my experience …	**a)** Three pages of notes were obliterated when I knocked over a glass of iced tea.
2. In case after case …	**b)** These data are practically meaningless.
3. In a series of cases	**c)** I did not look up the original reference.
4. A careful analysis of the obtainable data …	**d)** once
5. After further study of my colleagues …	**e)** A couple of others think so too.
6. It has long been known …	**f)** a useless topic selected by my committee.
7. A definite trend is evident.	**g)** They did not understand it either.
8. Correct within the order of magnitude.	**h)** I don't understand it.
9. It is generally believed that…	**i)** twice
10. It is clear that much additional work is required before a complete understanding occurs.	**j)** I quit.
11. A highly significant area for exploratory study …	**k)** thrice
12. I hope that this study will stimulate further research in this field.	**l)** Wrong.

Word Families

8. Fill in the gaps with the suitable words.

a) **ejects**	b) **objections**	c) **objective**	d) **project**	e) **projection**
f) **rejected**	g) **rejection**	h) **subjected**	i) **subjective**	j) **subjectivity**

1. The Swedish Academy of Sciences first ____ nomination of Marie Curie for her share of the Nobel Prize and proposed giving it only to Pierre.
2. Rutherford was an extremely stubborn and patient man, willing to entertain and speculate on possibilities after their____ by more traditionally minded scientists.
3. Objectivity is known to dominate science, but ____ is important, too, for it is here that creativity is introduced in the picture, and good science is as creative as good art.
4. ____ criteria set the height of the net and describe the boundaries of the court, but it is the passion of the **subjective** idea that strikes the ball.

5. The ____ concept of beauty is unwelcome in intellectual circles, and certainly has no place in academic critique of high art. Yet it is a word that comes readily to the lips of all of us.
6. In business and industry last year's figures serve the basis for the next year ____.
7. Seashell fossils found in high mountains indicate that in the past the world was ____ to massive earthquakes which threw up ancient seabeds to form mountains.
8. Babbage's Difference Machine No.1 was a tremendously ambitious ____. No calculator had ever worked with numbers bigger than four digits, yet Babbage planned to build a machine that could handle numbers of up to fifty.
9. One of the main attractions of the Yellow Stone national park is the "Old faithful" geyser that ____ a jet of hot water every 30 minutes.
10. Originally the plan of Channel construction met with many ____.

Phrasal Verbs

9. Insert the suitable verb:

came	***done***	***drew***	***get***	***ironed***	***pointed***	***sort***	***spelling***	***turned***	***working do***

1. It is Bacon writing in the first decades of the seventeenth century, who is usually credited with ____ **out** the principles of empirical science and the role that experiments should play in hypothesis testing.
2. When Newton made his theory of light and color known in 1672, Hooke ____ **out** that what was right in Newton's theory had been suggested by him seven years previously
3. Newland's system had its faults, but given time and encouragement he could have them ____ **out.**
4. In 1870, Julius Lothar Meyer (1830-1895), a German chemist, who independently from Mendeleev ____ **up** the periodic table, published his version.
5. The row over who had been the first to think of Calculus became so bitter that the Royal Society held an inquiry to ____ **out** the mess.
6. In 1755 Linnaeus ____ **down** the offer from the King of Spain to come and live at the Spanish court with a very handsome salary.
7. The occult qualities of late scholastic science were to be ____ **away with;** the only ideas which were clear and distinct were to be employed.
8. To answer the question about what transfers vibration, scientists ____ **up with** the idea of a weightless matter called 'ether'.
9. Romans did not ____ **round to** inventing paper or gunpowder, but when it came to technology and administration of a great empire they were equal to the Chinese.
10. In _____ **out** his ideas for the Analytical Engine, Babbage anticipated virtually all the key design elements of the modern computer.
11. For young Gauss whose inhuman memory enabled him to ____ **without** a table of logarithms, all the endless arithmetic was the sport of an infant.

Linking Words and Text Organizers

10. Fill in the gaps.

a) **as**	b) **apart from**	c) **Besides**	d) **but**	e) **like**
f) **Meanwhile**	g) **Moreover**	h) **Similarly**	i) **since**	k) **such**

Many factors ____ **(1)** the job market influence students' decisions. Evidently, many young people fail to see the relevance of physics ____ **(2)** there is no apparent "physics industry". Some of the best and brightest are drawn to appealing alternative disciplines, a number of which ____ **(3)** as bionics, mechatronics, material science, nanotechnology, biotechnology, IT are physics in all ____ **(4)** name. ____ **(5)** physicists try to promote their field with argument that physics is the technical "liberal arts" degree opening up a wide array of career options.

The seemingly opposed attitudes of scientists and engineers are not so much products of their education and background ____ **(6)** of their working environment. For example, engineers who work in research laboratories, behave much ____ **(7)** scientists, publishing papers and attending conferences. ____ **(8)**, scientists in product development laboratories are much more conscious of cost and schedule. ____ **(9)**, people with technical background are known to be quite flexible in adapting to new jobs. **____(10)** they seem to be in an increasing demand.

11. Choose the suitable word.

1. In 1913, the Danish physicist Niels Bohr showed that electrons contrary to the classical laws of physics – do not lose their energy during rotation and do **indeed / in fact** occupy certain well defined positions around the nucleus.
2. In the early 1970s, Hawking realized that quantum effects might apply to the 'event horizon' or rim of 'black holes'. If they did, he argued, they would make a black hole glow faintly, − and so perhaps be detectable **after all / at all**, making this hitherto theoretical idea a reality.
3.Waterston, **ahead of / in front of** both Thomson and Helmholz but roughly at the same time as Mayer, had the same insight about the way heat to keep the Sun hot might be generated by gravitational means.
4. In 1811, L. Avogadro made a discovery that would prove highly significant **in the long term** / **in known terms** – namely, that two equal volumes of gases of ant type, if kept at the same pressure and temperature, will contain identical number of molecules.
5. To the astonishment of those present, Archimedes just **at first hand / single-handedly** launched "Syracusia", one of the most luxurious and biggest ships built in the ancient times, by an ingenious arrangement of levers and pulleys.
6. The idea that atoms could rip themselves apart and change into different atoms – **in other words / on the other hand**, that one element could change into another – smacked of medieval alchemy and was firmly resisted by many scientists.
7. The eighteenth century represented a catching up, as science, **in general/ on average,** came to terms with the way Newton had codified physics and demonstrated the lawful, orderly nature of the Universe.
8. Right up to the closing years of the eighteenth century (and in Priestley's case a little **beyond /within** it**)** scientists discovered substances like phlogiston.

Grammar: Comparison. Noun Compounds

12. Translate the following sentences paying attention to comparison.

1. If one consults the archeological record, it seems clear that the Babylonian and Sumerian civilizations **had rather more than** rudimentary grasp of medicine, astronomy and applied mathematics, not to mention engineering.
2. Thales proposed that the prime substance was water; Anaxagoras believed it to be air while Xenophanes proposed **the rather less** glamorous option of mud.
3. In the works of pre-Socratic philosophers we see glimmerings of the scientific method and the search for causes and principles based on observation and reason, the truth became a province of thinkers, **rather than** priests.
4. Aristotelian physics and cosmology were **less** successful although **none the less** influential: his views dominated the mind of science down to the Renaissance.
5. Yet, in some ways his inventions were the **least** of his achievements.
6. Sociology is a science with **greatest** n**umber** of methods and the **least** results.
7. One key idea that emerges in Ada's notes is the notion that the Engine might have **far wider** applications than purely mathematical ones.
8. The great equations are just **as rich** a stimulus **as** poetry to the prepared imagination.
9. Just **as** gravity pulls the apple to the Earth, **so** gravity keeps the Moon in its orbit round the earth and the planets round the Sun.
10. Archimedes immersed in water a piece of gold that weighed **the same as the** wreath and pointed out the subsequent rise in the water level.

13. Fill the gaps using the following words. Translate the sentences.

a) **astonishing**	b) **better**	c) **greater**	d) **insatiable**	
e) **least**	f) **less**	g) **more** (x2)	h) **possible**	i) **short**

Example: The degree of one's emotion varies inversely with one's knowledge of the facts − **the less** you know, **the hotter** you get. *(B. Russell)*
Степень эмоций человека обратно пропорциональна его знанию фактов − чем меньше вы знаете, тем больше вы горячитесь.

1. Today's most powerful instruments probe distances **as** ____ **as** 10^{-18} meter.
2. Ada was convinced of her mathematical prowess, writing to Babbage that '**the more** I study **the more** ____ I feel my genius for it to be'.
3. You compress things into computer programs, into concise algorithmic descriptions. **The simpler** the theory, **the** ____ you understand something.
4. In using the instrument an experimenter has to make use of his or her own skills to obtain **as accurate** reading **as** ____.
5. According to Einstein's General Theory, objects with mass create distortions, or curvatures, in space-time, and **the larger** the object, **the** ____ the distortion.
6. The more we love our friends **the** ____ we flatter them. *Moliere*
7. The more we realize our minuteness and our impotence in the face of cosmic forces, **the more** ____ becomes what human beings have achieved. *Russel*

8. Every year it takes **less** to fly across the Atlantic and ____ to go to the office.
9. Middle age is when work is a lot **less** fun and fun is a lot ____ work.
10. That government is the **best** that governs **the ____**, because its people discipline themselves.
Thomas Jefferson

CONFUSABLES: Comparatives

14. Choose the right word.

1. Hooke and Huygens made their own telescopes, especially Huygens whose telescopes were technically **superior / inferior** to anything that had been done before.
2. Models by definition are **less** / **lesser** than the reality they represent, and for models of the Universe this constraint obviously must be particularly stringent.
3. Hypothesis is any sentence that has as a consequence **at least / lest** one empirical generalization.
4. A theory is deduced as a plausible explanation of facts derived from observation or experiment. It gains credibility through the **farther** / **further** accumulation of evidence.
5. As Hooke grew **elder / older**, he became increasingly depressed and withdrawn.
6. As **early / late** as 1909, the great British physicist J. J. Thomson was insisting: "The ether is not a fantastic creation of the speculative philosopher; it is as essential to us as the air we breathe" – this was said more than four years after it had been pretty incontestably established that it didn't exist.
7. At the design luminosity, **as many as / as much as** 20 events will occur, with each crossing of the needlelike bunches of protons. Each proton will have about 7 TeV of energy − 7,000 times as **many /much** energy as a proton at rest has embodied in its mass.
8. Serpentine and chrysotile asbestos are Identical forms. While the **former / latter** is a harmless mineral that consists of flat sheets of atoms, the **former** / **latter** contains nano-scale tubes of atoms, which have the potential to be toxic.
9. There are thought to have been about 20 **major / minor** glacial advance, with the **major / minor** Ice Age occurring in Europe in 15^{th} -16^{th} centuries.
10. Science graduates normally are offered positions of **senior / junior** associates at research institutes.
11. It is futile to do with **more / fewer** things which can be done with **fewer/more**. *William of Ockham*

15. Fill in the gaps with the suitable quantifiers:

many	**the many**	**much**	**few**	**the few**	**less**	**least**	**some**

1. All religions are founded on the fear of **____** and cleverness of **the few**. *Stendhal*
2. Good sense is a thing **all** need, **____** have, and **no one** think they want. *Franklin*
3. So **little done**, so **____** to do. *Cecil Rhodes*
4. Women are wiser than men because they know **____** and understand **more**. *James Stephens*
5. If a free society cannot help **the many** who are poor, it cannot save **____** who are rich.
John F. Kennedy
6. The classes that wash **most** are those that work **____**. *G.K. Chesterton*
7. **____** wit in the head makes much work for the feet.

8. You can fool **all** the people **some** of the time, and **____** of the people **all** the time, but you cannot fool **all** the people **all** the time. *A. Lincoln*

16. Fill in the gaps with the suitable pronouns:

another	**any**	**each**	**every** (x2)	**everybody** (x2)	**one**	**none**	**someone's**

1. A professor is one who talks in____ sleep.
2. **____** of us is as smart as all of us.
3. **_____** man desires to live long, but no man would be old. *Swift*
4. ____ wants to be right, but **no one** stops to consider if their idea of right is right. *F. Alexander*
5. A committee is a group of people who individually can do **_____** but as a group decide that that nothing can be done. *Fred Allen*
6. ____fool can make a rule and **every** fool can mind it.
7. _____must care about the world **one** will not see. *Russell*
8. If we were given by magic the power to read **_____other's** thoughts, I suppose the first effect would be to dissolve all friendships. *Russell*
9. No man is good enough to govern **_____** man without that **other's** content. *Lincoln*
10. **All** progress is based on the universal innate desire of _____ organism to live beyond its income. *S. Butler*
11. I am not absent-minded. It is the presence of mind that makes me unaware of_____ else. *Chesterton*
12. History is littered with the wars which _____ knew would never happen. *Powell*

Noun Compounds

17. Form corresponding noun compounds

1. выделения продуктов реакторов атомных станций
emissions/ nuclear/ plant/ reactors/ power
2. система мониторинга делания газообразных продуктов
fission /gaseous/ monitoring/ product/ system
3. концентрации высококачественного радиактивного ксинона
concentrations/ high/ radioxenon/ quality
4. соотношения активности радиактивных изотопов ксинона
activity / radioisotope/ ratios/ xenon
5. моделирование производства радиоактивных фармацевтических изотопов
isotope /simulations/ production/ radiopharmaceutical
6. методика анализа данных за счёт гамма-бета совпадений
analysis/ beta-gamma/ coincidence/ data /techniques
7. применение данных мониторинга радионуклидов
application/ data/ monitoring/ radionuclide
8. оценка выхода благородных газов на площадке реактора
estimation/ gas/ noble/ reactor/ releases/ site

9. оценка моментального выхода взрывной энергии
energy/ explosive/ estimation/ instant/ release
10. создание станций глобальной системы мониторинга радионуклеидов ксенона
establishing/ global/ stations/ network/ xenon /monitoring/radioanuclides

Phonetics

In which words are these letters not pronounced?

b **1)** doubt **2)** debt **3)** bomb **4)** bombing **5)** undoubtedly
6) climb **7)** plumber **8)** numb **9)** limb **10)** womb

g **1)** sign **2)** signature **3)** foreign **4)** significant **5)** design **6)** align
7) campaign **8)** paradigm **9)** malignant **10)** benign **11**) reign **12)** resignation

t **1)** buffet **2)** debut **3)** ballet **4)** trait **5)** rapport **6)** mortgage

p **1)** pneumatic **2)** psychology **3)** pseudoscience **4)** receipt **5)** pneumonia

k **1)** acknowledge **2)** acknowledgement **3)** knowledge **4)** knee **5)** knit
6) knight **7)** khaki **8)** knock **9)** knot **10)** knack

Words of Wit and Wisdom

☺ ☺ ☺ ☺ ☺

1. *I wonder if what we are publishing now is worth cutting down trees to make paper for the stuff.* ***R. Brautigan***
2. *Quoting: the act of repeating erroneously the words of others* ***A. Bierce***
3. *I don't like to write but I love to have written.* ***M. Kannin***
4. *No passion in the world is equal to the passion to alter someone else's draft.* ***H. Wells***
5. *I was working on the proof of my manuscript in the morning and took out a comma. In the afternoon I put it back.* ***O. Wilde***
6. *When I want to read a book I write one.* ***W. Churchill***
7. *I have made this letter longer than usual because I lack the time to make shorter.* ***B. Pascal***
8. *The desire to write grows with writing.* ***Erasmus***
9. Editors and authors **have to be able** to spell, publishers **can** be illiterate. ***Josh Billings***

10. *Every quotation contributes something to the stability or enlargement of the language.* ***S. Johnson***
11. *No author is a man of genius to his publisher.* ***H. Heine***

Part 2. COMPUTER-ASSISTED LANGUAGE LEARNING:

(1) INFOGRAFICS AND MIND MAPS

(2) VISUALISATION & INTEGRATION

COMPUTER-ASSISTED LANGUAGE LEARNING:
(1) INFOGRAFICS AND MIND MAPS

Unit 1. Advance of Science and Technology

Task 1. Watch and discuss a video on YouTube "The Greek Legacy: How the Ancient Greeks shaped modern mathematics" (https://www.youtube.com/watch?v=y1lIdkoIn0Y)
Listen to James Grime again and fill in the gaps.

1) Around _____ ago, a group of revolutionary thinkers changed the way we think about mathematics.
2) Through the idea of proof, the ancient Greeks showed that maths isn't just about performing calculations, but a way of _____ the reality of the world around us.
3) And the great Archimedes was even killed by _____ because he refused to leave a proof unfinished.
4) You've probably heard of _____, a mathematical fact about the sides of _____.
5) Good proofs are _____ true.
6) He compiled these results into one remarkable book called _____, and his proofs are as true today as when it was first written and have formed the foundations of modern mathematics.
7) From proofs about infinite _____ used in internet encryption to mathematical formulae used in engineering, the ancient Greeks have provided scientists, economists, _____, architects, and well, just about everyone, with a new _____ understanding of our world..
Answer the questions. If you don't know the answers, google them.
8) What is a proof?
9) What contribution did Euclid make to science?
10) Summarize the talk by James Grime.

Task 2. Read "Ancient India's Inventions in Science and Technology" (http://www.themysteriousindia.net/ancient-india-inventions-science-technology/) and create an infographic using one of the three tools: Piktochart (https://piktochart.com/) Venngage (https://infograph.venngage.com) Canva (https://www.canva.com/)

The algorithm is simple and similar to these tools:

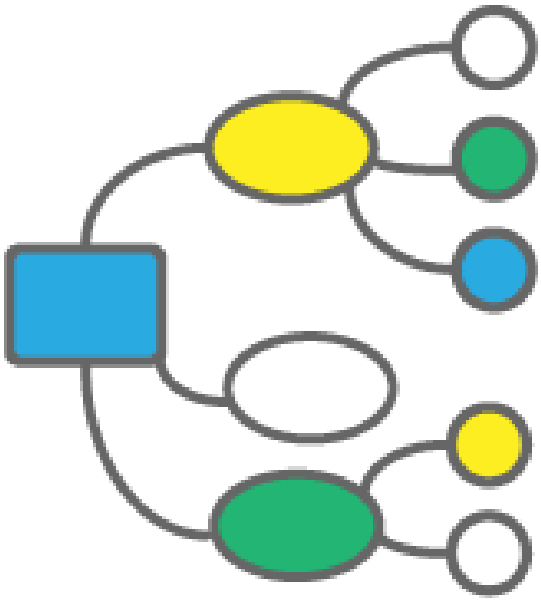
1. Register for free.
2. Choose 'Infografic' category.
3. Choose a template or create your own infographic.
4. Add charts and visuals using features on the left. Visualize your data and information with charts and text, add icons and images.
5. Customize your design.

Here an example of an infographic

Task 3. Read the text "Ancient Egypt Technology and Inventions". (http://ipfactly.com/ancient-egypt-technology-and-inventions/).Create a mind map to depict important words from the text with the use of Mindomo or Lucid chart to share your experience in groups.

How to create a mind map - Mindomo https://www.mindmup.com/; MindMeister https://www.mindmeister.com/ru: 1. Get started and create a new map 2. Name it and choose a mind map format 3. Enter words as a topic and add sub-topics by clicking TAB near your word 4. Make sure you add at least 3-4 key words for each of the subtopics.

Create your own mind map on the above text. An example of a mind map is shown below.



Example of a mind map

Task 4. Study the word cloud and do the exercise below:

1. Divide all words from the word cloud based on their classes (or parts of speech: nouns, pronouns, verbs, adverbs, adjectives, interjections, etc.).
2. Write 5 sentences using the most frequent words ("What Makes Science Possible" - ex.2).

Unit 2. Inevitability of Scientific Discovery

Task 1. Watch and discuss a TED Talk titled "Yup, I built a nuclear fusion reactor" (https://www.ted.com/talks/taylor_wilson_yup_i_built_a_nuclear_fusion_reactor/transcript) twice. If necessary, use the English subtitles.

Listen to Taylor Wilson again and fill in the gaps.

1) Well I built a _____ when I was 14 years old.
2) So this is similar to the reaction of the _____ _____ that's going on inside the Sun.
3) I don't see any _____ _____ _____ with fusion energy. Well it doesn't break even.
4) For hundreds of dollars, I've developed a system that exceeds the _____ __ _____ that are hundreds of thousands of dollars.
5) And I've developed a system to produce _____ _____. Instead of requiring multi-million-dollar facilities I've developed a device that, on a very small scale, can produce these _____.
6) So that's my fusion reactor in the background there. That is me at the _____ _____ of my fusion reactor.
7) So in about seven years of doing _____ _____, I started out with a dream to make a "star in a jar," a star in my garage, and I ended up meeting the president.

Answer the questions. If you don't know the answers, google them.

8) What does Taylor Wilson do?
9) How does Taylor's reactor work?
10) What is the reason of his success?

Match words with their meaning (из Видеотекста в задании 1)

Match English and Russian expressions:

1	to make the case	a	превышать
2	assemble	b	побочные продукты
3	slam smth together	c	работать над проектом
4	a nuclear physicist	d	начинать с (чего-то)
5	exceed	e	заявлять о
6	byproducts	f	заканчивать
7	by the way	g	физик-ядерщик
8	build the project	h	сталкивать вместе
9	ended up	i	собирать (что-то)
10	start out with	g	кстати

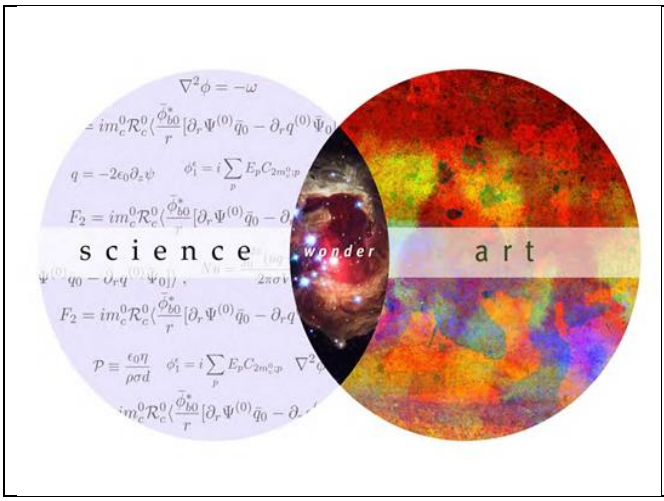
Task 2. Read "Why Art And Science Are More Closely Related Than You Think" (https://www.forbes.com/sites/quora/2016/03/16/why-art-and-science-are-more-closely-related-than-you-think/#3fc425b369f1) and create an infographic using one of the three tools: Piktochart, Venngage or Canva.

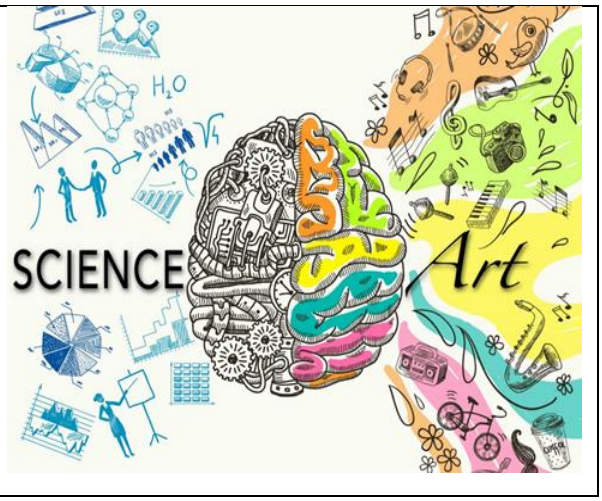
- Piktochart (https://piktochart.com/)
- Venngage (https://infograph.venngage.com)
- Canva (https://www.canva.com/)

The algorithm is simple and similar to these tools:

1. Register for free.
2. Choose a template. Create an infographic with the chosen templates.
3. Add charts and visuals using features on the left. Visualize your data and information with the charts and text, add icons and images.
4. Customize your design by adding some more attractive features.

Here are the examples of an infographic





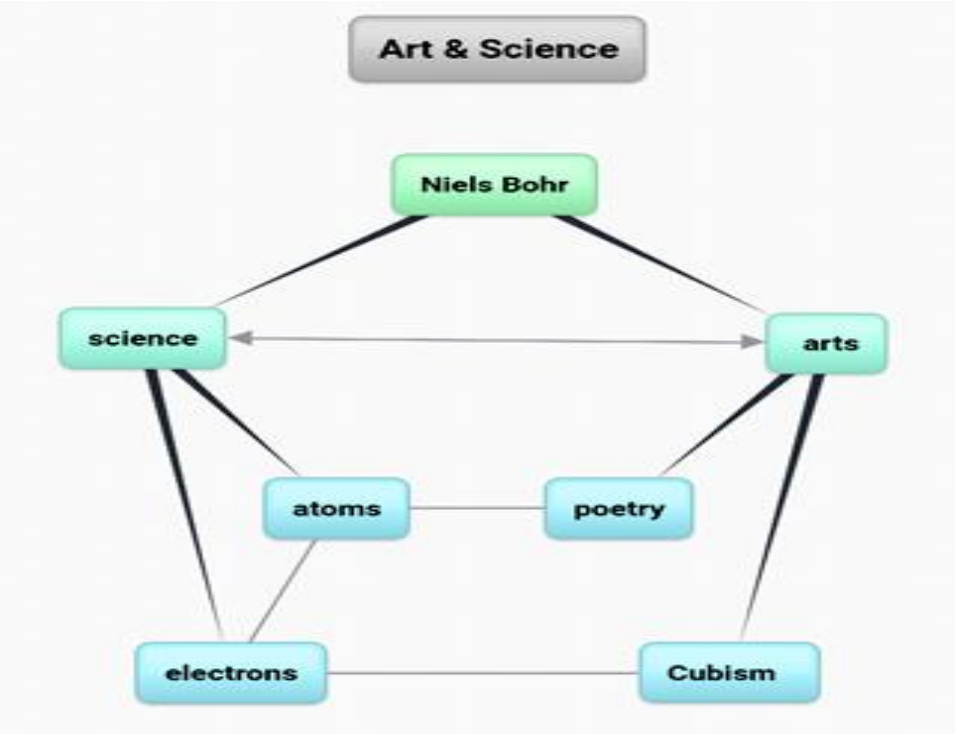
Task 3. Read the text "Art & Science" (http://www.poetryandscience.co.uk/art-science/) and create a mind map with the use of Mindomo chart to render it.

Follow the algorithm below and see an example.

How to create a mind map – Mindomo

- ✓ https://www.mindmup.com/
- ✓ https://bubbl.us

1. Get started and create a new map
2. Name it and choose a mind map format
3. Enter words as a topic and add sub-topics by clicking a small triangle near your word
4. Make sure you add at least 3-4 key words for each of the subtopics.



Task 4. Read the text "Paradigm Shift" and look at the world cloud below. Do the exercise below:

1. Divide all words from the word cloud based on their classes (or parts of speech: nouns, pronouns, verbs, adverbs, adjectives, interjections, etc.)
2. Write 5 sentences using the most frequent words.

UNIT 3. Errors, blunders, deadends in science

Task 1. Watch and discuss a video on YouTube "An Astronomer Responds To Flat Earth Theory": *https://www.youtube.com/watch?v=thxbiR-XfJo*

Listen to Stuart Clark again and fill in the gaps.

1) We see when ships leave the harbor, you can see as they gradually disappear below the _____.
2) All our physics is constructed now, the physics of orbits actually - of things going around of the Earth – is constructed with a _____ spherical world.
3) As human beings, we love stories because stories _____ our lives, of our world, they endow it with meaning and they can be _____.
4) But we see _____ the prevailing scientific theories of the day can be overturned as we move to more precise understanding of the Universe around us.
5) Maybe this obsession _____ is one of those. (with the flat Earth)
6) My own _____ is that they are doing it for comic effect, just to see how far they can push it.
7) The flat surface is very _____ to the other forces – it would be flexible and moved around.

Answer the questions. If you don't know the answers, google them.

8) What does the modern physics say about the surface of the Earth?
9) What is The Flat Earth Society?
10) Summarize the talk by Stuart Clark.

Задание 2. Read "Alchemy" at *https://crossref-it.info/articles/404/alchemy* and create an infographic using one of the three tools:

Piktochart: *https://piktochart.com/*

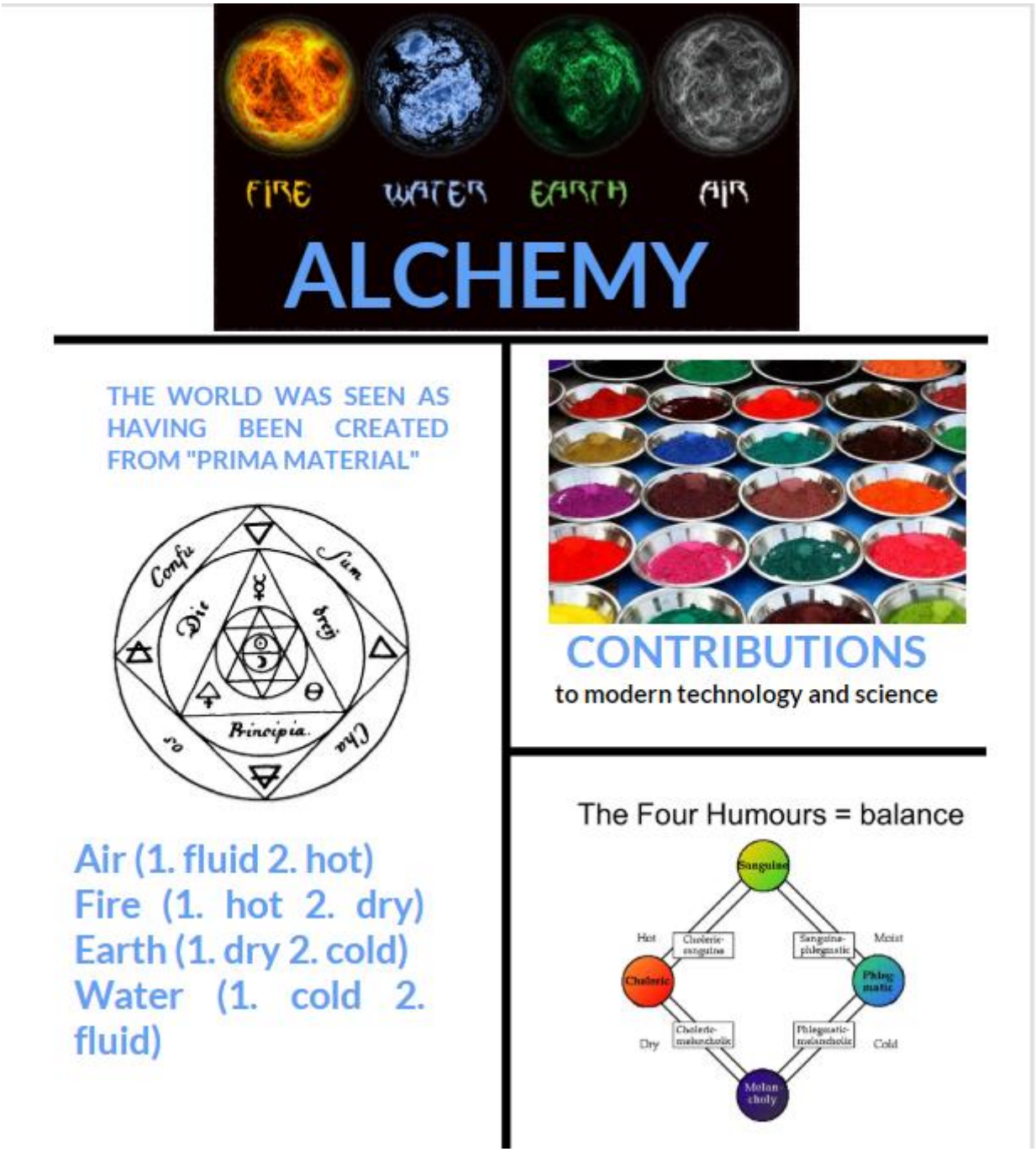
Venngage *https://infograph.venngage.com*

Canva *https://www.canva.com/*

The algorithm is simple and similar to these tools:

1. Register for free.
2. Choose 'Infografic' category (Canva).
3. Choose a template. Create an infographic with the chosen templates.
4. Add charts and visuals using features on the left. Visualize your data and information with charts and text, add icons and images.
5. Customize your design.

Here an example of an infographic

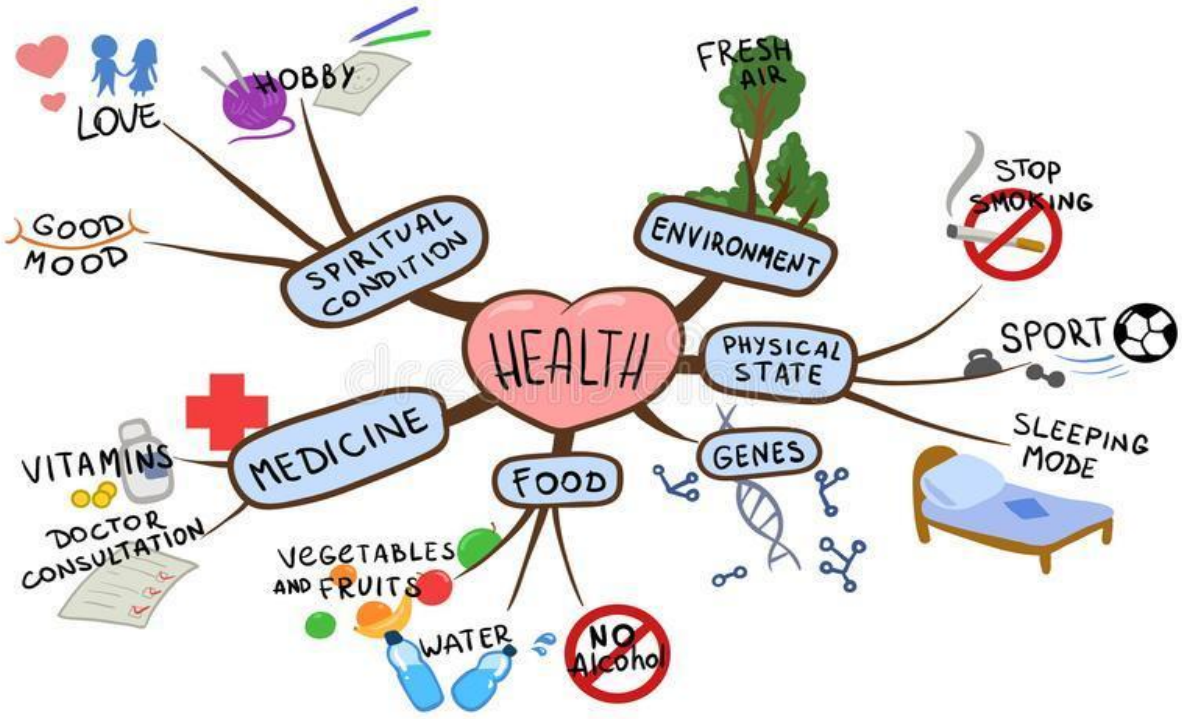


Задание 3. Read a text «11 Bizarre Inventions of the 19th Century You've Never Heard Of» (http://theoldtimey.com/11-bizarre-inventions-of-the-19th-century/)

Create a mind map to depict important words from the text with the use of Mindomo or Lucid chart to share your experience in groups.
Follow the algorithm below and see an example.
Follow the algorithm below and see an example.
How to create a mind map - Mindomo https://www.mindmup.com/

How to create a mind map MindMeister *https://www.mindmeister.com/ru*

Here is an example of a mind map. Create your own mind map for the above text.



Example of a mind map on the subject "HEALTH"

Задание 4. Read the text «Philosopher's stone, Phlogiston and Ether » and look at the world cloud below

Philosopher's stone gold **alchemist** do sterling service **in figurative sense** in literal sense **elude** premise
ether subsequently **stream of particles** discredit **turning point** matter **accurate** at the heart of **demolish** substance **vanish** swap **became centered on** burnable **Phlogiston** burning issue **owe much to**
contrary to tin **oxygen** mumble incantations **smoky** den **scientific orthodoxy** apparatus **mix together abandon** vibrate **interferometer** copper **alter** carry out experiment **streetcar** disturbance **unambiguous It is not for nothing that** loose **weightless** lean to the ideas of

Find Russian equivalents to some words:

1) Решающий момент (turning point), 2) в переносном смысле (in figurative sense), 3)механизм, аппарат (apparatus) 4) вещество (substance) 5)материя (matter) 6)быть многим обязанным (owe much to) 7)олово (tin) 8)беспокойство (disturbance) 9)эфир (ether) 10)отказываться, оставлять (abandon) 11) изменять, преобразовывать (alter)

UNIT 4 . Vision in science and technology

Задание 1. Watch and discuss **a TED Talk titled "How AI is making it easier to diagnose disease"**
(https://www.ted.com/talks/pratik_shah_how_ai_is_making_it_easier_to_diagnose_disease/transcript?language=en#t-192533).

Listen to Pratik Shah again and fill in the gaps.

1) And this intelligence of computers is often referred to as AI or _____. (*artificial intelligence*)
2) Our best way to help these patients is to perform _____ and ____ of these diseases. (*early detection; diagnoses*)
3) In patients who, unfortunately, are suspected of these diseases, an expert physician first orders very expensive medical imaging technologies such as fluorescent imaging, ____, _____ to be performed. (*CTs, MRIs*)
4) And using those two pieces of information, I can train _____ or _____ to provide patient's diagnosis. (*a standard deep neural network; a deep learning network*)
5) So, can we invent more _____ , _____ and more _____artificial intelligence architectures to solve these very important problems facing us today? (*scalable, effective; valuable*)
6) These information packets included colors, pixels, ____ and rendering of the disease on the medical image. (*geometry*)
7) Much to our surprise, we only required ____ of these composite images to train our algorithms to high efficiencies. (*50*)

Answer the questions. If you don't know answers, google them.

8) How do you understand AI?
9) What are CTs? What are MRIs?
10) Summarize the talk by Pratik Shah.

Задание 2. Before watching the video "The jobs we'll lose to machines and the ones we won't"
(https://www.ted.com/talks/anthony_goldbloom_the_jobs_we_ll_lose_to_machines_and_the_ones_we_won_t)**, name 3-5 pros and possible cons of using machines.**

Watch the talk delivered by Anthony Goldbloom and answer the following questions:

1) What is Machine Learning?
2) How are machines going to outperform human? What does it give?
3) When did Machine learning start making its way into industry? Give the examples of tasks it did then and does now.
4) Who was Percy Spencer? What invention is connected with his name?
5) Where have machines made very little progress?

Задание 3. Read "A Brief History of Physics" (https://passingcuriosity.com/2006/a-brief-history-of-physics/) **and create an infographic using one of the three tools: Piktochart, Venngage or Canva.**

- Piktochart (https://piktochart.com/)
- Venngage (https://infograph.venngage.com)
- Canva (https://www.canva.com/)

The algorithm is simple and similar to these tools:

5. **Register for free.**
6. **Choose 'Infografic' category (Canva).**
7. **Choose a template. Create an infographic with the chosen templates.**
8. **Add charts and visuals using features on the left. Visualize your data and information with charts and text, add icons and images.**
9. **Customize your design.**

Задание 4. Watch and discuss a video footage of a popular television sitcom "Big Bang Theory"

Video 1 https://www.youtube.com/watch?v=Nm_VZfo9fxA

Match words with their meaning

Words		**Meaning**	
Imply	Ponder	Угощения	Издеваться
Claim	Check out	Без преувеличения	Резервуар
Bully	Infer	Обруч	Высмеивать
Kid around	Hoop	Делать вывод	Заявлять
Mantis	Treats	Кинуть	Обдумывать
Hurtful	Tank	Предполагать	Взглянуть
Literally	Ditch	Дурачиться	Богомол
	Make fun of	Оскорбительный	

Video 2 https://www.youtube.com/watch?v=r77Ln33iNjk

Create a mind map with the use of Mindomo or Lucid chart to share your experience in groups. Use 5-7 words from a box and add 5-7 new ones by association.

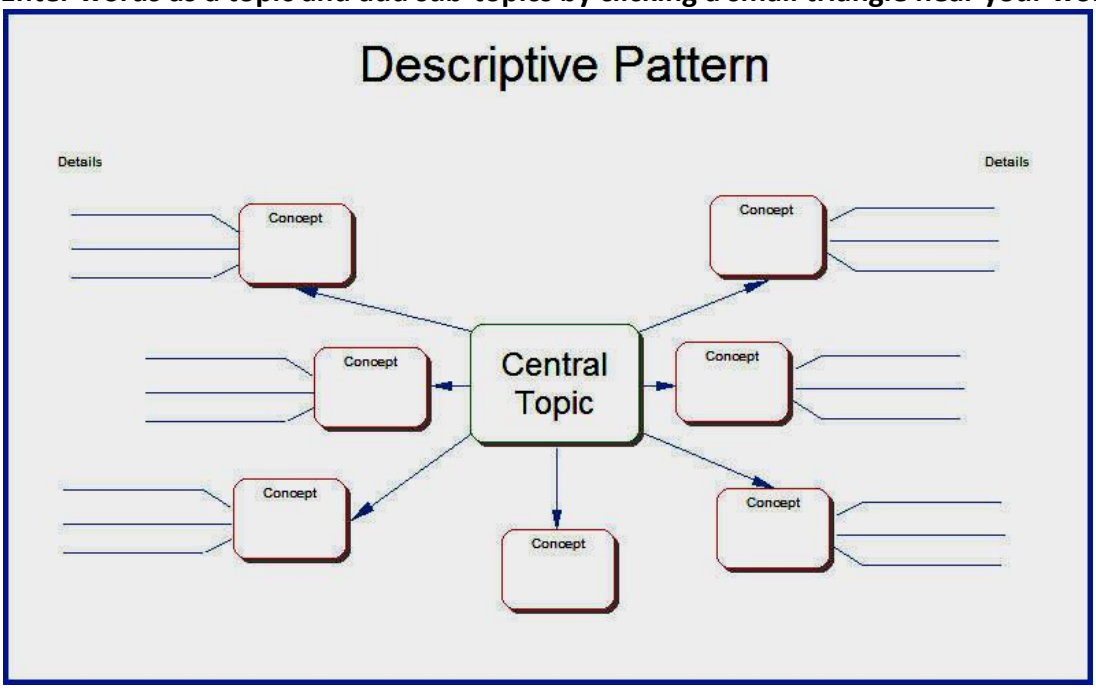
depressed genuinely well-being observation pheromone stink desperation attribute height attractiveness liquor cornucopia awkwardness mellifluous bladder request relationship level insane tedious physicist hippie object axis

Follow the algorithm below and see an example.

How to create a mind map - Mindomo https://www.mindmup.com/

1. **Get started**
2. **Create a new map**
3. **Name it and choose a mind map**

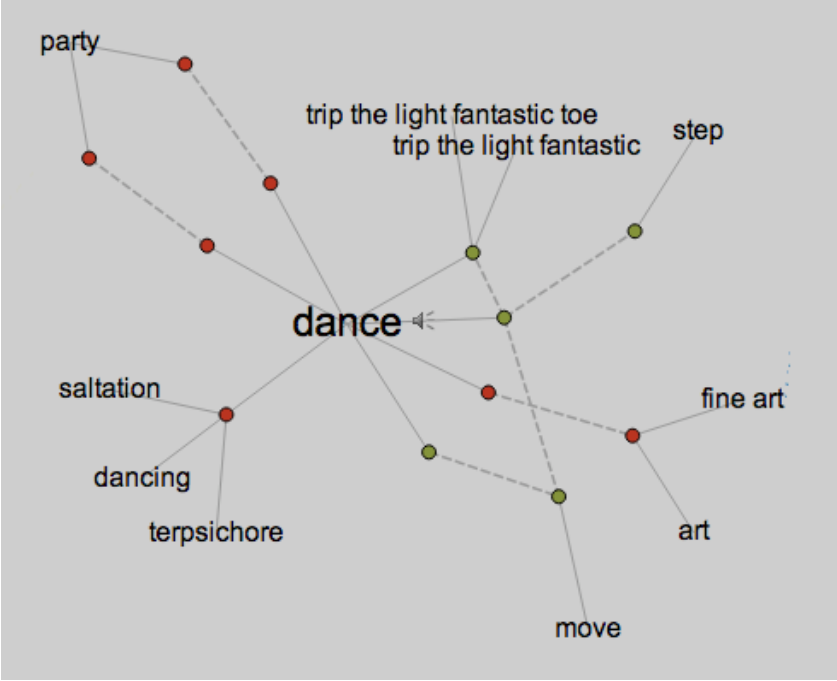
4. **Enter words as a topic and add sub-topics by clicking a small triangle near your word**



How to create a mind map - Lucid chart https://www.lucidchart.com/

1. **Enter your email address and click make a map, choose a free version**
2. **Click Mind map – Basic mind map**
3. **Start entering and adding the words you need**

Example:



COMPUTER-ASSISTED LANGUAGE LEARNING:
(2) VISUALISATION & INTEGRATION

UNIT 5. ACADEMIA AND ACADEMICS
Visualization task

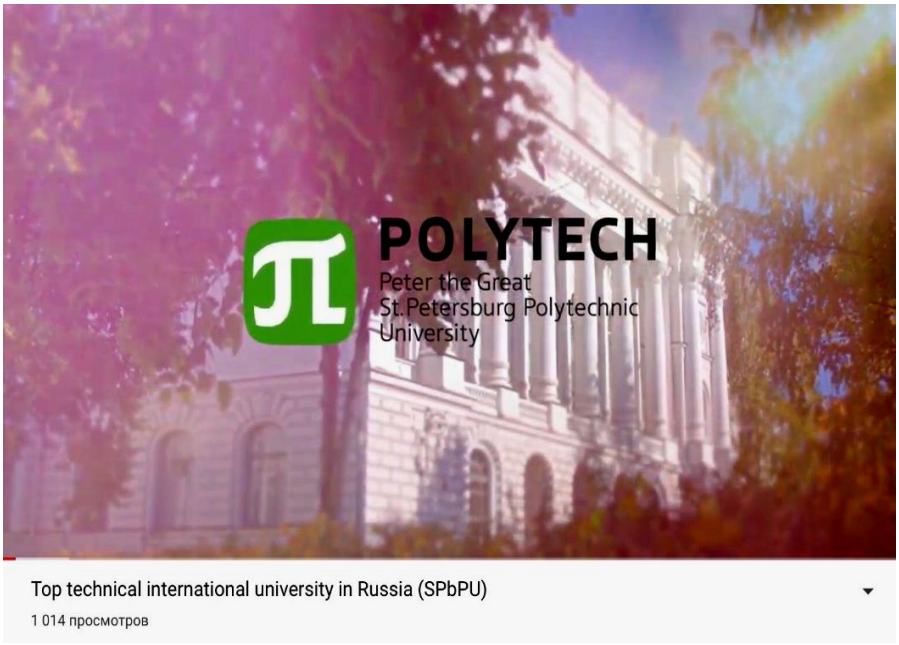
This infoposter visualizes the ***Academia and Academics*.** Answer the questions below in order to interpret the poster and prepare a short presentation on the Academic fields (1-2 minutes long).

1. What can you say about the award presented in the 2nd picture?
2. Do you know the difference between the UK and the US educational systems?
3. What do you think about the role of research in a study?
4. What kind of event is shown in the 4th picture? Do you think that regular participation in conferences is vital for a scientist?
5. What field of science are people shown in the 5th picture related to?

Integrated task

Read the text ***Academia and Academics*: *Peter the Great Saint Petersburg Polytechnic University,*** *w*atch the video, complementing the text, twice using subtitles, if necessary, and compare the content of both. Then answer the questions below and write the answers to these questions in the essay of 250-300 words.

:



VIDEO Top technical international university in Russia (SPbPU)
https://www.youtube.com/watch?v=4M6AfS0S8N8&feature=youtu.be

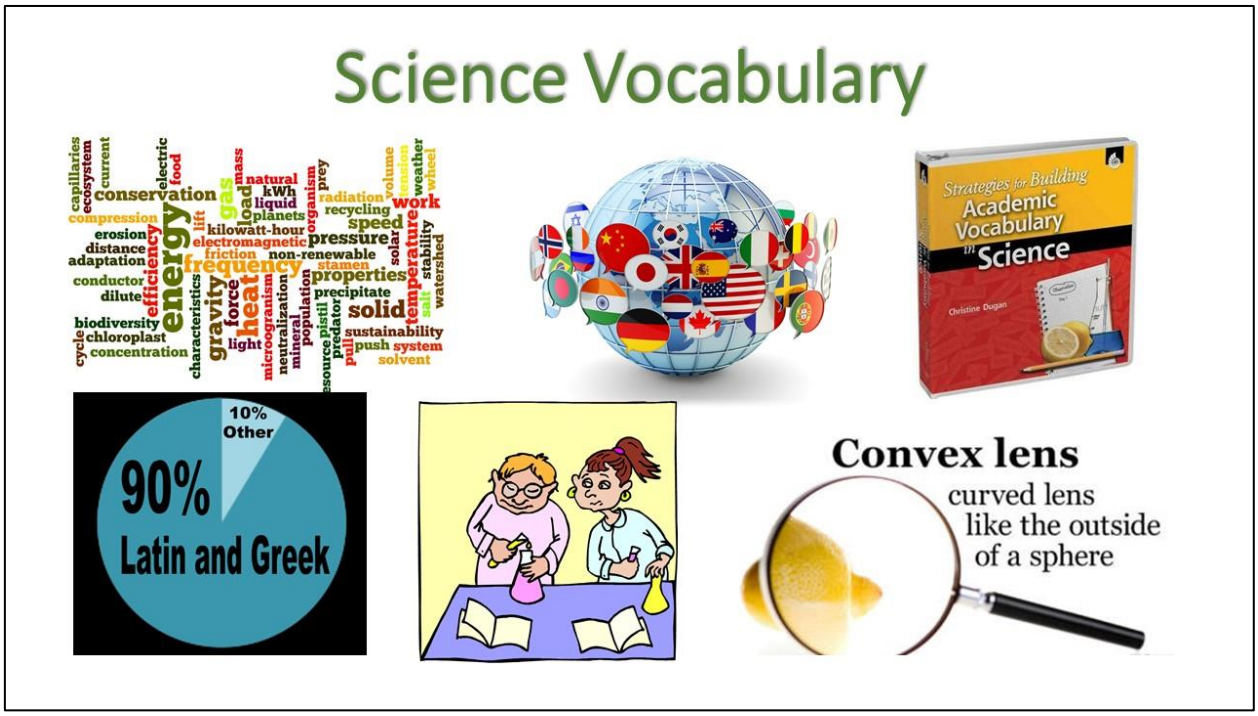
Answer the following questions:

1. How do the text and the video correlate? What do they have in common? What is different?
2. How does the Polytechnic University`s success is estimated in Russia and internationally?
3. Describe the Russian model of higher education.
4. What efforts does SPbPU take to maintain its high status?

UNIT 6. LANGUAGE OF SCIENCE AND TECHNOLOGY

Visualization task

This infoposter visualizes the text ***Language of Science and Technology.*** Answer the questions below in order to interpret the poster and prepare a short presentation on the topic of Language of Science Vocabulary (1-2 minutes long).



1. What is common between all words presented in the 1st picture?
2. What is your supposition concerning the role of the scientific vocabulary in academics?
3. What language has become the universal language of science and technology?
4. What is shown in the 4th picture? How can it be connected to the scientific vocabulary?
5. How can a person acquire a scientific vocabulary? What can be the ways of teaching it?
6. Did you know the term, presented in the 6th picture? What are the benefits of learning science terminology?

Integrated task

Read the text ***Language of Science and Technology,*** watch the video complementing the text, twice using subtitles, if necessary, and compare the content of both. Then answer the questions below and write the answers to these questions in the essay of 250-300 words.

Fraunhofer: English Is the Language of Science

VIDEO English Is the Language of Science

https://www.youtube.com/watch?v=pJkqSXH0ae8

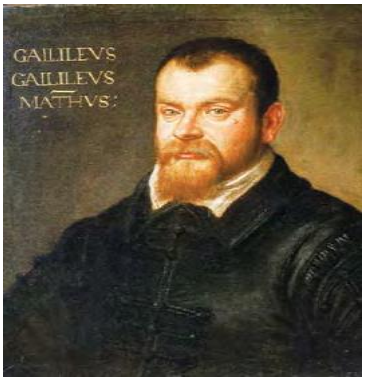
Answer the following questions:

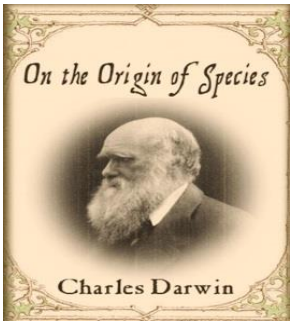
1. How do the text and the video correlate? What do they have in common? What is different?
2. Is the English language nowadays considered the language of science? Why? Was it always so or there were times when the situation was different?
3. Is it convenient for the modern scientific community that English is the language of science?
4. What, in your opinion, will the situation be in the future?

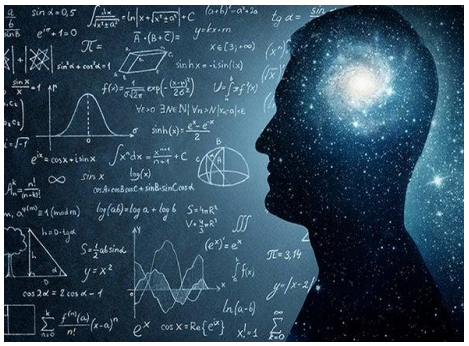
UNIT 7. MATHEMATICS – THE LANGUAGE OF SCIENCE

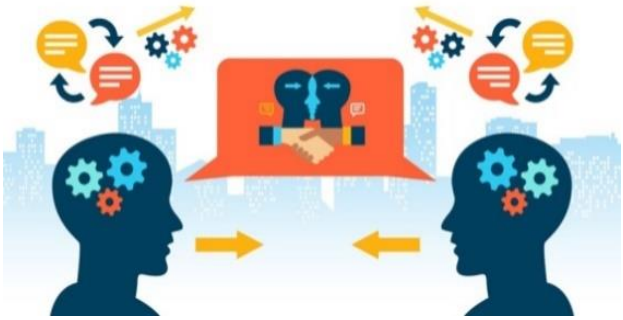
Visualization task

This infoposter visualizes that ***Mathematics is the Language of Science***. Answer the following questions in order to interpret the poster and prepare a short presentation (1-2 minutes long).









1. Which of the pictures may be considered a symbolic representation of mathematics as a language of science? Describe the picture
2. If you were to choose only one picture to show the link of mathematics and the language, which one would you choose? Give some reasons for your choice.
3. Which of the pictures may be considered a symbol of pedagogical aspect of the language science?
4. Which of the pictures may answer the question that mathematics is not only the science but also the language?
5. Who had a significant impact on the science of his time? What do you know about him?
6. In your opinion, why do people use equations? Which type of equations is used by scientists?
7. What non-mathematical theory does not contain a single equation? Could you name the author of the theory of evolution by natural selection?

Integrated task

Read the text ***Mathematics − the Language of Science,*** *w*atch the video complementing the text, twice using subtitles, if necessary, and compare the content of both. Then answer the questions below and write the answers to these questions in the essay of 250-300 words.

an Math Equations Be A Form of Art?

VIDEO Can Math Equations Be A Form of Art?
https://www.youtube.com/watch?v=Y955CrlKlC0

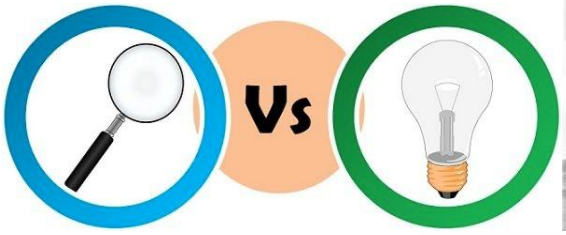
Answer the following questions:

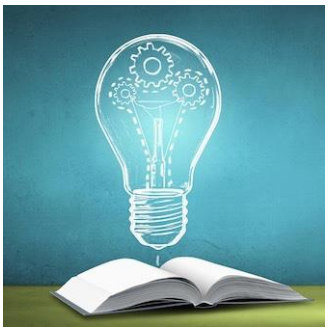
1. How do the text and the video correlate? What do they have in common? What is different?
2. What makes the equation objectively beautiful?
3. What does equation express?
4. What do poetry and mathematical equations have in common?

UNIT 8. INVENTION AND DISCOVERY: A NAME IN SCIENCE AND TECHNOLOGY

Visualization task

This infoposter visualizes the connection of ***Invention and Discovery in Science and Technology***. Answer the following questions in order to interpret the poster and prepare a short presentation on the connection of Invention and Discovery in Science and Technology (1-2 minutes long).





1. Which of pictures represented in the poster emphasizes the connection of invention and discovery? Why?
2. If you were to choose only one picture to show the link of science and technology, which one would you choose? Give some reasons for your choice.
3. Which of the pictures may prove that all inventions were made after discoveries?
4. Which of pictures shows the unique insights about the developments in science and technology?
5. Which of pictures is brought from U.S. magazine for more than 170 years What is the name of journal?
6. What is one of the most significant inventions in XX century? What picture can help you to choose the correct answer?

Integrated task

Read the text ***Invention and discovery: a name in science and technology,***

watch the video complementing the text, twice using subtitles, if necessary, and compare the content of both. Then answer the questions below and write the answers to these questions in the essay of 250-300 words.

VIDEO Top 10 Famous Inventors

https://www.youtube.com/watch?v=JFctqQwN_hk

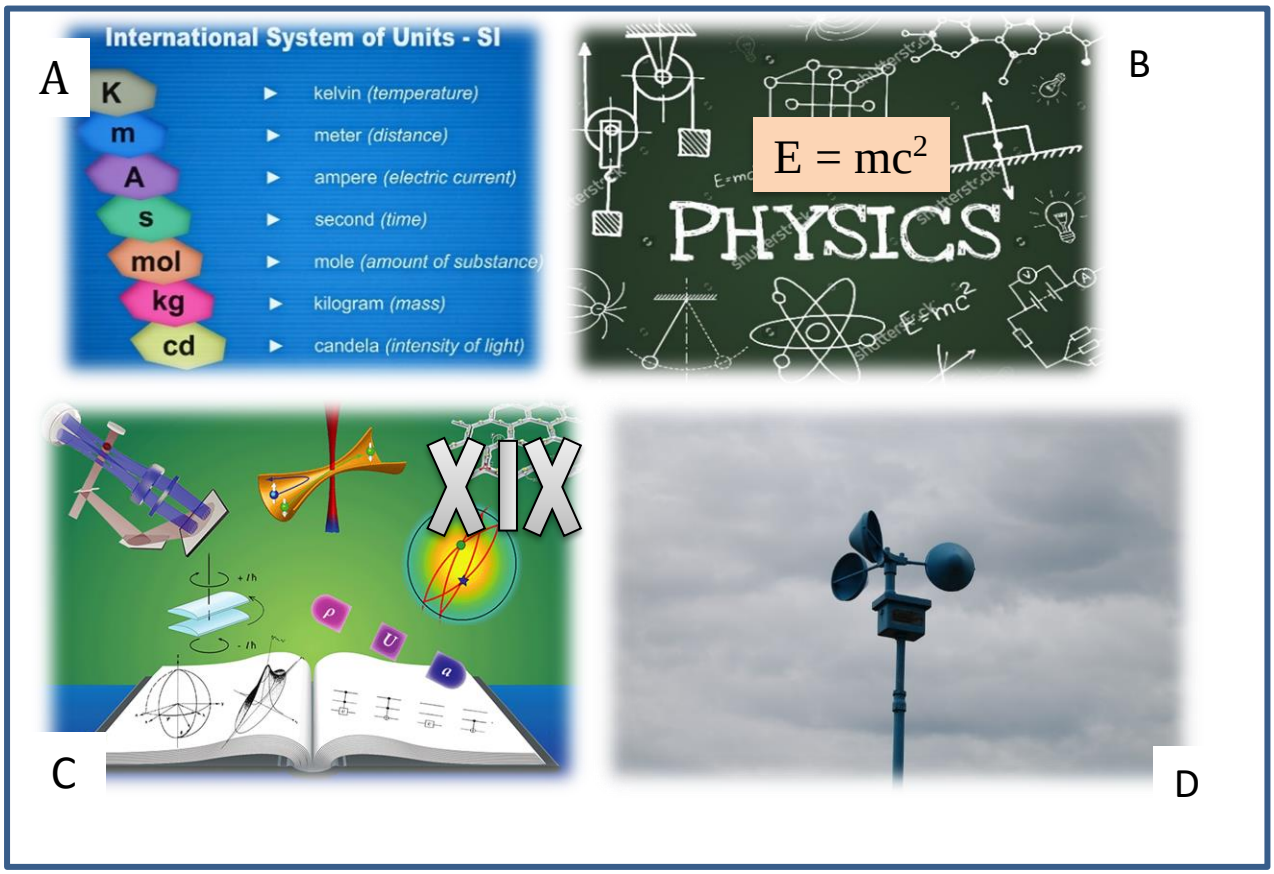
Answer the following questions:

1. How do the text and the video correlate? What do they have in common? What is different?
2. What famous names are mentioned in the video and in the text? (choose five names)
3. What important things did they invent?
4. How did these inventions influence the contemporary world?

UNIT 9. IMPORTANCE OF MEASUREMENT IN SCIENCE AND TECHNOLOGY

Visualization task

This infoposter visualizes the ***Importance of Measurements in Science and Technology***. Answer the following questions in order to interpret the poster and prepare a short presentation on the Importance of Measurement in Science and Technology (1-2 minutes long).

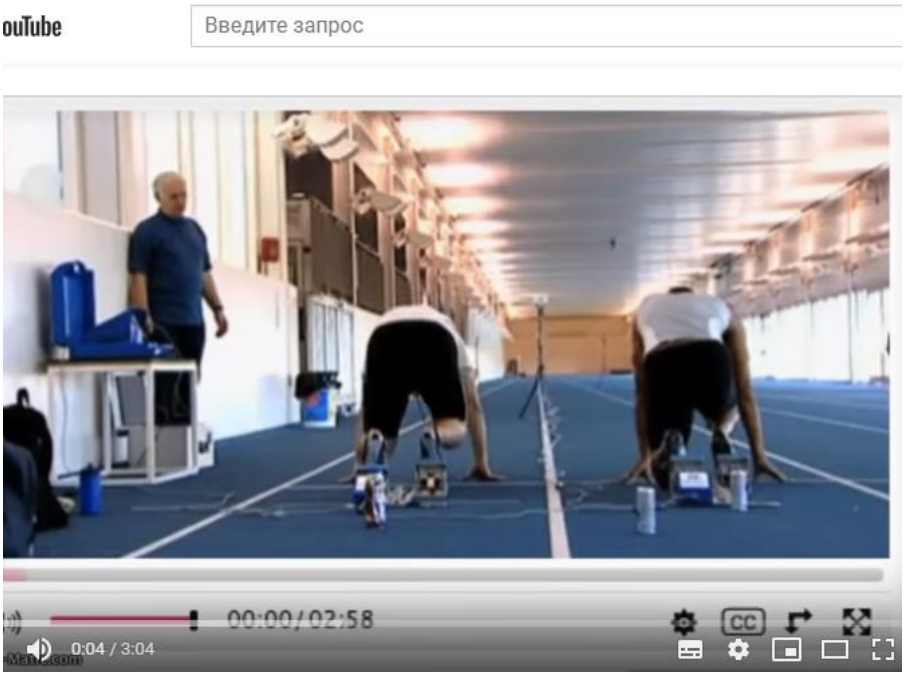


1. Which of the pictures shows a device used for measuring wind speed and direction?
2. What equation asserts a surprising equality between things? E = mc2
3. What form of metric system of measurements, commonly used in most countries? SI system
4. In what century scientists had pinned down most of the mysteries of the physical world: electricity, magnetism, gases, optics, acoustics, kinetics, and statistical mechanics?

[1-D (Anemometer); 2-B ($E = mc^2$); 3-A (SI system); 4-C (19^{th} century)]

Integrated task

Read the text ***Importance of Measurements in Science and Technology*** watch the video complementing the text, twice using subtitles, if necessary, and compare the content of both. Then answer the questions below and write the answers to these questions in the essay of 250-300 words.



VIDEO History of measurement:

https://www.youtube.com/watch?v=NValmBwli1Q

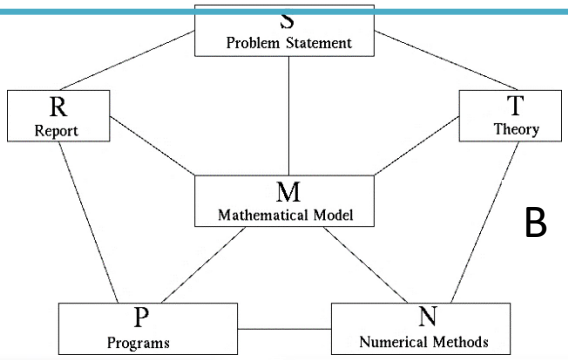
Answer the following questions:

1. How do the text and the video correlate? What do they have in common? What is different?
2. Why is measurement important?
3. What differs physics from the others sciences?
4. Which items are important to be stated in any measurement of a physical quantity?
5. What were the bases for the measurements of length in the ancient times?
6. How and where was the “meter” found?

Visualization task

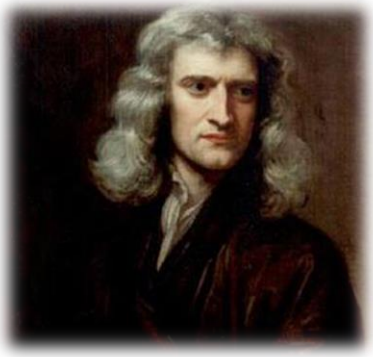
This infoposter visualizes the text ***Engineers and Scientists.*** Answer the questions below in order to interpret the poster and prepare a short presentation on the profession of Engineers and Scientists (1-2 minutes long).

A

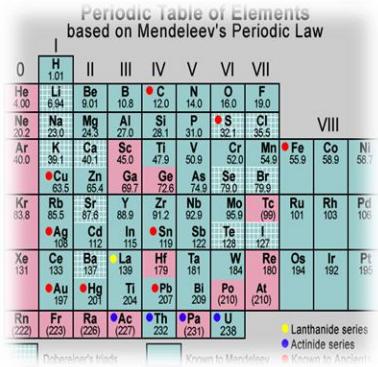


B

C



D



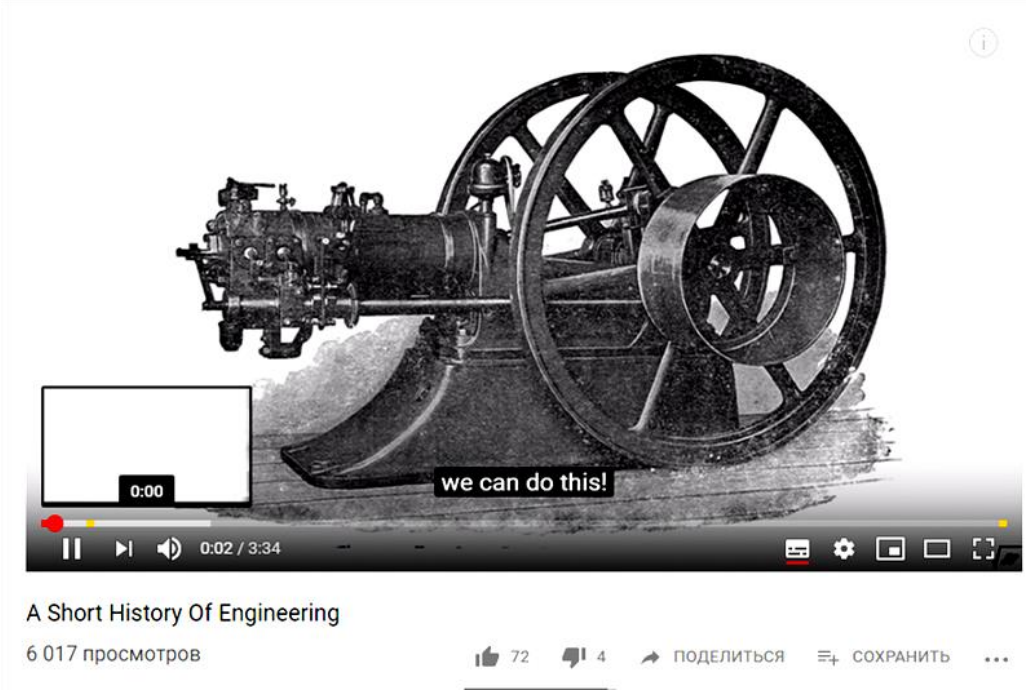
E

1. Who discovered classical physics? What do you know about him?
2. Who associated with the study, design, and implementation of engines? Name several areas of their work.
3. Knowledge of the _____ is a goal of fundamental research. Name the components.
4. Creating an appropriate _____ model of a problem allows engineers to analyse and test potential solutions.
5. Who said that “the chemical and physical properties of the elements recur periodically when the elements are arranged in the order of their atomic weights”?

[1-D (Isaac Newton); 2-A (Engineer); 3-C (Atomic structure);
4-B (Mathematical model); 5-E (Dmitri Mendeleev)]

Integrated task

Read the text ***Engineers and scientists,*** watch the video complementing the text twice using subtitles, if necessary, and compare the content of both. Then answer the questions below and write the answers to these questions in the essay of 250-300 words.



VIDEO: A short history of engineering.
https://www.youtube.com/watch?v=SXIuMLZqi0Y

Answer the following questions:

1. How do the text and the video correlate? What do they have in common? What is different?
2. Both the text and the video talk about the etymology of the word "engineer". Where does this term come from and what does it mean?
3. Ancient great engineering structures are described in both texts. Prove that in one of the texts information about some buildings is presented in more detail.
4. What is the most important and unique task of an engineer?

UNIT 11. MODERN MATERIALS
Visualization task

This infoposter visualizes the text ***Modern Materials.*** Answer the questions below in order to interpret the poster and prepare a short presentation on the new materials (1-2 minutes long).

1. What was the title of Richard Feynman's talk? (4)
2. What book is mentioned in the text "Nanotechnology"? (1)
3. How do most people envision nanotechnology? (2)
4. What nanotechnology is mentioned in the text "Nanotechnology in space"? (3)

Integrated task

Read the text ***Nanotechnology,*** watch the video complementing the text twice using subtitles, if necessary and compare the content of both. Then answer the questions below and write the answers to these questions in the essay of 250-300 words.

VIDEO: How nanotechnology works
https://www.youtube.com/watch?v=cyLtGj8dAJs

Answer the following questions:

1. How do the text and the video correlate? What do they have in common? What is different?
2. What is the potential of nanotechnology?
3. What are the examples of carbon atom arrangement?
4. Why does a nanobattery work better than an ordinary battery?
5. What are the most exotic applications of nanotechnology?

Visualization task

This infoposter visualizes the text on ***the careers in science and engineering.*** Answer the questions below in order to interpret the poster and prepare a short presentation on the career development (1-2 minutes long).

1. What field of activity attracts many physics doctorates?(4)
2. What is the main step in hiring? (1)
3. What should the employee provide when looking for a job? (2)
4. Who is hiring staff? (3)

Integrated task

Read the text on ***the careers in science and engineering,*** watch the video complementing the text twice using subtitles, if necessary, and compare the content of both. Then answer the questions below and write the answers to these questions in the essay of 250-300 words.

VIDEO: What is health information technology?

https://www.youtube.com/watch?v=D18sMdECYmk&app=desktop

Answer the following questions:

1. How do the text and the video correlate? What do they have in common? What is different?
2. Describe ups and down cycles of physics job market.
3. What is the situation with employment in science and technology area?
4. What does it mean to work in Health Information Technology?

ANSWER KEY

Unit 1
Advance of Science and Technology

1. Origin of Science: 1.D 2.C 3.B 4.F 5.E 6.A

2. What Makes Science Possible: 1.T 2.F 3.T 4.T 5.T 6.F

3. Word Families: 1.b 2.j 3.e 4.i 5.g 6.c 7.a 8.d 9.f 10.h

4. Confusables

Science and Technology: A Hen or an Egg

1. defined 2. meaningful 3. indeed 4. application 5. quite 6. exploitation 7. responses 8. attempt 9. technology 10. source 11. relationship 12. mathematics 13. applies 14. devices 15. modern 16. physicists 17. large-scale 18. association 19. develop 20. technologists

5. Phrasal Verbs

1. end 2. end up 3. end up 4. figure 5. figure out 6. head for 7. head 8. iron 9. iron out 10. size 11. size up 12. work 13. work out 14. work out 15. round 16. round off, round 17. usher in 18. usher 19. date 20. date back

Grammar:

Present Simple / Present Continuous/Present Perfect /Present Perfect Continuous

7. ***Fill in the gaps using the verbs in Present Simple or Present Continuous.***

1. A: have B: have/am having **2.** A: are being B: are **3.** A: am seeing B: see **4.** A: are…smelling B: smells **5.** A: are…weighing B: weighs **6.** A: feels B: are feeling **7.** A: are…looking B: looks **8.** A: is appearing B: appears **9.** A: Do…feel B: feel/am feeling **10.** A: fits B: is fitting

8. Some of the sentences contain an error. Identify and correct it.

1. Who does this idea belong to? **2.** I don't believe it! **3.** + **4.** I don't understand… **5.** + **6.** Who drives… **7.** …does this book contain? **8.** I have all the details… **9.** + **10.** I think we owe…

9. Use the correct verb form.

1. expect **2.** Do you think **3.** am thinking **4.** feel **5.** depends **6.** mean **7.** don't mind **8.** don't want **9.** do you realize **10.** don't see **11.** know **12.** prefer **13.** don't believe **14.** understand **15.** means **16.** Don't you care **17.** think **18.** are being **19.** suppose **20.** don't appear **21.** am seeing **22.** hear **23.** is expecting **24.** thinks **25.** am having **26.** remember **27.** think **28.** are being **29.** doesn't matter **30.** keep **31.** are thinking **32.** am making **33.** don't concern

10. Use the suitable verb form.

1. am writing 2. never reply 3. cost 4. is speaking 5. speaks 6. produce 7. is going on 8. correspond 9. get 10. delete 11. are delivering 12. deliver 13. make 14. is making 15. is developing 16. develop

11. Fill in the gaps using Present Simple or Present Continuous.

1. A: do you do **B:** work **2. A:** does…produce **B:** designs, constructs
3. A: Do you come **B:** am coming, come **4. A:** Are you attending **B:** am, try
5. A: Do you mean **B:** sounds **6. A:** Do you speak **B:** call
7. A: are you staying **B:** book, come **8. A:** am staying, like **B:** do, don't justify

12. Match sentences from column A describing the process with sentences from column B describing the result/consequence (Present Perfect / Present Perfect Continuous).

1. c **2.** f **3.** i **4.** j **5.** b **6.** h **7.** d **8.** e **9.** g **10.** a

13. Complete the dialogue using the verbs in different Present tenses forms.

1. A: do you come **B:** I come from Russia **2. A:** do you do **B:** I work as a/an …
3. A: have you been working **B:** I have been working for it for a few years
4. A: do you earn **B:** I earn quite a lot **5. A:** have you been studying **B:** I have been studying it for 5 years **6. A:** are you staying **B:** I'm staying at the 'Sputnik' **7. A:** have visited **B:** It's the second time I've come here **8. A:** have you already seen **B:** I've seen … **9. A:** are you having **B:** It' a tourist trip **10. A:** Are you enjoying **B:** Yes, I am. Everything is OK with it. / No, I am not…..

14. Use one of Present Tenses forms.

1. have examined/ have been examining/ are examining **2.** have analyzed **3.** try
4. have raised **5.** have **6.** have been doing **7.** goes **8.** has just increased **9.** pays
10. has refused **11.** have **12.** are steadily going up

15. Use the verbs in brackets in one of Present Tenses.

Global Environmental Issues

1. have spent **2.** have discovered **3.** are dying **4.** are disappearing **5.** has changed/ has been changing **6.** has resulted/ results **7.** brings about **8.** are continuously polluting
9. release **10.** have already caused **11.** have developed **12.** have already become
13. is getting **14.** produce **15.** have come

Unit 2
Errors, Blunders, Deadends in Science

1. Defunct Science, Bad Science, Pseudoscience, Anti-science

1.b 2.i 3.f 4.j 5.d 6.h 7.g 8.e 9.a 10.c

2. Philosopher's stone

1.a 2.o 3.m 4.k 5.h 6.e 7.d 8.f 9.i 10.g 11.c 12.l 13.j 14.h 15.b

3. Twists and Turns of Science

1.n 2.c 3.a 4.r 5.f 6.d 7.j 8.i 9.m 10.g 11.q 12.e 13.h 14.k 15.b 16.p 17.o 18.l

4. Read the text. Match the words from column A with their definitions from column B.

1.G 2.E 3.K 4.I 5.J 6.B 7.A 8.C 9.L 10.H 11.D 12.F

5. Word Families: 1.h 2.i 3.c 4.d 5.a 6.b 7.f 8.e 9.h 10.g

6. Confusables: 1.j 2.e 3.a 4.f 5.d 6.h 7.b 8.g 9.i 10.c

7. Phrasal Verbs: 1.i 2.g 3.f 4.d 5.h 6.j 7.c 8.a 9.e 10.b

Grammar: Past Tenses

9. Science and Universe

1. looked **2.** have been wondering **3.** do **4.** have always asked /have always been asking **5.** behave **6.** have put/ have been putting **7.** fall **8.** does the Sun come up **9.** answered **10.** laid **11.** described **12.** has **13.** came up with **14.** were **15.** worked/ were working **16.** looked **17.** originated 1**8.** explains **19.** move **20.** does

10. Use the verbs in the brackets in appropriate forms.

1. used to believe 2. used 3. are still used 4. used 5. to get used 6. used to oppose 7. used 8. Used 9. got so used 10. didn't use to become 11. got gradually used 12. is used 13. used to be

11. Open the brackets using the verbs in Past Simple and Past Continuous.

a) was negotiating; phoned; wanted **b)** was explaining; interrupted **c)** were investigating; asked **d)** was reading; decided **e)** was waiting; called **f)** was cleaning; dropped **g)** found; was looking for **h)** arrived; were trying

12. The Origins of Photography

1. took 2. had been 3. pointed 4. was shooting 5. survived 6. heard 7. had produced 8. worked 9. became 10. Took 11. had developed 12. allowed 13. had designed 14. was 15. were taking

13. Polar Exploration

1. discovered 2. had not heard 3. started 4. found out 5. had got 6. decided 7. discovered 8. did/ had done 9. was racing 10. got 11. had beaten 12. died

Unit 3
Vision in Science and Technology

1. Visionary Scientists and Inventors: 1.C 2.E 3.A 4.D 5.B

2. Einstein and Modern Technology

1. engineering 2. applying 3. implications 4. atomic 5. explanation 6. effect 7. ranging 8. technologists 9. inventions 10. findings

3. Zwicky – the Unsung Genius

1.f 2.d 3.c 4.a 5.i 6.j 7.b 8.h 9.k 10.g 11c. 12.l

4. Word Families:

1.b 2.i 3.f 4.h 5.a 6.g 7.e 8.c 9.d 10.j

5. Phrasal Verbs: 1.d 2.a 3.c 4.g 5.b 6.e 7.f 8.a 9.h 10.c 11.d 12.e 13.f 14.g

6. Confusables: 1.c 2.c 3.b 4.a 5.b 6.c 7.b 8.a 9.c 10.c

Grammar: Future Tenses

8. Choose the correct verb form.

1. will be moving 2. will have moved 3. does your train leave 4. leave

5. we've received 6. will have repaid 7. are 8. to arrive 9. will arrive 10. am
11. Shall 12. will get used

10. Match the two parts of the sentences.

1.b 2.d 3.a 4.c 5.f 6.h 7.e 8.g

11. PhD Exams

1. take 2. come back 3. will probably be 4. are 5. is 6. take 7. have 8. coincide 9. will cancel 10. make 11. will have read 12. will have 13. proceeds 14. listens 15. has

12. Economic Forecast

1.b 2.a 3.a 4.a 5.b 6.a 7.a 8.b 9.a (won't probably materialize) 10.c

13. The End of the Universe

1. will end **2.** die **3.** perish **4.** will die **5.** will be wiped out **6.** reach/ have reached **7.** will occur **8.** will take **9.** believe **10.** pushes /is pushing/ will push **11.** cools **12.** will ultimately lead **13.** will be/ is **14.** will reverse **15.** will end up **16.** is **17.** will ultimately die **18.** collide **19.** materializes **20.** will reverse

14. Professional Development

1. is explaining **2.** will be taking **3.** will collect **4.** meet **5.** will have produced **6.** are going to discuss **7.** will have agreed **8.** happens **9.** is going to offer **10.** gets **11.** meet **12.** will have finished **13.** have **14.** will e-mail **15.** have made up

Unit 4
Inevitability of Scientific Discovery

1. Paradigm Shift: 1.T 2.T 3.T 4.F 5.T 6.F 7.F 8.T

2. Scientific vs. Artistic Genius: 1.D 2.E 3.A 4.F 5.C 6.B

3. Word Families: 1.e 2.h 3.f 4.b 5.d 6.g 7. a 8.i 9.j 10.c

4. Confusables . Who Strikes the Ball?

1. attributed 2. extent 3. favored 4. aspire 5. conclusions 6. supportable 7. introduced 8. designing 9. evidence 10. ascribe

5. Fill in the gaps with the words from the box. **In my Humble Opinion**

1.m 2.f 3.e 4.a 5.k 6.d 7.h 8.l 9.b 10.n 11.c 12.i 13.o 14.j 15.g

Grammar: The Passive Voice

8. **Drugs from the deep**

1. has been known 2. are shrouded 3. is gained 4. is called 5. can be extracted 6. are believed 7. have already been discovered 8. are reported 9. was found 10. was also discovered 11. has been developed 12. can now be virtually eliminated 13. has been successfully developed 14. to be found 15. has been analyzed 16. is needed 17. are offered

10. Make up the dialogues using passive constructions.

1. ….jobs have been applied for? 2. ….was complained of/about? 3. ….was the car hired from? 4. ….is the patient going to be treated? 5. ….have been volunteered for?

11. Fill in the correct preposition.

1.for 2.to 3.to 4.to 5.on 6.with 7.to as 8.on 9.of 10.with

16. Match the two parts of the sentences

1.d 2.b 3.a 4.c 5.e 6.g 7.f

Unit 5
Academia and Academics

1. Peter the Great Saint Petersburg Polytechnic University

a) a junior/senior research associate **b)** scientist/scholar **c)** teacher/ lecturer **d)** associate professor **e)** academician **f)** academic process **g)** curriculum **h)** credit/ pass **i)** a matriculation book **j)** a post-graduate/ PhD student **k)** a post-graduate course **l)** PhD thesis/PhD paper/ doctorate **m)** Bachelor **n)** Master **o)** PhD (Engineering) **p)** full-time tuition **q)** part-time tuition **r)** extra-mural instruction/ e-learning **s)** department/ chair **t)** head of the Department **u)** seminar **v)** a term paper **w)** academic progress **x)** attendance

3. Match the words from column A with the synonym and definitions from column B.

1.c 2.g 3.u 4.a 5.l 6.b 7.t 8.p 9.d 10.n 11.e 12.s 13.h 14.j 15.f 16.o 17.v 18.r 19.m 20.q 21.i 22.k

Word Formation: Suffixes of agents /people *–er/or, -cian, -ic, -ist*

4. Form nouns describing people

People in Science and Technology

Example: astronomy – astronomer

a) academic	b) academician	c) analyze	d) architect
e) biologist	f) botanist	g) educationalist	h) chemist
i) experimenter	j) explorer	k) designer	l) industrialist
m) investigator	n) lecturer	o) mathematician	p) mechanic
q) philosopher	r) physicist	s) psychologist	t) physiologist
u) researcher	v) scientist	w) technologist	x) theoretician

5. Word Families:

1.n 2.k 3.d 4.g 5.h 6.j 7.o 8.l 9.c 10.e 11.i 12.h 13.p 14.b 15.f 16.a

6. Confusables

1. There are both theoretical and practical subjects on our **curriculum**.
2. I have lost my **matriculation** book and I have a problem with the director's office.
3. In four years we will have **internship** and then we will write our diploma **papers**.
4. Academician Alferov is to give a lecture at our department next week.
5. In five years we will be **awarded Master's** degrees.
6. After I **graduate from** university in five years I plan to be a **postgraduate**.
7. After the university I would like to **join** a research institute.
8. My brother works as a junior research **associate**.
9. My scientific councilor is Dr. Petrov. He **has a PhD in engineering**.
10. The **abstract** of my report for the conference is too long.

7. Choose the correct word

1. attendance 2. take 3. subject 4. ambition 5. founded 6. education 7. PhD 8. year 9. internship 10. grades

Translator's False Friends

8. **University and Education**

1. institution 2. liberal 3. doctoral 4. academicians 5. physicists 6. academy 7. mathematician 8. academic 9. journal 10. physics

***9.* Phrasal Verbs**

1.aside 2.down 3.up 4.up 5.on 6.down 7.up 8.for, after 9.back 10.out

10. Linking Words: Cause /Effect

1. For 2. for 3. so that 4. So 5. so, since 6. As, so 7. thanks to 8. because of 9. As 10. because of

Grammar: Reported Speech

12. Fill in the gaps using verbs of reporting.

1.**c** (concluded) 2.**j** (urged) 3.**e, g** (denying, explained) 4.**j** (urged) 5.**i** (remarked) 6.**d, h** (deny, muttered) 7.**b**, **a** (challenged, argued) 8. **f** (discussed)

13. Ann went for a job interview last week. Report HR manager's questions.

1. *The HR manager asked Ann* when she had graduated.
2. ……. what university she had graduated from.
3. ……. what her previous employment had been.
4. ……. what her responsibilities had been there.
5. ……. why she had left her previous employment.
6. ……. if/whether she was familiar with CAD/CAM.
7. ……. what salary she expected to receive.
8. ……. if/whether she could speak French.
9. ……. if/whether she would be willing to move to Morocco.
10. ……. if/whether he could/might see her references.

14. Use verbs of reporting in the indirect speech.

1. wished 2. congratulated 3. apologized 4.admitted 5. denied 6. agreed 7. permitted 8. warned 9. insisted 10. approved

Unit 6

Language of Science and Technology

1. The Language of Science

1.B 2.C 3.D 4.A

2. Scientific Word Building

1.d 2.e 3.b 4.i 5.g 6.f 7.c 8.j 9.h 10.a

3. Definition, classification, description

1. d 2. a 3. b 4. d 5. d 6. d 7. d 8. b 9. d 10. d

4. Find the English words corresponding to the given Greek elements.

1-e)-(2); 2-f)-(5); 3-d)-(1); 4-b)-(3); 5-a)-(6); 6-c)-(4); 7-j)-(8); 8-g)-(10); 9-k)-(7); 10-l)-(12); 11-i)-(9); 12-h)-(11)

5. Find the English words corresponding to the given Greek and Latin elements.

1.g 2.e 3.a 4.b 5.c 6.d 7.f 8.k 9.n 10.m 11.i 12.j 13.l 14.h

6. Find the English words corresponding to the given Latin elements.

1-c)-(5); 2-d)-(4); 3-a)-(7); 4-b)-(1); 5-f)-(2); 6-g)-(3); 7-e)-(6); 8-j)-(10); 9-l)-(13); 10-h)-(11); 11-i)-(8); 12-k)-(9); 13-m)-(12)

Word Families

8. Fill in the gaps with the words from the box.

1.a 2.e 3.h 4.d 5.c 6.g 7.i 8.b 9.f 10.j

Linking words (Latin)

11. E-publishing *vs.* (1) Paper Publishing

1.a 2.g 3.d 4.b 5.c 6.e 7.f

Grammar: Modality

12. Choose the correct modal verb.

1.i 2.g 3.j 4.d 5.a 6.e 7.c 8.f 9.h 10.b

14. **Choose the suitable word.**

1. capable 2. opportunity 3. unable 4. possibility 5. able, possibility 6. failed 7. inability 8. improbable 9. failed 10. able

15. Use suffixes -able/-ible *(smth. that can be done) and* ***prefixes un-/in- + suffixes -able/-ible*** *(smth. that cannot be done)* ***to form an adjective.***

1. observable (unobservable)
2. recoverable (unrecoverable)
3. understandable (ununderstandable)
4. indivisible (divisible)
5. inviolable (violable)
6. comparable (incomparable)
7. manageable (unmanageable)
8. recyclable (non-recyclable)
9. resistible (irresistible).
10. questionable (unquestionable)

16. Fill in the gaps with the words from exercise 15.

1.comparable **2.**indivisible **3.**observable **4.**irresistible **5.**understandable 6.recoverable **7.** inviolable **8.** recyclable 9.questionable **10.** manageable

17. Fill in the gaps with modal verbs.

1.should 2.dared 3.can't 4.can 5.don't need 6.can 7.can't 8.can 9.cannot 10.dares

Unit 7
Mathematics – the Language of Science

1. Equations in Science

1.F 2.T 3.T 4.T 5.T 6.F

1.basically 2.relatively 3.hugely 4.virtually 5.certainly 6.eventually 7.mathematically 8.better 9.mainly 10.extremely 11.very 12.sufficiently 13.practically 14.solely 15.practically

2. Fill in the gaps with the expressions from the box.

1.f 2.b 3.d 4.g 5.a 6.e 7.c

3. Fill in the gaps with the words from the box

1.g 2.c 3.b 4.e 5.j 6.i 7.a 8. f 9. d 10. h

4. I. The Dirac Equation

1.d 2.i 3.a 4.g 5.h 6.e 7.c 8.j 9.b 10.f

II. The Mollina Equation

1.a 2.e 3.d 4.g 5.h 6.i 7.b 8.f 9.c 10.j

5. **The Enigma of Scientific Laws**

1.thinkers 2.scientific 3.conveniently 4.explanation 5.mathematician 6.unverifiable 7.justification 8.quotation 9.memorial 10.astronomer

Word Families

6. Fill in the gaps with suitable words.

1.g 2.a 3.b 4.c 5.e 6.f 7.d 8.h 9.j 10.i

Confusables

7. The Magic Mystery of Mathematics

1.d 2.b 3.a 4.b 5.d 6.c 7.d 8.b 9.d 10.b.

Grammar: Participle I/ Participle II

10. Franklin's Daring Experiment

1. daring – *adjective* 2. flying – *gerund* 3. fitted – *participle II* 4. lightning – *noun* 5. caused – *participle II* 6. performing – *gerund* 7. trying – *participle I* 8. electrocuted – *participle II* 9. turned – *verb* 10. running – *participle I* 11. building – *noun* 12. damaging – *participle I* 14. amazed – *verb* 15. devastating – *adjective* 16. lightning – *noun*

11. Choose the suitable participle.

1. challenging 2. frustrated 3. confused 4. disgusting 5. fascinated 6. irritating 7. amused 8. puzzled 9. scared 10. embarrassing

12. Complete the dialogue by using a participle with a stronger meaning.

1.b 2.d 3.f 4.h 5.e 6.g 7.c 8.a

13. Match the phrase from column A with the reply from column B.

1.c 2.d 3.e 4.b 5.a 6.h 7.f 8.g

14. Looking for a Job

1. ever increasing 2. concerning 3. seeking 4. printed 5. dealing 6. diabled 7. having 8. working 9. advanced 10. expected

15. Mary Anning

1.h 2.a 3.b 4.e 5.d 6.f 7.g 8.i 9.k 10.j 11.l 12.c

16. Replace the clauses in bold with compound participles.

1.self-replicating 2.phase-shifting 3.sheet-forming 4.far-reaching 5.man-made 6.Swedish-speaking 7.English-speaking 8.self-invented 9.fast-growing 10.home-grown

Unit 8

Invention and Discovery: A Name in Science and Technology

***1. Read the text and decide whether the following statements are true or false*.**

Scientific American: 1.T 2.T 3.T 4.F 5.F

***2. Put the paragraphs in the correct order.* Popov, Marconi et al. A Sense of Urgency**

1.a 2.d 3.f 4.c 5.e 6.b 7.g 8.h 9.i

3. Fill the gaps using the word from the box.

1.f 2.e 3.i 4.a 5.g 6.j 7.d 8.c 9.h 10.b

***4.* Serendipity**

1.i 2.c 3.k 4.b 5.a 6.f 7.g 8.e 9.d 10.l 11.j 12.h

***5.* Units Named after Scientists**

1.h 2.i 3.f 4.e 5.d 6.c 7.j 8.a 9.b 10.g

6. Fill in the gaps with the words from the box.

I. 1. g 2. e 3. b 4. f 5.c 6. d 7.h 8. a

II. 9. Dog 10. Goldilocks 11. Demon 12. Cat

7. Use the italicized proper name to form a suitable adjective.

1. Tychonian 2. Cartesian 3. Voltaic 4. Brownian 5. Boolean 6. Hertzian.

8. **Coining and Naming**

1.d 2.a 3.b 4.c 5.e

Confusables : False Friends

9. **Choose the correct word.**

1. terrain 2. desert 3. rocket 4. physicists 5. designed 6. human 7. code 8. immigrant 9. Scottish 10. constructing

Phrasal Verbs

10. Match responses from column B to the phases from column A.

1.c 2.f 3.a 4.b 5.d 6.e 7.h 8.g

Word Families

11. Fill in the gaps with suitable words.

1.d 2.j 3.i 4.b 5.e 6.h 7.g 8.a 9.c 10.f

Linking Words: Concession / Contrast

12. Fill in the gaps with suitable words.

1.a (Although) **2.d** (however) **3.i** (yet); **f** (still) **4.g** (Though) **5.j** (Yet for)
6.e (nevertheless) **7.i** (yet) **8.a** (Although) **9.c** (Despite) **10.h** (unless); **b** (as); **b** (as)

Grammar:

16. ***Fill in the gaps using the words in the box.***

1.**h** (shortcomings) 2.**j** (workings) 3.**i** (teachings) 4.**b** (earnings) 5.**d** (footings) 6.**f** (proceedings) 7.**c** (findings) 8.**g** (reasoning) 9.**e** (gatherings) 10.**a** (belongings)

Unit 9
Importance of Measurements in Science and Technology

1. Read the text and decide whether the following statements are true or false.

1.T 2.T 3.F 4.T 5.F

2. Complete the table.

Dimensions and Parameters

verb	***noun***	***adjective***
magnify	magnitude	**magnification**
measure	**measurement**	**measureable**
lengthen	length	**long**
long	longitude	**longitudinal**
prolong	**prolongation**	**prolonged**
extend	extent	**extension**
broaden	**breadth**	broad
widen	**width**	wide
expand	**expansion**	**expansive, expandable**
	latitude	**latitudinal**
deepen	**depth**	**deep**
heighten	**height**	high
elevate	elevation	**elevating, elevated**
alter	altitude	**altitudinal**
strenghen	strength	**strong**
enforce	force, fortitude	reinforced

weigh	weight	**weighty**
enlarge	**enlargement**	large
warm (up)	**warmth**	warm
heat	**heat**	hot

3. Use the words from the table to fill in the gaps.

1.reinforced 2.magnitude 3.latitude 4.heat 5.depth 6.lengthen 7.broaden 8.deepening 9.elevation 10.magnification 11.enlargement

4. Read the text. Match the names of the scientists with units named after them.

1.h 2.i 3.f 4.e 5.d 6.c 7.j 8.a 9.b 10.g

5. Read the text. Match SI- prefixes to the corresponding numeric values.

Measures and Weights

Multiples:	yotta (Y) 10^{24}	zeta (Z) 10^{21}	exa (E) 10^{18}	peta (P) 10^{15}	tera (T) 10^{12}
	giga (G) 10^{9}	mega (M) 10^{6}	kilo (k) 10^{3}	hecto (h) 10^{2}	deca (da) 10^{1}
Submultiples:	deci (d) 10^{-1}	centi (c) 10^{-2}	milli (m) 10^{-3}	micro (μ) 10^{-6}	nano (n) 10^{-9}
	pico (p) 10^{-12}	femto (f) 10^{-15}	atto (a) 10^{-18}	zepto (z) 10^{-21}	yocto (y) 10^{-24}

Confusables

6. Instruments – Tools of Science

1.creative 2.ingenious 3.notable 4.accurate 5.trajectory 6.major 7.insight 8.impressive 9.phases 10.persuaded 11.true 12.novelty 13.spectacle 14.distant 15.Inspired 16.magnification 17.throughout 18.wind 19.humidity 20.microscopes

Phrasal Nouns

7. Find the corresponding Russian nouns.

1.c 2.e 3.h 4.d 5.f 6.a 7.j 8.g 9.i 10.b

Word Families

8 . Fill in the gaps with the suitable words.

1.j 2.i 3.d 4.e 5.f 6.a 7.g 8.h 9.c 10.b

Linking Words

9. Fill the gaps with the words from the box.

1. whereas 2. whenever 3. whoever 4. wherein 5. wherever; however
6. whoever; whoever 7. whatsoever 8. thereafter 9. thereby 10. whatever

Grammar: Infinitive Structures

12. ***Use the following verbs to complete the sentences.***

1.**d** (to exist) 2.**a** (to cool) 3.**h** (to survive) 4.**c** (to progress) 5.**f** (to do) 6.**b** (to develop) 7.**g** (to revert) 8.**e** (to hit)

13. Use the correct verb form.

1. … that every TV quiz participant **is expected to know**. 2. … **is thought to have been designed** by Hooke. 3. Linus Pauling **is considered to be** … 4…. all observations **are seen to be affected** with … 5. … the judge **is said to have replied** … 6**.** … **is known to be bringing/ to have brought** the third world … 7. Scientists **are known to complain** of … 8. … that **are** now **known to be elements** … 9. … the world **seems to be getting** better … ; … environmentalists **tend to believe**… 10. … either **appear to be exaggerated** … 11. … **doesn't appear to be** … 12. … **is unlikely to pose** … 13. … **may well turn out to be** …

14. Transform the sentences using Complex Object.

1. Newton showed Kepler's laws to be the consequence of the theory of universal gravitation.

2. Examination with x-rays shows halogens even in the solid state to possess diatomic molecules.
3. They expected acceleration to be different for different weights but that was not the case.
4. We can hardly expect the public to permit many mistakes in a field that aims …
5. Investigations revealed the age of the earth to be about 4,5 billion years.

Unit 10
Engineers and Scientists

1. Read the text and identify true and false statements. **Engineering**
1.F 2.T 3.T 4.F 5.T 6.T 7.F 8.T
2. Choose the right word. **Research in Science, Engineering and Technology**
1. technological 2.techniques 3.technologist 4. technology 5.technical 6.technological 7.technological 8.techniques
3. Fill in the gaps. **Research and Technology Combined**
1.b (decades) **2.f** (invention) **3.d** (engaging) **4.g** (objectives) **5.k** (task) **6.j** (suppressing) **7.e** (varying) **8.l** (identified) **9.h** (pursue) **10.c** (decided) **11.i** (receive) **12.a** (constructed)
Confusables
4. ***Choose the right word.***
I. Creativity in Science and Technology
1. c 2. c 3. b 4. c 5. b 6. a 7. c 8. b 9. a 10. b
II. Engineers and Scientists
1.a 2.c 3.a 4.c 5.b 6.a 7.c 8.a 9.a 10.b 11.a 12.b

Word Families

5 .Fill in the gaps with the suitable words.

1.**e** (inspiration) 2.**f** (inspired) 3.**a** (aspire) 4.**g** (inspiring) 5.**b** (aspirant)
6.**h** (perspiration) 7.**i** (respiratory) 8.**d** (expired) 9.**c** (conspire) 10.**h** (perspiration)

Phrasal verbs

6. Insert the suitable particles.
1.up 2.through 3.in 4.out 5.on 6.out 7.round 8.across 9.on 10.out

8 . Match the two parts. **Unless/ provided** 1.c 2.b 3.a 4.d 5.g 6.e 7.f

10. Choose the right option.
1.b 2.a 3.d 4.c 5.d 6.c 7.c 8.d
11. Form mixed conditional sentences. 1.c 2.d 3.a 4.b 5.e

12. Match the two parts. 1.c 2.e 3.a 4.g 5.b 6.d 7.f 8.i 9.h 10.j
13. Use the correct form of the verbs in brackets.
Art and Science. Subjectivity vs. Objectivity
1.had been/were 2.had never lived 3.would be; had never been painted
4.lived; would be; would have been composed 5.hadn't created

Unit 11
Modern Materials

1. Read the text. Decide whether the following statements are true or false.
Nanotechnology
1.T 2.T 3.F 4.T 5.T 6.F 7.T

Confusables

3. Fill the gaps using the words below. **Lavoisier - the father of experimental chemistry**
1.c 2.a 3.c 4.b 5.d 6.a 7.c 8.c 9.d 10.c

4. Fill the gaps with the following verbs. **Newlands and Mendeleyev**
1.f 2.i 3.b 4.c 5.d 6.a 7.e 8.k 9.n 10.m 11.l 12.g 13.j 14.h

5. Find correspondence between the names and symbols of the elements. **Elements**
1.Е b 2.Л c 3.Б d 4.З I 5.В f 6.Г k 7.Д h 8.А j 9.ё l
10.И g 11.К a 12.М m 13.Н o 14.Ж n

6. Fill in the gaps with the names of the elements.
1.hydrogen 2.iron 3.arsenic 4.manganese 5.sulfur 6.mercury 7.nitrogen
8.potassium 9.sodium 10.tin 11.antimony 12.silicon 13.tungsten 14.lead 15. fluorine

7. Form the suitable word. **Alloys**
1. successively **2.** inspired **3.** significant **4.** mixture **5.** joint **6.** metallic
7. Amazing **8.** observation **9.** additional **10.** varying **11.** constituents
12. mixture **13.** familiar **14.** especially **15.** evolution

8. Choose the right word. **Most widely used Metals**
1.B **2.**A **3.**B **4.**A **5.**C **6.**B **7.**A **8.**B **9.**C **10.**B **11.**C **12.**A **13.**B **14.**B
15.C **16.**B **17.**A

Word Families

9. Fill in the gaps with the suitable words.
1.**e** (emission) 2.**h** (submit) 3.**i** (transmit) 4.**d** (emitting) 5.**c** (emitted) 6.**a** (admit)
7.**b** (admission) 8.**f** (permit) 9.**j** (transmitters) 10.**g** (permissions)

Phrasal Nouns

10. Add the suitable particle to form nouns and fill in the gaps.
1.down- 2.back 3.by- 4.out 5.out 6.through+s 7.out 8.in 9.down 10.out

13. Complete the sentences according to the pattern:
Going to an international scientific conference
Example A**:** 1.a 2.k 3.m ***Example B*****:** 4.c 5.e 6.g 7.h ***Example C*****:** 8.b 9.d 10.f 11. j
Example D**:** 12.c 13.e 14.g 15.h ***Example E*****:** 16.i 17.l 18.n

16. Fill the gaps using the following words:
1.pulled 2.realised 3.were 4.was 5.shared 6.seen

Unit 12
Careers in Science and Technology

1. Read the text and decide if the following statements are true or false.
1. T 2. F 3. F 4. T 5. T 6. T 7. T

7. Find corresponding sentences. **Scientific research phases explained**
1.c/d 2.i 3.k 4.a 5.e/g 6.h/c 7.b 8.l 9.b/e 10.g/h 11.f 12.j

Word Families

8. Fill in the gaps with the suitable words.
1.**f** (rejected) 2.**g** (rejection) 3.**j** (subjectivity) 4.**c** (objective) 5.**i** (subjective) 6.**e** (projection) 7.**h** (subjected) 8.**d** (project) 9.**a** (ejects) 10.**b** (objections)

Phrasal Verbs

9. Insert the suitable verb:

1.spelling 2.pointed 3.ironed 4.drew 5.sort 6.turned 7.done 8.came 9.get 10.working 11. do

Linking Words and Text Organizers

10. Fill in the gaps.

1.**b** (apart from) 2.**i** (since) 3.**k** (such) 4.**d** (but) 5.**f** (Meanwhile) 6.**a** (as) 7.**e** (like) 8.**h** (Similarly) 9.**c** (Besides) 10.**f** (Meanwhile)

11. Choose the suitable word.

1.in fact 2.after all 3.ahead of 4.in the long term 5.single-handedly 6.in other words 7. in general 8. beyond

13. Fill the gaps using the following words. Translate the sentences.

1.i (short) **2.d** (insatiable) **3.b** (better) **4.h** (possible) **5.c** (greater) **6.f** (less) **7.a** (astonishing) **8.g** (more) **9.g** (more) **10.e** (least)

CONFUSABLES: Comparatives

14. Choose the right word.

1.superior 2. less 3. at least 4. further 5.older 6. early 7.as many as; much 8.latter; former 9.major; minor 10.junior 11.more; fewer

15. Fill in the gaps with the suitable quantifiers:

1.the many 2.few 3. much 4.less 5.the few 5.the few 6.least 7.Little 8.some

16. Fill in the gaps with the suitable pronouns:

1.someone's 2.None 3.Every 4.Everybody 5.nothing 6.Any 7.One 8.each 9.another 10.every 11.everything 12.everybody

Noun Compounds

17. Form corresponding noun compounds

1. nuclear power plant reactor emissions
2. gaseous product fission monitoring system
3. high quality radioxenon concentrations
4. xenon radioisotope activity ratios
5. radiopharmaceutical isotope production simulations
6. beta-gamma coincidence data analysis techniques
7. radionuclide monitoring data application
8. reactor site noble gas releases estimation
9. explosive energy instant release estimation
10. establishing network of global xenon radionuclide monitoring stations

SCRIPTS FOR UNITS 1-12

SCRIPT 1
The Greek Legacy: How the Ancient Greeks shaped modern mathematics

Around 2,500 years ago, a group of revolutionary thinkers changed the way we think about mathematics. Through the idea of proof, the ancient Greeks showed that math isn't just about performing calculations, but a way of understanding and testing the reality of the world around us. The sign above Plato's Academy was said to have read: let no one ignorant of geometry enter here. And the great Archimedes was even killed by a soldier because he refused to leave a proof unfinished. But, what is a proof?

Simply put, a proof is a convincing argument to demonstrate whether something is true or false. For example, if all dogs have four legs, then: is this a dog? It's easy to prove that just because all dogs have four legs, not everything with four legs is a dog. How about a mathematical proof? You've probably heard of Pythagoras's theorem, a mathematical fact about the sides of a right-angled triangle.

Here's one demonstration of the theorem. Does it convince you? Good proofs are undeniably true. 200 years after Pythagoras was around, another Greek mathematician called Euclid perfected the way to write proofs. With just a few basic assumptions known as axioms, Euclid was able to prove many other mathematical results. He compiled these results into one remarkable book called The Elements, and his proofs are as true today as when it was first written and have formed the foundations of modern mathematics.

From proofs about infinite prime numbers used internet encryption to mathematical formulae used in engineering, the ancient Greeks have provided scientists, economists, lawyers, architects, and well, just about everyone, with a new mathematical understanding of our world.

SCRIPT 2
Yup, I built a nuclear fusion reactor

So my name is Taylor Wilson. I am 17 years old and I am a nuclear physicist, which may be a little hard to believe, but I am. And I would like to make the case that nuclear fusion will be that point, that the bridge that T. Boone Pickens talked about will get us to. So nuclear fusion is our energy future. And the second point, making the case that kids can really change the world.

So you may ask -- (Applause) You may ask me, well how do you know what our energy future is? Well I built a fusion reactor when I was 14 years old. That is the inside of my nuclear fusion reactor. I started building this project when I was about 12 or 13 years old. I decided I wanted to make a star.

Now most of you are probably saying, well there's no such thing as nuclear fusion. I don't see any nuclear power plants with fusion energy. Well it doesn't break even. It doesn't produce more energy out than I put in, but it still does some pretty cool stuff. And I assembled this in my garage, and it now lives in the physics department of the University of Nevada, Reno. And it slams together deuterium, which is just hydrogen with an extra neutron in it. So this is similar to the reaction of the proton chain that's going on inside the Sun. And I'm slamming it together so hard that that hydrogen fuses together, and in the process it has some byproducts, and I utilize those byproducts.

So this previous year, I won the Intel International Science and Engineering Fair. I developed a detector that replaces the current detectors that Homeland Security has. For hundreds of dollars, I've developed a system that exceeds the sensitivity of detectors that are hundreds of thousands of dollars. I built this in my garage.

And I've developed a system to produce medical isotopes. Instead of requiring multi-million-dollar facilities I've developed a device that, on a very small scale, can produce these isotopes.

So that's my fusion reactor in the background there. That is me at the control panel of my fusion reactor. Oh, by the way, I make yellowcake in my garage, so my nuclear program is as advanced as the Iranians. So maybe I don't want to admit to that. This is me at CERN in Geneva, Switzerland, which is the preeminent particle physics laboratory in the world. And this is me with President Obama, showing him my Homeland Security research.

SCRIPT 3
An Astronomer Responds To Flat Earth Theory

I'm Dr. Stewart Clark. I'm an astronomer and I'm the author of the *unknown universe.* It's so clearly obvious that the world isn't flat. We see when ships leave the harbor you can see as they gradually disappear below the horizon. You can see if you go up onto a tall tower or a hill and you see more over the horizon. All our physics is constructed now the physics of orbits, actually things going around the earth, it is all constructed with this, with three dimensional spherical world and the pictures from space show our world as a globe and yet somehow there are some people that still seem to believe that the earth is flat.

So, as human beings, we love stories because stories make sense of our lives of our world, they endow it with meaning and they can be understandable. Science is a way of constructing what we hope is a true story - something that is demonstrably true through experiment but as we see throughout the ages the prevailing scientific theories of the day can be overturned as we move to more precise understanding of the universe around us. Generally speaking, those become more complicated, so there is a tendency for people to reject that reality.

The science of the day just falls back on uncomfortable myths, things that make them feel at home, things that make them much happier is that they know what's going on, maybe this is obsession with Flat Earth. The Flat Earth is one of those or maybe they're just people just contrarian I don't know it's one of those things that I find it so difficult to get my head around.

I mean I really do my own pet theory is that they're just doing it for comic effect just to see how far they can go. Let’s imagine for a moment that the earth was flat, well, how much thickness does it then have? These are the kind of questions you'd have to ask, you know, you've got an edge, well, would things fall off the edge? Well, how do you generate gravity to make the things fall? What is it there's actually causing the gravity to make things fall off the end? A flat surface is fairly unstable to the other forces, it would be flexible and move around, it's hard to even begin actually to talk about what a flat earth would be like because it's just so impossible.

SCRIPT 4
How AI is making it easier to diagnose disease

Computer algorithms today are performing incredible tasks with high accuracies, at a massive scale, using human-like intelligence. And this intelligence of computers is often referred to as AI or artificial intelligence. AI is poised to make an incredible impact on our lives in the future. Today, however, we still face massive challenges in detecting and diagnosing several life-threatening illnesses, such as infectious diseases and cancer. Thousands of patients every year lose their lives due to liver and oral cancer.

Our best way to help these patients is to perform early detection and diagnoses of these diseases. So how do we detect these diseases today, and can artificial intelligence help? In patients who, unfortunately, are suspected of these diseases, an expert physician first orders very expensive medical imaging technologies such as fluorescent imaging, CTs, MRIs, to be performed. Once those images are

collected, another expert physician then diagnoses those images and talks to the patient. As you can see, this is a very resource-intensive process, requiring both expert physicians, expensive medical imaging technologies, and is not considered practical for the developing world. And in fact, in many industrialized nations, as well.

So, can we solve this problem using artificial intelligence? Today, if I were to use traditional artificial intelligence architectures to solve this problem, I would require 10,000 -- I repeat, on an order of 10,000 of these very expensive medical images first to be generated. After that, I would then go to an expert physician, who would then analyze those images for me. And using those two pieces of information, I can train a standard deep neural network or a deep learning network to provide patient's diagnosis. Similar to the first approach, traditional artificial intelligence approaches suffer from the same problem. Large amounts of data, expert physicians and expert medical imaging technologies.

So, can we invent more scalable, effective and more valuable artificial intelligence architectures to solve these very important problems facing us today? And this is exactly what my group at MIT Media Lab does. We have invented a variety of unorthodox AI architectures to solve some of the most important challenges facing us today in medical imaging and clinical trials.

In the example I shared with you today, we had two goals. Our first goal was to reduce the number of images required to train artificial intelligence algorithms. Our second goal -- we were more ambitious, we wanted to reduce the use of expensive medical imaging technologies to screen patients. So how did we do it?

For our first goal, instead of starting with tens and thousands of these very expensive medical images, like traditional AI, we started with a single medical image. From this image, my team and I figured out a very clever way to extract billions of information packets. These information packets included colors, pixels, geometry and rendering of the disease on the medical image. In a sense, we converted one image into billions of training data points, massively reducing the amount of data needed for training.

For our second goal, to reduce the use of expensive medical imaging technologies to screen patients, we started with a standard, white light photograph, acquired either from a DSLR camera or a mobile phone, for the patient. Then remember those billions of information packets? We overlaid those from the medical image onto this image, creating something that we call a composite image. Much to our surprise, we only required 50 -- I repeat, only 50 -- of these composite images to train our algorithms to high efficiencies.

To summarize our approach, instead of using 10,000 very expensive medical images, we can now train the AI algorithms in an unorthodox way, using only 50 of these high-resolution, but standard photographs, acquired from DSLR cameras and mobile phones, and provide diagnosis. More importantly, our algorithms can accept, in the future and even right now, some very simple, white light photographs from the patient, instead of expensive medical imaging technologies.

I believe that we are poised to enter an era where artificial intelligence is going to make an incredible impact on our future. And I think that thinking about traditional AI, which is data-rich but application-poor, we should also continue thinking about unorthodox artificial intelligence architectures, which can accept small amounts of data and solve some of the most important problems facing us today, especially in health care.

SCRIPT 5
Top technical international university in Russia

Welcome to St. Petersburg - one of the most beautiful cities in the world, the northern capital of Russia. The most talented people have always had an urge to come here this gave a powerful impulse to the development of the city, which has been the center of Russian science and culture for three centuries. Here the cradle of Russian engineering and economic education was created in 1899.

Welcome to the Peter the Great St. Petersburg Polytechnic University. More than a century of its history and glory was created by people who taught and studied here The university has always been training highly qualified specialists. Today a new image of the Polytechnic University is created.

Polytechnic University is the leading technical University in Russia, which combines the traditions of fundamental Russian science with the best international educational and scientific practices. Positive changes gave the university the opportunity to occupy a stable position among the leading scientific and educational centers of the world within its educational and scientific institutions.

Over 50 Bachelor and more than 200 master programs are available to students. The structure of the university includes basic institutions where students are trained in technical economic and humanitarian areas. In the area of scientific research the Polytechnic University has positioned itself as a major multidisciplinary research center

Priority scientific areas at the university are experimental nuclear physics, life science, functional materials, nanotechnology, energy sufficient technology information, communication technology and advanced manufacturing technology. In addition supersectoral scientific areas are actively developing at the University in additive and supercomputing technology and aerospace research and development. The innovation center of the university has high-tech laboratories, which are created here equipped with modern world-class facilities.

Moreover, the supercomputer center equipped with the most modern computational systems is one of the most high capacity computer systems in Russia. Today the university combines all the features of a research innovation and entrepreneurial type of university. Among its partners are more than 200 Russian industrial enterprises and about 100 high-tech foreign companies.

For decades Polytechnic University has conducted successful international activities. Particular attention has been paid to the internationalization of the university. More than 18 international educational programs in English including double degree programs with leading partner universities have been developed. The university has developed partnerships with the world's leading universities and research centers. Expanding the program of academic mobility the university is open for cooperation and joint projects with universities all over the world

Combining the potential of foreign industrial partners the university implements its breakthrough scientific ideas by promoting the results of research technology and experience at the international level. This contributes to the improvement of the quality of education and the introduction of new educational technologies.

In April 2016 the Polytechnic University became the first Russian university to open a representative office in China in Pudong, new district of Shanghai. The aim of the representative office is to promote the brand Polytech in China and in the whole Asia-Pacific region. The next step is in promoting that Polytech on the world stage is in close cooperation with the higher education system.

In Spain in April 2017 we opened an official information center in Madrid. The new information center provides everyone with information about the educational programs of SPbPU. One of the basic principles of the educational process is that the Polytech is essential in participation of students in the research process. The University has about 200 research laboratories and centers and more than two dozens small innovative enterprises in Technology Park and business incubator.

While studying at the University students become independent creatively minded researchers and inventors organizers and coordinators of complex scientific and technical projects. In 2013 the Fab Lab was opened at the Polytechnic University. This was the first in the universities of St. Petersburg - a unique workshop for students where they can implement their creative scientific ideas.

University students are provided with everything necessary for study and recreation: Fundamental library Reading Rooms, a modern Sports Centre and comfortable student

dormitories. The Polytechnic University creates a special cultural creative and intellectual environment. The White Hall of the university is a unique concert hall located at its very heart. In their spare time students have the chance to become radio presenters or video operators, players in the hockey team or writers in the theatre or singers in the choir or builders of a racing car.

St. Petersburg Polytechnic University continues to be an essential source of opportunity for the discovery of fundamental science and the trajectory for education and engineering into the future.

SCRIPT 6
English is the language of science

If you're already dreaming in English I mean it's like you're already definitely in science you find all the documentation books, conferences proceedings and all the literature out there is mainly in English. All the top journals are English speaking journals or English within journals or the communication at International top meetings are in English, the core information exchange platform is English.

If you want to find out what the top scientists in the world are doing - they need to know English. I think Fraunhofer is very known for its development of the mp3 technology and Disease Control in aquaculture, the application of nanotechnology and beer using biocomputing to do data analysis of large data sets at Fraunhofer. English is a must - you're guaranteed to have to communicate with people in English almost on a daily basis.

We had an employee who we would really like to hire but his English proficiency isn't very good and he needs to work on a project which involves European partners. I have a lot of stories of people that either don't even dare to apply for jobs or they apply for jobs but they don't get them because they can't even go through the interview.

There are issues about communications based on many people's inability to be fluent in English. We definitely need English skills here. English has really helped me to communicate with people not only in Germany and also here in Chile but with people from different backgrounds. Learning English has granted me the opportunity to work in a more innovative environment, without English it would be impossible to play any role on international collaborations.

SCRIPT 7
Can Math Equations Be a Form of Art?

Hey guys, Tara Long here for D-news today - to talk about one of my favorite subjects, math. As it turns out it is as valid a form of art, as any other. Who knew?

Now it's difficult to put into words, exactly what it is that makes numbers and symbols so appealing - but according to scientists, it boils down to simple brain chemistry. In a recent study at University College in London, researchers showed a group of mathematicians 60 different mathematical equations, and asked them to rate those equations on a scale of “ugly” to "beautiful," while inside an iMRI scanner.

The results showed that the more "beautiful" an equation was - according to the test subject - the more likely it was to elicit activity in the A1 field of the medial orbit or frontal cortex. This is the part of your brain that's typically associated with emotional responses to visual and musical beauty. Meaning people like us respond to numbers and equations, the same way other people do to music or art.

But even people with no musical talent can still appreciate good music - so what constitutes beauty in math? And does the appreciation of it require some understanding of its meaning? Well, not necessarily.

To test that idea, researchers performed the same study on a control group - with no special appreciation of math. And while those subjects did show a significantly lower emotional response

to the equations - a handful of them were still capable of finding their beauty - even with no understanding of what they actually mean.

So, what makes an equation "objectively beautiful"? Is it just a formula of curves and shapes, maybe symmetry that makes it pleasing to the eye? It's difficult to quantify the exact reasons, but there is one equation consistently rated to be the most attractive - and that's Euler's identity ($1+ei\pi=0$) - perhaps because it contains the 3 most fundamental numbers in the mathematical universe, e, π, and i. It's a pretty hot equation, I'm not gonna lie.

What's the ugliest, you ask? According to the mathematicians in this study, it's this - Srinivasa Ramanujan's rapidly converging infinite series of π. But hey - there's a lot about math I don't know. I'm not a wizard.

If there's an equation out there you don't think gets enough recognition - then leave it in the comments below. Or twit at me. And I can judge it, based on its looks. Like a nerdy, hot or not. Or Tinder for geeks. And hey - if you've got more time to kill, why not go check out some of the other shows.

Today we're counting down our picks for the top 10 famous inventors. Before Alfred Nobel for blasting people used black powder what we call gunpowder which was very unstable and you could only ignite it with a fuse, you could not control very well when it ignited or the pattern of the explosion that was generated.

For this list we've looked at those inventors that have had the most important, most popular, most definitive effect upon the modern world. We're interested in those responsible for the inventions without which modern life would be very different.

SCRIPT 8
Top 10 Famous Inventors

Number 10: Marconi

Marconi was an Italian inventor and the father of long-distance radio transmission and winner of the 1909 Nobel Prize for Physics. He was not the first person experimenting with wireless technology but Marconi can be credited with turning the idea of radio waves into a commercial practical reality. Marconi remodeled wireless apparatus throughout his early career lengthening the distance between which messages could be sent and received. Like many physicists of his day Marconi thought that electromagnetic waves traveled like light in a straight line. What would happen, he wondered, when sending a signal thousands of miles beyond the horizon? He is best known for being the first person to successfully send a transatlantic message. Marconi's radio was also crucial in monitoring the 1912 sinking of the Titanic and saving at least some survivors indeed in 1912. It was the SOS from the Titanic's Marconi room that brought the Carpathia steaming to the seven or five survivors.

Number 9. James Watt

James Watt obtained a job at the University of Glasgow repairing astronomical instruments and set up a small workshop there. A steam power pioneer James Watts work became a foundation for the Industrial Revolution, which swept across the UK and the USA in the 18th and 19th centuries and eventually reached the entire planet. When Watt was a young man, the new common engine was used by most major factories, but he realized that that system was wasting large amounts of energy, until eventually Watt developed an efficient method for continuous rotary motion and unprecedented power rise of the machines magnificently followed in 1781after much financial hardship and struggle. Watt patented a steam engine that produced continuous rotative motion.

Number 8. Benjamin Franklin

Benjamin Franklin, one of the founding fathers of the United States, was a master of many trades. His inventing efforts were widespread but his most famous experiment centered around his

casting a kite into a lightning storm, frying electrical charge and subsequently developing the lightning rod as a means of ensuring safety in tall buildings. Franklin suggested that during a storm a wooden sentry box be placed atop a hill or inside a steeple when the pointed rod is attached to the roof. If a man inside the box held a wire touching the rod Franklin predicted he would see a shower of sparks when lightning struck the rod. Other inventions that can be attributed to Franklin include a glass harmonica bifocal eyeglasses and a urinary catheter with added flexibility. As we said his efforts were widespread well, many of Benjamin Franklin's contributions are still used today. So if you wear bifocals or talk about electric charge or survive a thunderstorm don't forget to cut out $100 bill Thank You to Franklin.

Number 7. The Wright brothers Orville and Wilbur

For one pair of Ohio brothers it took a little ingenuity and determination to turn their dream of flight into reality. Orville and Wilbur Wright are probably the most important names in the history of aviation and heavier-than-air flight. In the very early 1900's inventors across America and the world were racing to develop a reliable and practical machine in which human beings could controllably fly. The Wright brothers won that race when they managed to lift off on the beach of Kitty Hawk, North Carolina. They hadn't found a way to stay in the air for more than a minute, but that was about to change their invention of a 3-axis control which enabled multi-dimensional movement on a fixed-wing aircraft far outstripping any innovation of their peers. From then the sky really was the limit and their powerful engine of 40-foot wingspan could carry pilot and passenger over 50 miles in the relative comfort of padded seats. As a model B lands on the White House, flight becomes the American dream.

Number 6. John Logie Baird

The 1926 showed through television images in light and shade for the first set. One of many great minds associated with the development of television, John Logie Baird's, seemed always prominent when the most significant advances were made. Many historians credit him with being the first to produce a live moving grayscale TV image. It was basically a black cross, it's a bit flickery and a bit wobbly and he could just about, with some special focusing, just about get a white blob of a face. And he's also noted as the man behind the first publicly demonstrated color TV system transmitted on July 3rd 1928. A similar figure to Marconi and radio, Baird also worked to lengthen the distances between which TV could be broadcast leading the way for the international applications that it has today

Number 5. Archimedes

Scientists work to recover the text from this fragile document and they are discovering that Archimedes was further ahead of his time than they had ever believed. Of course, inventors were inventing things in ancient times as well and none more so than Archimedes. The brains behind the self-titled and still widely used Archimedes screw a device enabling efficient pumping of water. The ancient Greek engineer is probably best remembered as a mathematician: he is the most famous of the ancient mathematicians and the first to discover the value for π, the mathematical equivalent of inventing the wheel. The most famous Archimedes anecdote involves his creating a method to measure the volume of an irregularly shaped object. Perhaps he was sitting in the bath house one day wondering how a heavy bathtub can float when inspiration came to him. Upon working it out in the bath he ran down the street naked shouting *Eureka,* which is now the unofficial catchphrase of inventors everywhere.

Number 4 Leonardo da Vinci

He's well known as a great artist but in fact he also made great contributions to foundations of science. Another indisputable genius Leonardo da Vinci's inventions are often overlooked or at least overshadowed because of his legendary art work as Leonardo was among

most important painters of the Italian Renaissance and the father of the high Renaissance style. But da Vinci was more than just the Mona Lisa. In fact, many of his ideas were so advanced they weren't physically possible for hundreds of years after his death. Within his designs a helicopter, a calculator and even suggestions of solar power. His technical and anatomical drawing was also largely unrivaled, he was more than outside-of-the-box. He was intellectually adrift from the entire human race to understand how scientifically brilliant and innovative he was. We got to understand what was going on during his time and late 1400s when Leonardo was coming up as a young artist Europe was essentially devoid of most real science in the modern sense.

Number 3. Nikola Tesla

The archetypal mad scientist throughout much of the 20th century, Nikola Tesla's work went a little underappreciated. These things never quite work as you expect them to. In recent times efforts have been made to better preserve his story and the impact he had on electrical engineering especially. Tesla was most taken with the idea of wireless technology and he's best known for his work on alternating current electricity. The enduring images are those of him sitting and studying within highly charged laboratories, cleverer and crazier than almost anybody else that ever lived. Thunder is good, thunder is impressive but it is lightning that does the work.

Number 2. Alexander Graham Bell

So the story I will tell you begins when I was just a boy. The telephone is one of the cornerstone inventions of modern existence and Alexander Graham Bell was the man who made it possible. What if you could send the sound of a human voice so that one person could simply speak to another even if they were far away. Starting out his professional life by working with the deaf and hard of hearing, Bell harbored a lifelong fascination with sound and speech: “when I wasn't thinking about machines or working on my ideas I taught deaf children just like my father did”. He first began working on the telephone in the early 1870s and the first successful bi-directional transmission of clear speech was conducted on March 10th, 1876 when Bell called his colleague to say “Mr. Watson come here I want to see you”. That first phone call was actually conducted through this wire.

Number 1. Thomas Edison

The phenomenally prolific American inventor Thomas Edison, the holder of an incredible 1093 US patents, Thomas Edison was an extreme inventor. There were other great inventors, then there was Edison - he understood that inventing is not just having an idea and so he made Edison a name to be reckoned with a real rags to riches story. He's probably best known for his ultimate and original lightbulb. Edison worked to install his electric light into towns and cities across the globe demonstrating a knack for big business. The phonograph was also his creation and the alkaline storage battery. He screened early motion pictures and he even drew up ideas for an electric car. If Edison thought about it he did it and he usually did it well. Storage battery, the motion picture projector, the motion picture camera, the phonograph or record players as we would call it nowadays. Do you agree with our list? Who is your favorite famous inventor?

SCRIPT 9
History of Measurement

The meter is the base unit of length used in the majority of the world, long time for people to agree on just how long it should be. Measurements of length were originally based on the human body like the length of a foot or the span of a hand. This could lead to confusion as these lengths varied from person to person.

In ancient Egypt the base unit of length was a cubit of measurement that varied depending on the length of a person's forearms, hands and palms. To avoid these variations in length the Egyptians created a standard royal cubit. Copies of this cubit were produced in Granite and distributed to standardized measurement.

This system allowed construction to flourish in the region. Similar systems developed around the world but they tended to be specific to a region making trading difficult by the 18th century in France alone.

There were over 800 different names for measuring the variances in these measures, which meant there were around 250 thousand different units of measurement and a standard measurement needed to be found - the *meter*. It was decided that the meter should be a length that was the same the whole world over. A meter would be one ten-millionth of the distance from the North Pole to the equator. This was calculated using trigonometry and an official meter bar was created in Paris in 1795 using the decimal system.

Other lengths could be calculated simply from the new meter. The meter became the international standard for length but was redefined more accurately in 1983 we now define one meter as the distance which light travels in a vacuum in a little over 300 millionths of a second.

SCRIPT 10
A Short History of Engineering

Thousands of years of engineering, and now: we can do this! How did we come this far? Our journey starts with Imhotep: world's first known engineer, famous for designing the pyramid of Djoser.

A massive structure for its time, 62 meters high. The construction of this pyramid marks the start of new era: the Third and Fourth Dynasty of Egypt. In that era dozens of these pyramids were built, with this pyramid probably the first one.

All these pyramids were constructed without the use of wheels or pulleys. Although wheels were already commonly known in the Middle-East, they strangely didn't get to Egypt. Pulleys however, wouldn't be invented till a thousand years later.

Not even 100 years after the construction of Djoser's pyramid, the great pyramid of Giza was built: world's tallest structure for almost 4.000 years. From the seven wonders of the ancient world, this structure is the only one still standing today. The others were 'the hanging gardens of Babylon', 'the temple of Artemis', 'the statue of Zeus at Olympia', 'the Mausoleum at Halicarnassus, 'the Colossus of Rhodes' and 'the lighthouse of Alexandria', built in the city where 130 years later, the hourglass was invented: a great timekeeping device that could accurately track small amounts of time, since all they had before was the sundial, invented around 1500 BC and under some conditions the highly inaccurate water clock, invented 100 years earlier.

Although some say that water clocks already appeared in China as early as 4000 BC, China is also famous for inventing the trebuchet as early as 400 BC. This siege weapon improved attacking castles and fortresses by complementing the use of steel swords and the invention of the battering ram - first used in southern Italy. Although much of the engineering

of that time was related to military and war, also mechanical engineering started booming because Archimedes' screw was invented and the first watermills were used.

But engineering with water wasn't new, because long before - in the field of hydraulic engineering - the Egyptians started building dams for their agriculture, the Romans started building their famous aqueducts and the Greek built a kilometer long tunnel used for water transportation.

The Greeks were very active around that time, because a guy named Thales of Miletus discovered static electricity, the first step to electrical engineering, although real experiments in this field would not get started for the next two thousand years. Except for the fact that these three items were found together in Iraq, combined they can form a battery. But we are unsure whether this was ever functional or not.

All these people and all these nations were the very first engineers, since the modern word 'engineer' is derived from the Latin words 'ingeniare' and 'ingenium', meaning devise and cleverness. These creations and these inventions were made more than 2000 years ago but definitely contributed to the world we live in now.

SCRIPT 11
How nanotechnology works

Nanotechnology has the potential to change the world in many positive ways. It will improve many of the products that we use every day and make many new products possible but how is it going to do that? In a nutshell, nanotechnology is the science of very small things, usually smaller than a hundred nanometers but how small is that?

A hundred nanometers is equivalent to about a thousand atoms across or less. At this scale things that we take for granted can behave in very different ways. You can understand the differences if you think about carbon. If you arrange carbon atoms one way you get diamond, arrange them another way and you get graphite, arrange of them randomly and you get… The nanotech way to arrange carbon atoms is to roll them into nano scale tubes.

When you do that, you get something amazing. Carbon nanotubes aren't incredibly strong in light, they'll make it possible to create things like space elevators. The elevator will run up and down a nanotube ribbon into space. Another application of nanotechnology can be seen in batteries by making the granules inside the battery at a nanometer scale. It's possible to recharge the battery faster and the battery lasts longer. The nanoparticles have a lot more surface area and the whole battery works better.

Some of the more exotic ideas in nanotechnology involve new assembly methods. Scientists are experimenting with new nanomaterials that can grow or assemble themselves right now. Most things are made by taking a big piece of material and molding it or shaving it down in the nanotechnology world. You start with atoms and build things up giving you incredible control cells, which are already able to do this. The goal is to find ways for human beings to do this as well.

Nanotechnology is still a very young science but once it starts advancing it will affect almost every part of our lives, from medicine to computers to cars. It will be fascinating to watch it unfold so that's how nanotechnology works.

SCRIPT 12
What is health information technology?

So, one of the very common questions about health information technology, or HIT, is "Exactly what is it? What do they do?" And so a health information technician is first and foremost

an advocate of patient data. They are the experts at protecting the privacy and security of patient information, so they will usually work in a healthcare setting where there are medical records.

So, they are responsible for ensuring that the patient's healthcare data is secure and private. To become a health information technician you must first graduate from an accredited, two-year degree program, and then you must pass a certification exam that's titled the RHIT, which stands for a *registered health information technician.*

Some of the common health information job duties include data analysis and reporting. This individual would be an expert in analyzing the healthcare data and generating reports for the healthcare facility, so they would look at trends in a particular area and help the hospital to understand what's going on with the patients that they're seeing at that facility.

Another area is release of information. This person would be an expert in understanding what type and how much patient data should be released upon request. Other areas include medical coding. Some health information technicians go on to be medical coders. At the Rasmussen program, there are four medical coding courses within the curriculum, and they are very popular.

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