MODULE 10

LASER AND OPTICAL TECHNOLOGIES

"Any sufficiently advanced technology is indistinguishable from magic."
Arthur Charles Clarke, an English science-fiction writer.

Learning points for Module 10:

Reading:
Text 10A. Light Beam at the Service of Humanity
Text 10B. How the Flash Tube and the Crystal Make a Laser Beam
Text 10C. Photonics. How light really works
Vocabulary in context: Word definitions. Collocations. The opposites. Word quiz
Grammar*:* Participles and Participle Constructions
***Speaking*:** Which Laser Technology is the Most Important
Learning Skill: Critical thinking
***Learning aims*:**
- to practise reading and speaking about laser and optical technologies
- to learn and to practise active vocabulary related to the topic of the module
- to learn and practise how to use Participles and Participle Constructions
- to learn and to practise the skill of Critical Thinking

Lead-in

1. Match the words (1-6) with their definitions (a-f). Use a dictionary if necessary.

1. stimulated	a. energy in the form of heat or light that you cannot see and which can be very harmful
2. radiation	b. a word formed from the initial letters of other words
3. acronym	c. the increase in volume of a signal
4. emission	d. a line of radiation or particles flowing in one direction
5. beam	e. the act of sending out gases or other substances
6. amplification	f. made stronger or more active

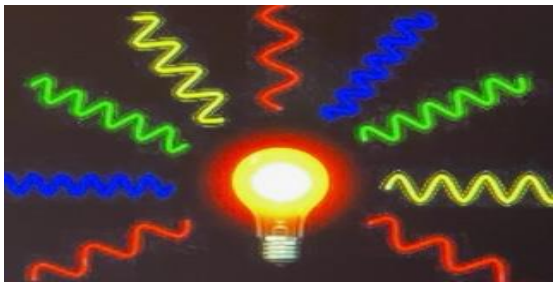
2. In groups answer the questions.

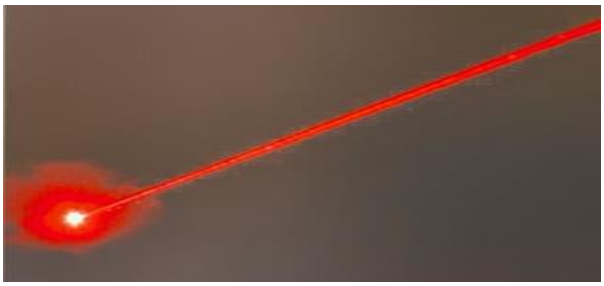
1. What is a laser?
   a. a device which produces a very narrow beam of light useful in many technologies
   b. a process of optical amplification of light based on radiation emission
   c. both *a* and *b*
2. What kind of word is the word ‘laser’?
   a. acronym
   b. shortening
   c. contraction
3. Can you decode the word ‘laser’? (use the words from task 1)
   L_____ A_____ by Stimulated E_____ of R_____ .

3. Study the pictures below. Which of the following words and phrases refer to ordinary light (1) and which to laser light (2)?

Coherent; its intensity decreases with distance; highly monochromatic; it is not strictly monochromatic; ~~organised;~~ less intense; travels in one direction; incoherent; highly intense; concentrated; travels in all directions; ~~disorganised.~~

1 **2**





Ordinary light:	disorganised, …
Laser light:	organised, …

READING
Part 1

4. Read the text and check your answers to lead-in tasks.

Text 10 A

Light Beam at the Service of Humanity

(1) Lasers often remind us of science fiction films and novels. Long ago science fiction writers* predicted the appearance of a mysterious fiery sword[1], which would become an invincible weapon[2]. The idea of using lasers as death rays[3] has also been employed by creators of such blockbusters as X-Men and Star Wars. And though the ray laser gun[4] still remains science fiction, putting a light beam at the service of humanity is embodied in myriads[5] of other uses based on laser technology.

(2) The word "laser" stands for “light amplification by stimulated emission of radiation”. A laser, an optical device that strengthens light waves and

generates very intense beams of light, represents a powerful light source. The difference between ordinary light and laser light is like the difference between the ripples[6] in your bathtub and huge waves on the sea. Until the invention of the laser, the available light sources were generally neither monochromatic nor coherent[7] and were of relatively low intensity. The laser produces a well-directed, very intense beam which is *monochromatic, directional* and *coherent*. *Monochromatic* means that all of the light produced by the laser is of a single wavelength. *Directional* means that the beam of light has a very low divergence[8]. Light from conventional sources, such as a light bulb or the sun, diverges, spreading in all directions. The intensity may be large at the source, but it decreases rapidly as the observer[9] moves away from the source. In contrast, the laser output has a very small divergence and can maintain high beam intensities over long ranges. Thus, relatively low power lasers are able to project more energy at a single wavelength within a narrow beam than can be obtained from much more powerful conventional light sources. *Coherent* means that the waves of light are in phase with each other. A light bulb produces many wavelengths, that is why its light is *incoherent*.

(3) The first discoveries that eventually brought us lasers were made at the dawn of the 20th century. In 1917, Einstein laid the foundation for the laser when he introduced the concept of *stimulated emission*. In 1954, Russian physicists Nikolay Basov and Alexander Prokhorov working on the quantum oscillator[10] created the first microwave generator, laser's predecessor,[11] and described the theory of its operation. At the same time, the idea how to generate stimulated emission at microwave frequencies was also developed independently by American physicist Charles Townes. He showed how this device, which was named a *maser*, could work. A decade later, in 1964, all three were awarded with the Nobel Prize in physics for their discoveries. In 1960, physicist from California Theodore Maiman demonstrated the first ruby[12] laser, which was considered the first successful light laser. Other types of laser quickly followed: a gas laser and a semiconductor injection[13] laser.

(4) Due to their remarkable properties lasers turned out to have all sorts of useful applications in different fields from communications to medicine. In science they are a great help in spectroscopy. They allow gigabytes of information to be recorded. They can be used to focus relatively low wattage power[14] to such high intensity that it can be used to cut, heat or vaporise material. They have numerous applications aboard spacecraft. Laser beams allow us to measure distances with much greater accuracy than ever before. Laser-sighting devices[15] are fitted to military and police rifles to help soldiers hit their targets. Lasers can be used as a defence[16] against nuclear missiles[17] and they may also be of use in thermonuclear fusion[18] reactors. Medicine and surgery have been transformed thanks to highly accurate laser scalpels and laser diagnostics. In the arts, lasers can provide fantastic displays of light.

(5) We are currently living in an era of intense development of lasers. New types of lasers (chemical, excimer, semiconductor, free electron) are introduced almost every year. New applications of lasers are constantly emerging. For example, not long ago archaeologists uncovered a new vast network of cities and roads in the thick jungles around the ancient Cambodian temple complex of Angkor Wat, implementing an aerial survey using Lidar (light detection and ranging). Lidar might also prove crucial in helping autonomous vehicles navigate. Lasers could have a huge impact on the world of computing. For example, a silicon laser computer chip promises faster data transfers. Laser developers say it could enable us to see people behind walls, detect underground infrastructure without digging holes, and develop navigation systems that do not rely on GPS.

**Herbert Wells in his novel "The War of the Worlds" in 1898 and Alexey Tolstoy in "The hyperboloid of Engineer Garin" in 1927.*

Vocabulary notes for text 10 A

[1] fiery sword	огненный меч
[2] invincible weapon	непобедимое оружие
[3] death rays	лучи смерти
[4] laser gun	лазерная пушка
[5] myriads (of)	несметное число
[6] ripples	рябь, зыбь
[7] coherent	когерентный
[8] divergence	дивергенция, расхождение
[9] observer	наблюдатель
[10] oscillator	осциллятор, генератор
[11] predecessor	предшественник
[12] ruby	рубин
[13] injection laser	инжекционный лазер
[14] wattage power	мощность в ваттах
[15] laser sighting	лазерный прицел
[16] defence	защита, оборона
[17] missiles	ракеты
[18] thermonuclear fusion	термоядерный синтез

5. Find the words and phrases in the text which have the following meanings.

§1

1. *a verb:* to make someone remember something
2. *a verb*: to use a particular idea or method
3. *a verb*: to continue to be in the same state or condition
4. *a verb*: to express clearly or show the importance of an idea or principle

§2

5. *a noun*: the product of making larger or greater in amount or intensity
6. *a noun*: the result of sending something out (*e.g.* gas or heat)
7. *a verb*: to make stronger
8. *a noun*: the point from which something begins
9. *an adverb*: in relation to something else
10. *a noun*: a shining line of light
11. *an -ing form of a verb*: covering a large area
12. *a verb*: to go down to a lower level
13. *a phrase* used when you are comparing objects or situations and saying that they are completely different
14. the amount of something (energy, work, information) produced by a machine

§3

15. *an adverb*: after a long time
16. *a verb phrase*: to provide something (idea, principle) from which another thing can develop

17. *a verb*: to give someone a prize for something they have done

§4, 5

18. *a prepositional phrase*: because of or thanks to
19. *an adjective*: unusual or surprising and therefore deserving attention
20. *a verb*: to have a particular result, especially one that you didn't expect
21. *a verb*: to write something (*e.g.* information) down
22. *a verb:* to change into a vapour
23. *a verb:* to find the size, length or amount of something
24. *a noun:* the quality of being correct and true
25. *a verb:* to carry out
26. *a verb phrase:* to be of primary importance

6. Read the text again and answer the following questions.

1. Why can we say that lasers were predicted long before their invention?
2. What is a laser? What does the word 'laser' mean?
3. What kind of beam do lasers have?
4. What do we mean by the words 'monochromatic, directional, and coherent' when we refer to laser light?
5. Why is the light from the laser so concentrated?
6. Who proposed the theoretical possibility of the process that made lasers possible?
7. Who created the first microwave generator?
8. Who demonstrated the first successful light laser?
9. What laser types are mentioned in the text?
10. Do you agree with the author's opinion that lasers have found myriads of useful applications? What examples do you think best prove this point?
11. While reading this text, which uses of lasers surprised you the most?
12. Can you think of an example of a laser device or technology that you have used or are using?

7. Read the statements and decide which of them are true (T) and which are false (F) according to text 10A. Explain why.

1.The word 'laser' means microwave amplification by stimulated emission of radiation.
2. Laser was invented at the dawn of the 20th century.
3. Albert Einstein was the first inventor of a laser.
4. Laser came into existence only in the second half of the 20-th century.
5. Unfortunately most of the applications of a laser proved to be unattainable in the real world.
6.The use of lasers in thermonuclear fusion reactors may be the key to the future.
7. Laser weapons are widely used by the military.
8. In medicine lasers can be used for various surgical procedures.
9. Very few inventions can match the impact of the laser's invention.
10. Laser technology has a promising future.

8. Complete the sentences using the information from the text without looking into the text.

1.The word laser is an acronym standing for …
2. Laser light differs from ordinary light due to its …

3. Russian physicists Nikolay Basov and Alexander Prokhorov created … while working on …
4. In 1960, physicist from California Theodore Maiman demonstrated …
5. Lasers turned out to have myriads of uses, from … to …
6. In science lasers provide great assistance with …
7. Laser-sighting devices are fitted to … to help soldiers …
8. Today new applications of lasers are …
9. Not long ago archaeologists uncovered … using Lidar.
10. In computing lasers could have …

9. Complete the table of laser applications using information from text 10 A. Add any other applications you know about.

Military	Engineering	Communications	Medicine	Arts	Any other?
sighting devices	cutting materials				

10. Speak about lasers according to the following plan. Make use of the words and word combinations in italics.

1. The definition of a laser
2. Laser light vs. ordinary light - a brief explanation
3. How lasers were invented
4. Lasers at the service of humanity
5. The future of laser technology

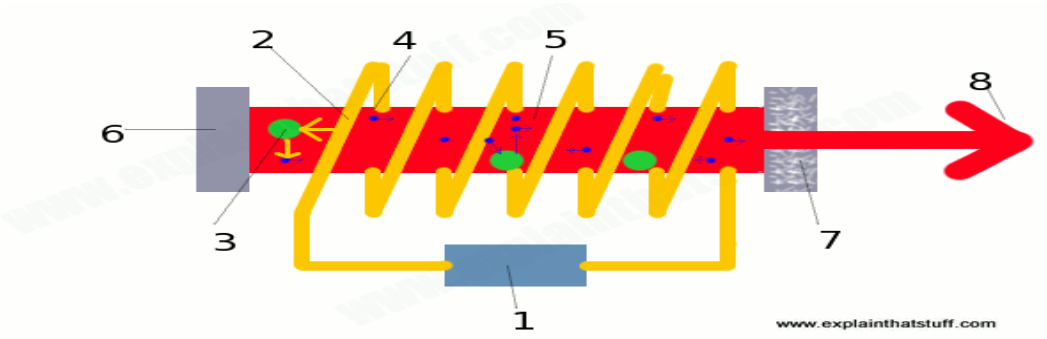
Light amplification, stimulated emission, radiation, laser beam, strengthen light waves, monochromatic, directional, coherent, lay foundation, create a maser, award the Nobel Prize, the first ruby laser, types of lasers, in different fields, measure distances, laser-sighting devices, surgery, new applications of lasers, prove crucial.

READING

Part 2

11. Read the description of the diagram and match the words below with numbers 1-8 in the diagram.

Photons, *partial*[1] mirror, ruby crystal, power source, atoms, laser beam, light *tube*[2]



You are looking at a red cylinder with a yellow zigzag tube *coiled*[3] around it. The red cylinder represents a ruby crystal and the yellow zigzag represents a tube of lighting. It coils around the ruby crystal and is connected to the power source in blue. When the laser is working, the light tube *flashes*[4] on and off, like a series of camera flashes. The grey disc to the left of the ruby crystal is a mirror and the one to the right of the crystal is a partial mirror, which means it *reflects*[5] part of the light (about 99%) but allows about 1% of the light to come through it to the right. The large green circles inside the crystal represent atoms and the small blue circles represent photons. The large red *arrow*[6] coming out of the right-hand side of the machine is a laser beam.

12. You are going to read about how a laser beam is made. Before you read the text put these notes into the best order.

- escaping photons form a powerful laser beam ( )
- atoms *absorb*[7] energy and give off a photon of light ( )
- the flashes *inject*[8] energy into the crystal in the form of photons ( )
- partial mirror lets some photons escape ( )
- electric supply makes the tube flash on/off (1)
- new photon hits an excited atom which emits two photons instead of one ( )
- a mirror reflects photons along inside of crystal ( )
- new photons travel inside crystal at the speed of light ( )

13. Now read the text and check your answers.

Text 10 B
How a Laser Beam Is Made

1. A high-voltage electric supply makes the tube flash on and off.
Every time the tube flashes, it "pumps" energy into the ruby crystal. The flashes it makes inject energy into the crystal in the form of photons.
2. Atoms in the ruby crystal (large green circles) *soak*[9] up this energy in a process called absorption. Atoms absorb energy when their electrons jump to a higher energy level. After a few milliseconds, the electrons return to their original energy level (ground state) by giving off a photon of light (small blue circles). This is called spontaneous emission.
3. The photons that atoms give off *zoom*[10] up and down inside the ruby crystal, traveling at the speed of light.
4. Every so often, one of these photons stimulates an already *excited*[11] atom. When this happens, the excited atom gives off a photon and we get our original photon back as well. This is

called stimulated emission. Now one photon of light has produced two, so the light has been amplified (increased in strength). In other words, "**l**ight **a**mplification"(an increase in the amount of light) has been caused by "**s**timulated **e**mission of **r**adiation" (*hence*[12] the name "laser", because that's exactly how a laser works!)

5. A mirror at one end of the laser tube keeps the photons *bouncing*[13] back and forth inside the crystal.

6. A partial mirror at the other end of the tube bounces some photons back into the crystal but lets some escape.

7. The escaping photons form a very concentrated beam of powerful laser light.

Vocabulary notes for text 10 B

[1]partial	частичный, неполный
[2]tube	трубка
[3]coil	обматывать
[4]flash	вспыхивать, сверкать
[5]reflect	отражать
[6]arrow	стрела
[7]absorb	поглощать
[8]inject	вбрызгивать, вдувать
[9]soak	впитывать
[10]zoom	*зд.* двигаться
[11]excited atom	возбужденный атом
[12]hence	поэтому, следовательно
[13]bounce	подпрыгивать, отскакивать

14. Read the text in detail and choose the best option to complete the sentences according to the information from the text.

1. The red cylinder in the diagram represents …
   a. a power supply
   b. a laser beam
   c. a ruby crystal
2. When the laser is working the light tube …
   a. highlights
   b. switches on
   c. flashes on and off
3. The partial mirror …
   a. doesn’t allow the light to pass through
   b. reflects part of the light
   c. reflects all the light
4. The large red arrow coming out of the machine is …
   a. a flow of atoms
   b. a laser beam
   c. a beam of ordinary light
5. When the tube flashes, it…

a. coils around the crystal
b. makes the crystal flash on and off
c. injects energy into the crystal

6. The photons that atoms give off …
   a. zoom up and down inside the ruby crystal
   b. make the tube flash
   c. emit radiation
7. Light amplification is caused by …
   a. spontaneous emission
   b. absorption
   c. stimulated emission
8. The photons that escape through the partial mirror …
   a. heat the crystal
   b. form a concentrated beam of light
   c. constitute 99% of the light produced by a laser

15. In pairs prepare to talk about a laser machine.

Student A. Talk about the basic components of a laser machine.

Student B. Talk about how a laser machine works.

READING

Part 3

16. Read the text and fill in the gaps with the words in italics.

Text 10 C. Part 1

Photonics

particles, entire, visible and invisible, far-reaching, cure, suggested, controversial, confirmed, cutting-edge, wavelengths, explore

Photonics is the science and technology of generating, controlling, and detecting photons, which are particles of light. Photonics underpins technologies of daily life from smartphones to laptops, medical instruments and lighting technology. The 21st century will depend as much on photonics as the 20th century depended on electronics.

Photonics is the science of light, it is the technology of generating, controlling, and detecting light waves and photons, which are 1. _____of light. The characteristics of the waves and photons can be used to 2. _____ the universe, to 3._____ diseases, and even to solve crimes. Scientists have been studying light for hundreds of years. The colors of the rainbow are only a small part of the entire light wave range, called the electromagnetic spectrum. Photonics explores a wider variety of 4._____ , from gamma rays to radio, including X-rays, UV and infrared light. It was only in the 17th century that Sir Isaac Newton showed that white light is made of different colors of light. At the beginning of the 20th century, Max Planck and later Albert Einstein 5._____ that light was a wave as well as a particle, which was a very 6._____

theory at the time. How can light be two completely different things at the same time? Experimentation later 7._____ this duality in the nature of light.

The word *Photonics* appeared around 1960, when the laser was invented by Theodore Maiman. Even if we cannot see the 8._____ electromagnetic spectrum, 9._____ light waves are a part of our everyday life. Photonics is everywhere; in consumer electronics (barcode scanners, DVD players, remote TV control), telecommunications (internet), health (eye surgery, medical instruments), manufacturing industry (laser cutting and machining), defense and security (infrared camera, remote sensing), entertainment (holography, laser shows), etc.
All around the world, scientists, engineers and technicians perform 10._____ research surrounding the field of Photonics. The science of light is also actively taught in classrooms and museums where teachers and educators share their passion for this field with young people and the general public. Photonics opens a world of unknown and 11. _____ possibilities limited only by a lack of imagination.

Text 10 C. Part 2

How Light Really Works

bouncing, solar panels, converted, incoming, absorbing, makes sense, excited, reflecting, photons, cells, photoelectric

Once we understand how atoms take in and give out energy, the science of light 12. _____ in a very interesting new way. Think about mirrors, for example. When you look at a mirror and see your face reflected, what's actually going on? Light (maybe from a window) is hitting your face and 13. _____ into the mirror. Inside the mirror, atoms of silver (or another very reflective metal) are catching the 14. _____ light energy and becoming 15. _____. That makes them unstable, so they throw out new 16. _____ of light that travel back out of the mirror towards you. In effect, the mirror is playing throw and catch with you using photons of light as the balls!

The same idea can help us explain things like photocopiers and 17. _____ (flat sheets of the chemical element silicon that turn sunlight into electricity). Have you ever wondered why solar panels look black even when they're in full sunlight? That's because they're 18. _____ back little or none of the light that falls on them and 19. _____ all the energy instead. (Things that are black absorb light, and reflect little or none, while things that are white reflect virtually all the light that falls on them, and absorb little or none. That's why it's best to wear white clothes on a hot day.) Where does the energy go in a solar panel if it's not reflected? If you shine sunlight onto the solar 20. _____ in a solar panel, the atoms of silicon in the cells catch the energy from the sunlight. Then, instead of producing new photons, they produce a flow of electricity instead through what's known as the 21._____ (or photovoltaic) effect. In other words, the incoming solar energy (from the Sun) is 22. _____to outgoing electricity.

17. Read the text again and answer the following questions.

1. What does photonics study?
2. How could the characteristics of waves and photons be put to practical use?
3. What kind of waves does photonics explore?

4. What discoveries did the scientists of the past make while studying light?
5. What does ‘duality of light’ mean?
6. Why can we say that photonics is everywhere?
7. Do you agree with the opinion that photonics is really important today?
8. What happens when you look at a mirror?
9. Why do solar panels look black in full sunlight?
10. Why is it best to wear white clothes on a hot day?
11. What happens to the solar energy in a solar panel?
12. Do you think pursuing a career in Photonics could be exciting and rewarding?

18. Listen to a short lecture about lasers and decide which of the following points below the speaker talks about.

https://www.youtube.com/watch?v=oUEbMjtWc-A

- The unique characteristics of laser light.
- How laser light is different from ordinary light
- How lasers are used in the military.
- How lasers are useful in eye surgery.
- How laser was invented.
- Different types of lasers.
- The operation of a ruby laser.
- How electronic transitions create stimulated emission.
- How the light becomes intensified and narrowed in wavelength inside a laser cavity.
- Innovations and improvements in laser technology.

Useful words: hallmark - клеймо, проба, признак; range finder- дальномер; vitreous humor - стекловидное тело; tour de force - проявление таланта, мастерства; xenon arc - (электрическая) дуга в атмосфере ксенона; flash lamp - импульсная лампа, the crests and troughs - точки подъёма и спада; resonant cavity - резонансная полость; avalanche – лавина; decay- распад.

19. Listen to the lecture again, take notes and answer the questions.

1. What examples does the speaker give to prove his point that ‘much of our technology today depends on lasers’?
2. What technology does he say highlights all other applications of lasers?
3. What are the advantages of a laser scalpel?
4. What are the three characteristics of laser light that the author calls ‘a tour de force of engineering’?
5. How are these three characteristics made?

VOCABULARY

Module 10 Word List

Text 10 A	Text 10 B

accuracy (n) amplify (v) amplification (n) award (v, n) beam (n) coherent (adj) decrease (v) due to (prep) embody (v) emit (v)/emission (n) fit (v) implement (v) in contrast to/with (n) lay/ laid (v) the foundation (n) measure (v) neither … nor (conj) output (n) prove crucial (v) radiation (n) relatively (adv) remain (v) remarkable (adj) remind (v) smth. source (n) spread (v) stimulate (v) strengthen (v) turn out (phr v) vaporise (v)	absorb (v) absorption (n) back and forth (adv) bounce (v) circle (v, n) every so often (adv) hence (adv formal) increase (v, n) inject (v) partial (adj) photon (n) reflect (v) represent (v) spontaneous (adj) **Text 10 C** confirm (v) consumer (n) controversial (n) cure (v) diseases far-reaching (adj) invisible (adj) lack (v, n) make (v) sense (n) particle (n) photonics (n) underpin (v)

20. Look at the words below. Explain their meaning and try to recall how they were used in text 10A.

Emission, to stimulate, radiation, beam, due to, to embody, directional, to strengthen, to measure, output, remarkable, relatively, to turn out, to award, accuracy, to be fitted, to implement.

21. Fill in the gaps with the words from Exercise 20 in the right form. The first letters are given. Translate the sentences into Russian.

Example: A **d**_____ microphone is the one that picks up sound from a specific area. → A **directional** microphone is the one that picks up sound from a specific area.

1. All our laboratories are **f**_____ with computers and high-speed internet access. 2. Some people think that electromagnetic **r**_____ from our mobiles is harmful. 3. Climatologists say that the **e**_____ of greenhouse gases contributes to global warming. 4. Melatonin, a hormone involved in controlling our sleep, is **s**_____ by darkness. 5. The sky cleared up and a **b**_____ of sunlight shone in through the window. 6. If we don't modernise, the **o**_____

from the factory will decrease. 7. Today it is **r**_____ easy to find any information thanks to the Internet. 8. The 20th century was **r**_____ for its inventions. 9. The Nobel Prizes are **a**_____ annually from a fund created for that purpose by the Swedish inventor and industrialist Alfred Bernhard Nobel. 10. A school's success can be **m**_____ in terms of the number of pupils who got into university. 11. Scientists need to be very careful about the **a**_____ of their research results. 12. Reforms should be **i**_____ that will allow the company to stay competitive. 13. Our students' ideas are **e**_____ in new classroom rules. 14. Exercising regularly is the best way to **s**_____ your immune system. 15. **D**_____ to the large volume of letters he is unable to answer personally. 16. Sometimes things don't **t**_____ out the way we think they're going to.

22. Guess the word by its definition. Use text 10A word list to help you.

1. If two or more waves have the same phase we call this light **c**_____.
2. When a liquid changes into gas we can say that it **v**_____.
3. **M**_____ colour refers to a colour scheme that is comprised of variations of one colour.
4. If one thing is in **c**_____ to another, it is very different from it.
5. If something **e**_____ heat, light or gas, it produces it and sends out by means of a physical or chemical process.
6. If someone **r**_____ you **of** a fact or event that you already know about, they say something which makes you think about it.
7. If someone or something **r**_____ in a particular state or condition, they stay in that state or condition and do not change.
8. You use the conjunction **n**_____ **n**__ when you are talking about two or more things that are not true or that do not happen.
9. Laser light is very **d**_____ which means that it is extremely narrow and is emitted in one direction.
10. A **l**_____ is a device that emits light through a process of optical amplification based on the stimulated emission of electromagnetic radiation.

23. Match the words with numbers (1-10) with the words with letters (a-j) to make up word collocations. Explain the meaning of these expressions and try to recall how they were used in text 10A.

Example: to lay + the foundation for something means 'to provide conditions that will make something possible', e.g. Einstein *laid the foundation* for the laser.

~~1. to lay~~	a. crucial
2. to prove	b. amplification
3. to measure	c. emission
4. light	d. source
5. stimulated	e. properties
6. to decrease	~~f. the foundation~~
7. conventional	g. distances
8. to spread	h. material
9. remarkable	i. rapidly

10. to vaporise	j. in all directions

24. Complete each sentence with the correct word to make up a word collocation from Exercise 23. Translate the sentences into Russian.

1. Buying the works of his contemporary artists, Pavel Tretiakov laid the _____ for one of the world's greatest collections of Russian paintings. 2. Learning the facts about how COVID-19 emerged may _____ crucial for preventing future outbreaks. 3. Before electricity was invented the _____ sources of light were candles or oil lamps. 4. The use of lasers to _____ distances is based on the principle of reflection of a laser beam. 5. One of the problems the inventors of a laser faced was how to create conditions for light _____ . 6. Stimulated _____ of radiation is the first and necessary condition for laser light generation, but it is not the only one. 7. Marketers know that the value of data _____ rapidly over time. 8. The fire was spreading out in all _____ because of the hot weather and strong wind. 9. The number of articles about new materials with some remarkable _____ has increased in the last years. 10. Processing materials with a laser beam allows engineers to cut, drill, weld, and even _____ different materials.

25. Match the words with the correct definition or synonym of each word as it is used in text 10B.

1. photon	a. to introduce (*e.g.* a fluid) into something forcefully
2. a partial (mirror)	b. a unit of energy that carries light and has zero mass
3. back and forth	c. the device that supplies energy
4. power source	d. to return or throw back (*e.g.* light or sound)
5. to emit	e. so, thus
6. to reflect	f. to move away from a surface
7. to absorb	g. not complete, limited
8. to bounce	h. to send out (*e.g.* light or gas)
9. concentrated	i. to take a liquid in
10. hence	j. focused
11. to inject	k. moving first in one direction and then in the opposite one

26. Look at the words below. Try to recall how they were used in text 10B or think of your own example sentences with some of these words.

Photons, mirror/partial mirror, power source, laser beam, light tube, to escape, ruby crystal, to reflect, to be connected to, to represent, to flash on and off, to absorb (a photon), to emit (a photon), to get excited, to inject.

Example: The photons that atoms give off zoom up and down inside the ruby crystal, travelling at the speed of light.

27. Find the opposites. Match the words in column A with their opposites in column B.

Example: 'to evolve' is the opposite of 'to decrease, worsen'.

A.	B.
1. to increase	a. input
2. to absorb	b. to emit (energy)
3. stimulated emission	c. disorganised
4. inside	d. to decrease
5. output	e. outside
6. to get excited	f. incoherent
7. to flash on	g. to reflect
8. to inject (energy)	h. to calm down
9. coherent	i. to weaken
10. organised	j. spontaneous emission
11. to strengthen	k. to prevent, delay
12. to implement	l. to flash off

28. Rewrite each sentence replacing the words in italics by their opposites. Use the words in brackets so that the new sentence has the meaning opposite to the first sentence. Translate the sentences into Russian.

Example: The production *efficiency* is the result of good work. (bad). → The production *inefficiency* is the result of poor work.

1. Black surfaces *absorb* more light than other colours. (white) 2. In spring wild birds *increase* in number in Moscow region. (in autumn) 3. *Spontaneous* emission takes place without interaction with other photons. (when photon emission is triggered by other photons) 4. It feels really warm *inside* on a winter morning. (cold) 5. A mouse and a keyboard are the examples of *input* devices. (a monitor and a printer) 6. For the system (such as an atom or a molecule) *to calm down*, you need to make its energy level lower. (higher than the ground state). 7. If you want to take a picture when it is dark you should choose a '*flash on*' mode. (in daylight) 8. Ordinary light unlike laser light is *incoherent* and *disorganized.* (laser light) 9. The committee agreed that it was necessary to *implement* the changes recommended in the report. 10. Our attention is *weakened* by stress. (mindfulness)

29. Use the word given in brackets to form a word which fits in the gap.

1. The name 'laser' stands for Light _____ by stimulated emission of radiation. (*amplify)* 2. Many enjoy the mental _____ of a challenging job. (*stimulate)* 3. Words _____ thoughts and feelings.(*embodiment)* 4. Difficulties _____ the mind, as labour does the body. *(strong)* 5. Laws controlling the _____ of greenhouse gases should be introduced. (*emit)* 6. Truth is the _____ of all knowledge. (*found*)7. A cloud is a mass of _____ in the sky. (*vaporise)* 8. A graphical _____ of the experiment results is required. (*represent)* 9. Do you think mobile phones emit _____ ? (*radiate)* 10. If a text is _____ , it means that it is well planned, clear and logical. (*coherence)*

30. Read the text and fill in the gaps with the following words in the appropriate form.

concentrated, coherence, weapon, monochromatic, stands for, emission,

beam, to encode and transmit, sophisticated, represents, hence, to vaporise

In «The War of the Worlds» written before the turn of the last century, H. Wells told a fantastic story of how Martians almost invaded our Earth. Their 1_____ was a mysterious «sword of heat». Today Wells' sword of heat has come to reality in the laser. The name 2_____ light amplification by stimulated 3_____ of radiation. Laser, one of the most 4_____ inventions of man, produces an intensive 5_____ of light of a very pure single colour. It 6_____ the fulfillment of one of the humankind's oldest dreams of technology to provide a light beam intensive enough 7_____ the hardest materials. There are few materials which are not suited for laser processing, 8 _____ laser treatment of materials has become an important technique lately. The laser's most important potential may be its use in communications. We send and receive the data, video and other information, using lasers 9 _____ the data at rates 10 to 100 times faster than radio, because lasers can generate a very intense, 10_____, highly parallel and 11_____ beam and 12_____ is a very important property of laser light.

31. Work in groups. Choose 5-7 words from Module 10 Word list and prepare a short news story to tell your group using these words. Ask your listeners to write down the words while they listen to your story. Compare your lists.

32. Summarise the text in English paying attention to the linking words and phrases.

A. Тема моего сообщения – изобретение, свойства и использование лазера. Вначале я расскажу об истории изобретения лазера, затем перейду к его свойствам, в-третьих (далее) я расскажу о типах существующих лазеров и, наконец, рассмотрю практическое использование лазера в различных областях. Итак, кого можно однозначно считать изобретателем лазера? Точного ответа на этот вопрос нет. Тем не менее, можно упомянуть ряд имен ученых, внесших вклад в создание лазера. Более того, двух-трёх из них можно назвать отцами этого изобретения. Несмотря на то, что вначале казалось, что в основном лазер найдет применение в военной области, лазерная винтовка, по-видимому, останется изобретением фантастов. Благодаря своему свойству производить чрезвычайно узкий луч света, лазер стал широко применяться во многих областях, например, в военной области и в медицине. Нельзя также переоценить роль лазера в компьютерной науке. Таким образом, можно видеть, что лазер имеет широкую сферу применения, от хирургических операций до устройств контроля скорости автомобилей. В заключение, хочу отметить, что то, что «смертельные лучи» не стали реальностью, только к лучшему.

B. Понятие «фотоника» появилось в конце XX века и вошло в повседневную жизнь. Это оптоволоконные линии связи, плоские экраны телевизоров и компьютерных мониторов, смартфоны и многое другое. Лазерная связь имеет высокое качество, большую пропускную способность, строгую конфиденциальность. И лазеры, и оптоволоконная оптика стали жизненно важными компонентами многих отраслей промышленности. Когда они объединяются, их потенциал стремительно растет.

Лазер, используемый в волоконно-оптических телекоммуникационных системах, это полупроводниковый лазер. В ходе многих исследований были накоплены новые знания о световых пучках, преобразования их энергии в другие виды энергии, получили мощное развитие такие научно-технические направления как квантовая электроника, волоконная

оптика, квантовая оптика, физика и техника лазерной плазмы, передача информации по лазерному лучу, лазерно-индуцированные термомеханические процессы, лазерная химия и многие другие. Были разработаны разнообразные источники световых пучков. Термин «фотоника» объединил все эти научно-технические направления.

SPEAKING AND DISCUSSION

Which laser technology is the most important?

33. Use the cards below to prepare to describe your technology. Present your ideas in mini groups. Decide in your group which technology out of these three is the most promising one. Why?

Student A's Card. Weather regulation

An international group of scientists have created a laser that can control lightning, changing its trajectory and attracting to the desired point.

To create a thunderstorm model, scientists used two flat parallel plates with an electric charge accumulated on them. When the charge reaches some value, a small lightning appears on the first plate and hits the section on the second. In the model, the researchers use laser-directed graphene particles. The laser beam heats the microparticles and creates a channel with a high permeability, through which an electric discharge begins to flow. During the experiment, physicists made the lightning move along a precise trajectory. According to experts, their discovery will help control the path of an electric discharge in air with great accuracy. Scientists believe that lightning control will be useful for weather control, in industry or medicine.

Student B's Card. In space

Scientists have created an experimental laser installation that will be able to build lasers to protect the Earth from asteroids in the future. For pumping it uses the radiation of diode lasers, and in the discharge chamber, atoms of inert gases are used. They are transferred to an excited state in the plasma created by an electric discharge. Thus, a much more powerful and high-quality ray flux is formed. In the future on the basis of such lasers it will be possible to create global anti-asteroid protection systems as well as compact and powerful sources of coherent radiation for use in industry. In addition, the proposed combination of technologies makes it possible to create a compact laser capable of emitting continuous radiation with a power of up to several megawatts.

Student C's Card. In medicine

Laser-based instruments are widely used in medicine. They are used in the treatment of cancer, removal of tumors of the vocal cords, brain surgery, plastic surgery, gynecology and oncology. Laser therapy causes less bleeding and damage to healthy tissue than standard surgical instruments and reduces the risk of infection. Surgical removal of tissue with a laser is a physical process like industrial laser drilling. Carbon dioxide lasers operating at 10.6 micrometers can burn tissue because infrared rays are strongly absorbed by water, which makes up the bulk of living cells. The laser beam cauterizes (прижигает) cuts, stopping bleeding in blood-rich tissues such as the gums (десны). Likewise, a laser with a wavelength of about one micrometer (neodymium YAG laser) can penetrate the eye, welding detached retina back into place, or cutting the inner membranes, which often become cloudy after cataract surgery. Less intense laser pulses can destroy abnormal blood vessels that propagate through the retina in diabetic patients, delaying the blindness often associated

with the condition. Ophthalmologists surgically correct vision defects by removing tissue from the cornea by reshaping the transparent outer layer of the eye using intense ultraviolet pulses from excimer lasers.

GRAMMAR

PARTICIPLES

Lead-in

34. Read the sentences below, explain their meaning or translate them into Russian paying attention to the words in italics. In groups discuss the following questions.

What are the highlighted words called? How similar are they to verbs and adjectives? What forms do they have? How are they translated into Russian?

- The noise of the car *coming* from an open window was very annoying.
- The new materials *used* in computer manufacturing deliver enhanced performance.
- *Having completed* the mission, the astronauts returned to the Earth.

STUDY NOTE

Participles are words derived from verbs that can function as adjectives and adverbs or as part of verb phrases to create verb tenses.

The main types of Participles are the **Present** Participle (or Participle I) - *coming*, the **Perfect** Participle- *having completed*, and the **Past** Participle (Participle II) - *used*.

Participles may also be identified with a particular **Voice**: active or passive. In **Passive** Participle phrases the grammatical subject is the logical object.

Present Participle Passive: After being arrested, he was taken to the police station.
Perfect Participle Passive: Having been told the bad news, he could not believe it.

35. Look at more examples of Participles from reading and complete the table. Try to define the meaning and function of the Participles in these examples.

1. The word "laser" stands for "light amplification by *stimulated* emission of radiation".
2. The idea of using lasers as death rays *employed* by creators of such blockbusters as X-Men and Star Wars still remains science fiction.
3. *Having been demonstrated* by Theodore Maiman in 1960, the first ruby laser was considered the first successful light laser.
4. *Having introduced* the concept of *stimulated emission*, Einstein laid the foundation for the laser.
5. *Laser-sighting* devices are *fitted* to military and police rifles to help soldiers hit their targets.
6. *Being installed* at one end of the laser tube, a mirror keeps the photons bouncing back and forth inside the crystal.
7. The *escaping* photons form a very *concentrated* beam of powerful laser light.
8. Light from conventional sources, such as a light bulb or the sun, diverges, *spreading* in all directions.

	Active	***Passive***
Present Participle (V+ing)	*doing*	*being done*

Perfect Participle* (having+V3)	*having done*	*having been done*
Past Participle (V3)		*done*

* There is also Perfect Continuous Participle form: having +been+ doing which focuses on the duration of the action as compared to Perfect Participle.

36. Compare the following pairs of phrases with Participle I and Participle II. Translate them into Russian.

1. developing industry - developed industry
2. changing distances – changed distances
3. a controlling device – controlled device
4. an increasing speed – an increased speed
5. a transmitting signal – a transmitted signal
6. a reducing noise – reduced noise
7. a moving object – a moved object
8. heating parts – heated parts

STUDY NOTE

Present and Past Participles can both be used as adjectives. The Present Participle describes what someone or something is (What kind?). The Past Participle describes how somebody feels. (How do you feel?)

a boring lesson makes you feel bored; but*: I was bored in the Maths lesson.*
I almost fell asleep.
Have you seen that film? It is absolutely terrifying. but: *He never flies, he is terrified of flying.*

37. Choose the correct form.

1. A: Have you read that new book yet? B: Only some of it. It's very…
a. bored b. boring
2. A: Did you enjoy your holiday? B: Oh, yes. It was very…
a. relaxed b. relaxing.
3. A: I'm going to a lecture tonight. Do you want to come? B: No, thanks. I'm not … in the subject.
a. interested b. interesting
4. A: Did you hurt yourself when you fell? B: No, but it was very …
a. embarrassed b. embarrassing
5. A: Was mother upset when you broke her vase? B: Not really, but she was very….
a. annoyed b. annoying
6. A: How do you feel today? B: I still feel very ….
a. tired b. tiring
7. A: You look ill. What's the matter? B: I've had a very … day.
a. tired b. tiring
8. Sit down - I've got some very … news for you.
a. excited b. exciting

9. He's got a very … habit of always interrupting people.
a. annoyed b. annoying
10. I'm very … by your behaviour.
a. disappointed b. disappointing

STUDY NOTE

The **Perfect Participle** (active and passive) is used to emphasise that one action happened before another. Perfect Participles are often used as part of Participle Constructions or Clauses (Participles combined with other words) that are equivalent to adverbial clauses within complex sentences.

Having won the match, they were happy. (After they had won the match, they were happy.)

38. Fill in the Perfect Participle, Active or Passive, of the verbs in brackets. Explain the meaning of Perfect Participle phrases or translate the sentences into Russian.

1. (Work) all day, I was feeling very tired in the evening. 2. (Live) in an English-speaking country for a few years, she spoke English like a native speaker. 3. (Rescue), an injured pilot was taken to hospital. 4. (Write) the test, the students handed in their papers. 5. (Sign) by the boss, the documents were sent to the customers. 6. (Interrupt) a few times, he was rather annoyed. 7. (Stop) the car, the police officer wanted to see the documents. 8. (Arrive) at the station, we called a taxi. 9. (Check in) for the flight, they were prepared for the passport control. 10. (Buy) the car, he stopped using public transport.

39. Choose the correct form of the Participle. Translate the sentences into Russian.

1. They were trying to fix a USB cable *having followed/following* the instructions from a YouTube video. 2. Serious faults *finding/found* in the project had to be corrected quickly. 3. The method *having been discussed/being discussed* by the engineers at the moment has numerous advantages. 4. *Having/having had* no job and no money, he couldn't pay the rent. 5. *Having applied/applied* a new technique, scientists increased the accuracy of the results. 6. People should be careful, while c*rossing/crossed* the street. 7. *Locking/having locked* the door, he left the house. 8. *Utilising/utilised* the principle of feedback, robots can change their operation in response to a changing environment. 9. *Completing/having completed* her work, she went home. 10. *Being/having been* an expert in the field of computers, he had no problem finding a well-paid job.

PARTICIPLE CONSTRUCTIONS

Lead-in

40. Look at the sentences below paying attention to the phrases in italics, which are the examples of Participle Constructions. Translate the sentences into Russian.

1. An international group of scientists have created a laser that can control *lightning changing its trajectory and pulling it to a given place.*
2. *Having been created in practice,* tactical-level combat laser systems are an example of the implementation of projects to develop laser weapons.

3. *Being able to cause less damage and reducing the risk of infection*, laser-based instruments are widely used in medicine.
4. *Flashing on and off*, the tube "pumps" energy into the ruby crystal.
5. *Representing* an amazing and powerful light source, lasers have found lots of useful applications.
6. In 1954, Russian physicists Nikolay Basov and Alexander Prokhorov *working on* the quantum oscillator created the first microwave generator.
7. *Having* all sorts of useful applications in different fields from communications to medicine, lasers are a good example of science fiction becoming a science fact.
8. Archaeologists uncovered a new vast network of cities and roads in the thick jungles around the ancient Cambodian temple complex of Angkor Wat *implementing* an aerial survey *using* Lidar.

STUDY NOTE
Participles are often used as part of **Participle Constructions or Clauses** (Participles combined with other words). Participle Constructions enable us to present information in a more economical way compared to complex sentences.

A humanoid drawn by Leonardo da Vinci is among the first verifiable automation. = A humanoid which was drawn by Leonardo da Vinci …
Being fitted with vision equipment, robots are able to 'see'. = As they are fitted with vision equipment…

Participle Constructions / Clauses act as *adjectives or adverbs* within sentences and usually are reduced adverbial or relative clauses. They describe something or someone or give information about condition, result, reason, time etc.

I met him while living in Moscow. (=adverbial clause - while I was living)
Who is that man sitting next to the rector? (=relative clause: man who is sitting)

Note that a passive form can also be used in Participle Clauses as an alternative to a since-clause: **having been + Past Participle**:
Having been unemployed for over two years, I found it difficult to find a job.
(=As I had been unemployed…)

41. Rewrite the following sentences with Participle Constructions according to the examples given below and identify the meaning of Participle Constructions.

Example: Used sparingly, fossil fuels will not run out in the next 50 years. = If we use fossil fuels sparingly, they will not run out in the next 50 years. (condition)
Having taken the wrong train, I found myself in Pskov, not Novgorod. = Because I had taken the wrong train, I found myself in Pskov, not Novgorod. (reason)

1. Walking in the woods, I suddenly realised that I had lost my way. 2. Having spent a lot of time doing my homework, I went to bed very late last night. 3. Given proper care, your car will operate smoothly for years. 4. Working in a bank, he was familiar with the best ways to invest money. 5. My sister is the one talking to the professor. 6. Having collected the data, he began analysing the results. 7. Having arrived at the site, the scientists discovered many fragments of the meteorite. 8.

Being one of the most beautiful Russian monuments, St Basil's Basilica is a World Heritage site. 9. Trying to sell more goods for cash, the company is losing money. 10. Karel Capek described a mechanical device that looked like a human but lacking human sensibility could perform only automatic, mechanical operations**.**

42. Use a Participle Construction to add the information in italics to the main sentence.

Example: Sam left school early *because he felt sick.* → ***Feeling sick,*** Sam left school early. *They spent all the money.* So they couldn't afford to buy a car. → **Having spent** all the money, they couldn't afford buying a car.

1. As she felt tired, Anna went to bed early. _____, Anna went to bed early.
2. After the boss had explained the problem, he told the employee to deal with it. _____, the boss told the employee to deal with it. *3. While he was drinking his coffee,* he was thinking about the problem. _____, he was thinking about the problem. *4. If it is looked after carefully,* the plant can live through the winter. _____ , the plant can live through the winter. *5. We filled up the car* and continued our journey. _____, we continued our journey. 6. *As the manager was impressed by my work,* he extended my contract. _____ , the manager extended my contract. 7. *They have written two tests today* and they are too tired to do the third one. _____, they are too tired to do the third one. 8. *He was driving home.* He had an accident. _____, he had an accident. 9. *He was trapped in a dilemma* and couldn't decide what to do. _____, he couldn't decide what to do. 10. *After I dropped him off at the station,* I drove straight to the supermarket. _____, I drove straight to the supermarket. 11. *The teacher was impressed by Mike's work,* so she gave him the highest mark. _____, the teacher gave him the highest mark. 12. *As he had been to England before,* he knew where to find a good hotel. _____, he knew where to find a good hotel.

STUDY NOTE

Negative Participle Constructions are also possible, in which case **'not'** normally comes **before** the Participle:

Not having seen the film, I could not take part in its discussion.

43. Combine the following sentences into one using a negative Participle Construction.

Example: I didn't want to hurt his feelings. I didn't ask any questions. → Not wanting to hurt his feelings, I didn't ask any questions.

1. As they haven't received all the applications yet, they are not ready to hire anyone. 2. I didn't want to lose my passport. I gave it to my father. 3. I didn't know how to reply. I didn't say a word. 4. He didn't see the accident ahead of him. He didn't stop his car. 5. They haven't followed the instructions. They have a problem with the cleaning robot. 6. They haven't found any flaws in the project. They can start it as soon as possible. 7. I had no phone. I couldn't call you. 8. He didn't notice a fuel warning light. He didn't fill up his car in time. 9. The method wasn't tested. It was not adopted. 10. He hadn't prepared for the exam. He failed it.

44. Put the verbs in brackets into the correct Participle form. (Some examples can have more than one correct answer with a difference in meaning). Identify Participle Constructions and explain their meaning.

1. (Give) a lecture, the professor was not using any notes. 2. The problems (discuss) at the conference are very important. 3. The shop (build) next to our university will open soon. 4. (Have) a car, she finds it easy to get around. 5. (Answer) the questions, he gave a lot of examples. 6. (Finish) his research, he was ready to write a report. 7. The equipment (install) by the company is of the highest standard. 8. (Turn) left or right, indicate it by using a turn signal. 9. (Reach) its maximum intensity, the volcano began to calm down. 10. (Say) good bye, he left the office. 11. (Read) by millions of readers, this book has rightfully become a bestseller.

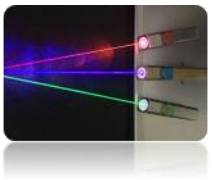
INDEPENDENT FURTHER STUDY

45. Match the sentences with the terms, related to technology. Match the pictures with the sentences.

1. 

2. 

3. 

4. 

5. 6. 7.

a) Laser Pointers; b) DVD and CD Players; c) Laser Light Shows and Holography; d) Surgery; e) Fiber Optical Communication; f) Barcode Scanner; g) Laser Cutting Machines

1) James Bond has demonstrated laser cutting in 1964 in Ian Flemings "Goldfinger".

2) These scanners use a laser beam that is scanned back and forth so rapidly that it appears as a line to the human eye.

3) These simple, pocket-sized lasers are used to highlight important areas during presentations.

4) The laser acts as a precise disc-reading mechanism.

5) The first use of a laser in medicine occurred in the early 1960s, when physicians used a laser on a human for the first time by destroying a retinal eye tumor with a ruby laser.

6) Both lasers and fiber optics have independently become vital components of many industries.

7) Laser shows produce visual displays by using beam effects; either by switching a stationary beam on and off or by creating dynamic beam effects.

STUDY NOTE

Participle Constructions (clauses) can be used after various **conjunctions** such as: when, while, if, though, etc. Note the following examples:

I hurt my arm while playing tennis.
*Remember to take all your belongings with you **when** leaving the train.*

46. Read and translate the sentences paying attention to the Participle Clauses.

1. **When completed** in 2010, the Burj Khalifa became the tallest tower in the world and one of the top attractions in Dubai. 2. **Though being** a school teacher of mathematics, Tsiolkovsky developed space travel principles that remain in use today. 3. **If compared** to today's TV pictures, the first black-and-white images had rather poor quality. 4. **While teaching** at school for the deaf, Bell became interested in sound and its transmission. 5. **Though discovered**, Newton's mistake had no influence on his theory. 6. **While conducting** experiments with communication devices and speech systems, Bell invented the telephone. 7. **If cooled** below zero degrees Celsius, water freezes. 8. **While working** on the quantum oscillator, Nikolay Basov and Alexander Prokhorov created the first microwave generator, which was the laser's predecessor.

47. Rewrite the following sentences with Participle Constructions adding an appropriate conjunction.

Example: Preparing for the presentation, I studied lots of materials**.** → While preparing for the presentation, I studied lots of materials**.**
1. Being one of the key issues today, information protection is the centre of attention for today's computer engineers. 2. Analysing the information on what is currently being tested, we can imagine what new robots will be like. 3. Being designed by researchers at the Stanford Research Institute in the late 1960s, an experimental model became one of the first real robots. 4. Having been added to vehicles, airbags saved numerous lives. 5. Being known to people from science fiction, robots didn't materialise until the invention of the computer in the 1940s. 6. Having used a television camera as a visual sensor, the engineers constructed a robot capable of arranging blocks into stacks. 7. Equipped with microprocessors, computerised robots can handle the data being fed to them by various sensors. 8. Being fitted with new safety features, robotic vehicles will be much safer than before. 9. Being one of the main sources of pollution, petrol cars are still widely used today. 10. Increasing the commercial use of robots, we continue to expand their applications.

STUDY NOTE

Participle Constructions can sometimes have **their own subjects** which are normally placed before the Participle. Participle constructions with subjects, which are also called the **Nominative Absolute Participle Constructions**, are equivalent to relative and/or adverbial subordinate clauses within complex sentences but are more formal.

The house sold at last, we were able to start planning to move out. (=When the house was sold, we were able to start planning to move out)

The chairman having finished, everyone began discussing what he had said. (=After the chairman finished, everyone began discussing what he had said.)

48. Explain the meaning or translate the sentences with Participle Constructions.

1. Gases are light substances, the lightest of them being hydrogen. 2. Electrons moving through a wire, electrical energy is generated. 3. Many Russian scientists worked in the field of electricity, Lodygin being one of the most prominent. 4. Numerous experiments having been carried out at the space station Mir, it became possible to construct the ISS. 5. With image sensors interpreting signs, lights and lane markings, a driverless car will be able to follow the traffic rules. 6. The question being very difficult, nobody could answer it. 7. The distance having been measured, computer adjusts the car's speed. 8. AI systems and machines having been developed, a few million jobs have consequently been lost by humans. 9. Fifty-six new underground stations having been opened, the public transport system has become more comfortable. 10. The word 'electronics' is derived from the word 'electron', the electron being a negatively charged subatomic particle.

49. Listen to two Grammar mini lessons on Participles and Participle Clauses and answer the following questions.

https://www.youtube.com/watch?v=H8E5EF0IEN0&t=1s
https://www.youtube.com/watch?v=RuTSOQ9kIdY

1. What are Participle clauses?
2. What do Participle clauses usually explain?
3. What do we mean by that Participle clauses often have implied subjects?
4. How can we make a Participle clause negative?
5. What is the difference between Present and Perfect Participle clauses?

50. Listen again and fill in the missing Participles. Explain their meaning. Then think of similar sentences about yourself with different types of Participle clauses.

1. _____, I relaxed completely
2. _____, she corrected it immediately.
3. _____, she phoned.
4. _____, she passed her driving test.
5. _____, they went home.
6. _____, I shave every day.
7. _____, I made a lot of mistakes.
8. _____coffee, I don't recommend it.

LEARNING SKILLS. CRITICAL THINKING

"I can guarantee the job I hire someone to do will change or may not exist in the future, so this is why adaptability and learning skills are more important than technical skills". – *Tony Wagner, education author.*

51. Try to define what we mean by a critical thinking approach to learning? Is it a useful skill to develop? Why?

STUDY NOTE

Critical thinking is fundamentally a process of questioning information and data. You may question the information you read in a textbook, or you may question what a politician, or a professor, or a classmate says. You can also question a commonly-held belief or a new idea. With critical thinking, anything and everything is subject to question and examination for the purpose of forming logical and rational viewpoints.

52. Decide which 5 skills below are the most important for developing critical thinking approach to learning. Explain why. Compare your list with other students' answers.

- Examining the information in detail from different perspectives
- Being flexible
- Checking closely whether the information is accurate
- Comparing the same issue from different points of view
- Being able to argue
- Distinguishing between facts and opinions
- Distancing yourself from the information given
- Accepting different points of view
- Being open-minded
- Being able to evaluate and form judgements
- Communicating and presenting your ideas logically
- Being inquisitive
- Having the desire to be well-informed/curious
- Being self-critical
- Being able to defend your opinion

53. Look at the list of tasks from this textbook. Which of them do you think are the examples of 'critical thinking' types of tasks?

1. Read and translate the text.
2. Answer the questions.
3. Compare and contrast two types of renewable energy.
4. Mark the following statements as true (T), false (F), or not given (NG).
5. Are there any arguments that the author doesn't present?
6. How does the author justify the argument?
7. Retell the text using the words below as your prompts.
8. Find the words using their definitions.
9. What do you think about the main message of the author?
10. Do you agree with the opinion of the author? Why? Why not?
11. Identify the highlighted tense forms and try to explain their meaning.
12. Put the words in the correct order to make sentences. Ask questions related to these sentences.
13. Did you like reading the article? Explain why.
14. Myth or Reality? Read some facts about electricity and decide whether they are true or false.

54. To find out more about critical thinking skills watch the video using the link below and answer the questions.

https://www.youtube.com/watch?v=6OLPL5p0fMg

1. Why is it important to develop learning skills (e.g. critical thinking skills) and how may they be useful for future life?

2. What different results might be achieved if we

a) memorise the solution to a problem

b) improve our critical thinking intellectual skills?

3. What does the skill of critical thinking refer to?

4. What principles should guide us to enhance critical thinking?

5. What do we mean by scepticism?

6. What should reasoning be based on?

7. What advantages are associated with adopting a critical thinking approach to learning?

8. What advantages might critical thinking approach to learning bring us?

Useful words*: self-reliance - уверенность в себе; comprehensive -всеобъемлющий, полный; flaws and biases - недостатки и предубеждения; intrinsic – присущий, внутренний; consciousness - осознание, понимание; dichtonomy – дихтомия: последовательное деление целого на две части или противопоставление двух объектов; ignorance - невежество, необразованность; intolerance - нетерпимость, непереносимость; ambiguity - неопределенность, неясность.*

More listening on the topic:

https://www.youtube.com/watch?v=m_8y1zWCUK0&t=1s

https://www.youtube.com/watch?v=dItUGF8GdTw

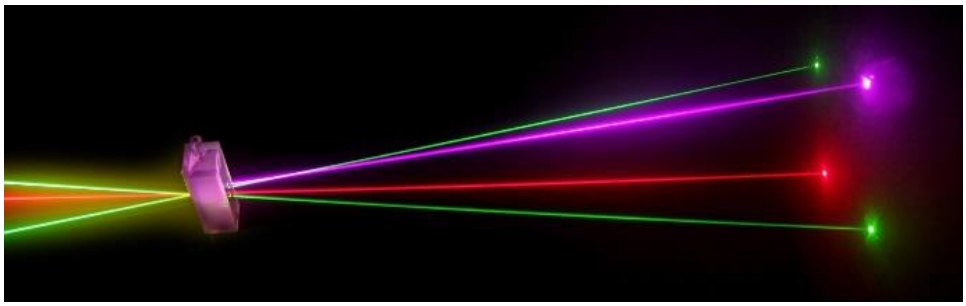
55. Read the tips on how to improve your critical thinking skills. Discuss them in groups. Have you already tried some of these techniques? When? Can you think of more tips to add to the list below? Share your ideas in class.

Here's how you can improve critical thinking skills:

1. Ask more questions, even basic ones;
2. Question your assumptions (=something that you accept as true without question or proof);
3. Develop your technical skills so that you can identify problems more easily;
4. Find ways to solve more problems;
5. Think for yourself and don't adopt other people's opinions without questioning them first;
6. Play games that require critical thinking skills;
7. Gather and assess relevant information and use abstract ideas to interpret it effectively;

8. Weigh the consequences of different actions before you act.

CHECK YOURSELF



1. Laser Quiz. Choose the right option.

1. Laser is a device for producing …
   a. spontaneous radiation
   b. scattered radiation
   c. stimulated radiation
2. Laser light is intense because …
   a. It has a few photons that are not in phase
   b. It has a very large number of photons that are in phase
   c. It has a very large number of photons that are not in phase
3. Commonly used Laser in MB-Computer printers is …
   a. He-Ne Gas
   b. ruby
   c. semiconductor
4. Laser light is different from others because …
   a. it is coherent
   b. it is intensive
   c. it is fast
5. The strength of early lasers was measured in … which was a measure of how many razor blades a laser beam could penetrate.
   a. amperes
   b. gillettes
   c. thermal units
6. Scientists are experimenting with huge lasers that are designed to reproduce conditions …
   a. at CERN's Large Hadron Collider.
   b. on the surface of the sun
   c. during the eruption of a volcano
7. Lasers are classified by … of the light pulses they use
   a. the amount of output power
   b. the power consumption
   c. by the brightness of their beams
8. Lasers have had military applications the most common of which is not …
   a. weapons that rely on laser-targeting
   b. defence systems

c. laser guns

9. Laser lights can't be seen in space because …
   a. the colours of the beams are not bright enough
   b. they are too far away
   c. they do not consist of any matter
10. What is used for bloodless surgery?
   a. anesthetic
   b. lasers
   c. fibre-optics

2. Five out of ten sentences below contain mistakes. Correct these mistakes.

1. Einstein proposed the theoretical possibility of the process that made lasers possible.
2. The key feature of a laser technology is that the amplification makes light that is very well defined, unlike ordinary light from such sources as the sun or a lamp.
3. Laser light consists of many wavelengths, with all the waves moving in one direction.
4. Light from conventional sources, such as a light bulb or the sun, diverges, spreading in all directions.
5. In 1964, Nicolay Basov and Alexander Prokhorov were awarded the Nobel Prize for their fundamental research in quantum electronics which led to the development of maser.
6. In 1954, the physicist from California, Theodore H. Maiman, created the first gas laser.
7. Today's laser and all of its applications are the result of an individual's efforts.
8. As it was suggested by science-fiction writers, the most useful application of lasers is a laser gun.
9. Due to their remarkable properties lasers turned out to have all sorts of useful applications in different fields.
10. Lasers can be classified into five types based on their application.

3. Repeat the words given in Vocabulary section. Guess the word using the definition and the first letter of the word. Think of your own sentences with these words.

1. To find the size, length or amount, using standard units (meters, inches etc.). **m**_____
2. A word made up from the first letters of the name of something. **a**_____
3. An increase in the effect or strength of something. **a**_____
4. A gas or other substance sent into the air. **e**_____
5. Put a substance through a special process in order to change its condition, *e.g.* liquid into gas. **v**_____
6. To represent a quality or an idea. **e**_____
7. To make someone remember something. **r**_____
8. To make stronger. **s**_____
9. The point from which something begins. **s**_____
10. As compared with other things the synonym of *fairly*. **r**_____
11. The amount of something (energy, work, information) produced by a machine. **o**_____
12. A prepositional phrase meaning because of or thanks to. **d**_____ __
13. Worthy of being noticed especially as being uncommon or extraordinary. **r**_____
14. To write something (*e.g.* information) down. **r**_____
15. A phrase used when you are comparing objects or situations and saying that they are completely different. **i**__ **c**_____

16. The quality of being correct and true. **a**_____
17. To turn out to be of primary importance. **p**_____ **c**_____

18. To use a particular idea or method. **e**_____
19. To continue to be. **r**_____
20. To fulfill or put into effect, carry out. **i**_____

4. Fill in the gaps using the words in italics. Retell these mini- texts using the words as prompts.

emission, vaporise, fields, treat, accuracy, amplification, beams, measure, engineering, sighting

The word "laser" stands for light 1_____ of stimulated 2_____ of radiation. Laser 3_____ can heat, melt or 4_____ materials and also to 5_____ and align structures. Lasers are used in different 6_____: medicine, military, 7_____ and arts. For example, in medicine they are used to 8_____ damaged tissue or in eye operations where high 9_____ is essential. In the military field they are used as 10_____ devices to identify targets.

amplify, directional, semiconductor, defence, frequency, devices, beams, solid, missiles, recording

Lasers are 11_____ which 12_____ light and produce 13_____ of light.
Light produced by lasers is very intense and 14_____ and pure in colour.
There are different types of lasers: 15_____ state lasers, gas, liquid and 16_____. Once it was believed that they could be used as death rays, but they are actually used as 17_____against nuclear 18_____ . Laser light can carry many information channels because of its high 19_____ . Lasers can also be used for information 20_____ and reading.

5. Choose the correct option.

1. I think I know the actor *played/playing* the main role in this new TV series. 2.The committee believe the answer *given/giving* by the politician wasn`t the whole truth. 3. All the games *played/playing* on the second day of the competition ended in a draw. That had never happened before. 4. *Checked in/having checked in,* we unpacked and went to get something to eat. 5. *Having watched/ after watched* his son win the competition, he was filled with pride. 6. She suddenly realised that the person *spoken/speaking* on the phone wasn`t her husband but a complete stranger. 7. He was sitting on the sofa *doing/having done* a crossword. 8. *Having paid/paid* for the meal, we left the restaurant. 9. *Being/been* exhausted, he fell asleep on the bus. 10. While *watching/being watched* a play, he fell asleep.

6. Combine the sentences into one using Participle Clauses of different types.

Example: I heard his name. It was mentioned several times. → I heard his name mentioned several times.

1. They called a doctor. The doctor lived nearby. 2. I broke the computer. The computer belongs to my sister. 3. The man is my teacher. The man is talking to the director. 4. We found a researcher. The researcher is working on the same problem. 5. Students will not be allowed to enter. Students have arrived late. 6. Don't shout at the children. The children are playing in the garden. 7. Who is

the man? The man is giving a lecture. 8. The client is over there. The client is waiting for you. 9. They are on the plane. The plane is flying to Turkey. 10. The car is mine. The car is parked in front of the office. 11. I left early. I felt sick. 12. My sister heard bad news. She wanted to cry. 13. I had worked hard all week. I was quite happy not to do anything at the weekend. 14. Before I make a decision, I need to discuss it with my family. 15. She had failed one of the exams. She wasn't able to get into university.

7. Choose the right option. Translate the sentences into Russian.

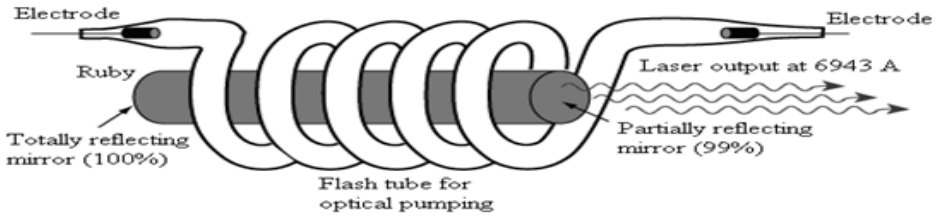
1. …. in 1889, the Eiffel Tower is now the symbol of Paris.
   a. building b. built c. having built
2. …. to Ekaterinburg, Mike started working as a journalist.
   a. being moved b. having moved c. moved
3. …. in the sun, your book will get yellow.
   a. having been left b. leaving c. left
4 ….. able to swim, I didn't drown.
   a. had been b. been c. being
5. …. to students, I realised I had a sore throat.
   a. talked b. being talked c. talking
6. …. in 1997 and … on a true story, "Titanic" was a huge success.
   a. having released/basing b. releasing/having based c. released/ based
7. An old lady ….. her dogs for a walk has asked me if I wanted to have a puppy.
   a. taken b. taking c. having taken
8. The book ….. to me on my last birthday turned out to be the best I've ever read.
   a. giving b. given c. was given
9. Anna moved to another city …… her old life behind.
   a. left b. has left c. having left
10. …… from university last year, I travelled around the world.
   a. having graduated b. I graduated c. graduating

8. Answer the following questions. Use the information in Module 10 texts.

1. Why do we say that lasers had been predicted before they were invented? 2. Why is laser light so powerful? 3. Do you agree that lasers were not created by a single person? Why? 4. Why do we claim to be in a period marked by the rapid evolution of lasers? 5. What is the most 'useful' application of laser technology in your opinion? 6. What is a ruby laser? 7. What other types of lasers are there? 8.What is a partial mirror used for in a laser machine? 9. What is photonics? 10. Why can we say that photonics is everywhere?

MODULE 10 PROGRESS TEST

Vocabulary. ***Decide which answer a, b or c best fits into each gap.***



Lasers are devices which make large groups of *1*_____ focus into a beam, but getting from a randomly moving photon generated from an electron to a nice *2*_____ is no easy task. But wait, how do we get atoms *3*_____ in the first place? The answer is flash tubes. These tubes act as a "pump" to start driving the atoms in our lasing medium. They *4*_____ extremely intense bursts of light in very short amounts of time, and this full spectrum light energizes the laser medium. As stated before, now that we have energized electrons, we can get photons! Once the laser medium begins emitting photons, they need to be *5*_____ and lined up in order to establish our beam. Most simple lasers have the same basic structure; the inside of a laser consists of a cylinder of some medium that can be *6*_____ (such as a gas like helium or neon in a gas laser, or a crystal like ruby). This cylinder is surrounded by a 7_____ , and has a 100% reflectivity mirror at one end to keep the photons *8*_____ the tube. The other end of the tube, the end that is actually emitting our beam, is capped with a *9*_____ mirror. This mirror allows photons to travel through it if they are moving in the right direction, but *10*_____ the photons if they aren't. In some cases, a photon may travel back and forth billions of times before it leaves the medium.

1. a. atoms	b. molecules	c. photons
2. a. signal	b. fla	c. beam
3. a. excited	b. nervous	c. stressed
4. a. excite	b. inject	c. emit
5. a. concentrated	b. collected	c. coordinated
6. a. motivated	b. electrified	c. energised
7. a. coils	b. flash tube	c. wire
8. a. back and forth	b. outside	c. inside
9. a. particular	b. partial	c. reflecting
10. a. reflects	b. absorbs	c. emits

Grammar. ***Decide which answer a, b or c best fits into each gap.***

1. _____ on the problem of combining laser and thermonuclear reaction,
scientists hope to produce a limitless source of energy.
a. Worked b. Working c. Having worked
2. _____ to project more energy at a single wavelength within a narrow beam than conventional light sources, lasers are widely used in industry and science.
a. Be able b. Being able c. Having been able
3. _____ an aerial survey using Lidar, archaeologists uncovered a new vast network of cities and roads in the thick jungles around the ancient Cambodian temple complex of Angkor Wat.
a. Implemented b. Being implemented c. Having implemented
4. _____ relatively low wattage power to a very high intensity, lasers are used to cut, burn or vaporise materials.

a. Focusing b. Focused c. Having been focused
5. _____ the distance between the Earth and the Moon using laser beams, scientists achieved much greater accuracy than ever before.
a. Measured b. Being measured c. Having measured
6. Operations _____ with the use of lasers are usually shorter and less painful than traditional surgeries.
a. performing b. performed c. having performed
7. _____ the distance by the time required to cover it, we obtained the average speed.
a. Divided b. Having divided c. Being divided
8. The weather _____ stormy, the flight had to be delayed.
a. been b. be c. being
9. A new technique _____ , the efficiency rose.
a. working out b. having worked out c. having been worked out
10. With alternative fuel vehicle _____, we`ll stop being dependent on conventional oil energy.
a. be produced b. being produced c. producing

MODULE 11

MATERIALS TECHNOLOGY. SUPERCONDUCTIVITY

"In the material sciences there are and have been,
and are most likely to continue to be heroic days."
J. Robert Oppenheimer, professor of physics.

Learning points for Module 11:

Reading:

Text 11A. Materials and Materials Science
Text 11B. New Materials That Could Change Our Lives
Text 11C. Superconductivity: Questions and Answers

Vocabulary in context: Word definitions. Collocations. Word quiz
Grammar: Conditional Sentences
Listening: Superconductors: Powering our Future?
Speaking and discussion: New Materials. Round table discussion "Superconductivity. Why is it Important?"
Learning Skill: Reflection and Self-Evaluation

Learning aims:

- to practise reading and speaking about materials and their properties
- to learn and practise the words related to the topic of the Module
- to learn and practise Conditional sentences
- to learn and practise the skill of reflection and self-evaluation

READING

Part 1

Lead in.

1. In groups brainstorm some ideas to answer the questions.

Products are things that people make or use, such as your textbook, your clothes, and your smartphone. People make products from different *materials*, like wood, metal, and plastic.

1.What products can you see around you?
2.What materials are they made of?
3. What other materials do you know?

2. Match the materials (1-7) to the descriptions (a-g).

1. compounds	a. materials that are not metal
2. exotic	b. iron and steel
3. ferrous	c. combinations of materials
4. ceramics	d. mixture of metals
5. alloy	e. plastic materials
6. non-metallic	f. minerals transformed by heat
7. polymers	g. rare or complex

3. Find the right answers in column B to finish the sentences in column A. Use a dictionary if necessary.

A	**B**
1. The first materials people used were 2. In the past the bricks were made of 3. The first metals people got were 4. The materials people learned to produce were 5. The materials that we grow 6. The materials that we mine are 7. The materials made from chemicals that come from oil are 8. Some new materials are	a. coal, oil, and minerals b. gold, bronze, iron c. stones, wood, plants d. sand, hay, clay e. plastics, nylon, acrylic f. silicon, fibreglass, liquid crystals g. glass, metals and concrete h. cotton, wool, paper

4. In pairs / groups, discuss these words from the article. Try to explain their meaning or translate them into Russian. Use a dictionary if necessary.

Substances, liquid, solid, properties, composites, gemstones, disease, to diagnose, to define, ceramics, to derive from, to acquire, to split into, to contribute to, generality, to comprise, alloy, silica and carbon materials, acceleration, to power.

5. Choose the best option. Read the text and check your answers.

1.What are materials?
   a. useful substances
   b. natural resources
   c. liquids and solids

2. Choose what materials science doesn't deal with.
   a. using biological systems and living organisms to create different products
   b. discovering and designing new materials
   c. the properties and characteristics of all materials

3. How does materials science relate to technology?
   a. All materials are a form of technology.
   b. It has no relationship with technology.
   c. It helps to develop technology by choosing the right material for the job. And man-made materials are a form of technology themselves.

4. Which of the following is not a classification of materials commonly used in materials science?
   a. ceramics
   b. polymers
   c. gemstones

5. In what way will the breakthroughs in materials science affect the future of technology?
   a. Materials science won't play an important role in the future.
   b. They are likely to affect the future of technology significantly.
   c. They will revolutionise the diagnosis of diseases caused by genetic factors.

Text 11 A
Materials and Materials Science

(1) We define materials as substances having properties which make them useful in machines, structures, devices, and other products. It would be no exaggeration to say that human civilization has been shaped by breakthroughs in materials science. In ancient times the choice of material gave the name to the era, for example, the Stone Age, the Bronze Age, the Iron Age, etc. So, materials science is one of the oldest forms of technology and applied science, deriving from manufacture of ceramics. It is concerned with a wide range of substances, from relatively easily acquired wood or stone, to modern man made materials such as plastics and glass, or even more advanced smart materials involving nano- and biotechnology in their manufacture. Part of materials science deals with classifying materials, which are generally split into four main groups: metals, polymers, ceramics, and composites.

(2) In the modern world materials are ubiquitous, and so pervasive[1] that we often take them for granted[2]. Virtually every segment of our daily life is influenced by materials. They have contributed to the advancement of a number of technologies, including medicine and health, information and

communication, national security and space, transportation, textiles, personal hygiene, agriculture, food science and the environmental protection. Materials have a generality comparable[3] to that of energy and information, and the three together comprise nearly all technology.

(3) Materials science also covers discovering and designing new materials and analysing their properties and structure. At present, it is a key discipline in the competitive global economy, a dynamic and exciting field with many remarkable new materials and discoveries. The power of materials advances can be illustrated by the following example: to build today's smartphone in the 1980s would have cost about $110 million, required nearly 200 kilowatts of energy (compared to 2kW per year today), and the device would have been 14 meters tall. So, materials science has virtually brought smartphones to the pockets of over 3.5 billion people. Important elements of modern materials science are products of the space race: the understanding and engineering of metallic alloys, silica and carbon materials, used in the construction of space vehicles.

(4) Today we are in the midst[4] of a materials revolution. Materials are evolving faster today than at any time in history enabling engineers to improve the performance of existing products and to develop innovative technologies that will enhance every aspect of our lives. Scientists are using powerful simulation techniques, as well as sophisticated machine learning algorithms, to propel[5] innovations forward at a blazing[6] speed and point them toward possibilities they had never considered. These tools have helped create the metamaterials* used in carbon fiber composites for lighter-weight vehicles, advanced alloys for more durable[7] jet engines, and biomaterials to replace human joints[8]. We also see breakthroughs in energy storage and quantum computing. In robotics, new materials are helping us create the artificial muscles[9] needed for humanoid, soft robots. Advances are currently happening at the macroscale down to microscale[10] for metamaterials, and at the nanoscale with graphene[11], carbon nanotubes[12], composites, thin metallic- and semiconductor-based films[13].

(5) To sum it up, we need to discover and develop new kinds of materials with the desired properties and at the relevant cost[14] to meet the challenges of the current world. Materials science may be the most important technology of the next decade. Breakthroughs in materials science are likely to affect the future of technology significantly. A vast acceleration in our ability to create new, advanced materials will power industries from energy to manufacturing. Thus, the future is bright for materials science and engineering.

* *metamaterial - an artificially structured material that exhibits extraordinary electromagnetic properties not available or not easily obtainable in nature.*

Vocabulary notes for text 11 A

[1]pervasive	широко распространенный
[2]take them for granted	считать само собой разумеющимся
[3]comparable	сопоставимый, соизмеримый
[4]midst	середина
[5]to propel	двигать, стимулировать, ускорять
[6]blazing	видимый, очевидный
[7]durable	надежный, прочный, крепкий
[8]joints	суставы

[9]muscles	мышцы
[10]microscale	на микроскопическом уровне
[11]graphene	графен
[12]nanotubes	нанотрубки
[13]films	пленки
[14]relevant cost	соответствующие затраты

6. Find the words and phrases in the text which have the following meanings.

§ 1

1. *a verb*: a physical material from which something is made**,** matter
2. *a noun*: a special quality or characteristic of something
3. *a noun*: an overstatement of the truth
4. *a passive verb*: to be formed or created
5. *a verb*: to have something as a source, to come from something
6. *a noun*: inorganic and nonmetallic materials that are essential to our daily lives
7. *a noun*: materials made up of two or more components

§ 2

8. *an adverb:* almost entirely, nearly
9. *a passive verb:* to be under the effect of something
10. *a verb:* to help something to happen or develop
11. *a noun:* the quality or state of being general
12. *a verb:* to be made up of something

§ 3

13. *a verb*: to include or deal with
14. *an adjective*: related to or based on competition
15. *a noun*: an ability to act or produce an effect
16. *a noun*: a substance composed of two or more metals or of a metal and a nonmetal
17. *a noun*: the dioxide of silicon SiO_2
18. *a noun*: a nonmetallic chemical element with atomic number 6 that readily forms compounds with many other elements

§ 4, 5

19. *a verb*: to develop by a process of evolution
20. *a noun*: the act of doing a job, an activity, etc.
21. *a noun phrase*: the imitative representation of the functioning of a system or a process
22. *a noun*: something (such as an instrument or apparatus) used in performing an operation
23. *a verb*: to put something new in the place of something else
24. *a verb phrase*: to perform so as to succeed
25. *an adjective*: happening or existing now
26. *a verb*: to act on and cause a change in (someone or something)
27. *a noun*: the act or process of moving faster or happening more quickly

7. Answer the following questions using the information from text 11A.

1. What are materials?
2. How important were materials in the past?
3. How old is materials science?

4. What does materials science primarily deal with?
5. What are the main groups of materials?
6. How do materials affect our daily life?
7. What can the role of materials in our life be compared with?
8. What examples of advanced materials does the author give and where are they used?
9. What tools are modern scientists using to create advanced materials?
10. In what fields do we see breakthroughs which are achieved due to the development of new materials?
11. How will materials help us meet the challenges of the current world?
12. Why can we say that the future is bright for materials science? Do you agree?

8. Work in groups. Prepare to give the definitions of some terms choosing from the list below. Then let your group guess the terms by their definitions.

Example: What do we call a matter from which a thing is or can be made? – material

Materials science, composites, alloys, polymers, ceramics, compounds, smart materials, nanotechnology, biotechnology, simulation techniques, machine learning algorithms, metamaterials, quantum computing.

9. Try to identify the main ideas of each paragraph using the following plan.

§ 1 introduces the topic of the text, gives the definition of materials and provides some background information about materials science and basic materials groups.
§ 2 gives more information about…
§ 3 expands on …
§ 4 is devoted to …
In § 5 the author points out…

10. Summarise text 11A adding some examples and other details to your summary from the previous exercise.

11. Work in pairs. Comment the points from text 11A and say whether you agree or disagree with these points. Explain your opinion.

Student A: Materials have a generality comparable to that of energy and information, and the three together comprise nearly all technology.
Student B: Materials science may be the most important technology of the next decade.

READING

PART 2

12. Find the right definition in column A for the words in column B. Use a dictionary if necessary. Then practise giving the definitions.

1

A.	B.

1. thick	a. different from
2. expensive	b. make or become less hot / colder
3. super-thin	c. the opposite of thin
4. keep something (cool)	d. costing a lot of money
5. unlike	e. extremely thin
6. cool down	f. cause to continue in a specific condition



2

A.	B.
1. cotton, linen and wool	a. a substance that covers a surface
2. similar	b. able to stretch and return to its original shape
3. a coating	c. natural fabric(s)
4. to save (e.g. money)	d. to continue to exist
5. to repair	e. to keep for use in the future
6. elastic	f. being almost the same
7. to join	g. to put something damaged back into good condition
8. to last	h. to connect things together

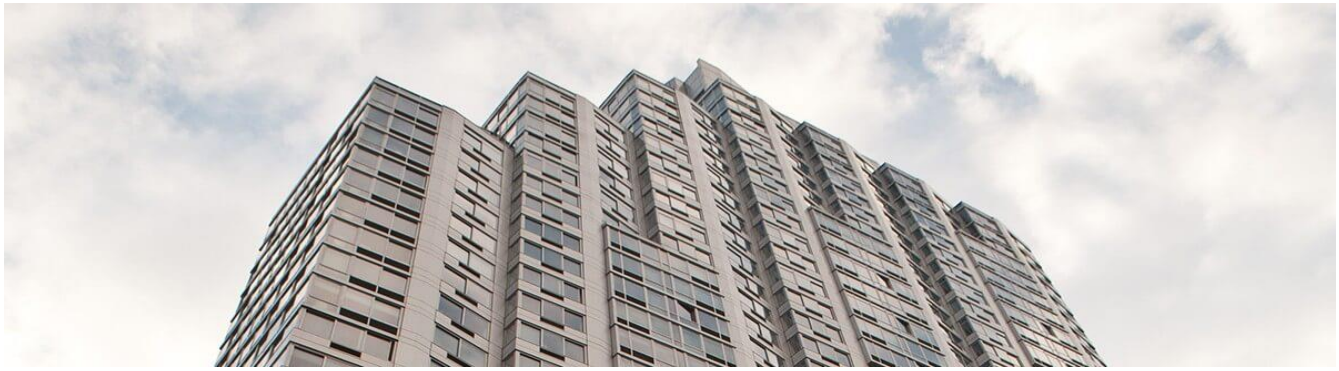
3

A.	B.
1. to cause	a. to make the events less frequent
2. wrap	b. to do something again in exactly the same way
3. resistance	c. material that is used to cover or protect objects
4. to attract	d. a force that stops the progress of something
5. to prevent	e. to make something happen
6. to cut incidences	f. allowing light through so that objects can be seen through it (*e.g. glass*)
7. to replicate	g. to keep from happening or existing
8. transparent	h. to pull or draw something towards them

13. Now read text 11 B and fill in the gaps with the words from the previous exercise in the right form.

Text 11 B

New Materials That Could Change Our Lives



(1) New, super-thin material cools buildings. A team of engineers has created a 1_____ material that could help 2_____ buildings cool even under direct sunlight. The engineers say the new material could provide an answer to air conditioners, which are 3_____ to run and need a lot of water. The material is 4_____ anything found in nature. It is a glass-polymer[1] hybrid that is just fifty micrometers 5_____. That's slightly thicker than the aluminium foil[2] we use for cooking. The key advantage of this technology is that it works 24/7 with no electricity or water usage and can cool objects even under direct sunlight. Just ten to twenty square metres of this material on the rooftop[3] could nicely 6_____ a house in summer.

(2) Scientists make self-repairing clothes. Humans have learnt many things from nature. These things have helped us in our daily life. The latest thing is self-repairing clothing. Scientists have developed a special way for clothing 7_____ rips and tears[4] by itself, without the need for sewing[5]. It works with materials such as cotton, 8_____ . Scientists looked at how squid[6] can cling on to things so well. The research team found a protein in the rings of teeth that cover the suckers[7] on a squid. The protein is 9_____ to the one found in the silk that spiders[8] use to make spider webs. It is very strong and 10_____ (stretchy). The new protein has been developed as part of a 11_____ , which is put on clothes. When the coating is dipped[9] in water, the area around the rip or tear 12_____ together in less than a minute. This could help clothes 13_____ longer and 14_____ us money. It could also be useful for military and survival clothes.

(3) Self-Cleaning Plastic. A revolutionary new plastic could help 15_____ bacteria and superbugs 16_____ disease and illness. Scientists have developed a new kind of 17_____, plastic wonder-wrap. They say it will drastically 18_____ of microbe transfer in hospitals, restaurants, kitchens, bathrooms and other places where bugs lie in wait. The material is like a conventional transparent 19_____ used to cover food. It can be shrink-wrapped[10] to protect places that 20_____ bacteria, like worktops, door handles, taps, hospital equipment and food containers. The researchers said the inspiration for their new material came from the lotus plant. They attempted 21_____ the method in which the leaves of this plant repelled[11] water. As the world confronts the crisis of anti-microbial 22_____, new material will become an important part of the anti-bacterial toolbox.

Vocabulary notes for text 11B

[1]glass-polymer	стеклополимер
[2]aluminium foil	алюминиевая фольга
[3]rooftop	крыша

[4]rips and tears разрывы
[5]sewing шитьё
[6]squid кальмар
[7]suckers присоски
[8]spiders пауки
[9]dipped смоченный
[10]shrink-wrapped упакован в термоусадочный материал
[11]repell отталкивать

14. Read text 11 B again and answer the questions below choosing the best option according to the information given in the text. Compare your answers in pairs or groups.

1.

1. Who created the super-thin material?

a. computer scientists b. a team of engineers c. Microsoft

2. According to the text? what is not required for the cooling material to function?

a. sunlight b. human labour c. energy and water

3. What concerns could the new material provide a solution to?

a. the meaning of life b. air conditioners c. shortage of water

4. How thick is the new material?

a. 15 micrometres b. 50 millimetres c. 50 micrometres

5. What is the new material slightly thicker than?

a. aluminium foil b. cardboard c. a piece of paper

6. How often will this new material work?

a. five days a week b. during daylight hours c. twenty four hours, seven days a week

7. How much of the material could cool down a house in summer?

a. enough to cover a football field b. 10 to 20 square metres c. 24/7

2.

1. From what have humans gained a lot of knowledge?

a. books b. nature c. experiments

2. What is needed for the self-repairing clothes to fix themselves?

a. water b. sewing c. glue

3. According to the text, what natural material is commonly used for the clothes besides cotton and linen?

a. nylon b. viscose c. wool

4. From which sea creature did scientists take inspiration for the concept of self-repairing clothes?

a. whale b. squid c. jelly fish

5. What type of silk contains the protein similar to the one found in a squid?

a. spider web silk b. Japanese silk c. synthetic silk

6. How long does it take for a rip or tear to join together?

a. an hour or so b. a few minutes c. less than a minute

7. What potential benefits could the new invention offer us?

a. time b. money c. material

3.

1. What could the new plastic prevent?

a. pandemics b. illnesses c. bacteria

2. How much transparency does the revolutionary new plastic have?

a. completely non-transparent b. somewhat transparent c. fully transparent

3. By how much did the article say the plastic would cut microbe transfer?

a. drastically b. a little c. totally

4. What is done to the plastic before it is applied to surfaces?

a. it is sprayed with water b. it is shrunk c. it is folded

5. What types of equipment did the article mention that the plastic could be used to cover?

a. hospital equipment b. computer equipment c. sports equipment

6. What served as the inspiration for the development of this plastic?

a. the water lily b. the sunflower c. the lotus plant

7. In what will the plastic play a significant role?

a. restaurant hygiene b. medicine c. an anti-bacterial toolbox

15. In pairs ask and answer the following questions. Add two or three more questions to this list. Take notes. Summarise your partner`s answers.

1.

1. Why do buildings get hot?
2. What are the advantages of cooling buildings with the help of new materials?
3. What questions would you like to ask the engineers who created this new technology to cool buildings?
4. What other things can we do to keep buildings cool?
5. How do you think this new cooling technology may change our life?

2.

6. What are the advantages of the new way for clothes to self-repair?
7. Would you wear clothes made from the new material?
8. Who might benefit from self-repairing clothes?
9. How popular do you think self-repairing clothes might be?
10. What other clothing innovations would you be interested in?

3.

11. What mental images come to mind when you hear the word 'plastic'?
12. What is revolutionary about the new plastic?
13. How much do you worry about bacteria and superbugs?
14. What effect might the new plastic have on our lives?
15. Did you enjoy reading this article? Why/not?

16. Use the cards below to prepare for a role-play exercise. In your group decide which invention is the most useful/least useful.

Role A — Cooling Material

You think cooling material is the best kind of material. Give three reasons why. Comment on other speakers' opinions. Tell the others why you do not agree that the materials they have talked about are more important than yours.

Role B — Self-repairing clothes

You think the material for making self-repairing clothes is the most useful out of the three. Give three reasons why. Comment on other speakers' opinions. Tell the others why you do not agree that the materials they have talked about are more important than yours.

Role C — Self-Cleaning Plastic

You think that self-cleaning plastic is the most useful out of the three. Give three reasons why. Comment on other speakers' opinions. Tell the others why you do not agree that the materials they have talked about are more important than yours.

READING

Part 3

17. Look through the text below and decide which § (1-5) is about…

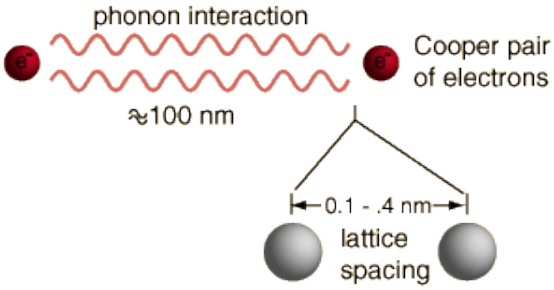
- High-temperature superconductivity
- Promising applications of superconductivity
- The discovery of superconductivity
- Theoretical explanation of superconductivity
- How superconductors are used

18. Read the text carefully paying attention to the words in italics and try to guess their meaning from the context. Circle any other words you do not understand or want to focus on and give their definitions. Find out their Russian equivalents using a dictionary.

Text 11C
Superconductivity: Questions and Answers

1. What is superconductivity and how was it discovered? *Superconductivity* is the absence of

measurable electrical *resistance* in certain substances at temperatures close to absolute zero. This temperature *varies* for different materials but generally is below 20 K (- 253.15 degrees C). First discovered in a mercury wire in 1911 by H. K. Onnes, a Dutch physicist, superconductivity is now known *to occur* in some 26 metallic elements and many compounds and alloys. The temperature below which a substance becomes superconducting is called the transition or critical temperature. Compounds are known that show superconductivity at liquid-nitrogen temperatures. Superconductivity is clearly important, as it has the potential to revolutionise electrical transmission, transportation, and physics as we know it. Onnes may have been based in Leiden but the *ground-breaking consequences* of his life`s work are now seen the world over.



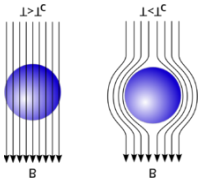
2. How can we explain the phenomenon of superconductivity? For almost 50 years after K. Onnes' discovery scientists were unable to develop a fundamental theory of superconductivity. In 1950 Lev Landau and Vitaly Ginzburg in Moscow formulated what came to be called the phenomenological Ginzburg-Landau theory of superconductivity. This theory had a great success in explaining the macroscopic properties of superconductors. In 1957 BCS theory or Bardeen-Cooper-Schrieffer theory, the first microscopic theory of superconductivity, was proposed. It was developed by the American physicists John Bardeen, Leon N. Cooper, and John R. Schrieffer. Cooper discovered that electrons in a superconductor are grouped in pairs, now called Cooper pairs, and that the motions of all of the Cooper pairs within a single superconductor are correlated; they *constitute* a system that functions as a single *entity*. Application of an electrical voltage to the superconductor causes all Cooper pairs to move, constituting a current. When the voltage is removed, current continues to flow indefinitely because the pairs *encounter* no opposition. For the current to stop, all of the Cooper pairs would have to *be halted* at the same time, a very unlikely *occurrence*. As a superconductor is warmed, its Cooper pairs separate into individual electrons, and the material becomes normal, or non-superconducting. Many other aspects of the behaviour of superconductors are explained by the BCS theory.

Table 10: Transition Temperatures of Some High-T_c Superconductors	
compound	T_c(K)
$Nd_{1.85}Ce_{0.15}CuO_4$	24
$La_{1.85}Sr_{0.15}CuO_4$	40
$YBa_2Cu_3O_7$	92
$Bi_2Sr_2Ca_2Cu_3O_{10}$	110
$Tl_2Ba_2Ca_2Cu_3O_{10}$	127
$Hg_2Ba_2Ca_2Cu_3O_8$	134

3. What about superconducting materials? Ever since Kamerlingh Onnes discovered that mercury becomes superconducting at temperatures less than 4 K, scientists have been searching for superconducting materials with higher transition temperatures. Until 1986 a compound of niobium and germanium (Nb_3Ge) had the highest known transition temperature, 23 K, less than a 20-degree increase in 75 years. Most researchers expected that the next increase in transition temperature would be found in a similar metallic alloy and that the rise would be only one or two degrees. In 1986, however, the Swiss physicist Karl Alex Müller and his West German associate, Johannes Georg Bednorz, discovered, after a three-year search among metal oxides, a material that had an *unprecedentedly* high transition temperature of about 30 K. They were awarded the Nobel Prize for Physics in 1987, and their discovery immediately stimulated groups of investigators in other countries to produce superconducting oxides with even higher transition temperatures. These high-temperature superconductors are ceramics.

4. Why is superconductivity important? The most important technological reason is having superconducting wires. Because a supercurrent has no electrical resistance, and thus does not heat the wire and change the electrical resistance, the supercurrent is much more *stable* than the electrical current through a metal wire. *Consequently*, the magnetic field produced by the supercurrent is also more stable. Having very stable magnetic fields allows much more precise measurements. These measurements range from magnetic resonance imaging (MRI) pictures to *precise* magnetic properties of materials. Besides the MRI machine, the most well-known use of superconductive materials is in particle accelerators, like the kind used in Large Hadron Collider (LHC). Another benefit of superconductors is that they are perfect diamagnets*. They *expel* any applied magnetic fields. This can be used in building magnetically *levitated* trains, which reduce *friction* and allow the trains to move at higher speeds.

5. And what about the future? There is a lot we don't know about superconductive materials, but we are developing new applications for superconductors every day. The hope is one day to use superconductivity in power transmissions, which would dramatically *reduce* energy costs around the world. Maglev trains, which use superconductivity to hover a train car above the rail, thereby eliminating friction that might slow a train down, may be the future of transportation. Who knows? Maybe one day we'll have electronics that utilise superconductors to give us smartphones that only need to be charged once a month or more. It's anyone's guess, but with the rapid advances in our technology, we'll all likely see superconductivity in our lives as a regular feature sooner rather than later.



*diamagnet - d*iamagnetism* is a quantum mechanical effect that occurs in all materials; when it is the only contribution to the magnetism, the material is called *diamagnetic.*

19. Look back at the article and write down some questions you would like to ask the class about the text. Ask your partner your questions. Then read one paragraph (1-5) thoroughly and tell your groupmates what you have read about.

STUDENT A's QUESTIONS (Do not show these to student B)	STUDENT B's QUESTIONS (Do not show these to student A)
1 _____ 2 _____ 3 _____ 4 _____ 5 _____	1 _____ 2 _____ 3 _____ 4 _____ 5 _____

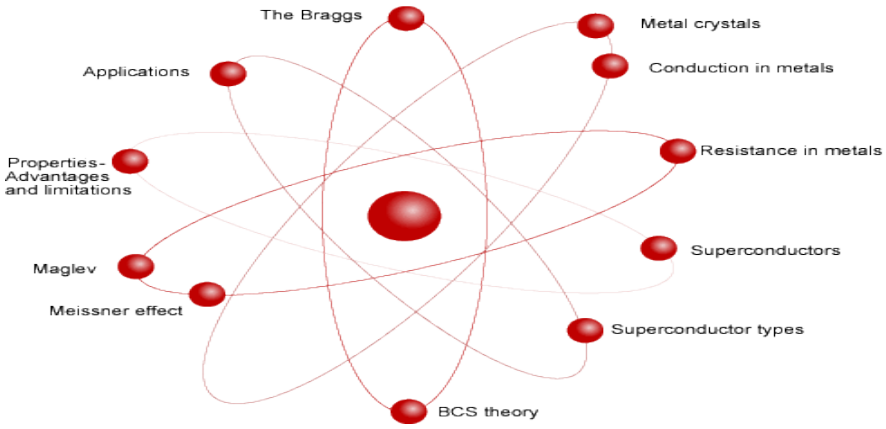
20. You are going to listen to a brief lecture "Superconductors: Powering our future". Can you think of 3-5 key points that you expect the lecture to discuss based on its title? Then listen to the lecture and check if you were right. Use a dictionary to help you understand the following words if necessary.

Quest(n), to hover above its track, to detect a disease, lead (n), to expel, liquid helium, to set off a gold rush, oxide materials, the boiling point, an emergent property.
https://www.youtube.com/watch?v=MT5Xl5ppn48

21. Listen again and put the notes from the lecture in the correct order.

- Neither MRI machines nor the particle accelerator at CERN would have been possible without the use of liquid helium cooled superconductors.
- When in 1986 two scientists in Zurich discovered superconductors that work at higher temperatures than researchers thought were ever possible, this set off a gold rush of activity.
- Green believes researchers will discover a room-temperature superconductor in the next 30 years.
- If researchers find something that can super conduct at room temperature, it will revolutionise how we transport and use energy.
- Researchers still do not understand how to predict which material will be a high-temperature superconductor or what causes their super conductivity.
- When you cool lead, mercury and certain compounds to extremely cold temperatures, they stop showing any electrical resistance, which makes them ideal for conducting electricity.
- Superconductors make it possible to have a maglev train, an MRI scanner, fast digital circuits.
- New high temperature superconductors have many very strange properties that are not understood even today.

22. Superconductivity Quiz. Choose the right answer. For some questions more than one answer may be correct.



1.What is superconductivity?

a. the ability of materials to conduct the electrical current of high power
b. the ability of materials to conduct electricity without losing any energy
c. the ability of materials to conduct the electrical current at a very high speed

2. When was superconductivity discovered?

a. in 1911 b . in 1933 c . in 1957

3.Who discovered superconductivity?

a. Lev Davidovich Landau and Vitaly Lazarevich Ginzburg
b. John Bardeen and Leon N. Cooper
c. Heike Kamerlingh Onnes

4. In what material was superconductivity first observed?

a. niobium-nitride b . titanium c . mercury.

5. What materials are high-temperature superconductors?

a. metals b . ceramics c . alloys

6. What is the transition temperature?

a. the temperature at which superconductivity occurs
b. the temperature at which superconductors return to normal state
c. the temperature at which a sudden change of physical properties occurs

7. What is the electrical resistance?

a. the absence of conductivity
b. the use of force to oppose someone
c. the degree to which a substance opposes the flow of current

8. What is a Cooper pair?

a. a pair of atoms b . a pair of molecules c . a pair of electrons

9. Why don't we use superconductors in power transmission more widely?

a. because we don't fully understand how superconductivity works
b. because superconductors are expensive to manufacture
c. because superconductors are fragile

10. What are the most widely used applications of superconductors?

a. for having superconducting wires
b. for making much more precise measurements, *e.g.* MRI (magnetic resonance imaging)
c. specific industrial uses

VOCABULARY

Module 11 Word List

Text 11 A	**Text 11 B**
acceleration (n)	(electrical) resistance (n)
acquire (v)	resistant (adj)
alloy (n)	cause (v)
applied science (n)	coating (n)
ceramics (n)	confront (v)
comparable (adj)	join (v)
composite (n, adj)	keep (v) cool
compound (n, adj)	last (v)
comprise (v)	provide (v) an answer
contribution (n)	repair (v)
cover (v)	replicate (v)
derive from (v)	save (v) money
enhance (v)	similar (adj)
exaggerate (v)	transparent (adj)
exaggeration (n)	unlike (prep)
field of science (n)	wrap (n, v)
general (adj)	
generality (n)	**Text 11 C**
materials science (n)	consequence(s) (n)
performance (n)	consequently (adv)
property (n)	constitute (v)
relevant (adj)	transition (n)
shape (v)	critical (adj) temperature
simulation (n)	encounter (v)
split (v)	expel (v)
substance (n)	ground-breaking (adj)
take (v) something for granted	levitate (v)
meet (v) the challenges	magnetic (adj) field (n)
tool (n)	occur (v)
	precise (adj)
	reduce (v)
	stable (adj)
	superconductivity (n)
	vary (v)

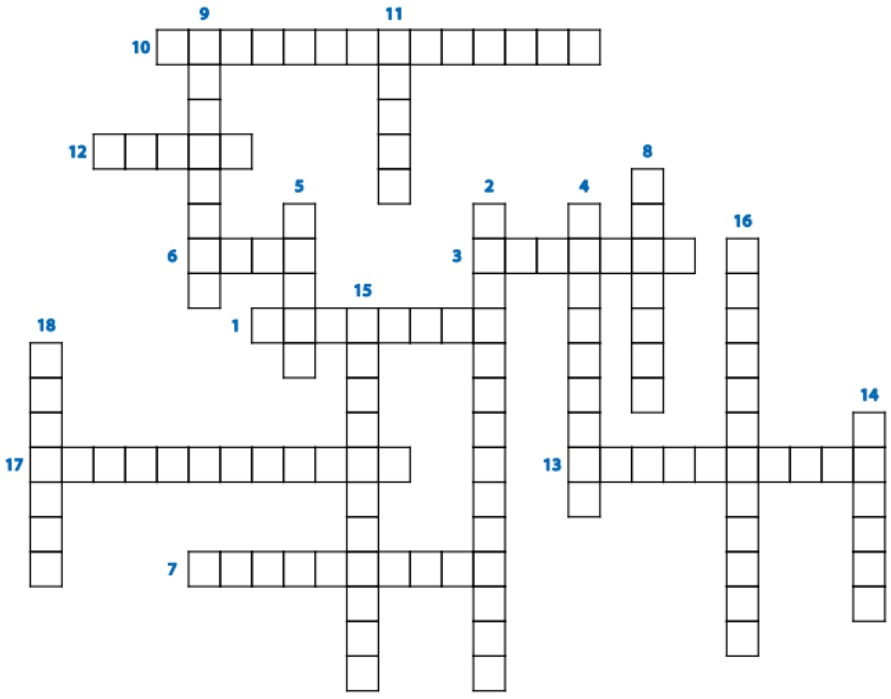
23. Check how well you remember the words from the list below. Read and translate them or explain their meaning. Try to recall how they were used in text 11A filling the gaps in the sentences.

To be shaped by, simulation, property, to derive from, to acquire, to comprise, composite, to meet

the challenges, substance, exaggeration, applied science, to take something for granted, field of science, to enhance, comparable (to), to cover something, tool, relevant.

1. We define materials as **s**_____ having **p**_____ which make them useful in machines, structures, devices, and other products. 2. It would be no **e**_____ to say that human civilization has been **s**_____ by breakthroughs in materials science. 3. Materials science is one of the oldest forms of technology and **a**_____ science, **d**_____ from manufacture of ceramics. 4. It is concerned with a wide range of substances, from relatively easily **a**_____ wood or stone, to modern man made materials. 5. In the modern world materials are ubiquitous, and so pervasive that we often take them for **g**_____ . 6. Materials have a generality **c**_____ to that of energy and information, and the three together **c**_____ nearly all technology. 7. Materials science also **c**_____ discovering and/or designing new materials and analysing their properties and structure. 8. Scientists are using powerful **s**_____ techniques, as well as sophisticated machine learning algorithms. 9. These **t**_____ have helped create the metamaterials used in carbon fibre **c**_____ for light-weight vehicles. 10. We need to discover and develop new kinds of materials with the desired properties and at the **r**_____ cost to meet the **c**_____ of the current world. 11. Today materials science is a dynamic and exciting **f**_____ with many remarkable new materials and discoveries. 12. Innovative technologies enable engineers to improve the performance of existing products which will **e**_____ every aspect of our lives.

24. Guess the word by its definition. Choose the words from Text 11A vocabulary list. Some phrases can be written as a solid word.



Across: 1. To consist of; be made up of. 3. To learn or develop (a skill, habit, or quality). 6. Something such as a piece of equipment or skill that is useful for doing a job. 7. An imitation of a situation or process. 10. A discipline that is used to apply existing scientific knowledge to develop more practical applications, for example: technology or inventions. 12. To give a particular shape or form to something. 13. Capable of or suitable for comparison. 17. An increase in speed or rate.

Down: 2. To assume that something is true without questioning it. 4. Physical material from which

something is made. 5. A metal made by combining two or more metallic elements, especially to give greater strength or resistance to corrosion. 8. Belonging to or existing in the present time. 9. An attribute, quality, or characteristic of something. 11. To divide into two or more groups. 14. To obtain something from a specified source. 15. The action or process of performing a task or function. 16. A statement that represents something as better or worse than it really is. 18. To make something better or improve the condition of something.

25. Read the sentences and choose the right option. Explain your choice or translate the sentences into Russian.

1. If a car turns a corner at a constant speed, it is *accelerating/assimilating* because its direction is changing. 2. This view is very pessimistic and tends to *exaggerate/enhance* the difficulties. 3. An example of a *simulation/stimulation* is a fire drill which is used to prepare people for an anticipated event. 4. Some examples of *tools/skills* that are often used today are the hammer, saws, shovel, telephone, and the computer. 5. The old word "abroad" which once meant "out of doors" has *accepted/ acquired* a new meaning and today is used as an adverb meaning "beyond the boundaries of one's country". 6. I go to the gym regularly but I don't like *comparative/competitive* sports. 7. The USA *consists/comprises* fifty states and one district. 8. A fire is *competitive/comparable* with the sun; both give light and heat. 9. Marie Curie is famous for her *connection/contribution* to science. 10. Some types of wood *shape/split* easily. 11. Bronze is a(n) *alloy/compound* of copper and tin. 12. Water is a chemical *composite/compound* of hydrogen and oxygen. 13. I like games in *general/generality* and especially football. 14. Strength and wisdom *derive/drive* from life force.

26. Look at the words below. Try to recall how they were used in texts 11B. Define their meaning or translate them into Russian.

Unlike, to keep cool, to repair, similar, to join, to last, transparent, to wrap up, to cause, to save money, to replicate, to confront.

27. Replace the words in bold with their synonyms using the words given below. Translate the sentences into Russian.

save, join, replicate, last, repair, transparent, cause, similar, unlike, keep something a secret

Example: The speed of the craft was reduced by air **friction**. → The speed of the craft was reduced by air **resistance**.

1. This car has **comparable** features to the other one, but it is much cheaper. 2. If you **connect** the dots on the paper, you'll get a picture. 3. He is taking the car to the garage to have it **serviced** this afternoon. 4. All the information you need is **stored** in this folder. 5. She's **very different** from her sister. 6.Researchers tried many times **to repeat** the original experiment. 7. Make sure that shirt isn't **see-through** when it gets wet. 8. Many illnesses are **brought about** by poor diet and lack of exercise. 9. My friend found a well-paid job but asked me **not to tell anybody** about it yet. 10. When they arrived the meeting **had been going on** for two hours already.

28. Find the following words or phrases in text 11C. Match some of these words with the definitions given below (1-14).

To occur, resistance, superconductivity, consequences, to vary, to encounter, critical/transition

temperature, to constitute, ground-breaking, consequently, to levitate, stable, precise, to reduce.
Example: an area around a magnet → a magnetic field

1. a verb meaning *to lessen or to lower*.
2. a verb meaning *to be faced with.*
3. an adjective meaning *careful, exact and accurate.*
4. a verb meaning *to happen* (especially about accidents and other unexpected events).
5. the property of allowing an electrical current to flow through without any resistance.
6. an adjective to describe something *new* and *revolutionary.*
7. the results of a particular action or situation.
8. a verb meaning *to be different* from each other.
9. the temperature at which a material becomes superconducting.
10. an adverb meaning *as a result.*
11. to *rise* and *float* in the air without any physical support.
12. an adjective meaning *firmly fixed* or not likely to move or change.
13. the degree to which a substance prevents the flow of an electric current through it.
14. a verb meaning *to make* something from a number of different parts.

29. Match the words with numbers (1-15) with the words with letters (a-o) to make up word collocations. Explain the meaning of these expressions and use them in examples of your own.

Example: ground-breaking discoveries: The discovery of electricity is an example of a ground-breaking discovery which has changed the world.

1. ground-breaking	a. granted
2. applied	b. world
3. magnetic	c. money
4. to take something for	d. useful properties
5. to meet	e. difficulties
6. current	f. science
7. transition	g. research
8. to keep	h. challenges
9. to save	i. resistance
10. electrical	j. cool
11. to possess	k. discoveries
12. the field of	l. field
13. to encounter	m. temperature
14. to cause	n. an answer
15. to provide	o. problems

30. Read the sentences below and find the words and expressions from Module 11 word list. Translate the sentences into Russian.

A. 1. I have some delicious chocolates that I've been saving for a special occasion. 2. I must get my bike repaired. 3. Have you wrapped up Jenny's present yet? 4. The fire caused a serious damage to their house. 5. You should save a copy of the receipt in case you want to exchange the goods. 6. They were in danger of starvation because of the drought which had lasted for several months. 7. The island is joined to the mainland by a road bridge. 8. If the seat is uncomfortable, you can try to vary its height. 9. Prices are usually reduced at the end of the season. 10. A healthy diet reduces your risk for cardiovascular diseases. 11. All the shops were closed and consequently, we couldn't buy any food.

B. 12. Evolution occurs as a result of adaptation to new environments. 13. Superconductivity means the complete absence of electrical resistance. 14. His latest ideas are exciting but they are not ground-breaking. 15. It is unlikely that any species will become extinct as a consequence of the oil spill. 16. The samples varied in quality but were generally acceptable. 17. A larger electric field would be needed in order to provide a sufficient electrostatic force to levitate the dust grains. 18. If the foundations of the house aren't stable, collapse is possible. 19. A strong magnetic field applied across an electrically conducting fluid affects thermal stability. 20. Similar to biological viruses, computer viruses viruses replicate themselves and are passed along from user to user. 21. One of the threats of using antibiotics too often is that bacteria may evolve to become resistant to antibiotics. 22. Copper has a very low resistance.

31. Work in groups. Choose 5-7 words from Module 11 Word list and prepare a short news story to tell your group using these words. Ask your listeners to write down the words while they listen to your story. Compare your lists.

32. Summarise in English using some key words from the vocabulary section.

1. Американские и шведские инженеры создали мягкую роботизированную ткань, которая может запоминать и воспроизводить движения владельца. Ткань состоит из полимерной оболочки, обладающей весьма сложной структурой и слоя мягкого материала, для которого растяжение равносильно изменению электрического сопротивления. Также в материал встроена эластомерная трубка. Ткань получила название Omni Fiber. Ее волокна отличаются особой тонкостью и гибкостью. Ожидается, что ткань будут применять для создания одежды для спортсменов или певцов.

2. Ученые придумали новое революционное применение древесины. Они придумали способ сделать её прозрачной. Это изобретение может полностью изменить то, как используются и производятся многие вещи в нашей жизни. Прозрачная древесина может однажды заменить стекло и использоваться в изготовлении окон и столов, для экранов телефонов и целого ряда других строительных материалов. Инновация возникла, когда исследователи экспериментировали с различными способами извлечения химических веществ из древесины, придающих ей цвет. Они были очень удивлены тем, насколько прозрачной может быть древесина. Они считают, что эта «новая» древесина потенциально может заменить стекло и некоторые оптические материалы. Прозрачное дерево намного прочнее и менее

опасно, чем стекло. Оно лучше изолирует от холода и является биоразлагаемым. Открытие все еще находятся на ранней стадии.

GRAMMAR
CONDITIONAL SENTENCES

Lead-in

33. Study the examples of four types of Conditional sentences below and answer the questions.

1. If we created more advanced materials, they would accelerate the development of industries from energy to manufacturing.
2. If substances are used to make products, they are called materials.
3. If new materials hadn't been discovered, a lot of products and technologies wouldn't have been developed.
4. If new tools to create materials continue to be used, we will soon see more breakthroughs in different fields.

What do they all have in common?
How are they different?
Which example expresses

- general truth;
- imagined future situation which is quite likely;
- hypothetical situation which is unlikely;
- hypothetical outcome.

STUDY NOTE

Conditionals are statements that describe both hypothetical and real scenarios. They are often referred to as **"If-clauses"** because they often begin with 'if'. What we express in the main clause, depends on what we express in the subordinate clause.
There are different **types** of conditions. Some are possible or likely, others are unlikely, and others are impossible.
If the weather is fine, *we eat outside on the terrace*. (Every time it happens, this is what we do.)
If the weather improves*, we'll go for a walk.* (It is possible or likely that the weather will improve.)
If the weather improved*, we could go for a walk.* (It is not likely that the weather will improve.)
If the weather had improved*, we could have gone for a walk.* (The weather did not improve – fine weather is therefore an impossible condition.)
These types of conditions are used in **four types of sentences**, called Zero, First, Second and Third Conditional sentences.

34. Look at the examples of different types of Conditionals and fill in the blanks. Add 2-3 examples of your own of each type of Conditionals.

Real (Zero) Conditional – *If I can't sleep I listen to the radio. If (=when) water is heated, it turns to steam.*
Type 1(1st) Conditional – *If I have a test tomorrow, I will study tonight. If you leave before ten you`ll catch the train.*
Type 2(2nd) Conditional – *If I had a car, I would give you a lift. If I lived in the country, I would have a dog.*
Type 3(3d) Conditional – *If he had prepared for the interview, he would have got the job. If I had closed the door, my flat wouldn`t have been broken into.*

We use Type ____ to talk about things that are true, that have happened, or are very likely to happen.
We use Type ____ to talk about past situations that didn`t happen. (unreal for the past)
We use Type ___ to talk about future situations when we believe it is quite likely. (probable future)
We use Type ___to talk about the possible result of an imagined situation in the present or future. (unreal for the present or future)

35. Focus on the verb forms in different types of Conditionals in the examples below and fill in the table.

1. If we *cool* certain materials to absolute zero, they *become* superconductors. (Zero conditional)
2. If the economy *is growing* by 6%, then it *is growing* too fast. (Zero conditional)
3. If new technologies *don't guarantee* safety, they *won't be adopted*. (Type 1)
4. If car makers *solve* some technical problems, electric cars *will soon replace* petrol cars. (Type 1)
5. If science fiction *became* science fact immediately, we *would be living* in an age of flying cars. (Type 2)
6. If robots *could think* or decide to do things differently, they *would replace* humans. (Type 2)
7. If self-cleaning plastic *was widely used*, it *would drastically cut* the incidences of microbe transfer in hospitals and restaurants. (Type 2)
8. If robots *hadn't been fitted* with vision equipment, they *wouldn't have been able* to see. (Type 3)
9. If a laser *had been used* for the operation, it *would have caused* less harm. (Type 3)
10. If internal combustion engine *had not been invented*, electric cars *would have dominated* our roads. (Type 3)

Types of Conditional	IF CLAUSE	RESULT (MAIN) CLAUSE
Real Conditional	Present Tense	
1st Conditional		
2nd Conditional		
3rd Conditional		

STUDY NOTE

You can also use **modals** (could, might, should, etc.) in the main clause instead of "would" to express the degree of certainty, permission, or a recommendation about the outcome.

Examples:
*If I had worked harder, I **might** have passed the exam.*
*You **could** have been on time if you had caught the bus.*
*If he called you, you **could** go.*

36. Look at more examples of Conditionals noticing the verb forms. Identify their types and decide whether the action expressed in the sentence is a-likely/possible; b-less likely/less possible; c-impossible. Translate the sentences into Russian.

1. If scientists use modern tools to propel innovations forward, they will lead us to more remarkable possibilities. 2. If a new super-thin material was used to cool our buildings, we would be able to save a significant amount of energy and money. 3. If advanced materials hadn't been created, smartphones wouldn't have become accessible to billions of people. 4. Materials science wouldn't have played a key role in shaping human civilisation if many remarkable new materials hadn't been developed. 5. If we had self-repairing clothes, there would be no need for sewing. 6. If a self-cleaning plastic were applied in hospitals, it could help prevent bacteria and superbugs from causing diseases. 7. If technology weren't advancing so rapidly, we wouldn't struggle so much to keep pace with it. 8. If a new technique for printing organic tissue (ткань) was created, scientists would be able to reproduce the body's organs via the use of 3D printing. 9. If our climate keeps getting warmer, we will soon require new technologies to cool our buildings. 10. If humans had not learned from nature, they would not have invented so many incredible technologies. 11. If the problem of global warming is not dealt with, our world will be a much more dangerous and difficult place to live in. 12. If electric cars become dominant, our cities will turn into much cleaner and quieter places.

37. Match the clauses below. Identify the types of Conditionals and explain their meaning.

A.	
1. If we had more students …	a. I`ll take a trip around the world.
2. My teacher wouldn't have been angry with me …	b. we would run the course.
3. If I have lots of money in the future …	c. if I had come to my class on time.
4. She wouldn`t have been given the current position in the company …	d. we can go to the country tomorrow.
	e. she's always tired in the mornings.
5. If you heat water to 100°C …	f. there wouldn't be so many accidents.
6. If the weather is fine …	
7. If she doesn't get a good night's sleep …	g. if she had been lazy and talentless.
8. If I still feel awful tomorrow …	h. I'll take the day off work.
9. If people didn't drive so fast on this road …	i. it boils.

B.	
1. If she doesn't pass the exam this year …	a. if I'd known how much petrol it uses.
2. If I had the time …	b. I'd love to learn to play tennis.
3. If he hadn't done engineering …	c. what would he have studied?
4. I would never have bought this car …	d. you won't get good tickets.
5. If you don't book now…	e. I would have taken the flat.
6. If the rent had been lower…	f. we'll miss our connection.
7. If the flight is late…	g. we get our skis out.
8. If it snows…	h. she can try again next year.
9. If you take another week off work …	i. the boss will definitely fire you.

38. Put the verbs in the correct tense. Translate the sentences into Russian.

Conditional 1.

1. If I (finish) _____ early, I will call you. 2. I (catch) _____ the 9:00 train, if I hurry up. 3. She will get the answer, if she (try) _____ to understand. 4. If you (be) _____ free earlier, we can go for a walk. 5. If you are hungry, I (make) _____ some sandwiches. 6. If he (study) _____ hard, he'll do well in the exam. 7. If you (not be) _____ back by 5pm, we'll leave without you.

Conditional 2.

1. If I (be) _____ a star, I would help those in need. 2. He (buy) _____ a house if he had a job. 3. She (be)_____ happy, if she married him. 4. If I (be) _____ you, I would ask for help. 5. If I had more time, I (go) _____ to the gym. 6. I (not/have to walk) _____ everywhere, if I bought a car. 7. If people used bikes instead of cars, there (not/be)_____ so much pollution.

Conditional 3.

1. If he (be)_____ more careful, he would not have had that terrible accident. 2. I (pass) _____ the exam if I had worked harder. 3. If he (not learn)_____ to play the guitar, he wouldn't have joined the band. 4. If the government (spend) _____all the money given, all the roads (be paved) _____ . 5. We wouldn`t have been able to answer your questions if we (read/not)_____ the book. 6. If he had left earlier, he (arrive) _____ on time. 7. If they (book) _____ earlier, they could have found better seats.

STUDY NOTE

Both ***would*** and ***had*** can be contracted to ***'d*** in conditionals. Remember two rules:
1. ***would*** never appears in the if-clause so if ***'d*** appears in the if clause, it must be abbreviating *had*.
2. ***had*** never appears before ***have*** so if *'d* appears on a pronoun just before *have*, it must be abbreviating ***would***.

39. Decide what contraction 'd stands for: would or had.

*Example***:** If **I'd** known you were in hospital, **I'd** have visited you. → If **I had** known you were in hospital, **I would** have visited you.
I'd have bought you a present if **I'd** known it was your birthday. → **I would** have bought you a present if **I had** known it was your birthday.

1. If you'd given me your e-mail, I'd have written to you. 2. If you'd asked me, I'd have phoned the customers to let them know.3. If I was rich, I'd spend all my time travelling. 4. You could have changed your opinion if you'd stayed longer. 5. I'd help you if I knew how. 6. If he'd listened to what his friends had been telling him he wouldn't have lost so much money. 7. They'd have got the job done more quickly if they'd had more people working on it. 8. If I saw a snake, I'd be terrified.

40. Put the verbs in brackets into the correct form and explain their meaning or translate the sentences into Russian.

Example:

- If you (to park) here, your car (to get towed). (Zero conditional) → If you park here, your car gets towed.
- If you (to catch) the fast train you (to get) home early. (Type 2) → If you catch the fast train you will get home early.
- If we asked him, he would help us. (Type 2) → If we asked him, he would help us.
- If I (to know) you were coming, I (to buy) a cake. (Type 3) → If I had known you were coming, I would have bought a cake.

1. If materials (to be) not so pervasive we (to be taking) them for granted. (Type 2) 2. If materials science (to be developing) so dynamically, it (to become) a key discipline. (Type 3) 3. If we (to continue) to develop materials with desired properties, materials science (to be) the most important technology of the next decade. (Type 1) 4. If clear safety rules for self-driving cars (to be created) they (to keep) our roads safe. (Type 1) 5. The accident (not/to happen) if you (to test) your brakes. (Type 3) 6. If computers (not/to be invented) lots of new jobs (not/to appear). (Type 3) 7. When the sun (to go) down, it (to get) dark. (Type 0) 8. What (to happen) if the Internet (to be invented) 100 years ago? (Type 3) 9. If unprecedented developments in AI technology (to continue), smart machines (to take) over millions of our jobs in the near future. (Type 1) 10. If he (not/to run) a red light, the accident (to happen). (Type 3)
2.

41. Write Conditional sentences of type 2 or 3 using the sentences given below according to the example. Answers may vary.

Example: The weather is bad. The flight is cancelled. → If the weather was not bad, the flight wouldn`t be cancelled. There was no lifeboat. Sailors couldn't keep afloat. → The sailors could keep afloat if there was a lifeboat.

1. I didn't prepare for the seminar. I couldn't answer the teacher's questions. 2. The inaccurate values were used. The result was an error. 3. There aren't many currents in this part of the ocean. Organic material isn't pulled down into the trenches. 4. It is much easier to compute satellite orbits. The Earth is perfectly spherical and has no atmosphere. 5. The research team used a free-falling autonomous

camera system. Many new species of animals were documented. 6. No satellites were launched. The transmissions of microwaves across the oceans were impossible. 7. The Earth doesn`t stay in one place in its orbit. Day and night change in length. 8. The technology is developing fast. It is hard to keep up with technology these days. 9. The vehicle was built with a new type of alloy. It wasn't badly damaged in a car crash. 10. Many ships were lost at sea. Their sailors didn't know how to find out their location.

STUDY NOTE

Phrases like **supposing/ in case/ provided/ providing that/ as long as/ on condition that/ imagine**, etc. can also trigger conditional structures.

We'll be there at about 7.30, ***provided*** *that there's a suitable train.*

You can play in the living room ***as long as*** *you don't make a mess.*

42. Read the following examples paying attention to the synonyms of 'if'. Explain their meaning or translate the sentences into Russian.

1. Provided that there are enough seats, anyone can go on the trip. 2. Provided that the plane takes off on time, we should reach Irkutsk by morning. 3. So long as a tiger stands still, it is invisible in the jungle. 4. The bank lent the company 100,000 pounds on condition that they would repay the money within six months. 5. You can get a senior citizen's concession providing you've got an ID card. 6. Supposing I don't arrive till after midnight, will the hotel still be open? 6. They may do whatever they like provided that it is legal. 7. Supposing you lost your passport while travelling, you'd have to go to the embassy, wouldn't you? 8. In case I forget later, here are the keys to the garage. 9. Let's take our swimming costumes in case there's a pool at the hotel. 10. I'll take some cash in case we need it on board.

STUDY NOTE

Unless roughly means 'except if' or 'if… not', usually occurring in 1st and 2nd conditional structures.

Unless *I phone you, you can assume the train is on time. (If I don't phone you, you can assume the train is on time)*

43. Change the following sentences so that each sentence contains the word 'unless'.

Example: You'll catch a cold **if** you don't wear warm clothes. → **Unless** you wear warm clothes, you'll catch a cold.

1. You won't get in if you don't have a ticket. 2. The match will be called off if the weather doesn't clear up. 3. I wouldn't get the job if I didn't pass my driving test. 4. If your English doesn't improve, you'll fail the exam. 5. If you don't slow down, you will have an accident. 6. If it doesn't rain soon, all the plants are going to die. 7. If you don't ask questions, you won't learn to think critically. 8. If we hadn't made a booking weeks in advance, we wouldn't have been able to get a flight. 9. We might need to cancel the show if we don't sell more tickets at the last minute. 10. If he hadn't recognised us, he might never have spoken to us.

44. Use your own ideas to complete the sentences. Think of your own examples with different types of Conditionals.

1. I like hot weather provided … 2. I'd walk to university unless … 3. You can borrow the money provided … 4. You won't get a good job, unless … 5. I could go out tonight if … 6. If I was free now … 7. If I saved a large sum of money … 8. If I had never studied English … 9. If I had not come to this university … 10. If I had been born 60 years ago … 11. If there was a power cut in this building … 12. If I found myself alone on a desert island …

STUDY NOTE
In formal situations we can use **should or had** + subject + verb instead of **if**.
Should you *wish to cancel your order, contact our customer service department.* (= If you wish to cancel your order…)
Had I *known you were waiting outside, I would have invited you to come in.* (If I had known you were waiting outside …)

45. Paraphrase the following sentences according to the model.

Example: **If** he calls, give him all the necessary details. → **Should** he call, give him all the necessary details.

If the robot designed by Leonardo da Vinci had been created, robots might have become commonplace much earlier. → **Had** the robot designed by Leonardo da Vinci been created, robots might have become commonplace much earlier.

1. If I had known about the meeting, I would have attended. 2. If he had been there, he could have helped them. 3. If she had not applied early, she wouldn't have been accepted. 4. If you had not left an hour early, you would have been late for the meeting. 5. If I see him, I'll pass on the message to him. 6. If you need anything, please call me. 7. If he calls you, I also want to speak to him. 8. If the test drive of an Uber car had been successful, self-driving vehicles would have developed more rapidly.

SPEAKING AND DISCUSSION

46. In groups of 3 study the list of common materials below. Define what type of material they are, what properties they possess and where they are used. Add 2-3 more materials to this list and prepare to tell other students about them.

Steel, glass, aluminium, titanium, gold, plastic, copper, rubber.

47. Match materials (1-5) with their applications (a-e). Add 2-3 more materials to this list and think of an example of their applications.

1. silicon	a. to look inside people's bodies
2. aerogels	b. to make pictures on the screen
3. composite materials	c. to make tiny parts for computers
4. fiber-optic cables	d. to build planes
5. liquid crystals	e. to insulate things

48. Use the cards below to describe your material and what makes its discovery a real breakthrough. Present your ideas in mini groups. Decide which new material is the most important.

We, humans, are always on the path of inventions and innovations. In addition to building new technologies and machines, the invention of new materials greatly influences the future of products and their manufacturing processes. Read about some of best new materials. Here they are!

Student A's Card.

Wood Sponge – the greener way to clean up oceans!

The Wood Sponge is a new material developed by turning wood into a stripped down version of itself by treating it with chemicals to remove hemicellulose and lignin. The result is a sponge of cellulose that can absorb 16-46 times its own weight. Also, it can be reused up to 10 times by squeezing out the absorbed oil. This new sponge surpasses all other sponges or absorbents we use today in terms of capacity, quality, and reusability. The reason why the Wood Sponge tops our list is its application – to absorb oil from water. Oil and chemical spillage has brought about unprecedented damage to water bodies all around the world, and looking for more efficient ways to combat it is an important area of research.

Student B's Card.

The strongest bio-material – stronger than steel and it's biodegradable!

The strongest biomaterial known to man was the Spider silk. However, the team of researchers has invented a new material that can be touted as the strongest biomaterial ever produced. The best part of this material is that even though it is artificial, it is biodegradable. Hence, it can be used as a great alternative to plastic and other non-degradable objects. The material is made from cellulose nanofibers that are sourced from wood and plant body. The final structure has a tensile stiffness of 86 gigapascals (GPa) and a tensile strength of 1.57 GPa. In other words, the new material is 8 times stiffer than a silk spider web.

Student C's Card.

The self-healing material - it does it without external stimulants!

This material is still in its early stage, but its properties are better than what we have ever seen before. Hence, this is a material we are going to see more in the future. It is a self-healing material that can heal itself by using carbon in the air. The materials can not only repair but can also grow or strengthen from taking in carbon from the atmosphere. The technology resembles how plants take in carbon dioxide to grow tissues and become stronger. A material that can absorb carbon from the atmosphere is an obvious advantage when we consider its ecological impact.

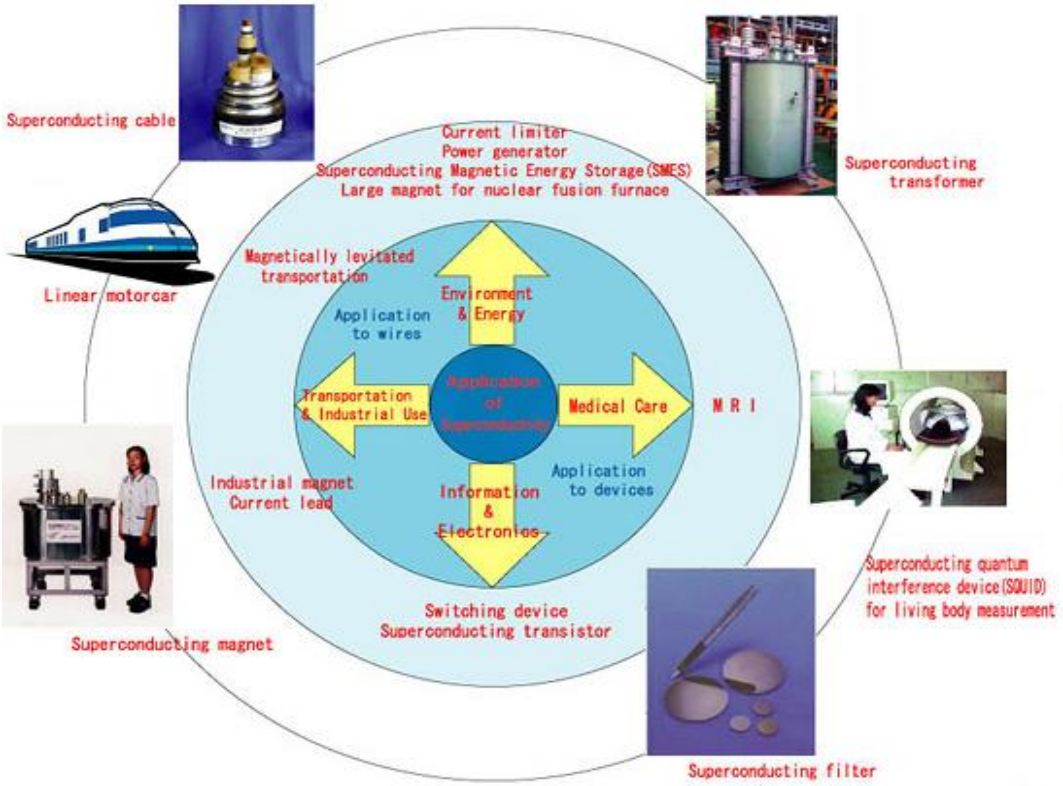
Student D's Card. In medicine

Silicon X – better than the original!

Silicon was touted as the revolutionary material that can do wonders in the tech industry. Nowadays, almost all of the processors, both high end and mobile are made from silicon semiconductors. Almost all of the semiconductors in the world use silicon as the base material. However, conventional silicon doesn't come without a few drawbacks. The largest one being that it can not

be used in batteries. In theory, silicon can provide vast improvements to the battery if it's used as the cathode. However, the problem is that if it is used in that way, the cathode will break during the charging cycle. The new Silicon X is a modified version that includes a mixture of silicon nanoparticles and other nanoparticles of a different substance. The matrix ensures that the silicon doesn't break away during charging. Batteries developed with Silicon X will have 3-6 times the capacity of graphene batteries that we use today.
(taken from https://interestingengineering.com/7-new-materials-invented-in-2018-that-could-change-our-lives)

49. Look at the following pictures. What applications of superconductivity do they illustrate?



50. Prepare for a round table discussion[1] of the topic "Superconductivity: why is it important?" Think about your own opinion on how important the research on superconductivity is and prepare some examples to prove your point. Make use of Module 11 materials or search the Internet for more information on the topic.

https://www.advancedsciencenews.com/application-superconductor-technology/

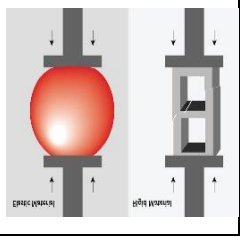
https://www.extremetech.com/extreme/208651-what-is-superconductivity

[1]Round table is a form of academic discussion. Participants agree on a specific topic to discuss and debate. Each person is given equal right to participate, as illustrated by the idea of a circular layout referred to in the term round table.

INDEPENDENT FURTHER STUDY

51. Match the actions with the verbs in the box.

Bend, compress, cut, drop, heat, melt, scratch, stretch, strike, vaporise.

1. 	2. 	3. 	4. 	5. 
6. 	7. 	8. 	9. 	10. 

52. Match the sentences. Use the dictionary if necessary.

1. This material doesn't burn or melt.	a. It's rigid.
2. This material doesn't break if you strike it or drop it.	b. It's hard.
3. You can't bend this material.	c. It's tough.
4.This material doesn't corrode if you put it in water.	d. It's heat-resistant.
5.You can't scratch this material or cut it.	e. It's corrosion-resistant

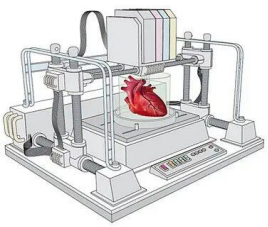
53. Match the words with their opposites. Think of materials which can be described by these adjectives.

Example: *Cotton and wool are soft materials.*

1. tough	a. soft
2. hard	b. heavy
3. rigid	c. weak
4. strong	d. brittle
5. light	e. flexible

54. Read the text and match the words in bold with their definitions below.

Breakthrough in Bio-printing of New Body Organs



Scientists say they have greatly **advanced** the possibility of being able to **reproduce** the body's **organs** via the use of 3D printing. Replacement organs could be created using a new technique for bio-printing organic **tissue.** This allows scientists to create networks of thin tubes and **vessels,** like those used in our body for the **flow** of blood and air. These are called vascular networks. One of the biggest roadblocks to generating functional tissue replacements has been our inability to print the complex vascular networks that can supply **nutrients** to densely populated tissues. Tissue engineering has **struggled** with this for a **generation**. Scientists believe

that the new **breakthrough** will allow medical practices to change in the future. If we can print tissues that look and now even breathe more like the healthy tissues in our bodies, will they also then functionally **behave** more like those tissues? This is an important question, because how well a bio-printed tissue **functions** will affect how successful it will be as a **therapy**. Scientists hope this method will help millions of people waiting for an organ **transplant**.

https://breakingnewsenglish.com/1905/190507-bioprinting

1. a substance that provides nourishment essential for growth and the maintenance of life
2. a part of an animal or human that is self-contained and has a specific vital function, such as the heart or liver
3. a tube or canal holding or transporting blood or other fluids
4. having made or caused to make progress
5. a smooth steady movement or supply of liquid
6. to create something very similar to something else
7. any of the types of material of which animals or plants are made
8. to act or conduct oneself in a specified way, especially toward others
9. to work or operate in a proper or particular way
10. a surgical operation in which an organ or tissue is taken out and replaced
11. all of the people born and living at about the same time, regarded collectively
12. treatment intended to relieve or heal a disorder
13. a sudden, dramatic, and important discovery or development
14. to strive to achieve or attain something in the face of difficulty or resistance

55. Read the text again and choose the right option (a, b, or c) according to the information in the text.

1. Who claimed bio-printing could be used to reproduce organs?
   a. engineers b. doctors
   c. scientists d. printers
2. What would the process of bio-printing create networks of?
   a. tubes and vessels b. users
   c. veins and canals d. tubs and vassals
3. What are the networks called that scientists can now bio-print?
   a. cyber networks b. muscular networks
   c. neural networks d. vascular networks
4. What substance can be transported to densely populated tissues?
   a. data b. oxygen
   c. nutrients d. blood
5. How long has the field of tissue engineering faced this challenge?
   a. too long b. decades
   c. years and years d. a generation
6. What will the new breakthrough change?
   a. doctors b. medical practices
   c. humanity d. longevity
7. What will determine the success of the new therapy?
   a. how well the tissue is printed b. the health of patients

c. the quality of the printer d. genes

8. Who do scientists hope this breakthrough will help?

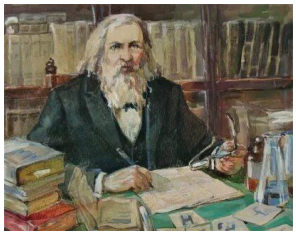
a. athletes b. older people

c. all of us d. people waiting for an organ transplant

56. Retell the text about bio-printing using the questions below.

1. Who said bio-printing could be used to reproduce organs?
2. What would bio-printing create networks of?
3. What are the networks called that scientists can now bio-print
4. What can be supplied to densely populated tissues?
5. For how have tissue engineering struggled?
6. What will the new breakthrough change?
7. What will affect the success of the new therapy?
8. Who do scientists hope this breakthrough will help?

57. Read texts A-D. Summarise the information by reporting the main facts.



A. D. I. Mendeleev (1834-1907) discovered the most important law of nature – the periodic law, according to which the properties of elements are in periodic dependence on the magnitude of their atomic mass. He published the book "Fundamentals of Chemistry"; it describes, in particular, the atomic and molecular structure of matter. D. I. Mendeleev also paid considerable attention to the problem of glass production.

B. The achievements of materials science in our country come from the founders of the largest scientific schools, F. Y. Levinson-Lessing, E. S. Fedorov, V. A. Obruchev, A. I. Fersman, N. A. Bellyubsky, who were engaged in the study of minerals and deposits of natural stone materials (rocks). New materials are being produced: Portland cement, new gypsum, cement concretes, polymer materials, etc.

C. Metals and metal alloys are widely used in mechanical engineering, which is why metallology is an important part of materials science.

The famous physicist Michael Farraday (1791 – 1867) used chemical analysis to study the properties of damask steel.

D. Of the subsequent works on materials science, the works of the outstanding Russian metallurgist mining engineer Major General P. P. Anosov (1799-1839) should be particularly noted. In 1831, he first used a microscope to study the structure of metals in the study of the structure of high-quality steel – bulat, the problem of which P. P. Anosov brilliantly solved at the Zlatoust plant (1837). He established a connection between the structure of steel and its properties. Anosov, in fact, was the initiator of the production of high-quality steels, which play an important role in modern technology. In his works, P. P. Anosov also studied the influence of carbon on the structure and properties of steel, assessed the role of a number of other elements.

58. Complete the summary using the information from Exercise 57.

D. I. Mendeleev discovered that the 1. _____ are in periodic dependence on the magnitude of their atomic mass.
The achievements of materials science in our country come from the founders of the largest scientific schools, F. Y. Levinson-Lessing, E. S. Fedorov, V. A. Obruchev, A. I. Fersman, N. A. Bellyubsky, who were engaged in the study of 2. _____of natural stone materials (rocks). New materials are being produced: Portland cement, new gypsum, cement concretes, polymer materials, etc.
Metals and metal alloys are widely used in 3. _____, which is why metallology is an important part of materials science.
The famous physicist 4._____studied the properties of damask steel.
P. P. Anosov used 5._____for the first time to study the structure of metals. In his works, P. P. Anosov also studied the influence of 6._____on the structure and properties of steel.

MIXED CONDITIONALS

STUDY NOTE

Often, things that did or did not happen in the past have results which continue or are still important in the present. We can emphasise this by using *if* with a past perfect verb, and *would* in the main clause.

*If I **hadn't met** Charles, I **wouldn't be** here now.* (I met Charles, so I'm here now.)

*She **wouldn't** still **be working** for us if we **hadn't given** her a pay-rise.* (We gave her a pay-rise, so she is still working for us now.)

Sometimes the *if* clause uses a past verb, and *would+have done* in the main. The context defines the meaning.

*If I **liked** gardening, I **would have bought** a country house long ago.*

59. Match the clauses and write the Mixed Conditional sentences.

1. If we had invested in new technology,
2. If people didn't suffer from range anxiety,
3. If new materials hadn't been discovered,
4. Unless so many different means of transport had been developed,
5. If they had told me about the problem earlier,
6. If I had studied English at school,
7. If you really wanted to go there,
8. If I had taken his advice,
9. If they had caught an earlier train,
10. If the Tu-144 hadn't been withdrawn,

a. people wouldn't be travelling so extensively today.
b. I wouldn't be in this mess now.
c. we would still be competitive.
d. everything would be all right now.
e. they would be here now.
f. more electric cars would have been produced.
g. I wouldn't find it so difficult to learn now.
h. our flights to distant parts of the country would be much shorter today.
i. materials science wouldn't be such an exciting and dynamic field as it is today.
j. you would have booked the trip long ago.

60. Sentence cards. Read out the first part of the Conditional sentence and try to find the ending. Underline the verbs in each half. Then try to finish the sentences in other ways.

1. If you haven't asked her out yet,	a. it must be three in the afternoon there.
2. If we are going to catch that train,	b. do it as soon as possible.
3. If you were thinking of applying for that job,	c. you never will.
4. If we are having them over for dinner,	d. we'd better get a move on!
5. If you knew you couldn't come,	e. don't bother, it's gone.
6. If you're having no luck getting through on the phone,	f. we'd better start cooking now.
7. If it's nine o'clock in the morning here,	g. why didn't you say so earlier?
8. If you must do the job anyway,	h. why don't you write an email?

CONDITIONALS IN SPEAKING

STUDY NOTE. In speaking, we often use *if*-clauses without main clauses, especially when asking people politely to do things. *If* is usually followed by *will, would, can* or *could* when it is used to be polite.

If you will kindly wait a moment, please?

If you could send me further details of the programme, I'd really appreciate it.

Would you get me some coffee if they have any?

61. Think of your own mini dialogues based on your everyday situations with 'polite' conditional forms and role play them in class.

Example:

Shop assistant to customer: **If** you **would** just sign here, please. (a more polite way of saying Just sign here, please.)

A is writing something for B and having difficulty:

A: If I **could have** a better pen …

B: Here, use this one.

A: Thanks.

REFLECTIVE LEARNING AND EVALUATING YOUR OWN PROGRESS

62. Answer these questions.

How do you understand the term 'reflective learning'? How important is it? What benefits may it bring? Do you analyse your progress while learning or do you mostly rely on your teachers' feedback? How self-critical are you? Give examples based on your learning experience.

63. Read the text below to find out more about the benefits of student reflection and self-assessment.

As a student in Higher Education you are responsible for your own progress and your development as an autonomous learner. It is crucial to avoid relying solely on assessments and external opinions. You will greatly benefit from the ability to self-assess through analysis and reflection, understanding your strengths, areas for improvement, and your priorities.

Developing the habit of reflection

Your performance as a student is likely to improve if you develop a habit of taking time to reflect on how you learn. You will find that you study more effectively if you consider:

- Changes in your motivation level
- Changes in your attitudes and ideas
- The effectiveness of your current study strategies
- Which skills you need to use for different kinds of assignments
- What is blocking your learning
- Gaps in your knowledge or your skills, etc.

Evaluating your own progress

Self-evaluation is the process of systematically observing, analysing and improving one's own actions or results. Analysing your results is essentially a form of reflection. It will also be important in the workplace. This is a valuable approach for supporting learning. It helps students to take control of their learning and gives them a chance to manage their own studies and development more independently.

Tools for self-assessment: setting personal goals, learner diaries, records of learning, checklists, can-do statements, report writing, etc.

(for more details on how to make use of some of these tips and tools go to Module 11 Appendix "Learning Skills.")

64. Next time you are going to give a talk or a presentation, make use of the self-assessment form given below. Compare your answers with your teacher's/your group mates' feedback. Summarise the results.

What went well	What didn't go well	How could I improve this next time
e.g. My text was well prepared, I spoke accurately and fluently.	*e.g.* I didn't make use of signaling phrases while switching to the next point.	*e. g*. Create a list of linking phrases to use while speaking.

CHECK YOURSELF

1. What type of material is it?

1. A chemical compound or mixture of compounds formed by polymerization and consisting essentially of repeating structural units. They include plastic and rubber materials.
2. They are compounds made up of either metallic or nonmetallic elements, such as earthenware,

porcelain, or brick, that have been shaped and then hardened by heating to high temperatures.
3. They are composed of two or more individual materials which allow them to achieve a combination of properties that is not displayed by any single material.
4. A building material made from a mixture of broken stone or gravel, sand, cement, and water, which can be spread or poured into moulds and forms a mass resembling stone on hardening.
5. A material that is made up of at least two different chemical elements one of which is a metal, *e.g.* steel.

2. Materials around us Quiz. Choose the right answer.

1. What is the most abundant element in the earth's crust?
   a. oxygen b. silicon c. hydrogen d. aluminium
2. What is human body primarily composed of?
   a. blood b. water c. tissue d. fat
3. ¾ of all elements in the periodic table are
   a. metals b. metalloids c. semimetals d. nonmetals
4. What is the main ingredient in glass?
   a. air b. sand c. iron d. water
5. What are fibre optic lines made of?
   a. thread b. steel c. glass d. copper
6. Which of these has the most powerful antimicrobial properties?
   a. aluminium b. stainless steel c. copper d. tin
7. Which of the following elements is not found in proteins?
   a. carbon b. steel c. oxygen d. nitrogen
8. From which of the following sources is quinine, a substance used to treat malaria, derived?
   a. hemp b. tomatoes c. stone d. tree bark
9. What is a malleable material?
   a. one that can be made into sheets b. one that conducts electricity c. one that bounces d. one that is waterproof
10. Which of the following is not a biological material?
    a. leather b. limestone d. wax d. plastic

3. True or False?

1. Materials science is a discipline that studies the properties of matter and its applications.

2. This science doesn’t study the relationships between the structure of materials at atomic or molecular scales.
3. Materials science is studied at many universities and has become part of forensic engineering or failure analysis.
4. Materials science is the most important technology today.
5. Smart materials are materials that are used for manufacturing smart devices.
6. Smart materials can be also called shape memory materials because they react to changes in their environment.
7. Materials science can be divided into different disciplines that study different materials and their properties: metallurgy, biomaterials etc.
8. Breakthroughs in materials science are likely to affect the future of technology significantly.
9. The examples of revolutionary materials include graphene, composites and wood.
10. Composites exist in nature, for example, a piece of wood is a composite.

4. Choose ten materials and find products made of these materials. Complete the table. Compare your examples.

What is the material	What product is made of this material?	What do you use this product for?
Wood	*furniture*	*We use furniture to make our life comfortable.*

5. Fill in the gaps with the words below.

Mercury, properties, without, helium, conduct, critical, range, exhibit, resistance, discovery, application, nitrogen.

Superconductors

Superconductors are materials that 1_____ electricity with no 2_____. This means that, unlike the more familiar conductors such as copper or steel, a superconductor can carry a current indefinitely 3_____losing any energy. They also have several other very important 4_____ , such as the fact that no magnetic field can exist within a superconductor.

The first 5_____of a superconductive material took place in 1911. If 6_____ is cooled below 4.1 K, it loses all electric resistance. This discovery of superconductivity was followed by the observation of other metals which 7_____ zero resistivity below a certain 8_____ temperature. Since then a number of superconducting materials has been presented. But for some years despite the enormous success of such materials, broader 9_____ of superconductors had been restricted (ограничивать) by the requirement for cooling to very low temperatures (1.5 - 5K) using liquid 10_____ . In 1987 a new remarkable material was discovered, which became a superconductor at just 90K. Because 90K can be reached using liquid 11_____ , a common industrial refrigerant, these discoveries opened for the first time the potential for a much wider 12_____ of devices. Over the next several months, as a result of finding out two more materials, the temperature of superconductors was increased up to 127K.

6. Read the sentences below and define what type of Conditional each sentence illustrates.

1. If they are watching TV, they won't hear you. 2. If he hadn't been so nervous in the interview, he would have got the job. 3. If my father had a day off, we always went to see my granddad. 4. If there were more buses, we would leave the car at home. 5. If test drives of self-driving cars had been successful, they would have progressed beyond the testing stage. 6. If the battery power of electric cars increased by ten per cent, it would result in the extra acceleration. 7. If flying cars became a reality, people would not spend hours in traffic jams.

7. Complete sentence b in each pair so that it has a similar meaning to sentence a.

Example: Bus lanes were introduced. Travelling by public transport was made easier. → Unless bus lanes had been introduced, travelling by public transport wouldn't have been made easier.

1. a) It's likely that there is life on other planets. If so, we are not alone. b) If _____ life on other planets, we _____ not alone. 2. a) The world's population will probably continue to increase. If so, we will need more food. b) If the world's population _____ to increase, we _____ more food. 3. a) Other intelligent beings might inhabit the universe. If so, they would be very different from us. b) If other intelligent beings _____ the universe, they _____ very different from us. 4. a) There aren't many TV programmes about science, some people don't know much about it. b) If there _____ more TV programmes about science, people _____ more about it. 5. a) We shouldn't have spent so much money on space research. Instead, we could have solved many other serious problems. b) If we _____ less on space research, we _____ many other serious problems. 6. a) Robotic vehicles have been used in dangerous environments for decades. The idea to create self-driving cars appeared. b) Unless robotic vehicles _____, the idea to create self-driving cars _____ . 7. a) A few accidents involving self-driving cars have happened. People decided that they were not safe. b) Unless a few accidents involving self-driving cars _____ , people _____ that they were not safe. 8. a) Neural networks take inspiration from the human brain. AI software is quite good at learning about scenarios it has never faced. b) If neural networks _____ inspiration from the human brain, AI software _____ quite good at learning about scenarios it had never faced.

8. There is a mistake in the second part of each sentence. Correct the mistakes so the second part follows on correctly from the first part.

1. He will pass his driving test if he will practise. 2. You can borrow the car tonight if you would take good care of it. 3. I wouldn't have made so much food if I knew they weren't coming. 4. If you buy two, you got a third one free. 5. I would have done better if I worked harder. 6. If I had the right tools, I can fix the flat tyre myself. 7. If you'd told me Kate was going to be there, I would never come to the party. 8. If I lived in that house, I will have it renovated. 9. We could understand him better if he would speak more slowly. 10. Stay at home if you won't feel better tomorrow.

9. Answer the following questions. Use the information in Module 11 texts.

1. What does materials science deal with?
2. Why is materials science so important?
3. What groups are materials generally split into?

4. Can you give an example of the oldest materials/of the most advanced materials?
5. What new technology is suggested for cooling buildings?
6. What is the idea of creating self-repairing clothes based on?
7. What can self-repairing clothes be especially useful for?
8. What problem will self-cleaning plastics help to solve?
9. What is superconductivity?
10. Where can the phenomenon of superconductivity be used?

MODULE 11 PROGRESS TEST

Vocabulary. ***Decide which answer a, b or c best fits into each gap.***

Today we are taking 1_____ many thousands of manufactured objects that 2_____ our comfort in everyday life: the vehicles that we travel in; the clothes that we wear; the machines in our homes and offices; the sport and gym equipment we use; the computers and phones that we can't live without; and more importantly, the medical technology that keeps us alive. Everything we see and use is made from materials 3_____ from the Earth or created by people. These materials can be split into four main groups: metals, polymers, ceramics, and 4_____ . The technological advances that have transformed our world over the last 20 years have been founded on the developments in Materials Science and Engineering. Materials are 5_____ faster today than at any time in history, enabling engineers to improve the 6_____ of existing products and to develop innovative technologies that will 7_____ all the aspects of our lives. Materials Science and Engineering has become a key discipline in the 8_____ global economy and is recognised as one of the technical disciplines. Due to the achievements in materials science we are 9_____ to develop new products and technologies that will make our lives safer, more convenient, more enjoyable and that will allow us to 10_____ the challenges of the future.

1. a. part in	b. advantage	c. for granted
2. a. comprise	b. contribute to	c. cover
3. a. derived	b. shaped	c. split
4. a. concrete	b. composites	c. superconductors
5. a. evolving	b. occurring	c. involving
6. a. acceleration	b. role	c. performance
7. a. cover	b. acquire	c. join
8. a. general	b. competitive	c. comparable
9. a. current	b. certain	c. unlike
10. a. solve	b. avoid	c. meet

Grammar.

Decide which answer a, b or c best fits into each gap.

1. If a material that becomes superconducting at much higher temperatures was found that _____ almost certainly _____ things along.

a. will…push b. would… push c. had… pushed

2. If mercury wire _____ to absolute zero, it loses resistivity.

a. was cooled b. is cooled c.will be cooled

3. If we apply a strong magnetic field to a superconducting material, it _____ to the normal state.

a. returned b. will be returned c. would be returned

4. If superconductivity occurred at room temperatures, we _____ losses in transporting energy.

a. could reduce b. could have reduced c. can reduce

5. Unless the theory of superconductivity _____ , we wouldn't have been able to understand the behavior of superconducting materials.

a. hadn't been created b. was created c. had been created

6. Unless lasers _____ nobody would have believed that science fiction could become science fact.

a. had been predicted b. hadn't been predicted c. were predicted

7. If new superconducting materials _____ , superconductivity wouldn't have become so important.

a. had been discovered b. hadn't been discovered c. weren't discovered

8. If driverless cars became commonplace, it _____ fundamentally _____ car use and traffic accidents would be prevented.

a. will change b. can change c. would change

9. Provided robots _____ emotions, they could become our perfect companions.

a. 'd understood and felt b. would understand and feel c. understood and felt

10. If Ford had not created an affordable car, they _____ mass produced.

a. wouldn't be b. wouldn't have been c. would have been

MODULE 12

FUTURE TECHNOLOGIES

"Anyone who has never made a mistake has never tried anything new."

Albert Einstein

Learning points for Module 12:

Reading:

Text 12A. Visions of the Future

Text12 B. What's the Big Idea?

Text 12C. The Future of the Computer Technology

Vocabulary in context: Word definitions. Collocations. Word quiz

Grammar: Unreal Uses of Past Forms. Revision: Infinitives and -ing forms of verbs

Listening: The Five Technologies That Would Change the World

Speaking: What Predictions Will Come True

Skills: The importance of being an autonomous learner

Learning aims:

- to practise reading and speaking about future technologies
- to learn and practise the words related to the topic of the module
- to revise and consolidate grammar studied in Modules 7-11
- to learn about how to become an autonomous learner

Lead in

1. Match two parts of quotes by famous people about the future. Choose two which you strongly agree with and explain why.

1.The best way to predict the future …	… who prepare for it today.
2.The future belongs to those …	The future is something to build.
3.The future is not something we enter.	… you cannot have one.
4. If you don't think about the future,	… is to invent it.
5.The future is not something to predict.	… in the beauty of their dreams.
6.The future belongs to those who believe …	The future is something we create

2. In groups discuss some predictions about the future. Which of them are really important for you? Choose 3 of them which you think are the most/least likely to happen. Compare your ideas with other groups and explain your opinion.

Craziest Predictions About the Future Experts Say Are Going to Happen

1. You'll communicate with dead relatives via virtual reality.
2. Your kitchen will restock itself.
3. You'll check email with your contact lenses.
4. We'll be communicating with thoughts.
5. We'll have dinosaur zoos with real woolly mammoths.
6. Artificial intelligence will replace artists.
7. Pills will be able to detect cancer.
8. Human beings will create "transhumans", "improved versions" of themselves that will eventually pose a threat to non-enhanced humans.
9. Driving by yourself will be passé (past) —and considered unsafe, automated cars will start to become something most people take for granted.
10. Nanobots in your bloodstream will protect you from getting sick.
11. You'll be able to smell your favorite TV shows.
12. Thanks to dangers like climate change, epidemics, population growth and even direct hits by asteroid, we'll need to find a way to leave Earth.

READING
Part 1

3. Find out the meaning of the words from Text 12 A by matching them with their definitions. Translate them into Russian. Use a dictionary if necessary.

A.

1. unpredictable	a. famous for something bad
2. notoriously	b. a belief or idea
3. spectacularly	c. changing the way things are done
4. notion	d. impossible to be predicted
5. meaningful	e. in a way that attracts attention
6. disruptive	f. to say something is true
7. to claim	g. useful, serious, or important

B.

1. to resort to	a. a mental image of something
2. vision	b. more than or not limited to something
3. tempting	c. easy to recognise because of being met before
4. beyond smth.	d. to do or use something (especially because no other choices are possible)
5. reassuring	e. to state something officially and publicly
6. familiar	f. attractive, fascinating, provoking
7. to declair	g. encouraging or soothing

C.

1. previous	a. to move *into* some place or thing
2. to head into	b. a large amount or number of something
3. to manage to do smth.	c. without any doubt, certainly
4. the flood (of smth.)	d. happening or existing before
5. cheap	e. to succeed in doing something
6. definitely	f. to make something known
7. to reveal	g. costing little money

4. Read text 12A and decide if sentences 1-8 below are True or False.

1. Lots of predictions about the future turned out to be completely wrong.
2. Thinking about the future makes our lives more meaningful.
3. Predicting the future is a waste of time.
4.Visions of the future may inspire useful discoveries.
5. The world in 2040 will be completely different, with food pills, flying cars and bases on the moon.
6. The world in 2040 will be like it is today.
7. The technology of the future will certainly get smaller, smarter and cheaper.
8. There are lots of ideas of what our life will be like, none of which is true.

Text 12 A

Visions of the Future

(1) What do we know about the future? Nothing. The future is … unpredictable.
Predicting the future is notoriously risky, especially if you claim to be an expert and then get it spectacularly wrong. In 1883 Lord Kelvin, president of Britain's Royal Society, declared that X-rays will prove to be a hoax[1]. Arthur Summerfield, the US Postmaster General in 1959, predicted that mail would be delivered within hours from New York to Australia by guided missiles[2]. And we should be glad that Alex Lewyt's 1955 notion of 'nuclear-powered vacuum cleaners' never made it to the drawing board[3].
(2) But even if we cannot predict the future, we need to think about the future. On a personal level thinking about the future, a process known as prospection, can make our lives more meaningful. On the level of humanity, it is one of the drivers of our development. Lots of inventions had been imagined before they were actually made. Today futurologists, scientists, engineers are trying to create visions of the future, visions which reveal disruptive ideas, which are inspiring, which can change the world.

(3) So, what our life might be like in the future? What does the future hold for the food we eat, the technology we use and the homes we live in? It would be tempting to resort to the clichés – food pills, flying cars and bases on the moon … but the reality will probably be less exciting. Some elements of our world will change beyond recognition while others will stay reassuringly (or disappointingly) familiar. Some innovations we might not notice, while others will change our lives forever.

(4) The world in 2040 will probably be much like it is today, but smarter and more automatic. Some futurologists say that we're heading into a future where improved battery technology will likely enable better electric cars, personal flying machines, Hyperloop transportation systems*, private space tourism and drone delivery services. We'll probably wear Band-Aid style fitness sensors on our skin, charge our devices using wireless power, let algorithms optimise and guard our homes, and have the next generation virtual assistants to help us manage the flood of data and make sense of it.
(5) Some of this might happen. Or none of it. Three things, however, are certain: technology will get smaller, smarter and cheaper. In fact, it will most likely get so small, smart and cheap that we'll be able to put computers and sensors into almost anything – bins[4] will tell the council[5] when they're full, 4K televisions will notice when we've stopped watching and turn themselves off to save power. We're on the road to the Internet of things where everything is connected, not only to the Internet but also to one another. Those are just a few ideas. But whatever happens next, it will definitely be a great time to be alive.

**Hyperloop transportation system is an ultra-high-speed ground transportation system proposed as a concept by Elon Musk. It consists of partially evacuated tubes and passenger or cargo pods moving at very high speeds.*

Vocabulary notes for text 12 A

[1]hoax – ложь, обман
[2]guided missiles – управляемые ракеты
[3]made it to the drawing board – дошли до стадии разработки
[4]bins – мусорные баки
[5]council – городской совет

5. Choose the best way to finish the sentences using the information from text 12A. In two cases more than one option is possible.

1. Predicting the future is _____ .
a. wrong b. makes no sense c. risky
2. The author claims that the future is _____ .
a. impossible to predict b. risky c. spectacular
3. We need to think about the future because _____ .
a. it makes our life meaningful b. it inspires innovations c. otherwise we won't survive
4. The future will probably be _____ than we think.
a. more exciting b. less exciting c. more disappointing
5. Some innovations _____ .
a. will change our lives b. will not be noticed c. will not be useful
6. The world in 2040 will be _____ .
a. better b. saferc. smarter
7. Improved battery technology will _____ .
a. guard our homes b. enable better electric cars c. manage data
8. It is certain that technology will get _____ .
a. more common b. smaller and smarter c. cheaper and safer

6. In mini groups comment the points from text 12A and say whether you agree or disagree with these points. Explain your opinion and think of your own examples to illustrate your opinion.

- Predicting the future is notoriously risky, especially if you claim to be an expert and then get it spectacularly wrong.
- Some elements of our world will change beyond recognition while others will stay reassuringly (or disappointingly) familiar.
- Three things, however, are certain: technology will get smaller, smarter and cheaper.

7. Work in pairs.

Student A: Find 2-3 examples of predictions that turned out to be wrong and tell student B about them.
Student B: Find 2-3 examples of predictions that turned out to be true and tell student B about them.

8. Students A strongly believe that life in 100 years will be better than life today; Students B strongly believe in the opposite. Change partners again and talk about your ideas.

READING
Part 2

9. Choose 3-5 questions from the list below and discuss them in groups. Summarise your answers and report the results in class.

1. Why is it important to invent new things?
2. How do you learn about new inventions?
3. What are the 3 greatest inventions of all time?
4. Which invention is more important, electricity or the Internet?

5. Which modern inventions you wouldn't be able to live without?
6. Who are your favourite inventors? Why?
7. What characteristics do inventors have?
8. Have you ever invented anything yourself?
9. Would you like to be an inventor?
10. Which important things might be invented in the future?

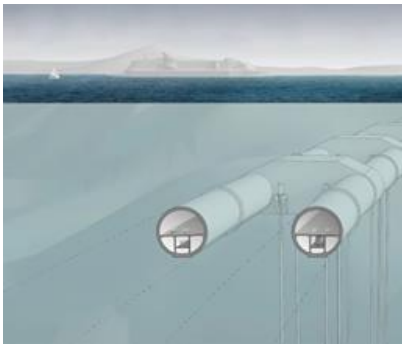
10. Look at these words from the article. Try to explain their meaning or translate them into Russian. Use a dictionary if necessary.

To mount, to keep stable, curved, an integral part, to account for, to require, entirely, capable of doing something, to reproduce, give off, to prove promising, to repair damage.

11. Now read text 12 B and fill in the gaps with the words from the previous exercise in the right form.

Text 12 B

What's the Big Idea?


(1) With the active development of robotics, we are increasingly seeing the emergence of more user friendly home robots. Whether it will be something like the ASIMO robot from Honda designed to help and communicate with people, or we are talking about machines that will replace people in some work positions (for example, waiters, reception workers), one thing is clear: the development of robotics will not stop. Relatively soon, in addition to televisions, computers, washing machines and microwaves, a small army of robot personal assistants will become an 1_____ _____ of almost every home on the planet.

(2) Developers at Samsung are trying to one-up[1] Google Glass, the technology that delivers the Internet via a pair of eyeglasses, by creating contact lenses 2_____ of displaying the same electronic information. Engineers have 3_____ a light-emitting diode on an off-the-shelf[2] soft contact lens, using a material the researchers developed: a transparent, highly conductive, and stretchy mix of graphene and silver nanowires. In addition to displaying the Internet, and a host[3] of accompanying applications, electronic contact lenses could 4_____ even more _____ in the medical field. Such lenses are currently being developed in order to filter light to compensate for vision problems. And while current efforts are limited to displaying one pixel on a given lens, it is a necessary first step toward making more complex versions in the future.

(3) The Norwegian coast may be beautiful but with more than a thousand fjords[4] cutting into it, getting from one place to another often 5_____lengthy[5] journeys. Norway has an ambitious plan to solve the problem by building the world's first floating submerged tunnel system about 30 meters (100ft) underwater. The first-of-its kind structure will be made up of two 1,200 meter (4,000ft) curved concrete tubes, floating up to 30 meters (100ft) below the surface. The tubes will be supported by pontoons on the surface and 6_____ stable with connecting trusses[6]. For extra stability, the construction might be bolted to the bedrock as well. On the surface, there would be wide gaps between the pontoons to allow ferries to pass through. Having this connection means that people there do not have to wait for a helicopter to go to the hospital.

(4) Scientists say that a new kind of robot can 7_____, *i. e.* create 'baby' robots. This is an example of science fiction becoming science fact. The scientists created the world's first "living" robots from the stem cells[7] of an African frog. Its scientific name – "xenopus laevis" – gave the xenobot its name. The xenobots are less than a millimetre wide. They can move, work together in groups and self-heal[8]. Although they are not what we imagine robots to be, scientists say they are technically robots. They are a machine-animal hybrid. The scientists say xenobots are "an 8_____ new life-form". The xenobots are very early technology. However, they could change science, medicine, technology and the way we live. They could carry out tasks inside our body to 9_____ _____ to organs. They could also help the environment by attacking micro-plastics in our oceans, or by cleaning up oil spills[9]. Despite the possible benefits, some people are worried about robots that can reproduce.

(5) Roads of the future could be lit by glowing[10] trees instead of streetlamps, thanks to a breakthrough in creating bioluminescent plants. Experts injected specialised nanoparticles into the leaves of a watercress plant[11], which caused it to 10_____ ___ a dim[12] light for nearly four hours. To create their glowing plants, engineers turned to an enzyme called "luciferase". Luciferases make up a class of oxidative enzymes found in several species that enable them to be bioluminescent, or emit light. For example, fireflies[13] are able to emit light via a chemical reaction with the luciferase enzyme. The reaction is highly efficient, meaning nearly all the energy put into the reaction is rapidly converted to light. Researchers believe with further tweaking[14], the technology could also be used to provide lights bright enough to illuminate a workspace or even an entire street, as well as low-intensity indoor lighting. Lighting 11_____ ____ around 20 per cent of worldwide energy consumption, so using bioluminescent plants for lighting will represent a significant cut to CO_2 emissions.

Vocabulary notes for text 12B

[1]to one-up - превзойти
[2]off-the-shelf - готовые
[3] a host of - множество
[4] fjords - фьорды
[5] lengthy - длительный
[6] truss - связка, балка
[7] stem cell - стволовая клетка
[8] self-heal - самовосстанавливаться
[9] oil spill– нефтяное пятно
[10] glowing - ярко светящийся
[11] watercress plant – растение кресс водяной
[12] dim - тусклый; неяркий (о свете)
[13] fireflies - жук-светляк

[14] tweaking – зд. доработка

12. Read text 12B in depth and answer the questions below choosing the best option according to the information given in the text. Compare your answers in pairs or groups.

1. What is certain regarding robots?
    a. their development will not stop
    b. unmanned robots are already taking over the world
    c. they will replace people
2. What types of robots will become an integral part of almost every home?
    a. ASIMO robots
    b. robots that will replace waiters and reception staff
    c. robot personal assistants
3. What features will the contact lenses currently under development by Samsung scientists offer?
    a. delivering the Internet
    b. monitoring health condition
    c. replacing Google Glass
4. Where else could electronic contact lenses prove to be more beneficial?
    a. displaying the Internet
    b. being used in a variety of applications
    c. in the medical field
5. What will set apart the Norwegian transport tunnel?
    a. it will be the world's first floating underwater tunnel system
    b. it will be the deepest
    c. it will use a helicopter
6. What won't xenorobots be able to do?
    a. to repair damage to our organs
    b. to help the environment
    c. to replace humans
7. What are some people worried about?
    a. robots being a new life-form
    b. robots being able to reproduce
    c. using robots for attacking micro-plastics in the oceans
8. What roads of the future could be lit by?
    a. streetlamps
    b. fireflies
    c. bioluminescent plants
9. What did specialised nanoparticles injected into the leaves of a plant cause it to do?
    a. to emit light
    b. to replace electricity
    c. to repair damage
10. What do researchers believe the bioluminescent plants will not be able to do?
    a. to illuminate workplace
    b. to provide indoor lighting
    c. to provide indoor heating

13. In pairs discuss the following questions. Add two or three more questions to this list. Take notes. Summarise your partner`s answers.

1. What trends in the development of robotics are we seeing?
2. What robots will become an integral part of almost every home?
3. What will new contact lenses be capable of?
4. What materials are used by the engineers who are working on these contact lenses?
5. What other applications apart from displaying the Internet do electronic contact lenses promise?
6. Do you think electronic contact lenses will be a useful technology?
7. How does the Norwegian government plan to solve the problem of lengthy journeys?
8. What will xenobots be able to do and what makes the technology revolutionary?
9. Where does the name "xenobot" come from?
10. What could xenobots help us with in the future?
11. What are some people worried about?
12. What do you think about the possibility of developing robots that can reproduce?
13. What could roads of the future be lit by?
14. What technology did engineers use to create their glowing plants?
15. What do researchers believe the technology could be used for in the future?
16. How might replacing conventional lighting with bioluminescent plants benefit people?

READING
Part 3

14. Before reading discuss the following questions. Summarise your ideas.

What role have computer technologies been playing over the last 30 years?
Do computers have a promising future? What ideas of how computers will be developing have you read or heard about? What do you think computers of the future will be like?

15. Scan the text and find out how the author answers the questions you discussed in the previous task. Compare your ideas with the ideas of the text.

16. Read the text noticing the words in italics and try to figure out their meaning from the context or look them up in a dictionary. Circle any other words you do not understand and find out their definitions or Russian equivalents using a dictionary.

Text 12 C
The Future of Computer Technology

In the past twenty years there has been a dramatic increase in the processing speed[1] of computers, network *capacity* and the speed of the internet. The advances have *paved the way* for the revolution in such fields as quantum physics, artificial intelligence, and nanotechnology. These advances will have a *profound* effect on the way we live and work.

Nanocomputers. Scientists are trying to use nanotechnology to make very tiny chips, electrical conductors and logic gates[2]. Using nanotechnology chips can be built up one atom at a time and hence there would be no waste of space which will enable much smaller devices to be built. Logic gates will be *composed of* just a few atoms and electrical conductors (nanowires) will be merely an

atom thick. A data bit will be represented by the presence or absence of an electron. Nanocomputing will give rise to four types of nanocomputers: electronic, chemical and biochemical, mechanical and quantum nanocomputers. For example, electronic nanocomputers are created through microscopic circuits using nanolithography[3], while mechanical nanocomputers use tiny mobile components, called nanogears[4], *to encode* information. Some scientists predict that such mechanical nanocomputers will be used to control nanorobots which will serve as antibodies that can be programmed. They will help protect humans against pathogenic bacteria and viruses that keep mutating rendering many remedies[5] ineffective against new strains[6]. So, nanorobots are predicted to be part of the future human medicine.

Quantum Computers. Another example of what computers will be like in the future is a quantum computer. Quantum computer uses quantum mechanical phenomena, such as entanglement and superposition[7], to process data. Quantum computation aims to use the quantum properties of particles to represent and structure data. Quantum mechanics is used to understand how to perform operations with this data. The quantum mechanical properties of atoms or nuclei[8] allow these particles to work together as quantum bits, or qubits. These qubits work together to form the computer's processor and memory. Qubits can interact with each other while being isolated from the *externa*l environment. This enables them to perform certain calculations much faster than conventional computers.

By computing many different numbers *simultaneously* and then interfering[9] the results to get a single answer, a quantum computer can perform a large number of operations in parallel and ends up being much more powerful than a digital computer of the same size.

In the tiny spaces inside atoms the ordinary rules of reality no longer hold. Defying all common sense, a single particle can be in two places at the same time. And so, while a switch in a conventional computer can be either on or off, representing 1 or 0, a quantum switch can paradoxically be in both states at the same time, saying 1 and 0 … Therein lies the source of the power. *Whereas* three ordinary switches could *store* any one of eight patterns, three quantum switches could hold all eight at once, taking a shortcut through time.

Quantum computers could prove to be useful for running simulations of quantum mechanics. This would benefit the fields of physics, chemistry, materials science, nanotechnology, biology, and medicine because currently advancement in these fields is limited by the slow speed of quantum mechanical simulations.

Quantum computing is ideal for tasks such as cryptography, modelling and indexing very large databases. Quantum computing research is supported to develop quantum computers for civilian and national security purposes, such as cryptanalysis.

So, what does the future of computer technology look like? Through nanotechnology computing devices are becoming progressively smaller and more powerful. Everyday devices with embedded technology and *connectivity* are becoming a reality. Nanotechnology has led to the creation of increasingly smaller and faster computers that can be embedded into small devices. The idea of pervasive computing aims to integrate software and hardware into all man made and some natural products. It is predicted that items such as clothing, tools, appliances, cars, homes, and even the human body will be embedded with chips that will connect them to an infinite network of other devices.

In the future network technologies will be combined with wireless computing, voice recognition, internet capability, and artificial intelligence with an aim to create an environment where the connectivity of devices is embedded in such a way that it is not inconvenient or visible and is always

available. In this way computer technology will saturate[10] almost every facet[11] of our life. What seems like virtual reality at the moment will become the human reality in the future of computer technology.

(Source: http: // www. geeks. com / techtips)

Vocabulary notes for text 12C

[1]processing speed – скорость обработки
[2]logic gates – логические элементы
[3]nanolithography - нанолитография
[4]nanogears - наноустройства
[5]remedies – средства защиты
[6]strains - штаммы
[7]entanglement and superposition – запутанность и суперпозиция
[8]nuclei – ядра атомов
[9]interfere –интерферировать (взаимодействовать)
[10]saturate - насытить
[11]facet – грань

17. Choose the right answer. For some sentences more than one option may be correct.

1. Two examples given by the author of the text of what computers of the future will be like are _____ .

a. quantum and embedded b. quantum and nanocomputers c. quantum and biocomputers

2. Nanotechnology has led to the creation of _____ .

a. smaller and faster computers b. embedded computers c. both

3. A quantum computer will be much more powerful than a digital computer of the same size because _____ .

a. it will be based on a completely different method of storing information and decision-making

b. it will be able to perform a large number of operations in parallel

c. both

4. Quantum computing is ideal for tasks such as _____ .

a. controlling nanorobots b. protect humans against viruses c. cryptography, modelling and indexing very large databases

5. The idea of pervasive computing means that _____.

a. software and hardware will be integrated into all man made and some natural products

b. every family will have two or more personal computers

c. computer technology will saturate every facet of our life.

18. Fact or Opinion?

1. In the past twenty years there has been a dramatic increase in the processing speed of computers.
2. Nanorobots will be part of the future human medicine.
3. A quantum computer uses quantum mechanical phenomena, such as entanglement and superposition, to process data.
4. A quantum computer can perform a large number of operations in parallel and ends up being much more powerful than a digital computer of the same size.
5. Currently advancement in such fields as physics, chemistry, materials science, biology, and medicine is limited by the slow speed of quantum mechanical simulations.
6. Quantum computing is ideal for such tasks as cryptography, modelling and indexing very large databases.
7. Almost any items such as clothing, tools, appliances, cars homes, and even the human body will be embedded with chips that will connect them to an infinite network of other devices.
8. One of the greatest achievements will be that what seems like virtual reality at the moment will become the human reality in the future of computer technology.

19. Answer the questions below. Think of 2-3 questions to ask your group mates about the future of computers.

1. Did you like the article? Why?/Why not? 2. What do you think about nanocomputers? How useful will they be? 3. Do you agree that quantum computers are a great technology that will be a real breakthrough in computing? Why? 4. Do you agree with the author's opinion that computer technology will 'saturate almost every facet of our life'? 5. Would you like to live at the time when 'virtual reality will become the human reality in the future of computer technology'. Why?/Why not?

20. Listen to what a futurologist says about technologies of the future and tick the ones he talks about.

https://www.youtube.com/watch?v=LjrkcgGNL6w&t=3s

- Hyperloop transport systems
- Quantum computing
- Artificial Intelligence
- Nanotechnology
- Gene editing
- Advanced materials
- Space travel
- Human computer interfaces
- 3D printing
- Extended Reality
- Controlled thermonuclear fusion

List of useful words.

1. outcomes – результаты
2. fraudulent – поддельный, мошеннический
3. displacement - вытеснение
4. viable - жизнеспособный
5. alter - изменять
6. inherit - наследовать
7. banned - запрещенный
8. wearable devices – носимые устройства
9. fitness tracker band – фитнес браслет
10. insights – идеи, взгляды
11. to merge - сливаться
12. divide between - разделение
13. to encompass – включать, охватывать
14. augmented reality – дополненная реальность
15. immersive digital experience – опыт погружения
16. spare parts – запасные части
17. obstacle - препятствие
18. counterfeiters - фальшивомонетчики
19. intellectual property – интеллектуальная собственность
20. fake license goods – поддельные товары

21. Listen again and answer the following questions.

1. What is Artificial Intelligence?
2. What will gene editing make possible?
3. What do you think about the idea that 'humans and machines will eventually merge to create truly augmented humans'?
4. What do you think about the possibility of going to Mars? What technology could allow you to meet friends on Mars?
5. What examples does the speaker give of the things that can be in 3D?

Which of the technologies the speaker mentions are the most promising, in your opinion? Can you add 2-3 more technologies to this list? Explain your choice.

22. Now listen to the first part of his talk and fill in the gaps with the words in italics.

Facet, avoid, foundation, recognition, impact, capable, outcomes, self-driving, machine learning, security checks, unless, particularly, virtual, enhance, empathy.

Artificial Intelligence

Artificial intelligence, or AI, and **1.**_____ _____ refer to the ability of machines to learn and act intelligently, meaning they can make decisions, carry out tasks, and even predict future **2.**_____ based on what they learn from data.
AI and machine learning already play a bigger role in everyday life than you might imagine. Alexa, Siri, Amazon's product recommendations, Netflix's and Spotify's personalised recommendations, every Google search you make, **3**._____ _____ for fraudulent credit card purchases, dating apps, fitness trackers... All are driven by AI.
AI is going to revolutionise almost every **4.**_____ of modern life. Stephen Hawking said, "Success in creating AI would be the biggest event in human history." And Hawking immediately followed that up with, "Unfortunately, it might also be the last, **5.**_____ we learn how to **6.**_____ the risks."
There are potentially huge risks for society and human life as we know it, **7.**_____ when you consider some countries are racing to develop AI-enabled autonomous weapons. AI and machine learning are the **8**._____ on which many other technologies are built. For instance, without AI, we wouldn't have achieved the amazing advances in the Internet of Things, **9.**_____ reality, chatbots, facial **10.**_____, robotics, automation, or **11**._____- _____ cars, just to name a few.
AI is also going to transform human jobs. AI-enabled automation will have a particularly significant **12.**_____ and may lead to the displacement of many jobs. But rather than subscribing to a vision of a dystopian future where all human jobs are given over to robots, I believe AI will make our working lives better. AI will **13.**_____ the work of humans, and new jobs will arise to replace displaced jobs.
What's more, as machines become more intelligent and **14.**_____ of carrying out more human tasks, I believe that our uniquely human capabilities, things like creativity, **15.**_____, and critical thinking, will become all the more precious and valuable in the workplaces of the future.

23. Listen to the same text again and answer the questions.

1. What do we mean by the term Artificial Intelligence?
2. What examples of using AI and machine learning in everyday life does the speaker give?
3. How does the speaker define the role of AI in the future? What reasons does he give?
4. What potential risks of developing AI does he mention?
5. What is the speaker's opinion on the role AI in our lives, positive or negative?

24. Fact or Opinion?

1. AI is the ability of machines to learn and act intelligently.
2. AI is playing a big role in everyday life.
3. AI is going to revolutionise modern life.
4. The impact of AI on our life is more negative than positive.
5. The development of AI will bring huge risks for society and human life.
6. AI has helped us achieve impressive progress in many technologies that wouldn't have been possible without it.
7. AI and machine learning are the foundation on which many other technologies are built.
8. Human capabilities like creativity, empathy, and critical thinking will become even more valuable and esteemed in the workplaces of the future.

25. Choose one of the technologies from listening and prepare to tell your group about it in more detail using the information provided by the speaker. Add your own opinion or comment.

VOCABULARY

Module 12 Word List

Text 12A	**Text 12B**
beyond (prep) recognition (n)	account (v) for
cheap (adj)	capable (adj) of doing
claim (v)	curved (adj)
declare (v)	entirely (adv)
definitely (adv)	give off (phr. v)
disruptive (adj)	an integral (adj) part (n)
familiar (adj)	keep (v) stable (adj)
the flood (n) of	mount (v)
head (v) into	prove (v) promising (adj)
make (v) sense (n) of	repair (v) damage (n)
meaningful (adj)	reproduce (v)
notion (n)	require (v)
notorious (adj)/notoriously (adv)	**Text 12 C**
predict (v)	be composed (v) of
previous (adj)	capacity (n)
reassuring(ly) (adj, adv)	connectivity (n)

resort to (v) reveal (v) spectacular (adj)/ spectacularly (adv) tempting (adj)	encode (v) internal/external (adj) pave (v) the way (n) profound (adj) simultaneously (adv) store (v) whereas (conj)

26. Guess the word from Text 12A vocabulary list using its definition. Translate the given examples into Russian. Practise giving the definitions and/or example sentences with these words.

Example: A verb which means *to provide or to bring and hand over*. e. g. ~ a letter or a parcel. → *to deliver*: to deliver a letter or a parcel.

A.

1. An adjective which means *famous for something bad*
   In the past London was ___for its smogs.
2. A noun meaning *a belief or idea*
   Children have different ___about the roles of their parents.
3. An adjective which is a synonym of *innovative or groundbreaking*
   a ___technology
4. An adjective which describes something *happening or existing before*
   the ___evening = last evening
5. A noun which means *a large amount or number of something*
   A ___of cheap imports has come into the country.
6. A verb meaning *to do or use something because it is the only thing available*
   ___to an armed conflict
7. A verb meaning *to make something (previously unknown) known to others*
   ___a secret
8. A verb which means *to say what will happen in the future*
   It is too early ___the results.
9. An adverb which means *in an impressive, dramatic, or eye-catching way*
   The skyscraper is ___lit up at night.
10. A verb which means *to move into some place*
    The students were ___into the laboratory to get ready for the experiment.

B.

11. We can use this phrase to say that a person or thing *has changed so much that you can no longer recognise them*
    a. The renovations changed the house ~.
12. A verb meaning *to say that something is true, typically without providing any proof*
    a. The criminal ___that he is innocent.
13. An adjective which describes something that is *serious, important, or useful in some way*
    a. a ___dialogue or look
14. We use this adjective to describe something that you *recognise or know well*

a. His voice sounded ~. I had heard it before.

15. An adverb meaning *without any doubt*
    a. He has ___decided to go on the cruise next year.
16. A verb which means *to announce something clearly, firmly publicly*
    a. They ___themselves to be bankrupt.
17. We use this adjective to describe *something that you want to do or have*
    a. This cake looks ___.
18. If you find something (e.g. someone's words) ___, it makes you feel *less worried*
    a. It was ___to hear his familiar voice.
19. When you ___of something, it means that you *succeed in understanding* it
    a. Everything he says ___to me. He is so clever!
20. If something is ___you can buy it at a *low price*
    a. This company provides ___Internet access, so it has a lot of clients.

27. Read the sentences and choose the right option. Explain your choice and translate the sentences into Russian.

A. 1. He **claims/confesses** that so many new and **disruptive/destructive** technologies have emerged over the last few years that they have the potential to truly reshape the world. 2. The test did not produce any **meaningful/meaningless** results. 3. He has always lived **besides/beyond** his means and we don't have the slightest **vision/notion** of what he does for a living. 4. At night lots of public buildings in Moscow are **notoriously/spectacularly** lit. 5. Vitamin E is **notoriously/ spectacularly** hard to get from food. 6. The house in the picture looked **familiar/tempting** but she couldn't remember why. 7. It is **familiar/tempting** to idealise the past. 8. I can't **manage/make sense of** that picture. 9. Children and elderly are entitled to **cheap/expensive** train tickets.

B. 10. The authorities **declared/delivered** the state of emergency during the Cumbre Vieja volcanic eruption on La Palma. 11. In spite of numerous **predictions/notions** about the future, we don't know for sure what life in the future will be like. 12. One of the **previous/familiar** predictions that came true was that some day people would be walking around with phones in their pockets. 13. Some findings of the study **reveal/resort to** rising sea levels. 14. The military resolved to **reveal/resort to** violence to recover the lost territory. 15. We received a **flood/flow** of phone calls after the information about our services was published in the local paper. 16. After a long argument we decided to **head into/resort to** town and do the shopping. 17. The operation was over and the doctor gave me some **familiar/reassuring** news. 18. Their attitude has **reassuringly/definitely** changed for the better since he explained his position.

28. Find the following words or phrases in text 12B. In pairs practise giving their definitions and use these words in your own examples.

§1 - 1. to an ever greater degree; 2. planned for a specific purpose; 3. belonging as a part of the whole; **§2 –** 4. having an ability to do something; 5. to attach to something for use or as equipment; 6. to be successful in the future; 7. an adjective which describes something involving a lot of different parts; **§3 –** 8. to need something; 9. having the form of a curve (not straight); 10. ensure that they are firmly fixed; **§4 -** 11. to produce a copy; 12. completely; 13. to put into good order; 14. advantages; **§5 –** 15. to emit; 16. to make up a particular amount or part of something.

29. Match the words with numbers with the words with letters to make up word collocations. Explain the meaning of these expressions and use them in examples of your own.

Example: to make life meaningful means *to try to develop a sense of meaning in life*. Psychologists believe that if you <u>make your life meaningful,</u> you'll be happy.

A.	
~~1. to make life~~	a. visions (of the future)
2. to reveal	b. the clichés
3. to create	c. familiar
4. disruptive	d. the truth
5. to resort to	e. ideas
6. reassuringly	f. occasions
7. on previous	g. recognition
8. beyond	h. ~~meaningful~~
B.	
9. virtual	a. of data
10. manage the flood	b. the future
11. to make	c. assistants
12. to pave	d. part
13. an integral	e. damage
14. to prove	f. sense of something
15. to repair	g. the way
16. to predict	h. promising

30. Replace the words in bold with their synonyms using the words from Exercise 29. Translate the sentences into Russian.

Example: Modern robots can **be taught** to use information from previous activities for future decisions. → Modern robots can **be instructed** to use information from previous activities for future decisions.

1. Futurology is a social science that studies current trends and **forecasts the future**. 2. Unrecorded knowledge is either forgotten or disorganised **unrecognisably.** 3. Listening is **an essential component** of the entrance exam. 4. After his renting the flat, we had to spend lots of money **to restore it.** 5. Sometimes **using** a cliché can help us explain important concepts and make our speech more impressive. 6. Unlike on the **earlier** occasion, the delegation didn't comprise a single person who could speak Chinese. 7. As the volume of information is growing, it is important for everyone to learn how to manage the **flow of** data. 8. Recycling things **is reasonable** for multiple reasons. 9. Scientists believe that data from the probe will **make it easier** to explore Mars in more detail. 10. The commercial future of this company looks **bright**. 11. One of the best ways to make your life **purposeful** is through setting and working towards life goals. 12. She says that when she finally chose **to be honest,** she experienced increased support from her colleagues. 13. People using smartphones instead of laptops and desktops for tasks like web browsing and streaming, is another example of a **revolutionary** innovation. 14. Futurologists imagine a future by constructing

a **recognisable reality which makes us feel less worried** rather than fabricating an entirely novel fictional universe.

31. Complete the sentences with the correct form of the word in capitals at the end of each sentence.

1. The _____ that the world would end in 2000 turned out completely wrong. PREDICT 2. It is _____ difficult to say anything new about the nature of politics. NOTORIOUS 3. If you _____ further explanation, you should ask your tutor. REQUIREMENT 4. _____ information concerning environmental issues is difficult to obtain. MEANING 5. The traditional ways of selling in a number of areas have recently been _____ by switching to the Internet. DISRUPTIVE 6. In my letter I thanked him for his kind comments about my performance which were very _____. REASSURE 7. If you _____ someone, you offer them something they want in order to encourage them to do what you want. TEMPTING 8. The commercial future of the company looks very _____ . PROMISE 9. When he returned to his home town after the war, he found that it had changed beyond _____. RECOGNISE 10. A _____ is a strange and interesting sight or performance. SPECTACULAR

32. Look at the words below. Try to recall how they were used in text 12C by filling the gaps in the sentences below. Translate the sentences into Russian.

External, simultaneously, pave the way, profound, whereas, capacity,

store, be composed of, connectivity, encode.

1. In the past twenty years there has been a dramatic increase in the processing speed of computers, network _____ and the speed of the internet. 2. The advances have _____ _____ for the revolution in such fields as quantum physics, artificial intelligence, and nanotechnology. 3. These advances will have a _____ effect on the way we live and work. 4. Using this technology logic gates will be _____ __ just a few atoms and electrical conductors (nanowires) will be merely an atom thick. 5. Mechanical nanocomputers use tiny mobile components, called nanogears, to _____ information. 6. Qubits can interact with each other while being isolated from the _____ environment. 7. By computing many different numbers _____ a quantum computer can perform a large number of operations in parallel. 8. _____ three ordinary switches could _____ any one of eight patterns, three quantum switches could hold all eight at once, taking a shortcut through time. 9. Everyday devices with embedded technology and _____ are becoming a reality.

33. Work in groups. Choose 5-7 words from Module 12 Word list and prepare a short news story to tell your group using these words. Ask your listeners to write down the words while they listen to your story. Compare your lists.

Example: Predicting the future is notoriously risky. Still we cannot stop thinking about the future. To be fair, a lot of fiction imagined what it might be like if human beings were capable of flying to the moon. But *From Earth to the Moon*, an 1865 novel by author Jules Verne, got closer with more of the details than most. And though his claim that a manned projectile would be fired into space by an enormous space gun turned out spectacularly wrong, he imagined the weightlessness that astronauts experienced, something an author in the mid-19th century would have no way of

knowing. Verne also predicted that three astronauts would be on that first moon mission—though his astronauts never actually walked on the moon—and that Tampa, Florida, would be the launch site.

34. Summarise in English using some key words from the vocabulary section.

Новые технологии, такие как биотехнологии, машинное обучение и искусственный интеллект (ИИ), действительно могут предложить новые решения кризисов, которые угрожают нашему перенаселенному миру. С другой стороны, они могут создавать опасности, способные дестабилизировать общество.

Технология, которая предлагается, как потенциально колоссальный прорыв, так и значительный риск, это машинное обучение. Машины могут "обучиться" играть, распознавать лица, переводить с одного языка на другой управлять сетями и др. Интеграция систем искусственного интеллекта в повседневную жизнь может принести большую пользу, но решения, принимаемые машинами, часто сложно понять или объяснить. Также для их работы возрастет необходимость предоставления личной информации, касающейся нашего местонахождения, круга общения, состояния здоровья, финансовых операций. Эти данные могут использоваться в благотворных целях, но также их использование может привести к возрастанию власти технологических компаний и нашей зависимости от них.

Предсказывается, что скоро произойдут радикальные изменения на рынке труда, вызванные ИИ. Машины будут выполнять множество задач, включая работу белых воротничков, начиная от рутинной юридической работы и бухгалтерского учета и заканчивая программированием, медицинской диагностикой и даже хирургией. Многие профессионалы обнаружат, что их с трудом заработанные навыки будут менее востребованы. Напротив, некоторые рабочие места в сфере услуг, такие как сантехник или садовод, требующие нестандартного взаимодействия с внешним миром, возможно, будут одними из самых сложных для автоматизации.

SPEAKING AND DISCUSSION

35. Use the cards below to prepare for a role-play exercise. In your group decide which invention is the most useful/least useful one.

Role A – The Wheel

You think the wheel is the biggest scientific breakthrough. Tell the others three reasons why. Tell them why their breakthroughs aren't as great. Also, tell the others which is the least important of these (and why): water purification, the Internet or electricity.

Role B – Water Purification

You think water purification is the biggest scientific breakthrough. Tell the others three reasons why. Tell them why their breakthroughs aren't as great. Also, tell the others which is the least important of these (and why): the wheel, the Internet or electricity.

Role C – The Internet

You think the Internet is the biggest scientific breakthrough. Tell the others three reasons why. Tell them why their breakthroughs aren't as great. Also, tell the others which is the least important of these (and why): water purification, the wheel or electricity.

Role D – Electricity

You think electricity is the biggest scientific breakthrough. Tell the others three reasons why. Tell

them why their breakthroughs aren't as great. Also, tell the others which is the least important of these (and why): water purification, the Internet or the wheel.

36. Read the text and discuss to what extent you believe the following predictions will come true.

Basically, It Will Be Like This

Ray Kurzweil is the world's foremost futurist, authoring bestsellers like "The Age of Spiritual Machines" and "How to Create a Mind". He's so influential that Google hired him to lead its artificial intelligence efforts. Kurzweil is known for making predictions, which are right about 86% of the time. Here are some of his most promising (and terrifying) visions of the 2020s and beyond.

- By the 2030s, 'nanobots' will plug our brains straight into the cloud.
- Kurzweil thinks that our 'cyborgification' will make us *more*, not less, human. Nanobots and the like won't just increase our logical intelligence, but our emotional intelligence. 'We're going to create deeper levels of expression,' he said.
- Kurzweil says he'll be able to 'bring back' his father Frederick Kurzweil through artificial intelligence. He says that by the 2030s, we'll be able to send nanobots into people's brains to extract memories of loved ones. Augment that with a DNA sampling of the deceased, and it will be possible to create a convincing virtual version of somebody who's passed on. Or so Kurzweil believes.
- Kurzweil says that in 2045, the computational power of artificial intelligence will be a billion times that of human intelligence. And our species will never be the same.
- If your mind is uploaded and virtual reality is fully immersive, then no doubt your body will be virtual, too. "The virtual bodies will be as detailed and convincing as real bodies".

37. What are your predictions for the way we will live in 100 years from now? Complete this table with your partner(s). Change groups and share your ideas.

	Prediction	Good or bad?	Why?
Food			
Smartphones			
Clothes			
Healthcare			
Your home			
Environment			
Your country			
Other			

GRAMMAR

UNREAL USES OF PAST FORMS

Lead-in

38. Read the sentences (1-6) below and decide if the verbs in bold describe situations that are:

a) true

b) imaginary or unreal

1. I wish I **had** more free time.
2. I **had** more time when I studied at school
3. He talks to us as though we **were** children.
4. We used to play in the park when we **were** children.
5. In Rome they **had** a nice accommodation not far from the coast.
6. Suppose I **invited** you to the theatre, would you go?

STUDY NOTE
Sometimes we can use *Past Tense Forms* to describe things which are seen as **unreal or unlikely.**
*If only I **didn't have** to study today!* (I have to study today)
*Suppose he **got** the job.* (he is probably not going to get it)

Wish/ If only/As if/ As though

39. Read and translate the sentences which are examples of using Past Tense Forms to describe unreal or hypothetical situations. Which group of examples describe things

- imagined or unreal in the present,
- imagined or unreal in the past?

A. 1. If only (I wish) she paid more attention. 2. He speaks English as if he were/was a native speaker. 3. He sounds as though he had a cold. 4. I wish the weather was a bit warmer. (but it isn't) 5. I wish I could help you.
B. 6. I wish (if only) I hadn`t agreed to take part. 7. If only (I wish) he had listened. 8. If only (I wish) we had seen him yesterday. 9. You are acting as if nothing had happened. 10. If only (I wish) I hadn't said that.

40. Look at the sentences in Exercise 39. Choose the correct alternative.

1. We use the **Past Simple** tense forms to talk about unreal situations in the
a. present b. past
2. We use the **Past Perfect** tense forms to talk about unreal situations in the
a. present b. past

STUDY NOTE
Unreal Past is the use of Past Tense Forms to talk about hypothetical (imaginary), unreal or improbable situations. We use:
Wish/ if only + ***Past Simple*** to express a wish about the **present**.
Wish/ if only + ***Past Perfect*** to express a wish about the **past**.
We can also use:
Wish/ if only + ***would (could)*** - to express an impossible wish for a future change or annoyance.
I wish it would stop raining.
I wish she would speak Russian.

41. Read the sentences and put the verbs into the correct tense form to describe hypothetical situations. In some sentences use the Passive Voice.

1. I wish I _____ (have) an opportunity to improve my knowledge and skills. 2. I wish I_____ (not take) a course in Programming. I didn't think it was so tiring. 3. He wishes he_____ (have) an interesting job. 4. She wishes she _____ (not start) to prepare for a higher degree. She changed her mind. 5. I think your offer is somewhat limited. I wish I _____ (be offered) a wider range of options. 6. I wish our tasks _____ (assess) once a month. But it wasn't accepted in my institution. 7. They give us so many assignments to complete. I wish they _____ (not do) that. 8. I wish I_____ (know) how to solve this problem, but I'm afraid I have no idea.

42. Now tell your partner about something that

a) you wish was/were different now:
Example: I wish my friend lived closer.
b) you wish could happen in the future:
Example: If only I could speak Italian.
c) you regret about the past;
Example: I wish I hadn't missed the job interview appointment.

It's high/ about time…/What if…/Suppose/Supposing…/I would rather (sooner) + different subject

STUDY NOTE
There are some other expressions with which we can also use Past Tense Forms to refer to **unreal** past, present or future: **It's high/about time…What if…/ suppose/supposing…I would rather/sooner +different subject.**
*It's high/ about time you **started** revising for the exams. (I wish you started…)*
*If only I had **started** revising for the exams earlier! (I'm sorry I haven't started revising for the exams earlier)*
*I would rather/sooner you **started** revising for the exams now. (I want you to start ...)*

43. Put the verbs in brackets into the Past Tense Form to describe hypothetical situations. Explain the meaning or translate the sentences into Russian.

1. It's high time we _____(leave). We are going to miss the train. 2. Supposing you_____ (come across) that job ad, where would you be working now? 3. I'd rather you _____ (study) more. Your exam is coming. 4. I' d rather you _____ (repair) your computer. You wouldn't have asked me to lend you mine. 5. I love your house as if it _____ (be) my own. 6. He talks about Pete as though he _____ (be) his best friend. 7. Suppose she _____ (have) the ability to explain things more clearly, would you trust her with presenting the case?

REVISION
PARTICIPLES. GERUNDS. INFINITIVES

44. Questions for revision.

1. What is a participle? What participle forms are there? How does it function in a sentence?
2. What is a participle clause (or participial phrase)? What does it consist of?

3. What is a gerund? How does it function in a sentence? What forms of gerunds are there? What is gerund phrase?
4. What is an infinitive? How does it function in a sentence? What forms of infinitives are there?

45. For each of the following sentences decide if the word or phrase in bold is a Participle, a Gerund or an Infinitive. Identify their functions or translate the sentences into Russian.

1. The technology that is called 'superhuman condition' is aimed at **countering** artificial intelligence **becoming** powerful enough **to destroy** the human race. 2. Scientists may soon be able **to interpret** what someone is saying simply by **analysing** their brainwaves as they speak. 3. Scientists say that that the algorithms that translate the brain activity into sentences on a screen have 97% translation accuracy rate but that they are working hard **to improve** on this. 4. The scientists say they are at the early stages of **being able** to machine-translate everything someone says. 5. The software **used** in their experiments matched features of speech that were repeated frequently to parts and shapes of the mouth. 6. Scientists say they have greatly advanced the possibility of being able **to reproduce** the body's organs via the use of 3D printing. Replacement organs could be created **using** a new technique for **bio-printing** organic tissue. 7. According to the opinion of the inventor of the World Wide Web if we give up on **building** a better Web now, then the Web will not have failed us. We will have failed the Web. 8. Governments must pass laws **to keep** people safe. 9. One of the concerns is how social media is used **to spread** misinformation. 10. A satellite start-up company has successfully launched its first satellites in a project aimed at **delivering** "affordable" Internet access to every corner of the globe.

46. For each of the following sentences decide which option is correct. Identify the function of the words in bold or translate the sentences into Russian.

1. The company intends **to launch/launching** several rockets every month, each **carrying/to carry** 39 satellites. 2. Experts have found that the **increased/to increase** use of mobile devices causes cyber addiction, sleep disruption and **to bully/bullying**. 3. More and more people realise that we need to take measures **to reduce/reducing** addiction to electronics. 4. One of the steps might be **to ban/to be banned** smartphones and personal tablets from schools. 5. **Having/have** a roof over your head is a basic human need, but there are 1.2 billion people in the world without adequate housing. 6. This may change thanks to a revolutionary, low-cost use of 3D printers **to construct/constructing** houses. 7. Two companies have joined forces **to try/tried** and ease homelessness around the world by **building/to build** affordable homes **using/to use** 3D printing. 8. Designers see possibilities for 3D **printed/being printed** houses to become common in years **to come/coming**. 9. Japanese engineers have invented a robot-wolf **scared/scaring** away wild animals that want **to eat/eating** crops of rice. 10. The researchers found that students **addicted/addicting** to the Internet had significantly more trouble **dealing/dealt** with their day-to-day activities, **including/to include** life at home, at work, or school and in social settings. 11. Scientists have designed a way **to make/making** see-through wood that could one day **replace/to replace** glass and some optical materials. 12. The see-through wood is a lot stronger and less dangerous than glass. It is better **at insulating/to insulate** against the cold and it is biodegradable. 13. While the Internet of Things has the potential **to drive/driving** fundamental economic and social change, there are "serious obstacles" to **ensuring/ensured** the infrastructure of this technological revolution. 14. In the future, electric cars will replace petrol cars. Environmentalists believe this will reduce the amount of CO_2 **put/putting** into the atmosphere. 15. The company was

started **to produce/produced** fully functional wooden replicas of miniature satellites **used/using** for space research, education and hobby purposes.

47. In the sentences below fill in the blanks with a Present or Past Participle, a Gerund or an Infinitive. Translate the sentences into Russian.

1. We think that computers are the most amazing machines (create) by humans. 2. Scientists have cast doubt on a previously (believe) assumption that the (process) speed of our brain starts to decline from the age of 20. 3. The results of the study show that our mental processing speed remains relatively constant until the age of 60, but does start (decline) from our seventh decade. 4. The volcano eruption in Tonga left many buildings (cover) in volcanic ash and the country's roads (block). 5. (Restore) full communications engineers need (repair) underwater cable (connect) Tonga to the WWW (cut) by eruption. 6. Microchips have been greatly improved by (reduce) their size. 7. In the past years most of us have spent extended periods of time online (use) an array of video-conferencing platforms which sometimes have been the only way (see) and chat to our loved ones. 8. One of the factors making video-conferencing (fatigue-induce) is the large number of faces (stare) at you in meetings. 9. Scientists have created a bacteria-filled concrete (prevent) cracks in a road from (become) larger which could considerably increase the lifespan of roads. 10. The idea (implant) a computer chip in a brain showcases one of the ambitions – to allow us (control) computers with our brain.

48. Identify the forms of the underlined phrases and translate the sentences into Russian.

1. He must be working in the garden now. 2. She seems to have been working all the morning. 3. Now I begin to see what you mean. 4. Having heard some noise at the corridor, I locked the door. 5. I'm looking forward to hearing from you. 6. Having been moved by the situation, we became volunteers. 7. I remember seeing the picture in the museum. 8. Having won the match, they felt more confident. 9. The work is supposed to be finished by tomorrow. 10. The work was to have been done before now. 11. I especially appreciate Mike's having organised the meeting. 12. Applicants to the university are expected to have completed a college preparatory program. 13. Not being satisfied, I decided to do something about the problem. 14. I think developing communication skills can help you succeed at work. 15. I'm tired of competing to be the best.

INDEPENDENT FURTHER STUDY

STUDY NOTE

Language is always changing. In 2022, 650 new English words were added to the Oxford English Dictionary – ranging from slang terms to professional titles and sports manoeuvers. As the world around us evolves, so do the ways that we describe it and our experiences within it. So, being able to understand the meaning of new words based on a linguistic guess might be an important skill to develop.

49. New English Words Quiz. Guess the meaning of the words in italics choosing from the given options. Think of a few more new English words to add to the words from the quiz and see if your group mates can guess their meaning.

1. What is a *ghost kitchen*?

   a. a kitchen in an abandoned[1] restaurant
   b. a kitchen which prepares restaurant-style food for delivery only
   c. a restaurant staffed by robots

2. The term *quarantini* was in the news in 2020. Is it…

   a. celebrities wearing designer face masks
   b. a baby born as a result of coronavirus quarantine
   c. a cocktail that you drink in quarantine

3. The word *smize* gained new significance. Does it refer to…

   a. gaining weight during lockdown
   b. drawing a conclusion from data
   c. smiling with your eyes

4. What is a *seagan*?

   a. someone who eats a vegan diet, but also sustainable[2] fish
   b. someone who only eats food they have caught from the sea
   c. someone who used to be a vegan, but now eats meat

5. We've all heard of a pandemic, but what is an *infodemic*?

   a. an excessive amount of information about a problem which may be misleading or confusing
   b. a compulsive need to continually search for information online
   c. an academic specialising in the analysis of infographics

6. Meatspace is …

   a. a restraurant found in the market area offering meat dishes
   b. a section of a grocery store where meat is sold
   c. the physical world and environment especially as contrasted with the virtual world of cyberspace

7. Everyone knows what a robot is, but what is a *cobot*?

   a. a robot that works alongside humans to help them at work
   b. an online assistant helping college students
   c. a robot available in bright colours

8. The climate crisis hasn't gone away. What is *green swan*?

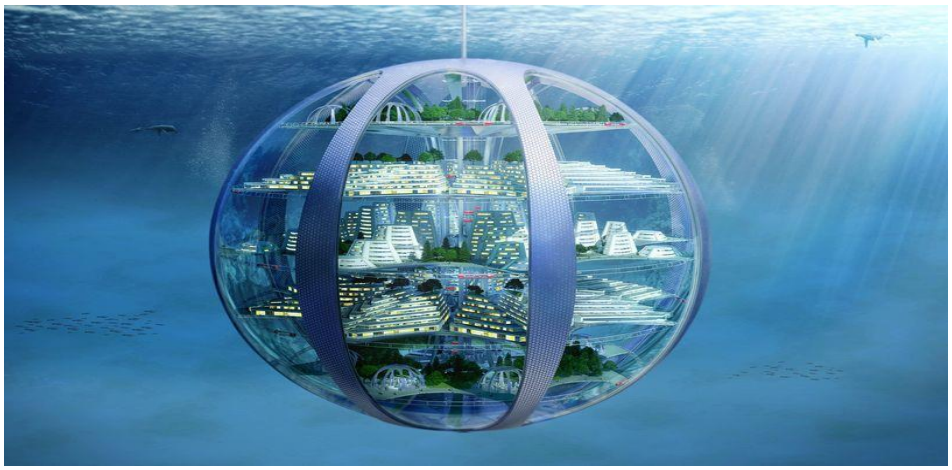
   a. a new species of swan discovered in the tropical forests of central america
   b. an unexpected event caused by climate change that has an impact on economies around the world

c. a swan that is marked with a patch of green dye[3] so its migration can be tracked

9. Not long ago we learned that *reacji* is a thing. But what kind of thing?
   a. an emoji that people click on to show a reaction
   b. a person who dislikes change
   c. someone who acts first and thinks later
10. What is a dumbphone?
   a. a phone that works only when it wants to
   b. a cell phone that does not include advanced software features such as email or an internet browser
   c. a phone that simply turned off and wouldn't turn back on

[1] abandoned – покинутый, заброшенный
[2] sustainable – устойчивый, не наносящий ущерба окружающей среде
[3] dye – краситель

50. Read the text and circle the correct word in each pair of the words in italics.



What Life Will Be Like in 100 Years from Now?

(1) Super skyscrapers[1], underwater cities and 3D-printed homes will all be a *reality/real* in 100 years' time, according to a new report. The SmartThings Future Living *Report/Rapport* was created by a group of academics and futurologists who suggest that in a century's time humans *will be able/are able* to live in 'Earth-scrapers', which will go up to 25 *storeys/stores* underground. One of the co-authors of the report said: "Our lives today are almost *unrecognisable/ recognisable* from those a century ago. The internet has *reorganised/ revolutionised* the way we communicate, learn and control our lives.

(2) Just 10 years ago, technology like SmartThings would have been inconceivable[2], yet today developments like this let us monitor, control and *save/secure* our living spaces with the touch of a smartphone. Over the next century we will *witness/withstand* further seismic shifts[3] in the way we live and interact with our *surroundings/spaces*." Some *respondents/respecters* suggest that 'bubble cities' will be created underwater making the *deep/depths* habitable[4] for humans. They also *believe/belief* personal drones will become a staple[5] *way/mode* of transport, as well as being used as futuristic "mules" to carry *entire/whole* homes *around/about* the world for holidays.

(3) Researchers also questioned 2,000 adults *around/about* the predictions they thought were most *likely/liking* to happen in the future. They predicted that in the future, *few/little* people will

go to an office because a large *minority/majority* will work from home and have virtual work meetings. Not only will furniture within homes become 3D-printed, but replicas of entire houses and structures will be printed. 3D-printing food (something already possible today) will also become smarter, with the ability to *reload/download* dishes from our favourite chefs and print them, ready to eat, in minutes.

(4) The colonisation of the Moon and then Mars will also have taken place, with commercial flights into space now a regular occurrence[6], alongside smarter homes that will be able to house LED screen walls that can be changed to *suite/suit* the mood, removing the need to redecorate[7]. There will also be less need for visits to the doctor. We will all have a home health capsule that will tell us what the problem is and give us *treating/treatment.* We will also be going into space for holidays and to get resources that we have *used down/used up* on Earth.

Useful words

[1]skyscraper(s)- небоскрёб
[2]inconceivable - невообразимый
[3]seismic shifts – гигантские сдвиги
[4]habitable – обитаемый, заселённый
[5]staple – основной, важнейший
[6]occurrence – случай, эпизод
[7]redecorate – производить ремонт

51. Read the text again and match the phrases in two columns to make sentences which are true according to the text.

1. The report answers the question what life might be like	a. way we communicate.
2. The way we live, work and play will	b. even more unbelievable.
3. The Internet has revolutionised the	c. the depths habitable for humans.
4. Changes in the next century would be	d. be totally different.
5. Futurologists suggest that humans will	e. in 100 years from now.
6. 3D printing will allow	f. and give us treatment.
7. Today we can control our living spaces	g. to print our favourite food.
8. Bubble cities will make	h. be able to live in 'Earth-scrapers'.
9. Health capsules will tell us what the problem is	i. for holidays.
10.We will also be going into space	j. with the touch of a smartphone.

52. Answer the questions according to the text.

1. What did one of the co-authors of the report say about the changes in the next century? 2. What makes academics and futurologists believe that we'll witness "seismic shifts" in the way we live? 3. Where does the article say humans will be able to live? 4. How will 3D printing technology transform our life? 5. Why will few people go to an office in the future? 6. Who will people need to visit less in the future? 7. What technology might remove the need to redecorate our houses? 8. Where will we be going on holiday?

53. Match the positive words on the left with their opposite negative words on the right. Think of a technology which each pair of words can describe.

Example: a handy or useless app

handy reliable high-speed secure state-of-the-art user-friendly cutting-edge sophisticated remarkable groundbreaking	*useless* slow difficult-to-use unreliable unsafe out-of-date conventional simple commonplace unimaginative

54. How do you feel about technology? Choose 2-3 adjectives from each column to describe your attitude to technology. Give examples.

Example: Technology is *fun*, for example, lots of people enjoy playing computer games.

convenient essential interactive educational innovative secure fun indispensable	unsafe annoying time-consuming demotivating invasive intimidating addictive

55. Read the passage below paying attention to the words which have their original plural forms and try to remember them.

There are a few words borrowed from other languages (Latin, Greek, French…) that have their original plural forms in English. *E.g.: plateau-plateaux, mafioso-mafiosi*. Some of them also have the standard plural form. *Formulars* is seen more often than *formulae*; *antenna-antennae or antennas* (pl). Some learners think that *media, strata, criteria,* and *phenomena* are all singular. They are not: *medium, stratum, phenomenon, criterion* are singular, while *data* can be used both as singular and plural. Here are some more foreign singular and plural forms of the words used in English: *nucleus-nuclei, analysis-analyses, axis-axes, crisis-crises, hypothesis-hypotheses, focus-foci* (technical-the point where beams of light meet after their direction has been changed), *syllabus-syllabi* or *syllabuses*.

STUDY NOTE

Some two-syllable words in English have the same form of the noun and the verb. When the word is a noun, the stress is on the first syllable and when it is a verb, the second syllable is stressed. Here are some words like this: *conduct, increase, record, etc.*

56. Underline the stressed syllable of the words in bold.

1. The minister was called to court to explain his **conduct**. 2. To **conduct** a decent advertising campaign, you need a lot of money 3. To enter the **contest** you must fill in an application. 4. Opposition party tried to **contest** the elections. 5. There has been a steady **decrease** in the number of visitors. 6. The driver **decreased** his speed as he approached the curve. 7. He **deserted** from the army. 8. In Daniel Defoe's book, the hero finds himself on a **desert** island. 9. The **import** duty was increased. 10. They **import** fine silk textiles from China. 11. The house **increased** in value. 12.

The economy has experienced a steady **increase**. 13. You can't **insult** people. 14. She swallowed the **insult**. 15. Please, **transfer** the data to a disk. 16. She has applied for a **transfer** to head office. 17. No one else was **present**. 18. The prizes were **presented**. 19. He made some **progress** in his study of French. 20. The country is fast **progressing**. 21. The museum is easily accessible by public **transport**. 22. Airships are designed to **transport** passengers and their luggage. 23. He is the holder of a world **record**. 24. The group has just **recorded** a new album. 25. He was **subjected** to severe criticism. 26. Don't deviate from the **subject**.

USES OF *WOULD* and *SHOULD*. OTHER POINTS

57. In which group of sentences (A-D) do the verbs in bold describe situations that are:

1. hypothetical Present or Past with *would;*
2. a polite command, request or wish;
3. are used in a very formal context in that-clause after nouns or adjectives expressing a demand, recommendation, desire, importance, necessity etc.
4. are used in a very formal context in that-clause with such verbs as *demand, insist, recommend, suggest, order, etc.*

A. 1. **Would** you like to listen to the audio again? 2. **I'd** like to tell you about the advantages of air travel. 3. **Would** you mind answering a few questions? 4. **I'd** prefer to do the online course in English rather than a face-to-face. 5. **Would** you help me with filling out this form?

B. 6. We **would** go out later, wouldn`t we? 7. He **wouldn`t** do that. 8. I **would** never run a marathon now. 9. I **would have appreciated** some help. 10. The keys **would be** in one of those drawers. 11. I **would never consider** changing career.

C. 12. We insist that a meeting **be held (or should be held)** as soon as possible. 13. The board recommends that the accounts **be (=should be)** checked. 14. I suggested that we **should wait** for him. 15. She insists that you **should see** a doctor. 16. I suggest that the meeting **should be postponed**. 17. I demand that I **(should) be allowed** to call my lawyer. 18. It is required that you **(should) do** what you were told to do.

D. 19. Was it necessary that my uncle **(should) be informed**? 20. It is necessary that the work (**should) be done** today. 21. It`s important that everybody (**should) listen** very carefully. 22. It is essential that every child (**should) have** the same educational opportunities. 23. It is important that everything **(should) be ready** by six o'clock. 24. It is advisable that she (**should) stay** in the hospital. 25. It is essential that safety **(should) remain** top priority.

STUDY NOTE

We use **would** for:

• polite requests: *Would you help me get the files?*

• the hypothetical Present or Past: *We would never dream of having our own plane.*

• strong desire for something: *I wish he would make more of an effort!*

Sometimes, in very formal contexts, **bare** infinitives are used after certain verbs (*demand, insist, propose, recommend, suggest, beg, order, request, etc*.) and after the adjectives of advice, necessity, and urgency *(advisable, high time, essential, necessary, important, urgent, etc.*). An

infinitive used in this way is called the **Subjunctive Mood**. But British speakers of English prefer **should +infinitive** or ordinary tenses, especially in less formal situations.

It is advisable (that) independent agency (should) be put in charge of this survey.
It is mandatory (that) no one (should) enter the lab without a permit.
It is urgent (that) he (should) complete the form at once.

58. Put the verbs in brackets into the Subjunctive tense forms. Explain the use of verb forms. How can we make the same sentences less formal?

1. He ordered that all lights (extinguish). 2. The doctor recommends (that) uncle John (hospitalise). 3. I propose (that) we (ask) for some assistance. 4. It is necessary that my sister (get) medical treatment. 5. It's important she (understand) your opinion. 6. I am concerned that they (think) I cannot be trusted. 7. The rules demand that all the papers (be submitted) without delay. 8. I suggest that the project (be completed) by the end of the year.

***59. Rewrite the following sentences starting with the words given in brackets. Put the verbs into the appropriate tense form to convey a hypothetical meaning. Translate the sentences into Russian. (Answers may vary)**

1. Industrial countries are trying to find an alternative power source. (It is high time …) 2. A new experimental nuclear fusion reactor is to be built. (They insist that…) 3. The use of light provides new ways of storing and processing information. (It is desirable …) 4. More and more technology shows up in operating rooms. (It is high time …) 5. Robotic surgery will speed recovery time of patients and decrease complications and discomfort. (It is possible that …) 6. Computer components are getting smaller over time and eventually will get down to the atomic scale. (Computer scientists suggest that, as…) 7. Touch screen technology is getting mainstream. (It is essential that….) 8. Robots are performing a wide range of surgeries. (It is advisable that … wider … in the future.)

New Tech Terms You Need to Understand

60. Study the examples below noticing the words in bold. Try to figure out their meaning from the context or translate them into Russian using a dictionary.

1. Me and a mate **crowdsourced** some ideas for our new tech **start up**, and came up with an **app** which could instantly find an ebook – something to read which matched your mood at that moment. It was a great idea – the only problem was then that we had no money to develop it, so we decided to crowdfund it, set up a kickstarter and we got 100 pledges in the first few days… 2. So there was this guy who was **trolling** anyone who disagreed with him on twitter, he was **tweeting** some horrible stuff. But then some **hacker** managed to **doxx** him! He had to shut up after that. 3. Zoella is one of the most successful **vloggers** out there – lots of young people now want to become **YouTubers** after seeing what she's done. **Hashtag** easy money! 4. I've been pretty unlucky with my **devices** recently – I almost got burned by a **phishing** scam, then my computer got infected by some **malware** and ended up being attacked by a **spambot,** so I decided to download some better antivirus software onto my phone but then it just **bricked**! 5. I definitely think of myself as an

early adopter, yeah – look, I mean have you seen my **smartwatch**?! Wearable tech is where it's at right now, though I'm really excited about new developments in **VR**... not to mention **AI**!
6. I don't always bother reading all the online commentary about news events, some of the supposedly outspoken opinionistas, well, they just write **clickbait** really, they're **trolling**, just to get attention. But I do take part in some **clicktivism**, I sign a lot of online petitions – I guess I'm what you'd call a **slacktivist**, yeah...!

61. Choose the right form of one of the words in bold from the previous exercise to go into the following sentences. Translate the sentences into Russian.

1. I find _____ - asking a wide range of people for information via social media can be a great way of getting new ideas or simply an answer to a question.
2. Places such as Silicon Valley in California are famous for the number of _____ that you find there – usually they're companies which are not much more than a couple of young people with some tech knowledge, a few bright ideas and a spirit of entrepreneurialism. 3. A lot of people don't like using social media in case they are attacked by _____ - usually men who use the power of anonymity that these sites offer to say horrible things. 4. Getting _____ can be unpleasant – of your personal details, phone number, home address and so on, are leaked onto the net, anyone could find you. 5. _____ didn't seem like a good idea when the idea first emerged at the beginning of the century, but the rise of YouTube and good, cheap camera technology has made it much more popular. 6. From a simple symbol used on Twitter, the #, a lot of people now use the word '_____' to simply define an idea or give an explanation. 7. I got an email which looked exactly like it came from my bank asking me to send them my online log-in details – it was a fake of course, and I realised that someone was _____ me. 8. My phone is totally dead now, I can't even switch it on, it's just _____ .
9. I had a Sinclair computer back in the 80s! Then I had one of the very first iPods, I've always got to be first to know what's going on and check out the latest tech, I'm an _____ . 10. Virtual reality, or just '_____ ' as it's called now, is now becoming increasingly popular in gaming, due to technological improvements over recent years. 11. When I see those things on the internet, 'You'll never believe what so-and-so has just done…' or 'This amazing picture has shocked the world – click here to see' I try to ignore them, it's just _____ . 12. I'm not sure _____ is a good way of protesting, I think signing online petitions, liking things on Facebook or retweeting things you agree with is pretty lazy, actually.

LEARNING STRATEGIES: HOW TO BECOME AN AUTONOMOUS LEARNER TIPS

62. Listen to episode 125: Language Tips and Tricks from 'English in 10 Minutes' podcast and take notes. Think of a few tips on how to improve your English based on your own experience. Prepare for a discussion about the best learning strategies to continue learning English by yourself.

https://englishin10minutes.com/2019/02/06/episode-125-language-tips-tricks/

CHECK YOURSELF

1. The Inventions that Changed the World Quiz. Answer the questions. Use key answers to help you if necessary.

1. In what country were paper and ink invented?
2. When was the World Wide Web introduced to the public?
3. What do such inventors as Tesla, Popov and Lodge have in common?

4. Many inventors contributed to the technology that created the television. There were conflicts between inventors over their rights to various aspects of this technology. Who invented the television?

5. Who invented the lever?
6. Who invented solar cells?
7. You cannot have a power grid without a transformer. Who invented it?

8. Who is credited with the invention of artificial rubber?
9. The periodic table that we know today was presented at the Russian Chemical Society. Who suggested it and when?
10. Who invented the combustion engine for a car?

(They invented radio technology / Gottlieb Daimler and Karl Benz / In April, 1993 / China / A. Stoletov, in the 1880s / Russian electrical engineer P. Yablochkov and physicist I. Usagin in the mid-1870s / Dmitriy Mendeleev / Vladimir Zworykin and Philo Farnsworth made the most significand contributions/ Russian chemist S. Lebedev, in 1910 / Archimedes)

For more questions go to https://www.inventor-strategies.com/free-quiz-questions.html.

2. Decide whether the statements below are True or False according to the information in Module 12 texts.

1. On a personal level a process of thinking about the future is known as prediction.
2. The technology of the future will certainly get bigger and cheaper.
3. Active development of robotics will lead to the creation of more user-friendly robots.
4. Samsung developers suggest that in the near future contact lenses will be capable of displaying the Internet.
5. The new tunnel transportation system Norway is planning to build will be about 30 metres underground.
6. Xenorobots are the world's first "living" robots that will be able to replace humans.
7. Using naturally bioluminescent plants for lighting will save 20 per cent of worldwide energy consumption.
8. Nanorobots will be part of the future human medicine.
9. Quantum computers will replace conventional computers.
10. According to some predictions, we are on the road to the Internet of things.

3. Read the text about predicting the future and choose the best answer a, b, or c for each gap.

What is next?

Not only does progress simplify our everyday life but it also transforms it beyond 1. _____!

What is next? Mankind has always wanted to know the answer to this question. But why have scientists rarely 2. _____ to predict correctly certain technological developments? Predictions about computing are 3. _____ bad, and they will likely continue to be. We simply have no idea what is possible in the future. Some people 4. _____ that the future will be basically the same as the present. Could we know that the Internet was going to offer us unparalleled freedom of information and expression? Could we make sense of gigabytes fifty years ago? Mobile devices are 5. _____ to have liberated us from our desks and given us the freedom to travel all over the world. 6. _____, the future is unpredictable. If we have trouble predicting the future development and impact of technology, it is not due to a failure of imagination. Indeed, our greatest flights of imagination 7. _____ exactly what makes technology so hard to 8. _____.
When it comes to the predictive value of science fiction, it is 9. _____ to conclude that our ability to anticipate the future will always be tragically limited by our current social conditions, or real-world technology. That is why we admire some science fiction writers. Herbert Wells is one of the most outstanding among them. His 10. _____ of future technology is rich. Wells imagined technological developments that altered the physical landscape. Wells anticipated television, video recorders, and powered commercial and combat aircraft.

1. a. the bounds	b. recognition	c. capability
2. a. able	b. succeeded	c. managed
3. a. meaningfully	b. notoriously	c. known
4. a. consider	b. contribute	c. tell
5. a. expected	b. declared	c. claimed
6. a. Definitely	b. Hopefully	c. Increasingly
7. a. reveal	b. open	c. improve
8. a. expect	b. make	c. predict
9. a. exciting	b. tempting	c. resulting
10. a. sight	b. vision	c. view

4. Choose the best answer a, b, or c for each gap.

1. A new kind of robot is an example of how _____ is becoming science fact.
a. science fiction b. hard work c. scientific research

2. Specialised nanoparticles injected into the leaves of a plant cause it _____ light.
a. glowb. emit c. illuminate

3. The growth of technological _____ means that a variety of media and learning-support tools now exist to help students.
a. capabilities b. capacity c. abilities

4. Digital platforms may offer _____ for students to watch lectures live or recorded versions later.
a. suggestions b. opportunities c. possibility
5. Nanotechnology essentially means controlling matter on a tiny _____ at the atomic and molecular level.
a. measure b. size c. scale

6. _____ our knowledge of materials at a nano-level we can create exciting new solutions and products.

a. Being used b. Having been used c. Using

7. Early computers of the 20th century famously required _____ rooms.
a. many b. empty c. entire

8. After the crash the aircraft was _____ beyond _____ and withdrawn from service.
a. damaged/repaired b. repaired/damage c. damaged/repair

9. With the control of electronic devices by our mind we will get a completely _____experience for us before.

a. familiar b. unfamiliar c. similar

10. _____smart watches we have Fitness bands (activity trackers) which usually track heart beat rate and calories.
a. Despite b. Therefore c. Besides

5. Complete these sentences with the correct form of the verbs in brackets.

1. If I (be) you, I would phone him. 2. If only I (revise) for my exam yesterday! 3. I wish I (not choose) this theme for my presentation. 4. If I (know) about the lecture, I would have definitely attended it. 5. I wish I (be) taller so that I could be in the basketball team. 6. If only children (read) more nowadays. 7. If only people (use/not) cars when they can use public transport. 8. I wish I (know) the answer, but I don't. 9. If they (try) to save water, the reservoir wouldn't have dried. 10. I wish you (be) quiet. I find your talking quite annoying.

6. Study the examples below and noticing the verbs in bold. Choose the correct alternative.

1. If we **had** a pool, I would swim every day.
a. They don't have any swimming pool. b. They had a swimming pool
2. Suppose I **bought** a new car, would you go with me to the sea?
a. He has a new car. b. He doesn't have a new car.
3. If she **had told** me about this before, I would have booked the tickets.
a. She didn't tell me. b. She doesn't tell me.
4. Provided new composite materials **were used,** overall aircraft weight **would be lighter**.
a. Composite materials were used. b. They don't use new composite materials.
5. I wish I **could have** a cup of coffee right now.
a. She doesn't have a cup of coffee. b. She has a cup of coffee.
6. My sister wishes she **had taken** that job.
a. She regrets she hasn't taken that job. b. She doesn't want that job.
7. He wishes he **wasn't** so bad at maths.
a. He is good at maths. b. He would like to be better at maths.
8. He wishes he **didn't need** to go to work so early.
a. He has to go to work very early. b. He likes to go to work early.
9. I wish Tim **wouldn't work** late so often.
a. Tim works late. b. I want Tim to come home not so early.
10. I wish our neighbours **would be** quiet!
a. They are not quiet. b. I don't mind the noise.

7. Complete the sentences with the words below. Put them into the correct form.

know fall act do try buy tell can do change

1. I wish I _____ afford to buy a new washing machine.
2. I wish I _____what is wrong with my computer.
3. It's time we _____something to stop water pollution in the river.
4. He always talks as though he _____on the stage.
5. He talks as if he _____all the work himself, but I know Tim helped him.
6. It's high time you _____your job.
7. If only they _____a bit harder, they would have won.
8. It's time we _____a new car.
9. I wish I _____anyone about this. Now everybody knows. I really regret.
10. If only he _____ill. He wouldn't have retired.

8. Rewrite the sentences using *I wish + Past Simple, Past Perfect or would* depending on the situation. Translate the sentences into Russian.

Example: I have a bad headache. → I wish I didn't have a headache.

1 I haven't got a flat of my own. I really would like to have one.

_____

2. I didn't walk in the park yesterday. I regret it now.

_____

3. We don't speak foreign languages. I would like us to.

_____

4. I didn't accept his invitation. I regret it now.

_____

5. They won't stop making a noise. I would like them to stop.

_____

6. I didn't tell the truth. I regret it now.

_____

7 You didn't reply to my letter. I'm very sorry you didn't.

_____

8. I'd like you to stop interrupting me.

_____

9. Correct mistakes in the sentences. Two sentences are correct.

1. Would you helped me drive the car to the service station? 2. I wish she will be here immediately! 3. I wish I knew what was going on in there. 4. Would you give me a lift after work today? 5. She wishes I won't jump with a parachute! 6. I want to know whether they would take part in the game. 7. It is essential that elderly people treated with dignity. 8. It is desirable that she should be here.

10. Use your own ideas to complete the sentences.

1. If she _____ , she would _____ .
2. If I were you, I would _____ .

3. If they had _____ , there would(n't) have _____.
4. If we had had _____ more _____, we could have _____.
5. If _____ were more _____, we would have _____ .
6. If _____ hadn't discovered (invented) _____, we would(n't) _____.
7. It's about time you _____ .
8. What if/suppose/supposing _____ ?
9. I would rather/would sooner you _____ .
10. I wish/if only you were/ they had/ I could _____ .

11. Read the sentences below and choose the right option. Translate the sentences into Russian.

A.

1. It is hard _____ a movie, a book, or a TV show that does not have some type of automobile in it.
a. find b. to find c. finding
2. Over generations, automobiles have influenced every aspect of society in many ways and have changed _____ with the times.
a. keep up b. kept up c. to keep up
3. The car manufacturing industry was revolutionised _____ a continuously moving assembly line.
a. by introducing b. to introduce c. introducing
4. The principle of having workers _____ to a specific post doing a specific job, allowed them to sell cars at a more affordable price, _____ to the gain in popularity of the automobile.
a. assigning/ contributed b. assigning/contributing c. assigned/contributing
5. While developing new cars today's engineers seem _____ more on the safety aspect of the car instead of its features.
a. focusing b. having focused c. to focus
6. _____ electric cars, our generation will virtually eliminate air pollution and make the air cleaner.
a. to drive b. by driving c. having driven
7. Maintenance will be more affordable as well; you will not have _____ about _____ the oil or submitting your car for an emissions test.
a. worry/ to change b. to worry/changing c. worrying/ changing
8. Electric cars provide a quieter environment for everyone _____ .
a. concerning b. being concerned c. concerned
9. Urban planners are now realising that old methods focused _____ traffic congestion are not enough _____ problems like population growth and carbon emissions.
a. to reduce/to solve b. on reducing/to solve c. on reducing /solving
10. _____ forms of transport, from cars to buses, and a switch to low-energy vehicles could make a huge difference to _____ the quality of air in big cities.
a. electrifying/improve b. electrify/improved c. electrified/improving

B.

11. Big cities are working _____ better use of their streets by _____ more bus lanes and pedestrian walkways, and expanding rail networks.
a. making/adding b. to make/ add c. to make/adding

12. The idea of a fully automated transportation system is _____ because it could improve safety by _____ human error.
a. intrigued/removing b. intriguing/removing c. intriguing/removed
13. The fantasy of _____ through the air like birds had been in people's imagination for hundreds of years before it became a reality.
a. having flown b. to fly c. flying
14. Many early attempts _____ ended in failure and death.
a. of flying b. to fly c. flying
15. Russian scientist Mikhail Lomonosov designed a model that used two propellers _____ in opposite directions on the same axis.
a. rotated b. being rotated c. rotating
16. Today's airplanes brought to reality a wide range of technological advancements _____ the introduction of full fly-by-wire flight controls technology.
a. included b. including c. being included
17. The aerobatics of the Su-35 leaves the impression that the aircraft is weightless: it can stop in mid-air and descend in circles, _____ like a leaf on the wind.
a. sailing b. to sail c. having sailed
18. Nothing we have seen really comes close to _____ what this plane can do in terms of manoeuverability.
a. do b. doing c. be doing
19. It was a case of science fiction _____ scientists forward until it became science fact.
a. propel b. propelling c. being propelled
20. The real robots that were actually built _____ on the production line in a car factory were far from humanoid.
a. to working b. to work c. worked

C.

21. The robot's computer may be set up by _____ all the separate movements out as a long computer program.
a. writing b. write c. having written
22. Robots are also suited _____ out dangerous tasks that are far too risky for people _____ , such as detonating car bombs.
a. to carry/attempting b. carrying/to attempt c. to carry/ to attempt
23. All the above robots including production-line robots, medical robots, movement _____ robots and self-driving cars are being widely developed and used today.
a. imitated b. imitation c. imitating
24. The real future of robotics is in the improvement of _____ robots and in _____ new ones.
a. existed/created b. existing/ creating c. existence/creation
25. Light from conventional sources, such as a light bulb or the sun, diverges, _____ in all directions.
a. spread b. spreading c. being spread
26. In 1954, Russian physicists Nikolay Basov and Alexander Prokhorov while _____ on the quantum oscillator created the first microwave generator - laser's predecessor.
a. having worked b. worked c. working

27. Due to their remarkable properties lasers turned out _____ all sorts of useful applications in different fields from communications to medicine.
a. to have b. having c. have
28. Part of materials science deals with _____ materials, which are generally split into four main groups.
a. classify b. classified c. classifying
29. Materials science also covers _____ new materials and analysing their properties and structure.
a. to discover and design b. discovery and design c. discovering and designing
30. We define materials as substances _____ properties which make them useful in machines, structures, devices, and other products.
a. to have b. having c. to have had

12. Make up sentences by matching their halves. Translate them into Russian paying attention to Gerunds, Infinitives and Participles.

A. 1. Having passed the exam, 2. Not knowing where the entrance was, 3. While talking to him, 4. Remember to take your bags 5. Instead of presenting his argument, 6. I visited her after 7. He denied having been offered money	a. she asked for directions at the reception. b. I was admiring his broad outlook. c. he felt very happy. d. for taking part in the concert. e. contacting her on the phone. f. he left the room. g. when leaving the train.
B. 8. You shouldn't be printing 9. It is forbidden to use the phones 10. Impressed by the paintings, 11. Founded 100 years ago, the university 12. Located in the city centre, 13. This room needs 14. I don't mind	a. he recommended the exhibition to his friends. b. the cinema is very popular. c. this right now. d. being told what to do. e. while driving. f. has increased the number of faculties lately. g. to be tidied up.

13. Answer the following questions. Use the information from texts 12 A, B, C.

1. Why thinking about the future is important both personally and for humanity as a whole? 2. Why is it difficult to predict the future? 3. Can you think of an example of a prediction that turned out to be wrong/a prediction which came true? 4. What kind of robots might become an integral part of almost every home soon? 5. What material did engineers use to create contact lenses capable of displaying electronic information? 6. What problem will be solved with the help of the first floating submerged tunnel system in Norway? 7. Why are xenobots considered to be an entirely new life form and what benefits will they bring? 8. In what way did experts prompt plants

to glow? 9. What is a nanocomputer and where will nanocomputers be used? 10. What are the advantages of quantum computers compared to the conventional ones?

MODULE 12 PROGRESS TEST

Vocabulary. ***Decide which answer a, b or c best fits into each gap.***

Even if someone (1)_____ to be an expert in a certain field it is still risky to (2)_____ the future. There were lots of situations when some experts (3)_____ their views which later on turned out to be (4)_____ wrong. We don't need to predict the future but we should think about it and prepare for it to make our life more (5)_____. On the other hand, thanks to those people who create visions of the future and break the chains of common thinking we are (6)_____ into the future which we are building today. It is (7)_____ to imagine flying cars and bases on the moon when we think about our life in the future but nobody knows for sure whether our life will change (8)_____ recognition or will probably stay reassuringly (9)_____ . One thing is certain, though. Technology will be getting smaller, smarter and cheaper and our future will (10)_____ be a great time to be alive.

1.	a. says	b. assumes	c. claims
2.	a. propose	b. predict	c. present
3.	a. declared	b. predicted	c. claimed
4.	a. spectacularly	b. reassuringly	c. competitively
5.	a. useful	b. familiar	c. meaningful
6.	a. running	b. heading	c. delivering
7.	a. reassuring	b. meaningful	c. tempting
8.	a. besides	b. beyond	c. beneath
9.	a. well-known	b. meaningful	c. familiar
10.	a. definitely	b. entirely	c. reassuringly

Grammar. ***Decide which answer a, b or c best fits into each gap.***

1. _____ with vision equipment, robots were able to see.
   a. Having fitted b. Having been fitted c. Fitting
2. When we try to envisage the future, almost all the predictions _____ are about the future of information technologies.
   a. making b. are made c. being made
3. The physicist watched the new superconductor _____to normal state.
   a. to return b. return c. to be returning
4. It requires an enormous power of brain to create such transportation systems which _____ people wherever they want without any limitations.
   a. will take b. would have taken c. taken
5. We wish modern discoveries _____ science and engineering to develop rapidly.
   a. allow b. will allow c. would allow
6. Suppose time travel _____ possible, where _____ , to the past or to the future?
   a. is /you go b. was /would you go c. would be / will go
7. An extremely coherent beam is said _____ for precise determinations of distances both large and small.

a. being used b. to have used c. to have been used

8. If flying cars _____ a reality, people _____ hours in traffic jams.

a. became/did not spend b. would become/ hadn't spent c. became/ would not spend

9. If new technologies don't guarantee safety, they _____ be adopted.

a. should b. shouldn't c. shouldn't have

10. Suppose quantum computers _____ classical computers, they _____ extremely advantageous for certain tasks where they could vastly outperform even our best supercomputers.

a. replaced/will be b. will replace/would be c. replaced/would be

EVERYDAY TECHNOLOGY QUIZ

1. Who created the first thermometer?

a. Anders Celsius
b. Hypatia
c. Galileo
d. Daniel Gabriel Fahrenheit

2. Who built the first steam engine in Russia and when?

a. *Ivan Polzunov* in 1766
b. Akinfiy Demidov in 1739
c. Ivan Kulibin in 1810
d. Fyodor Blinov in 1880

3. For what inventions did Emperor Napoleon I make Alessandro Giuseppe Antonio Anastasio Volta a count and senator?

a. brass cartridge
b. breech-loading[1] artillery
c. storage battery
d. electric telegraph

4. What was George and Robert Stephenson's Rocket, which reached a speed of 58 km per hour in 1829?

a. a locomotive
b. a compressed air torpedo
c. a hot-air baloon
d. a steamship

5. How was the message 'What hath God wrought!'[2] sent from Washington, D.C., to Baltimore, Maryland, on May 24, 1844?

a. By the first stage coach
b. By the first steamboat
c. By the first electric telegraph
d. By the first hot-air balloon

6. Who invented wireless telegraphy?

a. Samuel F.B. Morse
b. Guglielmo Marconi
c. Heinrich Hertz
d. Evelyn Granville

7. What new structural material was introduced by French gardener Joseph Monier in the design of his flowerpots?

a. cast iron
b. reinforced[3] concrete
c. fibre glass
d. polypropylene

8. What did Alfred Nobel invent?

a. stainless steel
b. smallpox[4] vaccine
c. X-ray machine
d. dynamite

9. Who invented the safety elevator?

a. Elisha Otis
b. Gustave Eiffel
c. George M. Pullman
d. Emily Warren Roebling

10. What is the popular name for a compression-ignition engine, in which fuel is ignited[5] without introduction of a spark?

a. Jet engine
b. Newcomen engine
c. Diesel engine
d. Wankel engine

11. Igor Sikorsky is best known for his successful development of which of these vehicles?

a. Concorde
b. Helicopter
c. Hydrofoil
d. Hovercraft

12. What important new technology was introduced by Vladimir Zworykin's iconoscope[6] of 1923 and kinescope of 1924?

a. talking motion pictures
b. X-ray diagnosis
c. all-electronic television
d. colour motion pictures

13. The world’s first working aircraft is claimed to have been created by a Russian military man

a. Alexander Mozhaysky
b. Igor Sikorsky
c. Konstantin Tsiolkovsky

d. Nikolay Zhukovsky

14. What Lebedev's discovery was crucial during the First and Second World Wars?

a. Radar
b. Antibacterial treatment
c. Synthetic rubber
d. Airborne firefighting

15. Early windmills transformed the kinetic energy of wind into what form of energy?

a. electrical
b. thermal
c. solar
d. mechanical

16. What device converts sunlight into electricity?

a. photovoltaic cell
b. optical fibre
c. reflector telescope
d. liquid-crystal display

17. In the 1970-s, which pair of American inventors on the West Coast produced the first personal computer to appeal to a broad market?

a. Douglas Engelbart and William English
b. Bill Gates and Paul Allen
c. Steve Jobs and Stephen Wozniak
d. William Hewlett and David Packard

18. What X-ray technique produces images of internal body structures as visual 'slices' of the body?

a. X-ray photography
b. ultrasonography
c. computerised axial[7] tomography
d. positron emission tomography

19. When did the first smartphone make its public debut?

a. 2007
b. 2001
c. 1993
d. 2005

20. What was launched into Earth orbit in 1990, was repaired by space-walking astronauts, and went on to generate spectacular images that contributed significantly to space science?

a. Spacelab
b. Hubble Space Telescope
c. Mir
d. International Space Station

Useful words

[1]breech-loading казнозарядный, заряжаемый с казенной части

[2]'What hath God wrought!' ‘Вот, что творит бог!’ цитата из библии
[3]reinforced concrete железобетон
[4]smallpox оспа
[5]is ignited воспламеняется, поджигается
[6]iconoscope иконоскоп
[7]axial осевой

GRAMMAR TEST

1. He completely forgot ____me the money. It was last month.
   a. lend c. lending
   b. being lent d. to have lent
2. Do you know how to avoid your car____ while driving?
   a. skidded c. to skid
   b. being skidding d. skidding
3. We watched the planes ____ .
   a. landing and taking off c. landed and took off
   b. to land and take off d. having landed and taking off
4. She asked for the letter ____ off at once
   a. to sent c. to send
   b. being sent d. to be sent
5. They didn’t allow the cars ____ here.
   a. to be parked c. to park
   b. being parked d. be parking

6 They didn’t expect the matter ____ so complicated.
   a. to be c. having been
   b. being d. be
7. Sunlight is known ____ various chemical reactions
   a. activated c. to activate
   b. being activated d. to be activated
8. The goods are unlikely ____ today
   a. unloaded c. being unloaded
   b. to be unloaded d. to unload
9. The processor ____ to be operating now.
   a. is certain c. certainly
   b. being certain d. certains
10. What made you ____ this approach instead of using the standard one?
   a. used c. being used
   b. use d. to use
11. I’d rather you ____ more. Your exam is in a week.
   a. to study c. studied
   b. being studied d. study
12. Provided new composite materials ___ used, overall aircraft weight would be lower.

a. were c. have been
b. are d. will be

13. I wish I ____ the answer, but I don't.
a. know c. had known
b. knew d. have known

14. ____ it is destroyed, this material could have damaging consequences.
a. If not c. As
b. Unless d. Had

15. I would rather you ____ as hard as you can.
a. to try c. having tried
b. try d. tried

16. Unless submersibles ____ used worldwide, we wouldn't be able to solve the ocean's mysteries.
a. were c. have been
b. weren't d. are

17. The term "quasar" _____as a contraction of "quasi-stellar (*star-like)* radio source" because in photographic images quasars resembled faint, star-like points of light.
a. originated c. originating
b. originate d. having originated

18. We congratulated her on ____ the exam.
a. having passed c. to pass
b. pass d. to have passed

19. I've never seen him ____ his temper.
a. lost c. having lost
b. lose d. to lose

20. A new technique ____ worked out, the results improved.
a. is c. having been
b. is being d. have been

APPENDIX 1

PRACTICAL SKILLS

CRITICAL THINKING

Critical thinking is an essential skill for most undergraduate and postgraduate students. You need to bring a critical thinking approach to every aspect of your study. Edward Glaser, who developed a test of critical thinking, defined it in this way: "Critical thinking calls for a persistent effort to examine any belief or supposed form of knowledge in the light of the evidence that supports it and the further conclusion to which it tends."

Critical thinking is clear, reasonable, reflective thinking focused on deciding what to believe or do. It means asking probing questions like "How do we know?" or "Is this true in every case or just in this instance?" It involves being skeptical and challenging assumptions rather than simply memorising facts or blindly accepting what you hear or read. Imagine, for example, that you're reading a history textbook. You wonder who wrote it and why, because you detect certain biases in the writing. You find that the author has a limited scope of research focused only on a particular group within a population. In this case, your critical thinking reveals that there are "other sides to the story."

Who are critical thinkers, and what characteristics do they have in common? Critical thinkers are usually curious and reflective people. They like to explore and probe new areas and seek knowledge, clarification, and new solutions. They ask pertinent questions, evaluate statements and arguments, and they distinguish between facts and opinion. They are also willing to examine their own beliefs, possessing a manner of humility that allows them to admit lack of knowledge or understanding when needed. They are open to changing their mind. Perhaps most of all, they actively enjoy learning, and seeking new knowledge is a lifelong pursuit. This may well be you!

No matter where you are on the road to being a critical thinker, you can always improve and finely tune your skills. Doing so will help you develop more balanced arguments, express yourself clearly, read critically, and glean important information efficiently. Critical thinking skills will help you in life in general, and in any profession. With critical thinking, you become a clearer thinker and problem solver.

When working in a critical way, ask questions such as those below:

1. What's happening? Gather the basic information and begin to think of questions.
2. Why is it important? Ask yourself why it's significant and whether or not you agree.
3. How do I know this is true? Ask yourself where the information came from and how it was constructed.
4. Who is saying it? How reliable is this source? What's the position of the speaker and what is influencing them?
5. What don't I see? Is there anything important missing?
6. What else? What if? What other ideas exist and are there other possibilities?

(Based on Stella Cottrell. The Study Skills Handbook. Fourth edition. Macmillan. 2013)

REFLECTIVE LEARNING AND EVALUATING YOUR OWN PROGRESS

Five methods of developing reflection:

1. Keep a learning journal or blog. Ask questions, structure your reflective thinking
2. Use the self-evaluation questionnaires
3. Keep an updated profile or portfolio
4. Make constructive use of feedback from tutors
5. Feel in progress sheets

Developing a portfolio

A portfolio is a file or folder where you bring together materials on a theme, i.e. key materials about your learning achievements and/or evidence of your work. It might include self-evaluation

sheets, action plans, a profile of skills you have developed, certificates, exams, an up-to-date list of your work experience, your ideas about your future learning etc.

Personal statements

A personal statement draws together details of where you are now, where you want to be, and how you will get there: learning goals, what you have done so far, wat you learned about yourself along the way, skills and qualities you have achieved with examples, what your next step will be.

Personal records

Maintain your own records to track your progress and achievements in ways that are meaningful to you: *e.g*. write a personal plan of what you want to gain and how you plan to achieve this, keep a journal or blog to reflect on your learning, etc.

Progress sheet: How well am I doing?

Course, unit or module	Date
Level	Year of study
Generally, how well am I doing in this Module?	On what am I basing this self-evaluation? (my marks, feedback from tutors, self-monitoring? Other ways?)
In this Module I am best at: What makes me better at these aspects?	On what am I basing this self-evaluation?
To do better, I need to improve: What prevents me from doing as well at present?	How will I bring about this improvement?
What have I already learnt, or improved, since starting this Module?	How do I know this? How long does it take? My level of confidence. My understanding. My level of enjoyment.

(Based on Stella Cottrell. The Study Skills Handbook. Fourth edition. Macmillan. 2013)

BEING AN AUTONOMOUS LEARNER

What is learner autonomy?

Learner autonomy is an important concept in education. It is defined as the learner's ability to take charge of his/her own learning. Learner autonomy is especially important in EAP (English for Academic Purposes) since students may need to continue to develop their EAP skills without the help of an EAP teacher.

What skills do autonomous learners need?

The main skills which autonomous learners require are:

- the ability to identify and set learning goals;
- the ability to plan and execute learning activities;
- the ability to reflect on and evaluate their learning;
- an understanding of the purpose of their learning;
- an understanding of their own learning processes;
- knowledge of a range of learning strategies and skills;
- clear motivation to learn.

In short, autonomous learners need to be proactive, reflective, self-aware and motivated.

Why is learner autonomy important?

There are four main advantages to becoming an autonomous learner. First, you may not always have the support of your teacher, and you will therefore need to be able to learn by yourself. Second, autonomous learners are likely to be more efficient in their learning, because the learning will be more personal and focused. Third, the skills required in autonomous learning are the ones which will be needed in future, for example, in the workplace. Finally, since autonomous learners are more proactive in their learning, they will usually succeed even though they may not always feel positive towards their learning or may sometimes lack motivation.

Developing learner autonomy

Developing learner autonomy involves learning how to learn, and is a gradual and sometimes difficult process. In order to become autonomous, learners need to be exposed to a range of useful learning activities, and have the opportunity to evaluate and reflect on these. In short, developing learner autonomy means developing a wide range of academic, intellectual, personal and interpersonal skills.

The table below shows what would happen with different types of students in planning for an assignment, such as an essay or presentation task.

Non-autonomous learner	Teacher tells students each step they need to take, and when they should do each one.
Semi-autonomous learner*	Teacher elicits ideas about what steps students should take, suggests some which may be missing, and negotiates a time when each one will be done.
Autonomous learner	Students decide for themselves what steps to take and when to do each one.

*The term 'semi-autonomous' is very broad, as most students would have some degree of autonomy rather than being halfway between autonomous and non-autonomous.

https://www.eapfoundation.com/studyskills/autonomy/