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Тетрадь

по английскому языку

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Глава I

Модуль №1

Глава 1

Семинар №1 08.02.24

1.1. Text 10A

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, which would become an invincible weapon. The idea of using lasers as death rays has also been employed by creators of such blockbusters as X-Men and Star Wars. And though the ray laser gun still remains science fiction, putting a light beam at the service of humanity is embodied in myriads⁵ 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 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 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. 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 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 created the first microwave generator, laser's predecessor, 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 laser, which was considered the first successful light laser. Other types of laser quickly followed: a gas laser and a semiconductor injection¹³ 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 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 are fitted to military and police rifles to help soldiers hit their targets. Lasers can be used as a defence against nuclear missiles and they may also be of use in thermonuclear fusion 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.

1.2. Exercise №1

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

1. stimulated
2. radiation
3. acronym
4. emission
5. beam
6. amplification

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

Solution

1. f
2. a
3. b
4. e
5. d
6. c

1.3. Exercise №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... .

Solution

1. a
2. a
3. Light Amplification by Stimulated Emission of Radiation

1.4. Exercise №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; organized; less intense; travels in one direction; incoherent; highly intense; concentrated; travels in all directions; disorganized.

Solution

Ordinary light:

- disorganized
- its intensity decreases with distance
- it is not strictly monochromatic
- less intense, incoherent
- travels in all directions

Laser light:

- organized
- coherent
- highly monochromatic
- travels in one direction
- highly intense
- concentrated

1.5. Exercise №6

[УСТНО]

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?

1.6. Exercise №7

[УСТНО]

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.

Глава 2

Домашнее задание №1 15.02.24

2.1. Exercise №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

Solution

1. remind
2. employ
3. remain
4. embody
5. amplification
6. emission
7. strengthen
8. source
9. ?
10. laser
11. spreading
12. decrease
13. the difference between
14. intensity
15. eventually
16. -
17. award
18. due to
19. remarkable
20. -
21. record
22. -
23. measure
24. accuracy
25. -

2.2. Exercise №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 _____.

Solution

1. Laser stands for "light amplification by stimulated emission of radiation."
"The word 'laser' stands for 'light amplification by stimulated emission of radiation'." (Paragraph 2)
2. Laser light is different from ordinary light because it's monochromatic, directional, and coherent.
"The laser produces a well-directed, very intense beam which is monochromatic, directional and coherent." (Paragraph 2)
3. Basov and Prokhorov created the precursor to the laser while studying the quantum oscillator.
"In 1954, Russian physicists Nikolay Basov and Alexander Prokhorov working on the quantum oscillator created the first microwave generator, laser's predecessor." (Paragraph 3)
4. In 1960, Maiman demonstrated the first ruby laser.
"In 1960, physicist from California Theodore Maiman demonstrated the first ruby laser." (Paragraph 3)
5. Lasers have diverse applications, from medicine to communications.
"Due to their remarkable properties, lasers turned out to have all sorts of useful applications in different fields from communications to medicine." (Paragraph 4)
6. Lasers assist greatly in scientific spectroscopy.
"In science they are a great help in spectroscopy." (Paragraph 4)
7. Laser-sighting aid devices soldiers in hitting targets.
"Laser-sighting devices are fitted to military and police rifles to help soldiers hit their targets." (Paragraph 4)
8. New laser applications are continually emerging.
"New applications of lasers are constantly emerging." (Paragraph 5)
9. Archaeologists found ancient structures using Lidar.
"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." (Paragraph 5)
10. Lasers in computing could greatly improve data transfer speeds.
"For example, a silicon laser computer chip promises faster data transfers." (Paragraph 5)

Глава 3

Семинар №2 15.02.24

Vocabulary

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)

Выполнять -

1. carry out
2. implement
3. do
4. make
5. created
6. turn out
7. produce/manufacture
8. run
9. execute

3.1. Exercise №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.

Solution

1. All our laboratories are **fitted** with computers and high-speed internet access.
2. Some people think that electromagnetic **radiation** from our mobiles is harmful.
3. Climatologists say that the **emission** of greenhouse gases contributes to global warming.
4. Melatonin, a hormone involved in controlling our sleep, is **stimulated** by darkness.
5. The sky cleared up and a **beam** of sunlight shone in through the window.
6. If we don't modernise, the **output** from the factory will decrease.
7. Today it is **relatively** easy to find any information thanks to the Internet.
8. The 20th century was **remarkable** for its inventions.
9. The Nobel Prizes are **awarded** annually from a fund created for that purpose by the Swedish inventor and industrialist Alfred Bernhard Nobel.
10. A school's success can be **measured** in terms of the number of pupils who got into university.
11. Scientists need to be very careful about the **accuracy** of their research results.
12. Reforms should be **implemented** that will allow the company to stay competitive.
13. Our students' ideas are **embodied** in new classroom rules.
14. Exercising regularly is the best way to **strengthen** your immune system.
15. **Due** to the large volume of letters he is unable to answer personally.
16. Sometimes things don't **turn** out the way we think they're going to.

3.2. Exercise №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

Solution

1. If two or more waves have the same phase we call this light **coherent**.
2. When a liquid changes into gas we can say that it **vaporizes**.

3. **Monochromatic** colour refers to a colour scheme that is comprised of variations of one colour.
4. If one thing is in **contrast** to another, it is very different from it.
5. If something **emits** heat, light, or gas, it produces it and sends out by means of a physical or chemical process.
6. If someone **reminds** 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 **remains** in a particular state or condition, they stay in that state or condition and do not change.
8. You use the conjunction **neither nor** when you are talking about two or more things that are not true or that do not happen.
9. Laser light is very **directional** which means that it is extremely narrow and is emitted in one direction.
10. A **laser** is a device that emits light through a process of optical amplification based on the stimulated emission of electromagnetic radiation.

3.3. Exercise №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
 2. to prove
 3. to measure
 4. light
 5. stimulated
 6. to decrease
 7. conventional
 8. to spread
 9. remarkable
 10. to vaporise
-
- a. crucial
 - b. amplification
 - c. emission
 - d. source
 - e. properties
 - f. the foundation
 - g. distances
 - h. material
 - i. rapidly
 - j. in all directions

Solution

1. f

2. a
3. g
4. c
5. b
6. i
7. h
8. j
9. e
10. d

3.4. Exercise №24

Complete each sentence with the correct word to make up a word collocation from Exercise 23.

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.

Solution

1. Buying the works of his contemporary artists, Pavel Tretiakov laid the **foundation** for one of the world's greatest collections of Russian paintings.
2. Learning the facts about how COVID-19 emerged may **prove** crucial for preventing future outbreaks.
3. Before electricity was invented the **primary** sources of light were candles or oil lamps.
4. The use of lasers to **measure** 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 **amplification**.
6. Stimulated **emission** 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 **decreases** rapidly over time.
8. The fire was spreading out in all **directions** because of the hot weather and strong wind.
9. The number of articles about new materials with some remarkable **properties** has increased in the last years.
10. Processing materials with a laser beam allows engineers to cut, drill, weld, and even **vaporise** different materials.

3.5. Exercise №25

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

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

Solution

1. b
2. g
3. k
4. c
5. h
6. d
7. i
8. f
9. j
10. e
11. a

3.6. Exercise №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.

1. to increase
2. to absorb
3. stimulated emission
4. inside
5. output
6. to get excited
7. to flash on
8. to inject (energy)
9. coherent
10. organised
11. to strengthen
12. to implement

B.

- a. input
- b. to emit (energy)
- c. disorganised
- d. to decrease
- e. outside
- f. incoherent
- g. to reflect
- h. to calm down
- i. to weaken
- j. spontaneous emission
- k. to prevent, delay
- l. to flash off

Solution

1. d
2. g
3. j
4. e
5. a
6. h
7. l
8. k
9. f
10. c
11. i
12. l

Глава 4

Домашнее задание №2 22.02.24

4.1. Exercise №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.

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)

Solution

1. White surfaces reflect more light than other colors. (black)
2. In autumn wild birds decrease in number in Moscow region. (in spring)
3. Spontaneous absorption takes place without interaction with other photons. (when photon absorption is triggered by other photons)
4. It feels really cold inside on a winter morning. (warm)
5. A monitor and a printer are the examples of output devices. (a mouse and a keyboard)
6. For the system (such as an atom or a molecule) to excite, you need to make its energy level higher. (lower than the ground state)
7. If you want to take a picture when it is bright you should choose a 'flash off' mode. (in darkness)
8. Laser light, unlike ordinary light, is coherent and organized. (ordinary light)
9. The committee agreed that it was unnecessary to implement the changes recommended in the report.
10. Our attention is strengthened by mindfulness.

4.2. Exercise №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)

Solution

1. The name 'laser' stands for Light Amplification by stimulated emission of radiation.
2. Many enjoy the mental stimulation of a challenging job.
3. Words embody thoughts and feelings.
4. Difficulties strengthen the mind, as labour does the body.
5. Laws controlling the emission of greenhouse gases should be introduced.
6. Truth is the foundation of all knowledge.
7. A cloud is a mass of vapor in the sky.
8. A graphical representation of the experiment results is required.
9. Do you think mobile phones emit radiation?
10. If a text is coherent, it means that it is well planned, clear and logical.

4.3. Exercise №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.

Solution

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 **weapon** was a mysterious «sword of heat». Today Wells' sword of heat has come to reality in the laser. The name 2 **'laser' stands for** light amplification by stimulated 3 **emission** of radiation. Laser, one of the most 4 **sophisticated** inventions of man, produces an intensive 5 **monochromatic** beam of light of a very pure single color. It 6 **represents** the fulfillment of one of humankind's oldest dreams of technology to provide a light beam intensive enough 7 **to vaporise** the hardest materials. There are few materials which are not suited for laser processing, 8 **hence** 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 data, video, and other information, using lasers 9 **to encode and transmit** the data at rates 10 to 100 times faster than radio because lasers can generate a very intense, 10 **concentrated**, highly parallel, and 11 **coherent** beam, and 12 **coherence** is a very important property of laser light.

4.4. Exercise №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.

4.5. Exercise №32

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

Solution

The text discusses the invention, properties, and use of lasers. Firstly, it outlines the history of laser invention, then transitions to its properties. Thirdly, it discusses the types of existing lasers and concludes by examining practical laser applications in various fields. While there is no definitive answer to who invented the laser, several scientists contributed to its creation. Despite initial expectations of mainly military use, lasers have found widespread application in areas such as warfare and medicine due to their ability to produce an extremely narrow beam of light. The text also highlights the role of lasers in computer science. Overall, lasers have a broad range of applications, from surgical procedures to vehicle speed control devices. In conclusion, the fact that "death rays" did not become a reality is ultimately beneficial.

The concept of "photonics" emerged in the late 20th century and has become part of everyday life, encompassing technologies like fiber optic communication lines, flat-screen TVs and computer monitors, smartphones, and more. Laser communication offers high quality, greater bandwidth, and strict confidentiality. Both lasers and fiber optics have become vital components of many industries, and their combined potential is rapidly expanding. Semiconductor lasers are used in fiber-optic telecommunication systems. Research in this field has led to advancements in areas such as quantum electronics, fiber optics, quantum optics, laser physics, laser chemistry, and more. The term "photonics" encompasses all these scientific and technical areas.

Глава 5

Семинар №3 22.02.24

5.1. Text 10C

Photonics

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.

How Light Really Works

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.

Solution

1. particles
2. explore
3. cure
4. wavelengths
5. suggested
6. controversial
7. confirmed
8. entire
9. invisible
10. cutting-edge
11. far-reaching
12. makes sense
13. bouncing
14. incoming
15. excited
16. photons
17. cells
18. reflecting
19. absorb
20. cells
21. photoelectric
22. converted

5.2. Exercise №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?

Solution

1. Photonics studies "generating, controlling, and detecting photons, which are particles of light."
2. The characteristics of waves and photons can be practically used to "explore the universe, to cure diseases, and even to solve crimes."
3. Photonics explores "a wider variety of wavelengths, from gamma rays to radio, including X-rays, UV and infrared light."
4. Scientists in the past discovered that "white light is made of different colors of light" and later confirmed that "light was a wave as well as a particle."
5. The "duality in the nature of light" refers to the fact that "light was a wave as well as a particle."
6. Photonics is everywhere because "light waves are a part of our everyday life."
7. Yes, photonics is important today as it underpins technologies crucial to daily life and offers possibilities for advancements in various fields.
8. When you look at a mirror, "atoms of silver... are catching the incoming light energy and becoming excited," which then "throw out new photons of light that travel back out of the mirror towards you."
9. Solar panels look black in full sunlight because they're "reflecting back little or none of the light that falls on them and absorbing all the energy instead."
10. It's best to wear white clothes on a hot day because "white reflect virtually all the light that falls on them, and absorb little or none."
11. Solar panels convert sunlight into electricity through "the photoelectric (or photovoltaic) effect."
12. Pursuing a career in Photonics could be exciting and rewarding as it involves "cutting-edge research" and offers "far-reaching possibilities limited only by a lack of imagination."

5.3. Exercise №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.

Solution

- The unique characteristics of laser light, enabling technologies like range finders, optical communications, bar code scanners, and medical procedures.
- The use of lasers in eye surgery, emphasizing the precision and safety of green laser light.
- The invention of the laser by Ted Maiman in 1960.
- The operation of a ruby laser, including stimulated emission and the creation of coherent light.
- The process of stimulated emission through electronic transitions.
- The intensification and narrowing of light within a laser cavity, resulting in coherent light with a nearly single wavelength.
- Ongoing innovations and improvements in laser technology while maintaining fundamental principles.

5.4. Exercise №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?

Solution

1. Examples of laser-dependent technology include range finding devices, optical communications, and bar code scanners.
2. Laser technology's application in eye surgery, such as retinal reattachment, showcases its unique characteristics and precision.
3. Advantages of a laser scalpel include the use of green laser light, which passes through the eye's lens and vitreous humor without causing damage, allowing for precise treatment of the retina without harming surrounding tissues.
4. The three characteristics of laser light termed 'a tour de force of engineering' are coherent light, a narrow beam, and nearly a single wavelength.
5. These characteristics are achieved through stimulated emission within a resonant cavity. Electrons returning to the ground state release light, initiating an avalanche of identical photons. Inside the cavity, reflection and alignment of light rays intensify and narrow the wavelength, resulting in coherent light.

Глава 6

Домашнее задание №3 29.02.24

6.1. Exercise №32

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

Solution

The text discusses the invention, properties, and use of lasers. Firstly, it outlines the history of laser invention, then transitions to its properties. Thirdly, it discusses the types of existing lasers and concludes by examining practical laser applications in various fields. While there is no definitive answer to who invented the laser, several scientists contributed to its creation. Despite initial expectations of mainly military use, lasers have found widespread application in areas such as warfare and medicine due to their ability to produce an extremely narrow beam of light. The text also highlights the role of lasers in computer science. Overall, lasers have a broad range of applications, from surgical procedures to vehicle speed control devices. In conclusion, the fact that "death rays" did not become a reality is ultimately beneficial.

The concept of "photonics" emerged in the late 20th century and has become part of everyday life, encompassing technologies like fiber optic communication lines, flat-screen TVs and computer monitors, smartphones, and more. Laser communication offers high quality, greater bandwidth, and strict confidentiality. Both lasers and fiber optics have become vital components of many industries, and their combined potential is rapidly expanding. Semiconductor lasers are used in fiber-optic telecommunication systems. Research in this field has led to advancements in areas such as quantum electronics, fiber optics, quantum optics, laser physics, laser chemistry, and more. The term "photonics" encompasses all these scientific and technical areas.

6.2. Exercise №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.

Solution

Stimulated: Past Participle (Active) - Having introduced the concept of stimulated emission, Einstein laid the foundation for the laser. In this context, "stimulated" describes the type of emission that Einstein introduced.

Employed: Past Participle (Passive) - The idea of using lasers as death rays employed by creators of such blockbusters as X-Men and Star Wars still remains science fiction. Here, "employed" indicates that the idea was utilized by creators.

Having been demonstrated: Perfect Participle (Passive) - Having been demonstrated by Theodore Maiman in 1960, the first ruby laser was considered the first successful light laser. This indicates that the first ruby laser was demonstrated by Theodore Maiman before being considered successful.

Having introduced: Perfect Participle (Active) - Having introduced the concept of stimulated emission, Einstein laid the foundation for the laser. This shows that Einstein introduced the concept before laying the foundation.

Laser-sighting fitted: Past Participle (Passive) - Laser-sighting devices are fitted to military and police rifles to help soldiers hit their targets. Here, "fitted" is used passively to describe the state of the devices after being installed.

Being installed: Present Participle (Passive) - Being installed at one end of the laser tube, a mirror keeps the photons bouncing back and forth inside the crystal. This indicates the ongoing action of installing the mirror in a passive voice.

Escaping concentrated: Present Participle (Active) - The escaping photons form a very concentrated beam of powerful laser light. Here, "escaping" and "concentrated" are used actively to describe the properties of the photons forming the laser beam.

6.3. Exercise №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

Solution

1. развивающаяся промышленность - развитая промышленность
2. изменяющиеся расстояния - изменённые расстояния
3. управляющее устройство - управляемое устройство
4. увеличивающаяся скорость - увеличенная скорость
5. передающий сигнал - переданный сигнал
6. уменьшающий шум - уменьшенный шум
7. движущийся объект - перемещённый объект
8. нагревающиеся детали - нагретые детали

6.4. Exercise №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

Solution

1. A: Have you read that new book yet? B: Only some of it. It's very...
Correct answer: b. boring

2. A: Did you enjoy your holiday? B: Oh, yes. It was very...
Correct answer: a. relaxed
3. A: I'm going to a lecture tonight. Do you want to come? B: No, thanks. I'm not ... in the subject.
Correct answer: a. interested
4. A: Did you hurt yourself when you fell? B: No, but it was very ...
Correct answer: b. embarrassing
5. A: Was mother upset when you broke her vase? B: Not really, but she was very....
Correct answer: a. annoyed
6. A: How do you feel today? B: I still feel very
Correct answer: a. tired
7. A: You look ill. What's the matter? B: I've had a very day.
Correct answer: a. tired
8. Sit down - I've got some very news for you.
Correct answer: b. exciting
9. He's got a very habit of always interrupting people.
Correct answer: b. annoying
10. I'm very by your behaviour.
Correct answer: a. disappointed

Глава 7

Семинар № 29.02.24

7.1. Exercise №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.

Solution

1. Having worked all day, I was feeling very tired in the evening.
2. Having lived in an English-speaking country for a few years, she spoke English like a native speaker.
3. Having been rescued, an injured pilot was taken to the hospital.
4. Having written the test, the students handed in their papers.
5. Having been signed by the boss, the documents were sent to the customers.
6. Having been interrupted a few times, he was rather annoyed.
7. Having stopped the car, the police officer wanted to see the documents.
8. Having arrived at the station, we called a taxi.
9. Having checked in for the flight, they were prepared for passport control.
10. Having bought the car, he stopped using public transport.

7.2. Exercise №39

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

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

Solution

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

7.3. Exercise №41

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

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.

Solution

1. While walking in the woods, I suddenly realized that I had lost my way.
2. Because I had spent a lot of time doing my homework, I went to bed very late last night.
3. If given proper care, your car will operate smoothly for years.
4. Being someone who worked in a bank, he was familiar with the best ways to invest money.
5. The one talking to the professor is my sister.
6. After having collected the data, he began analyzing the results.
7. Upon having arrived at the site, the scientists discovered many fragments of the meteorite.
8. St Basil's Basilica, being one of the most beautiful Russian monuments, is a World Heritage site.
9. In trying to sell more goods for cash, the company is losing money.
10. Karel Capek described a mechanical device resembling a human but lacking human sensibility, capable only of performing automatic, mechanical operations.

7.4. Exercise №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.

Solution

1. *Feeling tired*, Anna went to bed early.
2. *Having explained the problem*, the boss told the employee to deal with it.

3. Drinking his coffee, he was thinking about the problem.
4. If carefully looked after, the plant can live through the winter.
5. Having filled up the car, we continued our journey.
6. Impressed by my work, the manager extended my contract.
7. Having written two tests today, they are too tired to do the third one.
8. Driving home, he had an accident.
9. Trapped in a dilemma, he couldn't decide what to do.
10. After dropping him off at the station, I drove straight to the supermarket.
11. Impressed by Mike's work, the teacher gave him the highest mark.
12. Having been to England before, he knew where to find a good hotel.

7.5. Study note

Participles Overview

- 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:
 - Present Participle (Participle I), e.g., *coming*
 - Perfect Participle, e.g., *having completed*
 - Past Participle (Participle II), e.g., *used*
- Participles may also be identified with a particular Voice: active or passive.

Present and Past Participles as Adjectives

- 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?).

Perfect Participle

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

Participle Constructions

- Participles are often used as part of Participle Constructions or Clauses, enabling a more economical presentation of information compared to complex sentences.
- Participle Constructions act as adjectives or adverbs within sentences and usually are reduced adverbial or relative clauses.
- They can be used after various conjunctions such as: when, while, if, though, etc.

Negative Participle Constructions

- Negative participle constructions are possible, where 'not' normally comes before the Participle.

Example Sentences

1. A humanoid drawn by Leonardo da Vinci is among the first verifiable automation.
2. Being fitted with vision equipment, robots are able to 'see'.
3. I hurt my arm while playing tennis.
4. Remember to take all your belongings with you when leaving the train.
5. Not having seen the film, I could not take part in its discussion.