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Department
for Language Studies

FOREIGN LANGUAGE 2

Guidelines for independent work assignments for students of technical specialties level B2

Almaty 2022

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Methodical guidelines contain material for classes and individual work on the basis of IELTS and TOEFL international exams.

Methodological guidelines are designed for the 1st year students of technical specialties of all forms of education

Fig.9, Table 3, bibliography - 5 titles.

Reviewer: Associate Professor, Department of E. E. A.S. Baimaganov,

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Unit 7 Transport

Text 7 A

The beam-operated traffic system

The number of people killed each year on the road is more than for all other types of avoidable deaths except for those whose lives are cut short by tobacco use. Yet road deaths are tolerated - so great is our need to travel about swiftly and economically. Oddly, modern vehicle engine design - the combustion engine - has remained largely unchanged since it was conceived over 100 years ago. A huge amount of money and effort is being channeled into alternative engine designs, the most popular being based around substitute fuels such as heavy water, or the electric battery charged by the indirect burning of conventional fuels, or by solar power. Nevertheless, such innovations will do little to halt the carnage on the road. What is needed is a radical rethinking of the road system itself.

The Beam-Operated Traffic System, proposed by a group of Swedish engineers, does away with tarred roads and independently controlled vehicles, and replaces them with innumerable small carriages suspended from electrified rails along a vast interconnected web of steel beams crisscrossing the skyline. The entire system would be computer-controlled and operate without human intervention.

The most preferable means of propulsion is via electrified rails atop the beams. Although electric transport systems still require fossil fuels to be burnt or dams to be built, they add much less to air pollution than the burning of petrol within conventional engines. In addition, they help keep polluted air out of cities and restrict it to the point of origin where it can be more easily dealt with. Furthermore, electric motors are typically 90% efficient, compared to internal combustion engines, which are at most 30% efficient. They are also better at accelerating and climbing hills. This efficiency is no less true of beam systems than of single vehicles.

A relatively high traffic throughput can be maintained - automated systems can react faster than can human drivers - and the increased speed of movement is expected to compensate for loss of privacy. It is estimated that at peak travel times passenger capacity could be more than double that of current subway systems. It might be possible to arrange for two simultaneous methods of vehicle hire: one in which large carriages (literally buses) run to a timetable, and another providing for hire of small independently occupied cars at a slightly higher cost. Travelers could order a car by swiping a card through a machine, which recognizes a personal number code.

Monorail systems are not new, but they have so far been built as adjuncts to existing city road systems. They usually provide a limited service, which is often

costly and fails to address the major concern of traffic choking the city. The Beam-Operated Traffic System, on the other hand, provides a complete solution to city transportation. Included in its scope is provision for the movement of pedestrians at any point and to any point within the system. A city relieved of roads carrying fast moving cars and trucks can be given over to pedestrians and cyclists who can walk or pedal as far as they wish before hailing a quickly approaching beam-operated car. Cyclists could use fold-up bicycles for this purpose.

Since traffic will be designated an area high above the ground, human activities can take place below the transit system in complete safety, leading to a dramatic drop in the number of deaths and injuries sustained while in transit and while walking about the city. Existing roads can be dug up and grassed over, or planted with low growing bushes and trees. The look of the city is expected to improve considerably for both pedestrians and for people using the System.

It is true that the initial outlay for a section of the beam-operated system will be more than for a similar stretch of tarred road. However, costs for the proposed system must necessarily include vehicle costs, which are not factored into road-building budgets. Savings made will include all tunnels, since it costs about US $120,000 per kilometer to build a new six lane road tunnel. Subway train tunnels cost about half that amount, because they are smaller in size. Tunnels carrying beamed traffic will have a narrower cross-sectional diameter and can be dug at less depth than existing tunnels, further reducing costs.

The only major drawbacks to the proposal are entrenched beliefs that resist change, the potential for vandalism, and the loss of revenue for car manufacturers. Video camera surveillance is a possible answer to vandalism, while the last objection could be overcome by giving car manufacturers beam-operated vehicle building contracts. 60% of all people on earth live in cities; we must loosen the immediate environment from the grip of the road-bound car.

Questions 1-4. Refer to Reading Passage "The Beam-Operated Traffic System", and complete the flowchart below with appropriate words or phrases from the passage.

Current city traffic system

Internal combustion engine	Independently control vehicles	Conventional tarred road system	Traffic choking the city

Proposed City Traffic System

_____ (1) rails	_____ (2) -controlled carriages	_____ (3) System	city without any _____ (4)

Questions 5 – 9. Choose the most suitable heading from the list of headings below for the seven sections of Reading Passage "The Beam-Operated Traffic System".

List of Headings

a) Returning the city to the people
b) Speed to offset loss of car ownership
c) Automation to replace existing roads
d) A safe and cheap alternative
e) The monorail system
f) Inter-city freeways
g) Doing the sums (*Example*)
h) The complete answer to the traffic problem
i) Cleaner and more efficient

5) Section (ii) _____
6) Section (hi)_____
7) Section (iv)_____
8) Section (v)_____
9) Section (vi)_____
Example: Section (vii)____g__

Questions 10-12. Refer to Reading Passage, and look at the statements below. Write S if the statement is Supported by what is written in the passage, and write NS if the statement is Not Supported

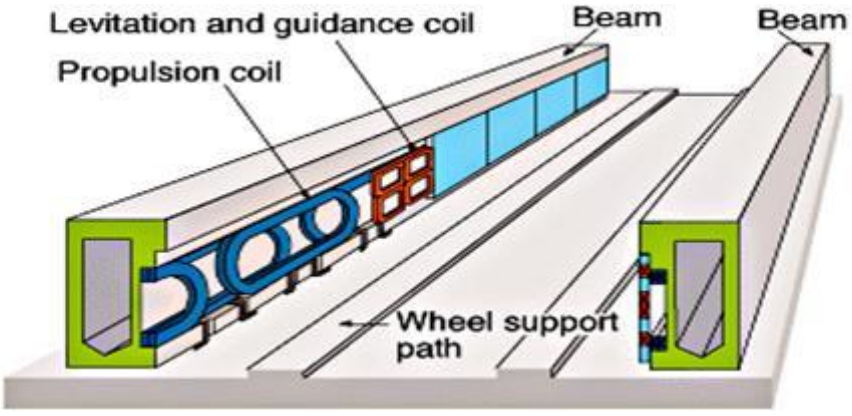
10) The increased speed of traffic in a Beam-Operated Traffic System is due to electric motors being 90% efficient.

11) Beamed traffic will travel through tunnels costing less to build than subway tunnels.

12) A possible solution to willful damage to the System is to install camera equipment.

Text 7B

High – speed train

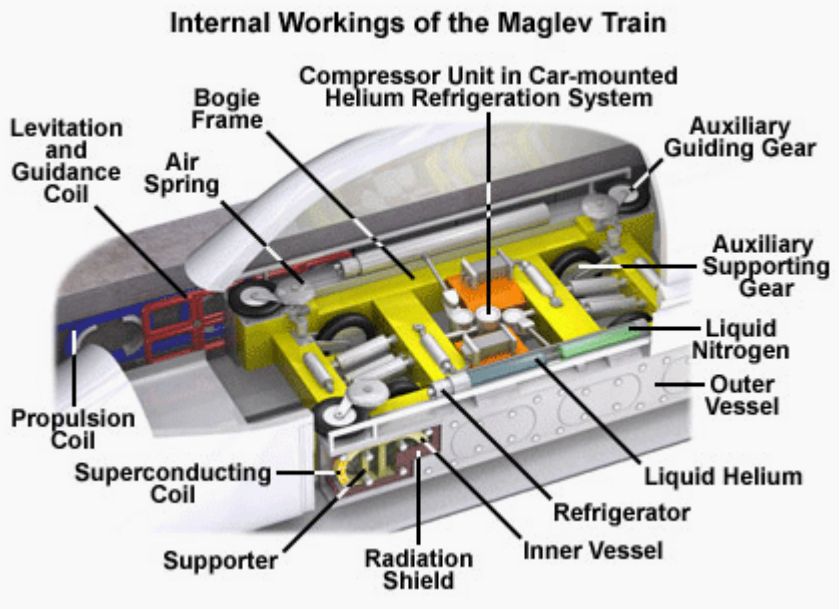


The Shinkansen, or bullet train, is a high-speed train which operates throughout Japan, connecting major cities. Services began in 1964, and at 210 kilometers per hour it was then the fastest train in the world. Now, trains operating on the Sanyo line, which connects Shin-Osaka and Hakarta, regularly achieve speeds of 300 kilometers per hour. There speeds are made possible by aerodynamic design of the Shinkansen and the system of motors it uses. Instead of having an engine which pulls the carriages along, the train is powered by a series of powerful electric motors which run along the length of the train. The zero series train, for example, uses a total of 64 sets of motors with a combined output of 11,840 kilowatts.

In Tokyo, between 1986 and 1996, the number of commuters increased sixteen-fold, and it became clear that the motor car was not a sensible solution. Trains are faster and cause less pollution than cars, and most Shinkansens can carry at least 1,200 passengers, as the carriages are double-deckers. The train runs on a normal train track, but it can only reach top speed on straighter parts of the line.

Another type of high-speed train is Maglev, which is short for magnetically-levitated train. The first of there to operate commercially was built in Shanghai, connecting the city centre to the Pudong International Airport. The Maglev's top speed is 430 kilometers per hour. This is 130 kilometers per hour faster than Shinkansen. It can cover the distance between Shanghai and the airport, which is 31 kilometers, in eight minutes, an average speed of 268 kilometers per hour – not quite as fast as the top average speed for the Shinkansen.

There are three basic components to the Maglev: firstly a large electrical power source, secondly metal coils along a guide way or track, and thirdly, large guidance magnets underneath the train. Magnets in propulsion coil move the train forward. These magnets rapidly alternate between north and south, so the train is pulled forward by the forces of attraction and repulsion as it moves between them. Similarly, magnets beneath the train and below the track cause it to levitate, or float. As soon as the train is levitated, power is supplied to a second set of coils, the propulsion coils at the side of the track. The Maglev has no wheels and does not make any contact with the ground.



Compared with the Shinkansen, the Maglev has both advantages and disadvantages. The biggest advantage is that because the Maglev makes no contact with the track and has no moving parts, it should in theory need no maintenance, which would make it much cheaper to run. Another bonus is that Maglev trains are almost silent. The only sound is that of the air rushing by. The Shinkansen is quiet, but not as quiet as Maglev. The Maglev can also accelerate more quickly, and is more efficient when going uphill. It also uses slightly less energy than the Shinkansen, and is less damaging to the environment.

The main disadvantage is that the Maglev track is very expensive to build. The Shinkansen track cost US $1.2 billion to build, just for 31 kilometers. This makes it the most expensive train track in the world. Also, because it cannot run on a normal railway, it is limited in where it can go. It is only really able to connect two very large areas to be commercially profitable. Nevertheless, maglevs are currently being considered in Japan, Germany and the United States, and may become the land transport of the future.

Question 1-8. Match the words and the definitions:

a) aerodynamic	1) a vehicle, usually a bus or train, with two floors
b) double-decker	2) to change between two things and repeat the change frequently
c) levitate	3) to rise or lift something into the air
d) alternate	4) designed so that it moves quickly and easily through the air
e) attraction	5) keeping something in good working condition
f) repulsion	6) to move quickly away from something and keep going faster
g) accelerate	7) a force that pulls or keeps things together
h) maintenance	8) a force that pushes or keeps things away from each other

Questions 9 – 12. Read the passage and choose the correct answer

9) The Shinkansen has …

a) more than one engine.

b) motors in the carriages.

c) an engine at the back.

d) a special type of track.

10) in comparison with the Shinkansen, the Maglev has …

a) a higher average speed.

b) more carriages.

c) a faster maximum speed.

d) lower ticket prices.

11) one advantage of Maglev over the Shinkansen is that …

a) it can run on a normal track.

b) it is powered by maglev.

c) it is cheaper to build.

d) it can go faster more quickly.

12) One disadvantage of the Maglev is that …

a) it has no wheels.

b) it disturbs the air.

c) it cannot make a profit in Shanghai.

d) it needs a special track.

Question 13 - 21. Read the passage again and complete the summary with no more than three words or a number.

The Shinkansen currently runs the (13) ____ in Japan and achieves average top speed of (14) ____. This is made possible by its aerodynamic design and a (15) ____ along the train. It was introduced because of a dramatic increase in the amount of (16) ____ in the capital city. It does not need special (17)____. Even faster is Maglev, which is powered by (18)____. This may be more economical to (19) ____ than the Shinkansen, but it is (20) ____ to build and only link (21)____ cities.

Text 7 C

Advantages of public transport

A. A New study conducted for the World Bank by Murdoch University's Institute for Science and Technology Policy (ISTP) has demonstrated that public transport is more efficient than cars. The study compared the proportion of wealth poured into transport by thirty-seven cities around the world. This included both the public and private costs of building, maintaining and using a transport system. The study found that the Western Australian city of Perth is a good example of a city with minimal public transport. As a result, 17% of its wealth went into transport costs. Some European and Asian cities, on the other hand, spent as little as 5%. Professor Peter Newman, ISTP Director, pointed out that these more efficient cities were able to put the difference into attracting industry and jobs or creating a better place to live. According to Professor Newman, the larger Australian city of Melbourne is a rather

unusual city in this sort of comparison. He describes it as two cities: 'A European city surrounded by a car-dependent one'. Melbourne's large tram network has made car use in the inner city much lower, but the outer suburbs have the same car-based structure as most other Australian cities. The explosion in demand for accommodation in the inner suburbs of Melbourne suggests a recent change in many people's preferences as to where they live. Newman says this is a new, broader way of considering public transport issues. In the past, the case for public transport has been made on the basis of environmental and social justice considerations rather than economics. Newman, however, believes the study demonstrates that 'the auto-dependent city model is inefficient and grossly inadequate in economic as well as environmental terms'.

Bicycle use was not included in the study but Newman noted that the two most 'bicycle friendly' cities considered - Amsterdam and Copenhagen - were very efficient, even though their public transport systems were 'reasonable but not special'.

It is common for supporters of road networks to reject the models of cities with good public transport by arguing that such systems would not work in their particular city. One objection is climate. Some people say their city could not make more use of public transport because it is either too hot or too cold. Newman rejects this, pointing out that public transport has been successful in both Toronto and Singapore and, in fact, he has checked the use of cars against climate and found 'zero correlation'. When it comes to other physical features, road lobbies are on stronger ground. For example, Newman accepts it would be hard for a city as hilly as Auckland to develop a really good rail network. However, he points out that both Hong Kong and Zürich have managed to make a success of their rail systems, heavy and light respectively, though there are few cities in the world as hilly.

In fact, Newman believes the main reason for adopting one sort of transport over another is politics: 'The more democratic the process, the more public transport is favored.' He considers Portland, Oregon, a perfect example of this. Some years ago, federal money was granted to build a new road. However, local pressure groups forced a referendum over whether to spend the money on light rail instead. The rail proposal won and the railway worked spectacularly well. In the years that have followed, more and more rail systems have been put in, dramatically changing the nature of the city. Newman notes that Portland has about the same population as Perth and had a similar population density at the time.

B. In the UK, travel times to work had been stable for at least six centuries, with people avoiding situations that required them to spend more than half an hour travelling to work. Trains and cars initially allowed people to live at greater distances without taking longer to reach their destination. However, public infrastructure did not keep pace with urban sprawl, causing massive congestion problems which now make commuting times far higher.

C. There is a widespread belief that increasing wealth encourages people to live farther out where cars are the only viable transport. The example of European cities refutes that. They are often wealthier than their American counterparts but have not generated the same level of car use. In Stockholm, car use has actually fallen in

recent years as the city has become larger and wealthier. A new study makes this point even more starkly. Developing cities in Asia, such as Jakarta and Bangkok, make more use of the car than wealthy Asian cities such as Tokyo and Singapore. In cities that developed later, the World Bank and Asian Development Bank discouraged the building of public transport and people have been forced to rely on cars - creating the massive traffic jams that characterize those cities.

D. Newman believes one of the best studies on how cities built for cars might be converted to rail use is The Urban Village report, which used Melbourne as an example. It found that pushing everyone into the city center was not the best approach. Instead, the proposal advocated the creation of urban villages at hundreds of sites, mostly around railway stations.

E. It was once assumed that improvements in telecommunications would lead to more dispersal in the population as people were no longer forced into cities. However, the ISTP team's research demonstrates that the population and job density of cities rose or remained constant in the 1980s after decades of decline. The explanation for this seems to be that it is valuable to place people working in related fields together. 'The new world will largely depend on human creativity, and creativity flourishes where people come together face-to-face.'

Questions 1-5. You should spend about 20 minutes on Questions 1-13, which are based on Reading Passage 95. Reading Passage 95 has five paragraphs, A-E. Choose the correct heading for each paragraph from the list of headings below. Write the correct letter a-h, in boxes 1-5 on your answer sheet.

List of Headings

a) Avoiding an overcrowded center
b) A successful exercise in people power
c) The benefits of working together in cities
d) Higher incomes need not mean more cars
e) Economic arguments fail to persuade
f) The impact of telecommunications on population distribution
g) Increases in travelling time
h) Responding to arguments against public transport

1) Paragraph A
2) Paragraph B
3) Paragraph C
4) Paragraph D
5) Paragraph E

Questions 6-10. Do the following statements agree with the information given in Reading Passage 95? In boxes 6-10 on your answer sheet, write

TRUE if the statement agrees with the information

FALSE if the statement contradicts the information
NOT GIVEN if there is no information on this

6) The ISTP study examined public and private systems in every city of the world.
7) Efficient cities can improve the quality of life for their inhabitants
8) An inner-city tram network is dangerous for car drivers
9) In Melbourne, people prefer to live in the outer suburbs
10) Cities with high levels of bicycle usage can be efficient even when public transport is only averagely good.

*Questions 11-13. Look at the following cities (*Questions 11-13*) and the list of descriptions below. Match each city with the correct description, A-F. Write the correct letter, A-F, in boxes 11-13 on your answer sheet.*

11) Perth
12) Auckland
13) Portland

List of Descriptions

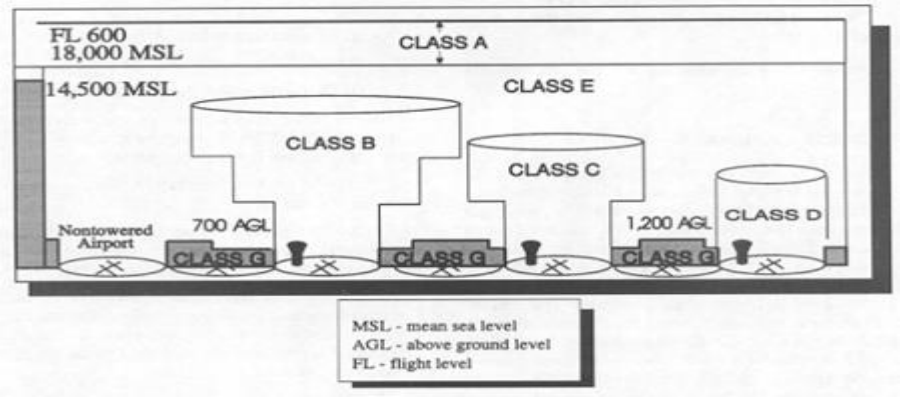
a) successfully uses a light rail transport system in hilly environment
b) successful public transport system despite cold winters
c) profitably moved from road to light rail transport system
d) hilly and inappropriate for rail transport system
e) heavily dependent on cars despite widespread poverty
f) inefficient due to a limited public transport system

Unit 8

Aircrafts

Text 8 A

Air traffic control



A. An accident that occurred in the skies over the Grand Canyon in 1956 resulted in the establishment of the Federal Aviation Administration (FAA) to regulate and oversee the operation of aircraft in the skies over the United States, which were becoming quite congested. The resulting structure of air traffic control has greatly increased the safety of flight in the United States, and similar air traffic control procedures are also in place over much of the rest of the world.

B. Rudimentary air traffic control (ATC) existed well before the Grand Canyon disaster. As early as the 1920 s, the earliest air traffic controllers manually guided aircraft in the vicinity of the airports, using lights and flags, while beacons and flashing lights were placed along cross-country routes to establish the earliest airways. However, this purely visual system was useless in bad weather, and, by the 1930s, radio communication was coming into use for ATC. The first region to have something approximating today's ATC was New York City, with other major metropolitan areas following soon after.

C. In the 1940s, ATC centers could and did take advantage of the newly developed radar and improved radio communication brought about by the Second World War, but the system remained rudimentary. It was only after the creation of the FAA that full-scale regulation of America's airspace took place, and this was fortuitous, for the advent of the jet engine suddenly resulted in a large number of very fast planes, reducing pilots' margin of error and practically demanding some set of rules to keep everyone well separated and operating safely in the air.

D. Many people think that ATC consists of a row of controllers sitting in front of their radar screens at the nation's airports, telling arriving and departing traffic what to do. This is a very incomplete part of the picture. The FAA realized that the airspace over the United States would at any time have many different kinds of planes, flying for many different purposes, in a variety of weather conditions, and the same kind of structure was needed to accommodate all of them.

E. To meet this challenge, the following elements were put into effect. First, ATC extends over virtually the entire United States. In general, from 365m above the ground and higher, the entire country is blanketed by controlled airspace. In certain areas, mainly near airports, controlled airspace extends down to 215m above the ground, and, in the immediate vicinity of an airport, all the way down to the surface. Controlled airspace is that airspace in which FAA regulations apply. Elsewhere, in uncontrolled airspace, pilots are bound by fewer regulations. In this way, the recreational pilot who simply wishes to go flying for a while without all the restrictions imposed by the FAA has only to stay in uncontrolled airspace, below 365m, while the pilot who does want the protection afforded by ATC can easily enter the controlled airspace.

F. The FAA then recognized two types of operating environments. In good meteorological conditions, flying would be permitted under Visual Flight Rules (VFR), which suggests a strong reliance on visual cues to maintain an acceptable level of safety. Poor visibility necessitated a set of Instrumental Flight Rules (IFR), under which the pilot relied on altitude and navigational information provided by the plane's instrument panel to fly safely. On a clear day, a pilot in controlled airspace

can choose a VFR or IFR flight plan, and the FAA regulations were devised in a way which accommodates both VFR and IFR operations in the same airspace. However, a pilot can only choose to fly IFR if they possess an instrument rating which is above and beyond the basic pilot's license that must also be held.

G. Controlled airspace is divided into several different types, designated by letters of the alphabet. Uncontrolled airspace is designated Class F, while controlled airspace below 5,490 m above sea level and not in the vicinity of an airport is Class E. All airspace above 5,490 m is designated Class A. The reason for the division of Class E and Class A airspace stems from the type of planes operating in them. Generally, Class E airspace is where one finds general aviation aircraft (few of which can climb above 5,490 m anyway), and commercial turboprop aircraft. Above 5,490 m is the realm of the heavy jets, since jet engines operate more efficiently at higher altitudes. The difference between Class E and A airspace is that in Class A, all operations are IFR, and pilots must be instrument-rated, that is, skilled and licensed in aircraft instrumentation. This is because ATC control of the entire space is essential. Three other types of airspace, Classes D, C and B, govern the vicinity of airports. These correspond roughly to small municipal, medium-sized metropolitan and major metropolitan airports respectively, and encompass an increasingly rigorous set of regulations. For example, all a VFR pilot has to do to enter Class C airspace is establish two-way radio contact with ATC. No explicit permission from ATC to enter is needed, although the pilot must continue to obey all regulations governing VFR flight. To enter Class B airspace, such as on approach to a major metropolitan airport, an explicit ATC clearance is required. The private pilot who cruises without permission into this airspace risks losing their license.

Question 1- 6 Reading Passage has seven paragraphs, A-G. Choose the correct heading for paragraph A -G from the list below. Write the correct letter a-j.

List of Headings

a) Disobeying FAA Regulations
b) Aviation disaster prompts action
c) Two coincidental developments
d) Setting Altitude Zones
e) An oversimplified view
f) Controlling pilots' license
g) Defining airspace categories
h) Setting rules to weather conditions
i) Taking of Safety
j) First step towards ATC

1) Paragraph A
2) Paragraph C
3) Paragraph D
4) Paragraph E

5) Paragraph F
6) Paragraph G

Question 7-13. Do the following statements agree with the given information of the reading passage?

TRUE if the statement agrees with the information
FALSE if the statement contradicts the information
NOT GIVEN if there is no information on this

7) The FAA was created as a result of the introduction of the jet engine.
8) Air traffic control started after the Grand Canyon crash in 19 56.
9) Beacons and flashing lights are still used by the ATC today.
10) Some improvements were made in radio communication during World War II.
11) Class F airspace is airspace which is below 365m and not near airports.
12) All aircraft in class E airspace must use AFR.
13) A pilot entering class C airspace is flying over an average-sized city.

Text 8 B

The Wright brothers

This question has often been posed: Why were the Wright brothers able to succeed in an effort at which so many others had failed? Many explanations have been mentioned, but three reasons are most often *cited*. First, they were a team. Both men worked congenially and cooperatively, read the same books, located and shared information, talked *incessantly* about the possibility of manned flight, and sewed as a consistent source of inspiration and encouragement to each other. Quite simply, two geniuses are better than one.

Both were glider pilots. Unlike some other engineers who experimented with the theories of flight, Orville and Wilbur Wright experienced the practical aspects of aerodynamics by building and flying in kites and gliders. Each craft they built was 1 slightly superior to the last, as they incorporated knowledge that they had gained from previous failures. They had realized from their experiments I that the most serious challenge in manned flight would be stabilizing and *maneuvering* the aircraft once it was airborne. While others concentrated their efforts on the problem of achieving lift for take-off, the Wright brothers were focusing on developing a three-axis control for guiding their I aircraft. By the time that the brothers started to build an airplane, they were already among the world's best glider pilots; they knew the problems of riding the air first hand.

In addition, the Wright brothers had designed more effective wings for the airplane than had been previously engineered. Using a wind tunnel, they tested more than two hundred different wing designs, recording the effects of slight variations in shape on the pressure of air on the wings. The data from these experiments allowed the Wright brothers to construct a superior wing for their aircraft.

In spite of these advantages, however, the Wright brothers might not have succeeded had they not been born at precisely the opportune moment in history. Attempts to achieve manned flight in the early nineteenth century were *doomed* because the steam engines that powered the aircrafts were too heavy in proportion to the power that *they* produced. But by the end of the nineteenth century, when the brothers were experimenting with engineering options, a relatively light internal combustion engine had already been invented, and they were able to bring the ratio of weight to power within acceptable limits for flight.

1) Which of the following is the main topic of the passage?

a) The reasons why the Wright brothers succeeded in manned flight

b) The advantage of the internal combustion engine in the Wright brothers' experiments

c) The Wright brothers' experience as pilots

d) The importance of gliders to the development of airplanes

2) The word cited in paragraph 1 is closest in meaning to which of the following?

a) disregarded

b) mentioned

c) considered

d) proven

3)The word incessantly in paragraph 1 could best be replaced by which of the following?

a) confidently

b) intelligently

c) constantly

d) optimistically

4) What kind of experience did the Wright brothers have that distinguished them from their competitors?

a) They were geniuses

b) They were glider pilots

c) They were engineers

d) They were inventors

5) Find the sentence in paragraph 2 that explains the most serious problem that the Wright brothers anticipated in constructing a manned aircraft.

6) Look at the word maneuvering in the second passage. Find the word or phrase in this passage that is closest in meaning to maneuvering.

7) Why does the author suggest that the experiments with the wind tunnel were important?

a) Because they allowed the Wright brothers to decrease the weight of their airplane to acceptable limits

b) Because they resulted in a three-axis control for their airplane

c) Because they were important in the refinement of the wings for their airplane

d) Because they used the data to improve the engine for their airplane

8) The word they in paragraph 4 refers to
a) the Wright brothers
b) aircraft
c) engines
d) attempts
9) The word doomed in paragraph 4 is closest in meaning to
a) destined to fail
b) difficult to achieve
c) taking a risk
d) not well planned
10) In paragraph 4, the author suggests that the steam engines used in earlier aircraft had failed because
a) They were too small to power a large plane.
b) They were too light to generate enough power.
c) They did not have internal combustion power.
d) They did not have enough power to lift their own weight.
11) The passage discusses all of the following reasons that the Wright brothers succeeded EXCEPT
a) They worked very well together.
b) They both had practical experience building other aircraft.
c) They made extensive tests before they completed the design.
d) They were well funded.

Text 8 C

Lighter than air' ships

Before reading the text, think about the difference between air balloons and airships, and what airships are used for or could be used for in the future. Now read the text. How many of your ideas are talked about in the text?

It's one hundred years since the first commercial airships. Following a major crash, Zeppelin-style airships became unpopular, and were superseded by the new technology of aero planes. Now, however, safer airships are being developed. How will they be used in the future?

An airship is different from an air balloon because it has an engine and a steering system. There were several attempts at making a viable airship around the beginning of the twentieth century until designers made the Zeppelin-style airship, which was the only type of airship big enough to carry passengers and cargo.

Polar explorers were some of the first people to recognize the potential of airships for exploring remote areas and there was a flight inside the Arctic Circle as early as 1907. The first airship to reach the North Pole was on 12 May, 1926, followed by a major expedition in 1931.

These early airships were filled with highly flammable hydrogen and they tended to leak gas, which led to some serious accidents. The new airships, called

‘hybrid air vehicles’, use non-explosive helium and lose very little gas and, even if there is a hole, it takes days for the gas to leak out, making them much safer than the early airships. They can also take off and land almost anywhere on anything from ice to sand or even water. This makes them particularly useful in areas where there are no roads or where roads can be dangerous or unusable for months in winter.

Another potential use of hybrid air vehicles is for fighting forest fires. Currently planes are used for this, but they can only carry around 13,000 liters per trip and have to fly dangerously close to the fire. Large airships could carry up to one million liters of water and fly higher, above the flames. They could drop 200,000 liters of water an hour over a large area, making them much safer and more efficient. Helicopters could fill up the airship with more water while they are still in the sky. There are also plans to use the airships after a fire has been put out to help a burnt-out forest regrow by dropping seedlings, fertilizer and water.

It’s also possible that hybrid air vehicles will be used for leisure purposes in the future. For example, you could hire an airship to have a party on board and take a leisurely trip across the Atlantic with excellent food, drink and entertainment, like being on a luxury cruise liner in the sky.

1) Which paragraph in the text talks about the following?

a) airships used for fighting fires

b) how airships are different from air balloons

c) how airships could be used for pleasure

d) how airships were used for exploration

e) how hybrid air vehicles are different from the early airships

2) Read the article and decide if the sentences are true (T) or false (F). Circle the correct statements and correct those that are false.

a) Airships and air balloons are the same. *T/F*

b) Explorers used airships at the beginning of the twentieth century. *T/F*

c) Hybrid air vehicles are more dangerous than early airships. *T/F*

d) Hybrid air vehicles can carry 13,000 liters of water per trip. *T/F*

e) Hybrid air vehicles can fly higher than planes and so are safer for fire-fighting. *T/F*

e) Hybrid air vehicles are used now to help a forest regrow after a fire. *T/F*

3) Without looking at the text, see if you can remember the actual word used in the text, to replace the words in brackets with the same meaning.

a) An airship is different from a balloon because it has a _____ . (a way to control the direction in which a vehicle moves)

b) There were several _____ at making a viable airship. (efforts)

c) The Zeppelin-style airship was big enough to carry passengers and _____ . (things that are being sent by ship, plane, train, or truck)

d) Polar explorers recognized the _____ of airships for exploring remote areas . (the possibility to develop or achieve something in the future)

e) The first airship reached the North Pole in 1926, followed by a major _____ in 1931 . (a long journey organized for a particular purpose, especially to a dangerous or distant place)

4) The text contains several examples of the passive because we are interested in the action and not who did the action, eg planes are used rather than pilots use planes because we are not interested in who flies the planes. Look at the text again and underline other examples of the passive.

5) Now use the verbs in brackets in the correct form to make passive sentences.

a) The first commercial airships _____ (make) at the beginning of the nineteenth century

b) Early airships _____ (use) by polar explorers

c) The North Pole _____ (reach) by airship in 1926

d) A major expedition _____ (make) by airship in 1931

e) Now water for fighting fires _____ (carry) in planes

f) In the future, it's possible that airships _____ (fill) with water while they are still in the sky

g) In the future, it's possible that seedlings, fertilizer and water _____ (drop) to help the forest regrow

h) In the future, it's possible that airships _____ (hire) for parties

6) Discuss these questions with your partner(s).

a) What did you find interesting or surprising about airships?

b) Have you travelled in an air balloon/would you like to travel in an air balloon?

c) Would you like to travel in an airship? Why/Why not?

d) Can you think of any other possible uses for airships?

Unit 9 Submersibles

Text 9 A

The Census of Marine Life

Scientists on the Polar stern expedition have just finished searching the ocean bottom off the Antarctic Peninsula to look for any mollusks or other creatures that live under several hundred meters of ice. They cruised waters made more accessible when the Larsen A and B Ice Shelves shattered. For the exploration, they used a German icebreaker that pushes slowly through ice 1.5 m thick. An earlier expedition to the area had videoed what looked like clams living there. That earlier expedition couldn't bring back samples, but the crew cruise could.

The expedition is part of ten – year international project called the Census of Marine Life. Some 2,000 researchers at schools, museums and government agencies

in more than 70 countries are developing new method for studying marine life and are sampling the residents of both familiar and unfamiliar waters.

Some general trends are already emerging, such as worrying drops in some species' populations as modeled by computer programs. Yet the current phase of the census emphasizes fieldwork over computer modeling, says Ron O'Dor, the census scientific coordinator. "There was perfectly good reason why people didn't know very much about the ocean," says O'Dor. For example, standard winches on research vessels can take eight hours just to lower a collecting contraption to the bottom, and then another eight hours to haul a single sample back up. Because cruise time runs up big bills in a hurry, deep-ocean samples are extremely valuable. And only recently did remotely – operated vehicles and underwater digital cameras become good at collecting deep-ocean samples and images.

Now, the census has grown to 17 projects. One project research for historical records of sea life, such as fishing communities' tax records, as measured in barrels of their catch. Another relies heavily on modeling to predict the future of marine populations. Fourteen projects focus on field studies of marine creatures, from albatrosses soaring over the water to microbes living several kilometers deep.

The remaining census participants are creating the Ocean Biogeographic Information System (OBIS), which offers interest access to 12.9 million records of 77,000 species from 200 databases.

Planners early on recognized that the ocean depths need special attention. Scientists; knowledge of marine life is, literally, shallow. Although the ocean bottom lies 4,000 m underwater on average and in places plunges much deeper, nearly 90 per cent of the original entries into OBIS came from the top 100m of water, and 99 per cent came from the top 3.000 m. "nobody knows how many or what type of organisms live at lower depth," O'Don says.

With a wide variety of techniques, scientists are working to take a good look into the sea. Nicolas Makris and his fish – tracking research group at the Massachusetts Institute of Technology recently unveiled a sensor that can observe 10,000 square kilometers at a time over the continental shelf. Older tracking system for fiah could cover just 100 square meters at a time. Those systems gave only rough ideas of the size of huge fish clusters that swam this way and that. In a test off the coast of New Jersey, the new tool detected what may be the largest school of fish ever recorded in one image. It covered an area the size of Manhattan and included some 20 million fish.

The census is finding where fish aren't, as well as where they are. Sharks don't seem to frequent the ocean below 3,000 m. say Imants G. Priede of the Aberdeen in Scotland and his colleagues. They looked at worldwide records and their own sampling data from five cruises in the northeastern Atlantic. Shark species inhabit the water down to 2,000 m, they report. In the depths though, sharks rarely appear, although bony fish live there. Sharks are "apparently confined to about 30 per cent of the total ocean," the researchers report. That puts all of them within the reach of fishing fleets, so sharks may be more vulnerable to over-exploitation than previously thought," the researchers concluded.

Question 1-6. Complete the notes below. Write no more than three words for each answer. Polar stern expedition:

a) exploring area around Antarctic Peninsula
b) footage of ____ (1) obtained by earlier expeditions
c) current expedition able to ____ (2) to be studied
d) forms parts of Census of Marine Life

Current trends:

e) computers indicate falls in ___ (3)
f) census concentrating on ___ (4) rather than theoretical predictions
g) improved technology (such as ____ (5) and ____ (6) saves time and money

Question 7-11. Complete the summary. Choose no more than two words from the passage for each answer.

The Census of Marine Life aims to learn more about life in the ocean. It involves creating (7) ____to study and sample marine life. Better technology makes this possible. The different projects that make up the census work in different ways. Apart from those that concentrate on fieldwork, others study (8) ____, such as those kept by tax authorities, and computer models. One study used (9)____ to scan the bottom of the ocean for fish. Another analyzed sampling data and (10) ____ and came to the conclusion that shark population could be (11) ____ to the effects of the fishing industry.

Question 12. Choose two letters A-F. Which two factors make exploring the bottom of the ocean particularly difficult?

a) Thick surface ice
b) Falling numbers of creatures
c) High operating costs
d) Poor computer modelling
e) Technological limitations
f) The presence of sharks

Text 9 B

Tidal Power

Undersea turbines which produce electricity from the tides are set to become an important source of renewable energy for Dritain. lt is still too early to predict the extent of the impact they may have but all the signs are that they will play a significant role in the future.

A. Operating on the same principle as wind turbines, the power in sea turbines comes from tidal currents which turn blades similar to ships' propellers, but unlike wind, the tides are predictable and the power input is constant. The technology raises the prospect of Britain becoming self-sufficient in renewable energy and drastically

reducing its carbon dioxide emissions. If tide, wind and wave power are all developed Britain would be able to close gas, coal and nuclear power plants and export renewable power to other parts of Europe. Unlike wind power which Britain originally developed and then abandoned for 20 years allowing the Dutch to make it a major industry undersea turbine could become a big export earner to island nations such as Japan and New Zealand.

B. Tidal sites have already been identified that will produce one sixth or more of the UK's power - and at prices competitive with modern gas turbines and undercutting those of the already ailing nuclear industry. One site alone, the Pendand Firth between Orkney and mainland Scotland, could produce 10% of the country's electricity with banks of turbines under the sea, and another at Alderney in the Channel Islands three times the 1.200 megawatts of Britain's largest and newest nuclear plant, Sizewell B, in Suffolk. Other sites identified include the Bristol Channel and the west coast of Scotland, particularly the channel between Campbeltown and Northern Ireland.

C. Work on designs for the new turbine blades and sites are well advanced at the University of sustainable energy research group of Southampton. The first station is expected to be installed off Lynmouth in Devon shortly to test the technology in a venture jointly funded by the department of Trade and Industry and the European Union. AbuBakr Bahaj, in charge of the Southampton research said: The prospects for energy from tidal currents are far better than from wind because the flows of water are predictable and constant. The technology for dealing with the hostile saline environment under the sea has been developed in the North Sea oil industry and much is already known about turbine blade design, because of wind power and ship propellers. There are a few technical difficulties, but I believe in the next five to ten years we will be installing commercial marine turbine farms.' Southampton has been awarded £2'l5. U.`D over three years to develop the turbines and is working with Marine Current Turbines. a subsidiary of IT power; on the Lynmouth project. EU research has now identified 1GB potential sites for tidal powen BG% round the coasts oil Britain. The best sites are between islands or around heavily indented coasts where there are strong tidal currents.

D. A marine turbine blade needs to be only one third of the size of a wind generator to produce three times as much power. The blades will be about 20 metres in diameter so around 30 meters of water is required. Unlike wind power there are unlikely to be environmental objections. Fish and other creatures are thought unlikely to be at risk from the relatively slow turning blades. Each turbine will be mounted on a tower which will connect to the national power supply grid via underwater cables. The towers will stick out of the water and be lit to warn shipping, and also be designed to be lifted out of the water for maintenance and to clean seaweed from the blades.

E. Dr Baha has done most work on the Alderrney site, where there are powerful currents. The single undersea turbine farm would produce far more power than needed for the Channel Islands and most would be fed into the French Grid and be re-imported into Britain via the cable under the Channel.

F One technical difficulty is cavitation, where low pressure behind a turning blade causes air bubbles. These can cause vibration and damage the blades of the turbines. Dr Bahaj said: 'We have to lest a number of blade types to avoid this happening or at least make sure it does not damage the turbines or reduce performance. Another slight concern is submerged debris floating into the blades. So far, we do not know how much of a problem it might be. We will have to make the turbines robust because the sea is a hostile environment but all the signs that we can do it are good.

Questions 1-4. Reading Passage 2 has six paragraphs, A-F. Which paragraph contains the following information? Write the correct letter; A-F in boxes 14-17 on your answer sheet. NB You may use any letter more than once.

1) the location of the first test site

2) a way of bringing the power produced on one site back into Britain

3) a reference to a previous attempt by Britain to find an alternative source of energy

4) mention of the possibility of applying technology from another industry

Questions 5 – 10. Choose five letters A-J. Write the correct letters in boxes 18-22 on your answer street. Which five of the following claims about tidal power are made by the writer?

a) It is a more reliable source of energy than wind power

b) It would replace all other forms of energy in Britain

c) Its introduction has come as a result of public pressure

d) It would cut down on air pollution.

e) It could contribute to the closure of many existing power stations in Britain

f) It could be a means of increasing national income

g) It could face a lot of resistance from other fuel industries

h) It could be sold more cheaply than any other type of fuel

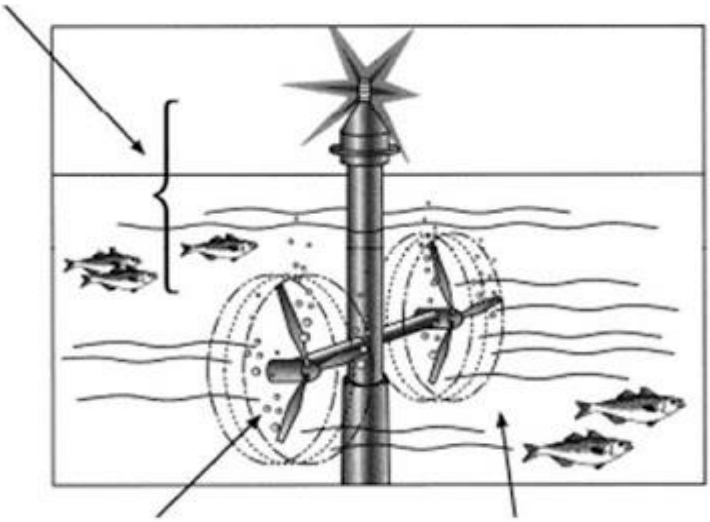
i) It could compensate for the shortage of inland sites for energy production

j) It is best produced in the vicinity of coastlines with particular features

Questions 10 – 13. Label the diagram below Choose no more than two words from the passage for each answer.

An Undersea Turbine

Whole tower can be raised for ____(10) and the extraction of seaweed from the blades



Air bubbles result from the (11)____ Sea life not in danger due to the fact that blades are comparatively (12)____ behind blades. This is known as (13)____.

Text 9 C

The Royal National Lifeboat Institution at Lyme Regis

Only two years after the foundation of the Royal National Institute for the Preservation of Life from Shipwreck in 1824, Lyme Fiegis was fully recognized as a town that needed a lifeboat.

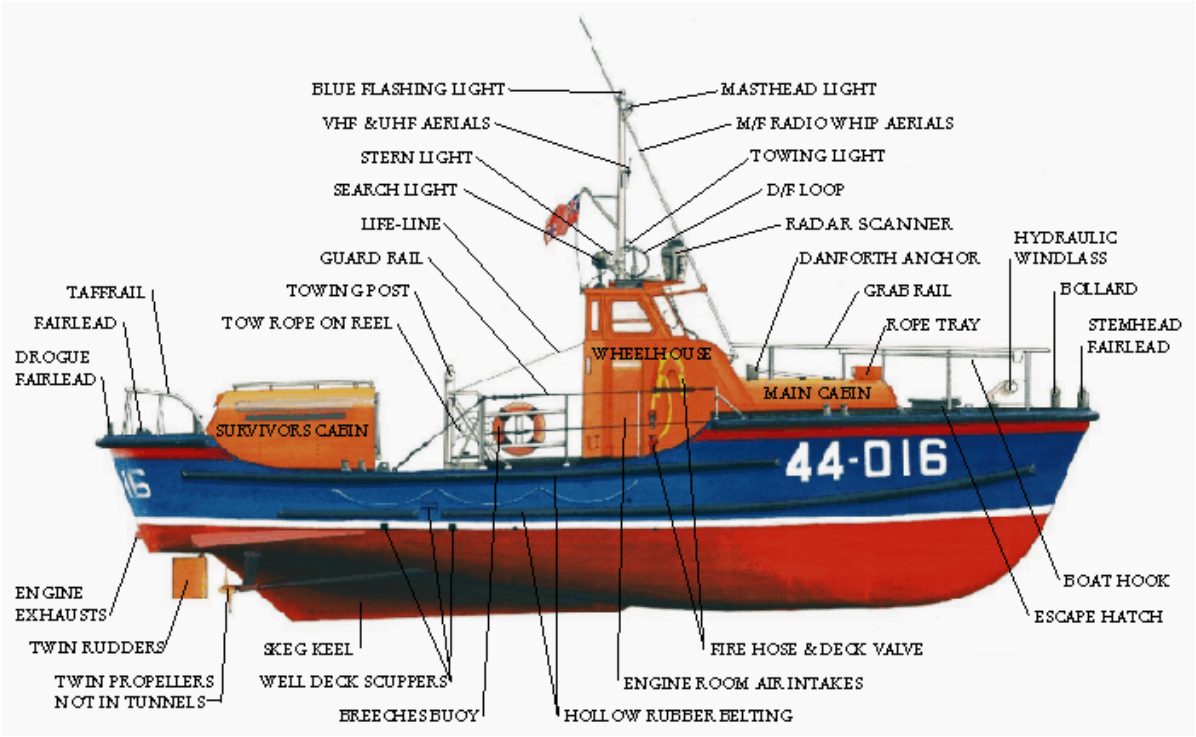
This need had been originally highlighted in the November of 1824 when, during a tremendous storm, the lives of the crew of the barque Unity were saved by local men at Black Ven, east of the town. The actions of three of the rescuers gained recognition in the awarding of a gold medal and two silver medals respectively. These were some of the first RNLI medals to be awarded.

Early in 1825, a Coastguard Captain named Richard Spencer altered a local boat by fitting airtight compartments and cork tendering so that it could be used as a “propel” lifeboat. The organization that we now know of as the RNLI (since 1854) was pleased with Spencer’s experiments and in 1826 brought the saving of life at sea under its auspices.

From 1826 to 1852 the station was served by two locally converted vessels, but no records exist as to their names. It was the events of Boxing Day 1852 that stimulated the need for a purpose—built lifeboat in the town, when four of the five life boatmen perished on service to the barque Heroine carrying emigrants bound for Australia.

The following years saw two 8m “Peake Plan" lifeboats at the town and in 1866 the first named lifeboat, the William Woodcock, was placed on station. The 10m

vessel carried out 7 rescue call-outs and was replaced in 1891 by the Susan Ashley and then by the Thomas Masterman Hardy in 1915. In all, these five sailing and rowing lifeboats carried out 32 call-outs before the station was closed in 1932, as motorized lifeboats from Exmouth and Weymouth were believed to be able to cover the area.



In 1937, and with only local boats once again acting as lifeboats, the Royal Air Force Marine Craft Unit came to the town and operated their fast patrol and safety launches from the site of what is now the Marine Centre west of Monmouth Beach. The Royal Air Force unit was closed in 1964. With the boom in boating as a recreation, and Lyme Regis now a thriving holiday resort, the town was yet again without a lifeboat: but after long discussions and hard fundraising, June 10th 1967 saw the re-opening of an RNLI lifeboat station in the town and almost 900 call-outs later, it is still operating to this day.

There have been many services at Lyme Regis that have been recognized by awards: in total, 1 Gold, 7 Silver and 3 Bronze Medals since 1825. The most prestigious in recent years being in August 1979 when helmsman John Hodder with his crew of three rescued a party of five persons (including a small boy) from their yacht White Kitten in storm force conditions.

John Hodder and crewman Colin Jones (who single-handedly sailed the yacht to the safety of the harbour) were each awarded the Bronze Medal and the crew was also presented with the Ralph Glister Award for the most meritorious rescue by an inshore lifeboat that year.

The lifeboat now stationed here was funded almost entirely by local donations and came into service on 29 th September 1997. She is a longer, wider and more powerful successor to the Atlantic 21 being powered by twin 7Oh.p. engines giving a maximum speed of 34 knots. Pearl of Dorset is fitted with a satellite navigation

system, VHF radio, righting capability in the event of a capsize, and first aid equipment. The crew is normally three, including the helmsman.

The boat is launched from its DO-DO trolley (meaning Drive On, Drive Off). This is maneuvered by a semi-submersible tractor enabling speedy launches particularly at low water. The station prides itself on an average launch time from initial call to leaving the harbor of just seven minutes. Each year the lifeboat launches over one hundred times on rescue call-outs and exercises, many of which involve other rescue services.

Today's volunteer life boatmen here come from all walks of life. Only two of the crew of fourteen are professional seafarers: the rest are made up of such professions as teachers, market gardeners, engineers, builders and chefs. The crew is supported by a similar number of people on the shore acting as mechanics, tractor drivers, radio operators and other invaluable shore helpers. They are all dedicated to the saving of life at sea and can only do so by the continued support of the public.

Questions 1—5. Look at the events and dates below. Match one date to each event. Use each date once only. Write your answers in boxes l—5 on your answer sheet.

1) A lifeboat service was provided by the armed forces
2) Several life boatmen died carrying out a rescue
3) The first dedicated lifeboat was created
4) The lifeboat service was relocated to other coastal towns
5)The Royal National Institute for the Preservation of Life from Shipwreck changed its name

1824	1825	1852	1854	1866	1932	1937	1964	1967

Questions 6—8. Choose the correct letter; a), b), c) or d. Write the correct letter in boxes 6—8 on your answer sheet.

6)The current lifeboat was mostly paid for by
a) the local council
b) local people
c) the crew
d) the RNLI
7) The current lifeboat is launched
a) from a trolley
b) from a larger boat
c) in shallow water
d) in under seven minutes
8) John Hodder won a medal for
a) rescuing so many people
b) skilful sailing in bad weather
c) sailing single-handed
d) rescuing a small boy

Questions 9-13.Do the following statements reflect the claims of the writer? In boxes 9—I3 on your answer sheet, write

YES if the statement reflects the claims of the writer
NO if the statement contradicts the claims of the writer
NOT GIVEN if it is impossible to say what the writer thinks about this

9) Richard Spencer's lifeboat saved many lives
10) Lyme Regis has had its own lifeboat service since 1937
11) The lifeboat service is important to the local economy
12) The present lifeboat will not sink if it turns over in the water
13) Life boatmen come from a wide variety of backgrounds

Unit 10

Lasers and optical fibers

Text 10A

The word laser was *coined* as an acronym for Light Amplification by the Stimulated Emission of Radiation. Ordinary light, from the Sun or a light bulb, is emitted spontaneously, when atoms or molecules get rid of excess energy by themselves, without any outside *intervention*. Stimulated emission is different because *it* occurs when an atom or molecule holding onto excess energy has been stimulated to emit it as light.

Albert Einstein was the first to suggest the existence of stimulated emission in a paper published in 1917. However, for many years physicists thought that atoms and molecules always were much more likely to emit light spontaneously and that stimulated emission thus always would be much weaker. It was not until after the Second World War that physicists began trying to make stimulated emission dominate. They sought ways by which one atom or molecule could stimulate many others to emit light, amplifying it to much higher powers.

The first to succeed was Charles H. Townes, then at Columbia University in New York. Instead of working with light, however, he worked with microwaves, which have a much longer wavelength, and built a device he called a "maser," for Microwave Amplification by the Stimulated Emission of Radiation. Although he thought of the key idea in 1951, the first maser was not completed until a couple of years later. Before long, many other physicists were building masers and trying to discover how to produce stimulated emission at even shorter wavelengths.

The key concepts *emerged* about 1957. Townes and Arthur Schawlow, then at Bell Telephone Laboratories, wrote a long paper *outlining* the conditions needed to amplify stimulated emission of visible light waves. At about the same time, similar ideas crystallized in the mind of Gordon Gould, then a 37-year-old graduate student at Columbia, who wrote them down in a series of notebooks. Townes and Schawlow published their ideas in a scientific journal, *physical Review Letters*, but Gould filed

a patent application. Three decades later, people still argue about who deserves the credit for the concept of the laser.

1) The word “coined” in line 1 could best be replaced by
a) created
b) mentioned
c) understood
d) discovered
2) The word “intervention” in line 4 can best be replaced by
a) need
b) device
c) influence
d) source
3) The word “it” in line 5 refers to
a) light bulb
b) energy
c) molecule
d) atom
4) Which of the following statements best describes a laser?
a) A device for stimulating atoms and molecules to emit light
b) An atom in a high-energy state
c) A technique for destroying atoms or molecules
d) An instrument for measuring light waves
5) Why was Towne's early work with stimulated emission done with microwaves?
a) He was not concerned with light amplification.
b) It was easier to work with longer wavelengths.
c) His partner Schawlow had already begun work on the laser.
d) The laser had already been developed.
6) In his research at Columbia University, Charles Townes worked with all of the following EXCEPT
a)) stimulated emission
b) microwaves
c) light amplification
d) a maser
7) In approximately what year was the first maser built?
a) 1917
b) 1951
c) 1953
d) 1957
8) The word “emerged” in line 20 is closest in meaning to
a) increased
b) concluded
c) succeeded

d) appeared

9The word “outlining” in line 21 is closest in meaning to

a) assigning

b) studying

c) checking

d) summarizing

10) Why do people still argue about who deserves the credit for the concept of the laser?

a) The researchers' notebooks were lost

b) Several people were developing the idea at the same time

c) No one claimed credit for the development until recently

d) The work is still incomplete

Text 10 B

Striking Back at Lightning with Lasers

Seldom is the weather more dramatic than when thunderstorms strike. Their electrical fury inflicts death or serious injury on around 500 people each year in the United States alone_ As the clouds roll in, a leisurely round of golf can become a terrifying dice with death — out in the open, a lone golfer maybe a lightning bolt's most inviting target. And there is damage to property too. Lightning damage costs American power companies more than $100 million a year.

But researchers in the United States and Japan are planning to hit back. Already in laboratory trials they have tested strategies for neutralizing the power of thunderstorms, and this winter they will brave real storms, equipped with an armory of lasers that they will be pointing towards the heavens to discharge thunderclouds before lightning can strike.

The idea of forcing storm clouds to discharge their lightning on command is not new. In the early 1960s, researchers tried firing rockets trailing wires into thunderclouds to set up an easy discharge path for the huge electric charges that these clouds generate. The technique survives to this day at a test site in Florida run by the University of Florida, with support from the Electrical Power Research Institute (EPRI), based in California. EPRI, which is funded by power companies, is looking at ways to protect the United States' power grid from lightning strikes. `We can cause the lightning to strike where we want it to using rockets: says Ralph Bernstein, manager of lightning projects at EPRI. The rocket site is providing precise measurements of lightning voltages and allowing engineers to check how electrical equipment bears up.

Bad behavior

But while rockets are fine for research. They cannot provide the protection from lightning strikes that everyone is looking for. The rockets cost around S1,200

each, can only be fired at a limited frequency and their failure rate is about 40 per cent. And even when they do trigger lightning, things still do not always go according to plan. 'Lightning is not perfectly well behaved,' says Bernstein. `Occasionally, it will take a branch and go someplace it wasn't supposed to go.'

And anyway, who would want to fire streams of rockets in a populated area? 'What goes up must come down,' points out Jean-Claude Diels of the University of New Mexico. Diets is leading a project, which is backed by EPRI, to try to use lasers to discharge lightning safely — and safety is a basic requirement since no one wants to put themselves or their expensive equipment at risk. With around $500,000 invested so far, a promising system is just emerging from the laboratory.

The idea began some 20 years ago, when high-powered lasers were revealing their ability to extract electrons out of atoms and create ions. If a laser could generate a line of ionization in the air all the way up to a storm cloud, this conducting path could be used to guide lightning to Earth, before the electric field becomes strong enough to break down the air in an uncontrollable surge. To stop the laser itself being struck, it would not be pointed straight at the clouds. Instead it would be directed at a mirror, and from there into the sky. The mirror would be protected by placing lightning conductors dose by. Ideally, the cloud-zapper (gun) would be cheap enough to be installed around all key power installations, and portable enough to be taken to international sporting events to beam up at brewing storm clouds.

A stumbling block

However, there is still a big stumbling block. The laser is no nifty portable: it's a monster that takes up a whole room. Diels is trying to cut down the size and says that a laser around the size of a small table is in the offing. He plans to test this more manageable system on live thunderclouds next summer.

Bernstein says that Diels's system is attracting lots of interest from the power companies. But they have not yet come up with the $5 million that EPRI says will be needed to develop a commercial system, by making the lasers yet smaller and cheaper. `I cannot say I have money yet, but I'm working on it,' says Bernstein. He reckons that the forthcoming field tests will be the turning point — and he's hoping for good news. Bernstein predicts `an avalanche of interest and support' if all goes well. He expects to see loud-zappers eventually costing $50,000 to $100,000 each.

Other scientists could also benefit. With a lightning `switch' at their fingertips, materials scientists could find out what happens when mighty currents meet matter. Diels also hopes to see the birth of `interactive meteorology' — not just forecasting the weather but controlling it. `If we could discharge clouds, we might affect the weather,' he says.

And perhaps, says Diels, we'll be able to confront some other meteorological menaces. `We think we could prevent hail by inducing lightning,' he says. Thunder, the shock wave that comes from a lightning flash, is thought to be the trigger for the torrential rain that is typical of storms. A laser thunder factory could shake the

moisture out of clouds, perhaps preventing the formation of the giant hailstones that threaten crops. With luck, as the storm clouds gather this winter, laser-toting researchers could, for the first time, strike back.

Questions 1-3. Choose the correct letter, a), b), c) or d). Write the correct letter in boxes 1-3 on your answer sheet.

1) The main topic discussed in the text is

a) the damage caused to US golf courses and golf players by lightning strikes

b) the effect of lightning on power supplies in the US and in Japan

c) a variety of methods used in trying to control lightning strikes

d) a laser technique used in trying to control lightning strikes

2) According to the text, every year lightning

a) does considerable damage to buildings during thunderstorms

b) kills or injures mainly golfers in the United States

c) kills or injures around 500 people throughout the world

d) damages more than 100 American power companies

2) Researchers at the University of Florida and at the University of New Mexico

a) receive funds from the same source

b) are using the same techniques

c) are employed by commercial companies

d) are in opposition to each other

Questions 4-6. Complete the sentences below. Choose no more than two from the passage for each answer. Write your answers in boxes 4-6 on your answer sheet.

4) EPRI receives financial support from _____

5) The advantage of the technique being developed by Diets is that it can be used _____

6) The main difficulty associated with using the laser equipment is related to its _____

Questions 7-10.Complete the summary using the list of words, A-I, below. Write the correct letter, a-i, in gaps 7-1.,

In this method, a laser is used to create a line of ionization by removing electrons from (7)____. This laser is then directed at (8)____ in order to control electrical charges, a method which is less dangerous than using (9)____ As a protection for the lasers, the beams are aimed firstly at (10)____.

a) cloud-zappers	b) atoms	c) storm clouds
d) technique	f) ions	g) rockets
h) conductors	i) thunder	

Questions 11-13. Do the following statements agree with the information given in Reading Passage 115? In boxes 11-13 on your answer sheet write:

YES if the statement agrees with the claims of the writer

NO if the statement contradicts the claims of the writer
NOT GIVEN if it is impossible to say what the writer thinks about this

11) Power companies have given Diels enough money to develop his laser
12) Obtaining money to improve the lasers will depend on tests in real storms
13) Weather forecasters are intensely interested in DieIs's system

Text 10 C

Lasik surgery

Lasik surgery is a new method of restoring certain kinds of vision loss. Lasik is an acronym derived from the word “laser” and some medical terms.

Unlike cataract surgery, which restores vision to eyes marred by a cloudy lens, Lasik is an elective procedure performed on healthy eyes. Generally, patients who choose Lasik surgery suffer from myopia, or nearsightedness, which means that their eyes cannot visualize distant objects. It also corrects farsightedness, the inability to see close objects, as well as astigmatism, which is a visual distortion that causes blurred vision. But the procedure does not correct press by opia, the inability of the eye to focus that comes naturally with age.

Lasik surgery is painless. Recovery is fast, and vision stabilizes quickly. Also, it is easy to go back to fine-tune results. Using a special knife, the surgeon slices a microscopically-thin hinged flap in the top of the cornea, exposes what is under the flap, and then zaps the exposed tissue with a laser for a preprogrammed number of seconds. The laser sculpts the cornea according to the correction needed. The flap is then carefully replaced. The eye’s natural suction enables the flap to adhere without stitches.

Generally, Lasik is not appropriate for patients with high levels of nearsightedness or astigmatism. It is also possible that patients with large pupils will experience glare and halos after surgery. Likewise, some patients have been left with serious and uncorrectable problems after the procedure, including glare, haze, double vision, ghosting, or irregular astigmatism, a permanent warping of the cornea.

1) What is the talk mainly about?
a) Different procedures for improving the eyes
b) Several different eye defects
c) A particular kind of eye surgery
d) The benefits of Lasik surgery

2) Organize the following according to the order in which they take place during Lasik surgery:
a) Apply the laser
b) Slice the flap
c) Replace the flap
d) Expose the eye

3) The author contrasts cataract surgery from Lasik surgery by stating that Lasik surgery

a) is not a surgery of necessity

b) is safer

c) is more important

d) is more useful

4) Of the following types of eye problems, which would not be a likely candidate for Lasik surgery?

a) Myopia

b) Astigmatism

c) Presbyopia

d) Farsightedness

Text 10 D

Each advance in microscopic technique has provided scientists with new perspective, on the function of living organisms and the nature of matter itself. The invention of the visible-light microscope late in the sixteenth century introduced a previously unknown realm of single-celled plants and animals. In the twentieth century, electron microscopes have provided direct views of viruses and *minuscule* surface structures. Now another type of microscope, one that utilizes X rays rather than light or electrons, offers a different way of examining tiny details; *it* should extend human perception still farther into the natural world.

The dream of building an X-ray microscope dates to 1895; its development, however, was virtually halted in the 1940's because the development of the electron microscope was progressing rapidly. During the 1940's electron microscopes routinely achieved resolution better than that possible with a visible-light microscope, while the performance of X-ray microscopes resisted improvement. In recent years, however, interest in X-ray microscopes has revived, largely because of advances such as the development of new sources of X-ray illumination. As a result, the brightness available today is millions of times that of X-ray tubes, which, for most of the century, were the only available sources of soft X rays.

The new X-ray microscopes considerably improve on the resolution provided by optical microscopes. They can also be used to map the distribution of certain chemical elements. Some can form pictures in extremely short times; others hold the promise of special capabilities such as three-dimensional imaging. Unlike conventional electron microscopy, X-ray microscopy *enables* specimens to be kept in air and in water, which means that biological samples can be studied under conditions similar to their natural state. The illumination used, so-called soft X rays in the wavelength range of twenty to forty angstroms (an angstrom is one ten-billionth of a meter), is also sufficiently penetrating to image intact biological cells in many cases. Because of the wavelength of the X rays used, soft X-ray microscopes will never match the highest resolution possible with electron microscopes. *Rather*, their

special properties will make possible investigations that will complement *those* performed with light- and electron-based instruments.

1) What does the passage mainly discuss?
a) The detail seen through a microscope
b) Sources of illumination for microscope
c) A new kind of microscope
d) Outdated microscopic techniques
2) According to the passage, the invention of the visible-light microscope allowed scientists to
a) see viruses directly
b) develop the electron microscope later on
c) understand more about the distribution of the chemical elements
d) discover single-celled plants and animals they had never seen before
3) The word "minuscule" in line 5 is closest in meaning to
a) circular
b) dangerous
c) complex
d) tiny
4) The word "it" in line 7 refers to
a) a type of microscope
b) human perception
c) the natural world
d) light
5) Why does the author mention the visible-light microscope in the first paragraph?
a) To begin a discussion of sixteenth-century discoveries
b) To put the X-ray microscope in a historical perspective
c) To show how limited its uses are
d) To explain how it functioned
6) Why did it take so long to develop the X-ray microscope?
a) Funds for research were insufficient
b) The source of illumination was not bright enough until recently
c) Materials used to manufacture X-ray tubes were difficult to obtain
d) X-ray microscopes were too complicated to operate
7) The word "enables" in line 22 is closest in meaning to
a) constitutes
b) specifies
c) expands
d) allows
8) The word "Rather" in line 28 is closest in meaning to
a) significantly
b) preferably
c) somewhat

d) instead

9) The word "those" in line 29 refers to

a) properties

b) investigations

c) microscopes

d) X rays

10) Based on the information in the passage, what can be inferred about X-ray microscopes in the future?

a) They will probably replace electron microscopes altogether

b) They will eventually be much cheaper to produce than they are now

c) They will provide information not available from other kinds of microscopes

d) They will eventually chance the illumination range that they now use

Unit 11

Test 11A

Artificial Intelligence

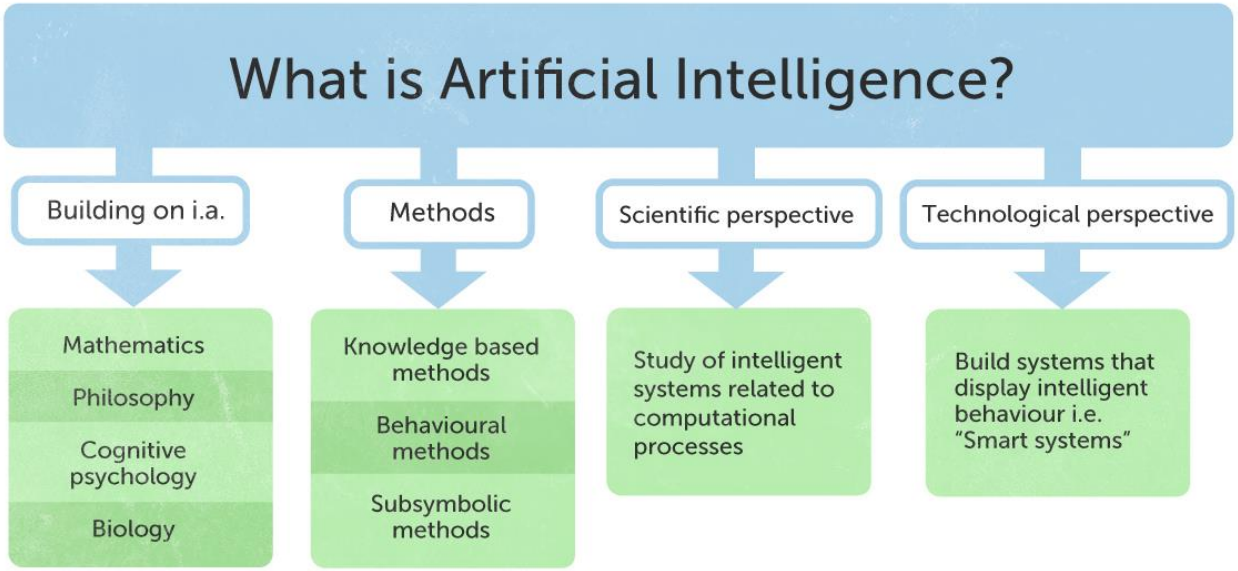
A. After years in the wilderness, the term 'artificial intelligence' (AI) seems poised to make a comeback. AI was big in the 1980 s but vanished in the 1990 s. It re-entered public consciousness with the release of Al, a movie about a robot boy. This has ignited public debate about AI, but the term is also being used once more within the computer industry. Researchers, executives and marketing people are now using the expression without irony or inverted commas. And it is not always hype. The term is being applied, with some justification, to products that depend on technology that was originally developed by AI researchers. Admittedly, the rehabilitation of the term has a long way to go, and some firms still prefer to avoid using it. But the fact that others are starting to use it again suggests that AI has moved on from being seen as an over-ambitious and under-achieving field of research.

B. The field was launched, and the term 'artificial intelligence' coined, at a conference in 1956 by a group of researchers that included Marvin Minsky, John McCarthy, Herbert Simon and Alan Newell, all of whom went on to become leading figures in the field. The expression provided an attractive but informative name for a research program that encompassed such previously disparate fields as operations research, cybernetics, logic and computer science. The goal they shared was an attempt to capture or mimic human abilities using machines. That said, different groups of researchers attacked different problems, from speech recognition to chess playing, in different ways; AI unified the field in name only. But it was a term that captured the public imagination.

C. Most researchers agree that AI peaked around 1985. A public reared on science-fiction movies and excited by the growing power of computers had high expectations. For years, AI researchers had implied that a breakthrough was just around the corner. Marvin Minsky said in 1967 that within a generation the problem of creating'artificial intelligence' would be substantially solved. Prototypes of

medical-diagnosis programs and speech recognition software appeared to be making progress. It proved to be a false dawn. Thinking computers and household robots failed to materialise, and a backlash ensued. `There was undue optimism in the early 1980 s; says David Leaky, a researcher at Indiana University. 'Then when people realized these were hard problems, there was retrenchment. By the late 1980s, the term AI was being avoided by many researchers, who opted instead to align themselves with specific sub-disciplines such as neural networks, agent technology, case-based reasoning, and so on.

D. Ironically, in some ways AI was a victim of its own success. Whenever an apparently mundane problem was solved, such as building a system that could land an aircraft unattended, the problem was deemed not to have been AI in the first plate. 'If it works, it can't be AI; as Dr Leaky characterizes it. The effect of repeatedly moving the goal-posts in this way was that AI came to refer to 'blue-sky' research that was still years away from commercialization. Researchers joked that AI stood for `almost implemented'. Meanwhile, the technologies that made it onto the market, such as speech recognition, language translation and decision-support software, were no longer regarded as AI. Yet all three once fell well within the umbrella of AI research.



E. But the tide may now be turning, according to Dr Leake. HNC Software of San Diego, backed by a government agency, reckons that their new approach to artificial intelligence is the most powerful and promising approach ever discovered. HNC claim that their system, based on a cluster of 30 processors, could be used to spot camouflaged vehicles on a battlefield or extract a voice signal from a noisy background - tasks humans can do well, but computers cannot. 'Whether or not their technology lives up to the claims made for it, the fact that HNC are emphasizing the use of AI is itself an interesting development; says Dr Leaky.

F. Another factor that may boost the prospects for AI in the near future is that investors are now looking for firms using clever technology, rather than just a clever business model, to differentiate themselves. In particular, the problem of information overload, exacerbated by the growth of e-mail and the explosion in the number of

web pages, means there are plenty of opportunities for new technologies to help filter and categorize information - classic AI problems. That may mean that more artificial intelligence companies will start to emerge to meet this challenge.

G. The 1969 film, 2001: A Space Odyssey, featured an intelligent computer called HAL 9000. As well as understanding and speaking English, HAL could play chess and even learned to lip-read. HAL thus encapsulated the optimism of the 1960s that intelligent computers would be widespread by 2001. But 2001 has been and gone, and there is still no sign of a HAL-like computer. Individual systems can play chess or transcribe speech, but a general theory of machine intelligence still remains elusive. It may be, however, that the comparison with HAL no longer seems quite so important, and AI can now be judged by what it can do, rather than by how well it matches up to a 30-year-old science-fiction film. 'People are beginning to realize that there are impressive things that these systems can do; says Dr Leake hopefully.

Questions 1-5. Reading Passage 81 has seven paragraphs, A-G. Which paragraph contains the following information?

1) how AI might have a military impact
2) the fact that AI brings together a range of separate research areas
3) he reason why AI has become a common topic of conversation
4) how AI could help deal with difficulties related to the amount of information available electronically
5) where the expression AI was first used

Questions 6-11 Do the following statements agree with the information given in Reading Passage?

TRUE if the statement agrees with the information
FALSE if the statement contradicts the information
NOT GIVEN if there is no information on this

6) The researchers who launched the field of AI had worked together on other projects in the past
7) In 1985, AI was at its lowest point
8) Research into agent technology was more costly than research into neural networks
9) Applications of AI have already had a degree of success
10) The problems waiting to be solved by AI have not changed since 1967
11) The film 2001: A Space Odyssey reflected contemporary ideas about the potential of AI computers.

Questions 12 - 14. Choose the correct letter

12)According to researchers, in the late 1980s there was a feeling that
a) a general theory of AI would never be developed.
b) original expectations of AI may not have been justified.

c) a wide range of applications was close to fruition.
d) more powerful computers were the key to further progress.
13) In Dr Leake's opinion, the reputation of AI suffered as a result of
a) changing perceptions
b) premature implementation
c) poorly planned projects
d) commercial pressures
14) The prospects for AI may benefit from
a) existing AI applications
b) new business models
c) orders from Internet-only companies
d) new investment priorities

Text 11 B

Three ways to levitate a Magic Carpet

It sounds like a science fiction joke, but it isn't. What do you get when you turn an invisibility cloak on its side? A mini flying carpet. So say physicists who believe the same exotic materials used to make cloaking devices could also be used to levitate tiny objects. In a further breakthrough, two other research groups have come a step closer to cracking the mysteries of levitation.

Scientists have levitated objects before, most famously using powerful magnetic fields to levitate a frog. But that technique, using the repulsive force of a giant magnet, requires large amounts of energy. In contrast, the latest theories exploit the natural smaller amounts of energy produced by the quantum fluctuations of empty space.

In May 2006, two research teams led by Ulf Leonhardt at St Andrew's University, UK, and John Pendry at Imperial College, London, independently proposed that an invisibility cloak could be created from exotic materials with abnormal optical properties. Such a cloaking device – working in the microwave region – was manufactured later that year.

The device was formed from so-called 'metamaterials', exotic materials made from complex arrays of metal units and wires. The metal units are smaller than the wavelength of light and so the materials can be engineered to precisely control how electromagnetic light waves travel around them. "They can transform space, tricking electromagnetic waves into moving along directions they otherwise wouldn't," says Leonhardt.

Leonhardt and his colleague Thomas Philbin, also at St Andrew's University, realized that this property could also be exploited to levitate extremely small objects. They propose inserting a metamaterial between two so-called Casimir plates. When two such plates are brought very close together, the vacuum between them becomes filled with quantum fluctuations of the electromagnetic field. As two plates are brought closer together, fewer fluctuations can occur within the gap between them, but on the outer sides of the plates, the fluctuations are unconstrained. This causes a

pressure difference on either side of the plates, forcing the plates to stick together, in a phenomenon called the Casimir effect.

Leonhardt and Philbin believe that inserting a section of metamaterial between the plates will disrupt the quantum fluctuations of the electromagnetic field.In particular, metamaterials have a negative refractive index, so that electromagnetic light waves entering a metamaterial bend in the opposite way than expected, says Leonhardt. That will cause the Casimir force to act in the opposite direction – forcing the upper plate to levitate. The work will appear in the New Journal of Physics.
Federico Capasso, an expert on the Casimir effect at Harvard University in Boston, is impressed. "Using metamaterials to reverse the Casimir effect is a very clever idea," he says. However, he points out that because metamaterials are difficult to engineer, it's unlikely that they could be used to levitate objects in the near future.

But there are good signs that quantum levitation could be achieved much sooner, by other methods. Umar Mohideen at the University of California Riverside and his colleagues have successfully manipulated the strength of the Casimir force by increasing the reflectivity of one of the plates, so that it reflects virtual particles more efficiently. Modifying the strength of the Casimir force is the first step towards reversing it, says team member Galina Klimchitskaya at North-West Technical University in St Petersburg, Russia.

Capasso and his colleagues have also been working on an alternative scheme to harness a repulsive Casimir effect. Their calculations show that a repulsive Casimir force could be set up between a 42.7 micrometre-wide gold-coated polystyrene sphere and a silicon dioxide plate, if the two are immersed in ethanol. "Although the Casimir force between any two substances – the ethanol and gold, the gold and the silicon dioxide, or the silicon dioxide and the ethanol – is positive, the relative strengths of attraction are different, and when you combine the materials, you should see the gold sphere levitate," he says.

Capasso's early experiments suggest that such repulsion could occur, and that in turn could be used to levitate one object above another. "It's very early work, and we still need to make certain this is really happening, but we are slowly building up experimental evidence for quantum levitation," says Capasso, who presented his results at a conference on Coherence and Quantum Optics in Rochester, New York, in June.

'This is a very exciting experimental result because it is the first demonstration that we can engineer a repulsive Casimir force/ says Leonhardt.

Questions 1-5. Do the following statements agree with the information given in Reading Passage?

TRUE if the statement agrees with the information
FALSE if the statement contradicts the information
NOT GIVEN if there is no information on this

1) A mini flying carpet is a possibility according to some scientists
2) Cloaking devices can be used for levitation

3) Scientists now know all about levitation
4) Things can be transported from place to place using empty space technology
5) The most recent research into levitation has made use of large magnets

Questions 6 – 10. Choose the correct letter, A, B, C or D.

6) Ulf Leonhardt and John Pendry
a) worked together on a project in 2006
b) both came up with the same idea
c) invented the microwave oven
d) used only basic objects in their research

7) Metamaterials are
a) similar to light, but with a smaller wavelength
b) a combination of simple metals and wires
c) able to change where electromagnetic waves go
d) engineered when light waves travel around them

8) The importance of the Casimir effect is that it
a) doesn't require a vacuum in order to work
b) increases the number of plates that can be used
c) creates large and frequent fluctuations
d) creates pressure difference and stickiness

9) Leonhardt and Philbin think that putting a metamaterial between two plates will
a) cause the top plate to rise above the bottom plate
b) stop electromagnetic light waves bending
c) stop the Casimir force from working
d) not affect electromagnetic fluctuations

10) Why is it important to change the strength of the Casimir force?
a) to reflect the plates
b) to help reverse the force
c) to see virtual particles better
d) to enable other scientists to progress

Questions 11 – 40. Complete each sentence with the correct ending A – F below.

11) Capasso is unconvinced that _____
a) gold can be used to produce levitation
b) a particular type of ethanol has to be used
c) the levitation will last for only a few seconds
d) using metamaterials will help lead to levitation in the short term
e) his experiment will be extremely costly to perform
f) his idea is still only a theory

12) Capasso has calculated that
a) gold can be used to produce levitation
b) a particular type of ethanol has to be used

c) the levitation will last for only a few seconds
d) using metamaterials will help lead to levitation in the short term
e) his experiment will be extremely costly to perform
f) his idea is still only a theory

13) Capasso has admitted that

a) gold can be used to produce levitation
b) a particular type of ethanol has to be used
c) the levitation will last for only a few seconds
d) using metamaterials will help lead to levitation in the short term
e) his experiment will be extremely costly to perform
f) his idea is still only a theory

Unit 12

Text 12 A

The Rocket from East to West

A. The concept of the rocket, or rather the mechanism behind the idea of propelling an object into the air, has been around for well over two thousand years. However, it wasn't until the discovery of the reaction principle, which was the key to space travel and so represents one of the great milestones in the history of scientific thought that rocket technology was able to develop. Not only did it solve a problem that had intrigued man for ages, but, more importantly, it literally opened the door to exploration of the universe.

B. An intellectual breakthrough, brilliant though it may be, does not automatically ensure that the transition is made from theory to practice. Despite the fact that rockets had been used sporadically for several hundred years, they remained a relatively minor arte-fact of civilization until the twentieth century. Prodigious efforts, accelerated during two world wars, were required before the technology of primitive rocketry could be translated into the reality of sophisticated astronauts. It is strange that the rocket was generally ignored by writers of fiction to transport their heroes to mysterious realms beyond the Earth, even though it had been commonly used in fireworks displays in China since the thirteenth century. The reason is that nobody associated the reaction principle with the idea of traveling through space to a neighboring world.

C. A simple analogy can help us to understand how a rocket operates. It is much like a machine gun mounted on the rear of a boat. In reaction to the backward discharge of bullets, the gun, and hence the boat, move forwards. A rocket motor's 'bullets' are minute, high-speed particles produced by burning propellants in a suitable chamber. The reaction to the ejection of these small particles causes the rocket to move forwards. There is evidence that the reaction principle was applied practically well before the rocket was invented. In his Noctes Atticae or Greek Nights, Aulus Gellius describes 'the pigeon of Archytas', an invention dating back to about

360 BC. Cylindrical in shape, made of wood, and hanging from string, it was moved to and fro by steam blowing out from small exhaust ports at either end. The reaction to the discharging steam provided the bird with motive power.

D. The invention of rockets is linked inextricably with the invention of 'black powder'. Most historians of technology credit the Chinese with its discovery. They base their belief on studies of Chinese writings or on the notebooks of early Europeans who settled in or made long visits to China to study its history and civilization. It is probable that, sometime in the tenth century, black powder was first compounded from its basic ingredients of saltpeter, charcoal and Sulphur. But this does not mean that it was immediately used to propel rockets. By the thirteenth century, powder propelled fire arrows had become rather common. The Chinese relied on this type of technological development to produce incendiary projectiles of many sorts, explosive grenades and possibly cannons to repel their enemies. One such weapon was the 'basket of fire' or, as directly translated from Chinese, the 'arrows like flying leopards'. The 0.7-meter-long arrows, each with a long tube of gunpowder attached near the point of each arrow, could be fired from a long, octagonal-shaped basket at the same time and had a range of 400 paces. Another weapon was the 'arrow as am flying sabre', which could be fired from crossbows. The rocket, placed in a similar position to other rocket-propelled arrows, was designed to increase the range. A small iron weight was attached to the 1.5m bamboo shaft, just below the feathers, to increase the arrow's stability by moving the center of gravity to a position below the rocket. At a similar time, the Arabs had developed the "egg which moves and burns". This 'egg' was apparently full of gunpowder and stabilized by a 1.5m tail. It was fired using two rockets attached to either side of this tail.

E. It was not until the eighteenth century that Europe became seriously interested in the possibilities of using the rocket itself as a weapon of war and not just to propel other weapons. Prior to this, rockets were used only in pyrotechnic displays. The incentive for the more aggressive use of rockets came not from within the European continent but from far-away India, whose leaders had built up a corps of rocketeers and used rockets successfully against the British in the late eighteenth century. The Indian rockets used against the British were described by a British Captain serving in India as 'an iron envelope about 200 millimeters long and 40 millimeters in diameter with sharp points at the top and a 3m-long bamboo guiding stick'. In the early nineteenth century, the British began to experiment with incendiary barrage rockets. The British rocket differed from the Indian version in that it was completely encased in a stout, iron cylinder, terminating in a conical head, measuring one meter in diameter and having a stick almost five meters long and constructed in such a way that it could be firmly attached to the body of the rocket. The Americans developed a rocket, complete with its own launcher, to use against the Mexicans in the mid-nineteenth century. A long cylindrical tube was propped up by two sticks and fastened to the top of the launcher, thereby allowing the rockets to be inserted and lit from the other end. However, the results were sometimes not that impressive as the behavior of the rockets in flight was less than predictable. Since then, there has been a huge development in rocket technology, often with devastating results in the forum

of war. Nevertheless, the modern-day space programs owe their success to the humble beginnings of those in previous centuries who developed the foundations of the reaction principle. Who knows what it will be like in the future?

Questions 1-4 Reading passage 11 has six paragraphs labeled A-F. Choose the most suitable headings for paragraphs B-E from the list of headings below. Write the appropriate letter a-i.

List of Headings

a) How the reaction principle works
b) The impact of the reaction principle
c) Writer's theories of the reaction principle
d) Undeveloped for centuries
e) The first rockets
f) The first use of steam
g) Rockets for military use
h) Developments of fire
i) What's next?

1) Paragraph B
2) Paragraph C
3) Paragraph D
4) Paragraph E

Questions 5 and 6. Choose the appropriate letters A-D and write them in boxes 5 and 6 on your answer sheet.

5) The greatest outcome of the discovery of the reaction principle was that
a) rockets could be propelled into the air
b) space travel became a reality
c) a major problem had been solved
d) bigger rockets were able to be built
6) According to the text, the greatest progress in rocket technology was made
a) from the tenth to the thirteenth centuries
b) from the seventeenth to the nineteenth centuries
c) from the early nineteenth to the late nineteenth century
d) from the late nineteenth century to the present day

Questions 7-10. From the information in the text, indicate who first invented or used the items in the list below. Write the appropriate letters A-E in boxes 7-10 on your answer sheet. You may use any letter more than once.

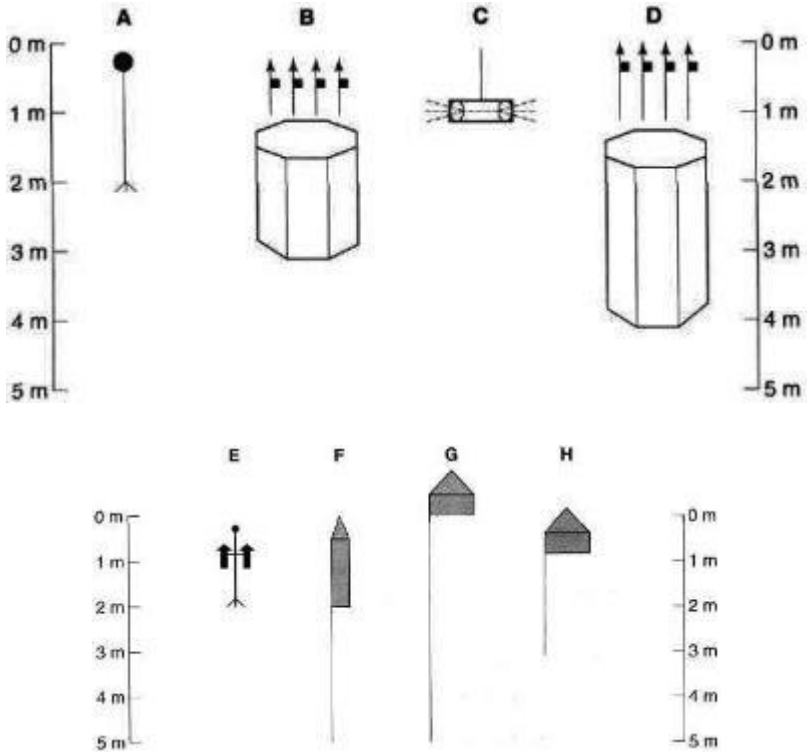
7) black powder
8) rocket-propelled arrows for fighting
9) rockets as war weapons
10) the rocket launcher

First invented or used by

a) the Chinese
b) the Indians
c) the British
d) the Arabs
e) the Americans

Questions 11-14. Look at the drawings of different projectiles below, A-H, and the names of types of projectiles given in the passage, Questions 11-14. Match each name with one drawing. Write the appropriate letters A-H in boxes 11-14 on your answer sheet.

11) The Chinese 'basket of fire'
12) The Arab 'egg which moves and burns'
13) The Indian rocket
14) The British barrage rocket



Text 12 B

Reaching the stars

A. Our nearest star, Proxima Centauri, is 4.2 light years away – more than 200,000 times the distance from the Earth to the Sun. such vast distances would seem to put the stars well beyond the reach of human explorers. Suppose we had been able to ride abroad NASA's Voyager 1, the fastest interstellar space probe yet built. Voyager 1 is now heading out of the solar system at about 17 kilometers per second. At this rate it would take 74,000 years to reach Proxima Centauri.

B. What would it take for humans to reach the stars within a lifetime? For a start, we would need a spacecraft that can travel at close to the speed of light. There has been no shortage of proposals: vehicles propelled by repeated blasts from hydrogen bombs, or from the destruction of matter and antimatter. Others resemble huge sailing ships with giant reflective sails, pushed along by lasers. All of these ambitious schemes have their disadvantages, and it is doubtful they could really go the distance.

C. Now there are two radical new possibilities on the table that might just enable us, or at least our descendants, to reach the stars. One physicist has outlined his design for a spacecraft powered by dark matter, which is apparently extremely abundant, even if we cannot see it, and two mathematicians have proposed a craft powered by an artificial black hole.

D. Nobody disputes that building a ship powered by black holes or dark matter would be extremely difficult. Yes, remarkably, there seems to be nothing in our present understanding of physics to prevent us from making either of them. Most astronomers are convinced of the existence of dark matter because of the way its gravity pulls on the stars and galaxies we see with our telescopes. Such observations suggest that dark matter outweighs the universe's visible matter by a factor of about six. So a dark matter starship could pick up its fuel on the way and would therefore not need to carry any.

E. It is speculated that dark matter particles could be made to collide, thus annihilating each other and converting their mass to energy. One kilogram of dark matter could release 10 billion times more energy than 1 kilogram of dynamite. Even less certain is the detail of how a dark matter rocket might work. The matter could be collected and compressed, which would increase its annihilation rate, and the quicker it travels, the quicker it would scoop up its fuel and accelerate. It is thought that such a rocket might be able to come close to the speed of light within a few days.

F. Another possibility concerns the construction of a rocket using black hole as fuel. Very small black holes emit far more radiation than large, stellar-mass black holes, according to the equations describing black holes. A black hole weighing about a million tones would make a perfect energy source, it has been calculated. It is a small enough to generate enough radiation to power a starship, yet large enough to survive without radiating all its mass during a typical stellar journey of about 100 years in duration.

G. Recently, one possibility is to hunt for a pre-existing black hole, but theorists have been skeptical and prefer an alternative proposal of making one. To create a black hole, one would need to concentrate a tremendous amount of energy into a tiny volume of, say, 20 cubic meters. Solar energy would be collected in solar panels, each 250 kilometers across, orbiting just a few million kilometers away from the Sun and soaking up sunlight for about a year. The resulting million-ton black-hole would be about the size of an atomic nucleus. The next step would be to manoeuvre it into the focal range of a parabolic mirror attached to the back of the crew quarters of a starship. The resulting gamma ray photons would be the starship's exhaust and would push it forwards. A black-hole starship could accelerate to close to the speed of light

in a few decades, it is thought, and once you were travelling at this speed in your starship, time would slow down for you, so you would age3 more slowly than your friends and family back on Earth.

Question 1-2. Which two proposals to power superships might allow people to travel to the stars within a human lifespan?

a) hydrogen bombs
b) laser-driven sails
c) black holes
d) dark matter
e) solar energy

Question 3-4. Complete the summary below. Choose no more than one word from the passage for each answer.

One theory proposes a collision of a dark matter (3)____, which would be mutually destroyed, thus resulting in a transformation of their physical components into (4)____. Such a procedure would be capable of producing vastly greater force than using a conventional explosive. Acquisition and compression of the matter would speed up its (5)____ and the vehicle might approach light speed in a very short time.

Question 6-12. Reading Passage has seven paragraphs, A-G. Choose the correct heading for each paragraph from the list if headings below. Write the correct number, i – ix.

List of headings

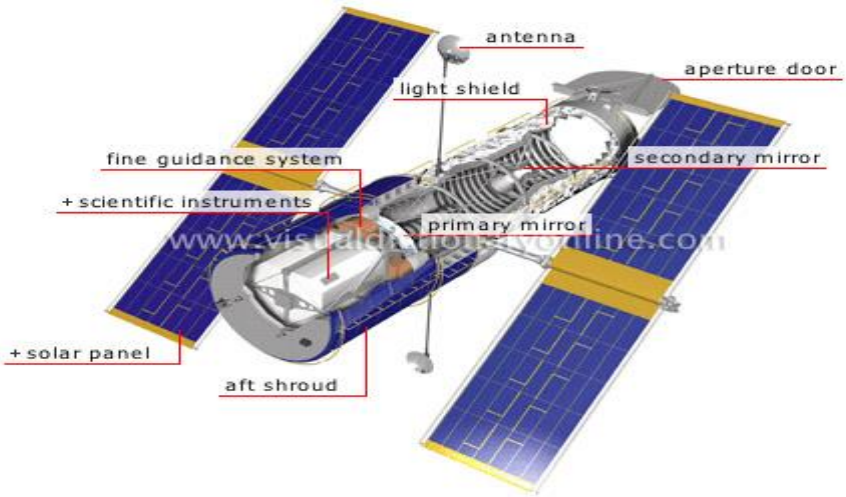
a) More attractive idea for long-range space travel
b) An ideal size of a possible source of power
c) Stars too far to reach with present-day technology
d) A plentiful supply of power in space?
e) Unlikely suggestions for interstellar travel
f) The ageing process for space travelers
g) Dangers of using dark matter as fuel
h) A man-made power source
i) Energy generated and speed reached using dark matter

6) Paragraph A
7) Paragraph B
8) Paragraph C
9) Paragraph D
10) Paragraph E
11) Paragraph F
12) Paragraph G

Text 12 C

Hubble

The 32,000–word novella The Time Machine by H.G. Wells, published in 1895, is generally credited with popularizing the idea of time travel by means of a time machine, a vehicle which takes the occupant backward or forward in time. Dozens of sequels and adaptations over the years have further promoted the notion. Indeed, Albert Einstein's Theory of Special Relativity lays the foundation for the possibility of time travel. So far, no one has demonstrated the ability to travel in time. However, time machines have been constructed, and they do allow glimpses into the past.



The most efficacious time machine currently in existence is the Hubble Telescope, named after the American astronomer Edwin P. Hubble. Its capability to locate distant astronomical targets and lock in on them, permitting their faint light to aggregate on its detectors, allows it to peer far into the past. Light travels 186,000 miles per second. The Hubble Telescope has looked back in time at 10,000 galaxies whose light left them billions of years ago. Therefore, utilizing the telescope as time machine, astronomers are able to contemplate galaxies as they were eons ago.

Although the telescope was launched into space in 1990, its inception was almost a half– century earlier as astronomer Lyman Spitzer, Jr. mulled over the possibility of a large space telescope in a 1946 report, "Astronomical Advantages of an Extra–Terrestrial Observatory." Because the earth is bathed in its constantly churning atmosphere, earth–based telescopes cannot penetrate deep space; the atmosphere distorts the view. Telescopes were constructed on mountains, but there was still no way to wholly escape the effects of the layers of gases enveloping the earth.

During the 1960s, the Space Race between the then–Soviet Union and the United States was accelerating. The National Aeronautics and Space Administration (NASA) was established. Funds for space endeavors were abundant, and plans for a large space telescope, by then designated the LST, were underway. The designs called

for a 2.4–meter primary telescope mirror which could be transported into space by one of NASA's rockets. According to National Geographic's Imaging Space and Time, the resolving power of the deep space telescope would be "equivalent to being able to distinguish the left and right headlights of a car in California seen from New York, or features less than 1/30,000 the size of the full moon. This was at least a tenfold increase over the atmospheric limit."

One of the primary challenges involved in successfully transporting the telescope into space was protecting the mirror from the jarring vibrations that occur during launch. It was crucial that the mirror be able to withstand the shuttle's vicissitudes as well as the volatile atmospheric conditions found in space. If not, the precise shape of the mirror could be compromised, and its imaging capability significantly weakened.

After the telescope had been launched, astronomers subsequently realized that the primary mirror had not been ground correctly. A lens in the test instrument was about one millimeter askew, which is large by optical standards. In 1993, space–walking astronauts installed corrective lenses which improved the eyesight of the Hubble. In 2009, the corrective lenses themselves were replaced with a supersensitive spectrograph with built–in corrective lenses. The new spectrograph is expected to provide insight into the origins of stars and galaxies.

The successor to Hubble, the James Webb Space Telescope, is expected to be launched in 2014. It will observe only in infrared, so it will complement the Hubble Telescope, which observes in the visible and ultraviolet light ranges.

Hubble currently has the capability to view galaxies that were formed 45 13.7 billion years ago, long before humans existed, in an area called the Hubble Ultra Deep Field. Astronomers aspire to see beyond the Hubble Ultra Deep Field to a time that is devoid of galaxies, a time before galaxies had formed. If H.G. Wells was onto something in his novella, that time may be close at hand. As one of the characters in the popular work asked, "If Time is really only a fourth dimension of Space, why is it, and why has it always been, regarded as something different? And why cannot we move in Time as we move about in the other dimensions of Space?"

Less than a decade after Wells' novella, Einstein's Special Theory Relativity seemed to concur with Wells' character by proposing that traveling through space at the speed of light would alter time by causing it to dilate, raising the possibility of not merely glimpsing the past, but perhaps traveling to it.

1) According to the passage, which of the following statements is/are true of the Hubble Telescope?

a) It is unable to observe light on the infrared part of the spectrum
b) It will be replaced by the James Webb Space Telescope in 2014
c) It was initially constructed in 1946, but not launched until 1990

2) According to the passage, who had the idea for the Hubble Telescope?

a) H.G. Wells
b) Albert Einstein
c) Lyman Spitzer, Jr.

d) Edwin P. Hubble
e) James Webb

3) In line 33, vicissitudes most closely means
a) long delays which may compromise the shuttle launch
b) toxic emissions which may cause corrosion around the mirror
c) sound waves which may penetrate the mirror
d) atmospheric conditions which may compromise the mirror
e) shaking and quivering which may cause changes in the mirror

4) In the context of the passage, which of the following best articulates the author's opinion of the inception of the Hubble?
a) It was a pipedream with little imminent chance of success
b) It was a literary vehicle with little basis in reality
c) It was an emergency response to the quickening Space Race
d) It was based on a scientific proposition which was not proven
e) It was a waste of time and money which were needed elsewhere

5) The primary purpose of the passage is to
a) draw a comparison between H.G. Wells' notion of time travel with Albert Einstein's Special Theory of Relativity
b) discuss the construction of the Hubble Space Telescope as a tool for exploring deep space
c) examine difficulties which precipitated construction of corrective lenses for the Hubble's primary mirror
d) describe the circumstances which underlay the mid–century national drive toward a large space–based observatory
e) dispute the argument that the Hubble Telescope functions as a modern–day time machine

6) It can be inferred that the author regards time travel as
a) an effective hook for a work of fiction, but an improbability in the reality of astronomy
b) an interesting literary notion, but proven to be impossible by Einstein's Special Theory
c) a persuasive topic in fiction, as well as a hypothetical possibility in light of Einstein's Special Theory
d) a ridiculous idea whose time has come and gone, as well as an astronomical improbability
e) the incoherent literary construction of a fictional author, with little relevance to today's scientific community

7) It can be inferred from the passage that scientists believe that time is
a) a constant
b) unidirectional
c) a spatial dimension
d) an impenetrable mystery
e) an imaginary construction

Answer keys:

Unit 7

Transport

Text 7 A

1. electrified 2. computer 3. Beam-Operated Traffic 4. roads 5. C 6. I 7. B 8. H 9. A 10. NS 11. S 12. S

Text 7 B

1) double-decker
2) alternate
3) levitate
4) aerodynamic
5) maintenance
6) accelerate
7) attraction
8) repulsion
9) A
10) C
11) D
12) D
13) major cities
14) 300 mph
15) series of motors
16) commuters
17) track
18) magnets
19) run
2o) expensive
21) very large

Text 7 C

1) b 2) g 3) d 4) a 5) c 6) FALSE 7). TRUE 8) NOT GIVEN 9) FALSE 10) TRUE 11) F 12) D 13) C

Unit 8

Text 8 A

1 b 2 c 3 e 4 d 5 h 6 g 7 FALSE 8 FALSE 9 NOT GIVEN 10 TRUE 11 TRUE 12 FALSE 13 TRUE

Text 8 B

The Wright brothers

1A 2B 3C 4D 5sentence 4, paragraph 2 6guiding 7C 8C 9A 10D 11D

Unit 9

Text 9 B

1c 2e 3a 4c 5 a 6 d 7 e 8f 9 j 10 maintenance 11 slow (turning) 12 low pressure 13 cavitation

Text 9 C

1) 1937 2) 1852 3) 1825 4) 1932 5) 1954 6) B 7) A 8) B 9) NOT GIVEN 10) NO 11). NOT GIVEN 12) YES 13) YES

Unit 10

Lasers and optical fibers

1C 2D 3D 4A 5D 6D 7D 8D 9B 10C

Text 10 A

1A 2C 3B 4A 5B 6C 7C 8D 9D 10B

Text 10 B

1 D
2 A
3 A
4 power companies
5 safely
6 size
7 B

8 C
9 G
10 D
11 NO
12 YES
13 NOT GIVEN

Text 10 C

Lasik surgery

1 D 2 B D A C 3 A 4 B.

Unit 11

Text 11 A

1E 2 B3 A 4 F 5 B 6 NOT GIVEN 7 FALSE8 NOT GIVEN 9 TRUE 10 FALSE 11 TRUE 12 B 13 A 14 D

Unit 12

Text 12 A

1. d 2. a 3. e 4. g 5. B 6. D 7. A 8. A 9. B 10. E 11. B 12. E 13. F 14. G

Text 12 C

1 a) 2 c) 3 e) 4 a) 5 b 6 c) 7 c)

Список литературы

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Content

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Luara Dmitrievna Sergeeva

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