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SAFETY OF LIFE ACTIVITY

Учебно-практическое пособие

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Оглавление

Предисловие

Цели пособия — ознакомление обучающихся с англоязычной терминосистемой специальностей «Пожарная безопасность», «Защита в чрезвычайных ситуациях», «Инженерная защита окружающей среды»; формирование умений и навыков использования полученных знаний в сфере профессиональной коммуникации.

В пособии три раздела, в которых имеются тексты, тренировочные упражнения и словники. Также приведены тексты для дополнительного чтения.

UNIT 1

Text A. Accident

Ex. 1. Read the text and translate it into Russian.

Accident, unintended and unforeseen event, usually resulting in personal injury or property damage. In law, the term is usually limited to events not involving negligence, that is, the carelessness or misconduct of a party involved, or to a loss caused by lightning, floods, or other natural events (Act of God). In popular usage, however, the term *accident* designates an unexpected event, especially if it causes injury or damage without reference to the negligence or fault of an individual. The basic causes of such accidents are, in general, unsafe conditions of machinery, equipment, or surroundings, and the unsafe actions of persons that are caused by ignorance or neglect of safety principles.

Organized efforts for the prevention of accidents began in the 19^{th} century with the adoption of factory-inspection laws, first in Britain and then in the United States and other countries (Factory System). Fire insurance and accident insurance companies made efforts to enforce safety rules and to educate the public. Factory inspectors and inspectors from fire insurance and casualty insurance companies carried on a campaign against unsafe conditions and actions, and at the beginning of the 20^{th} century a new branch of engineering developed, devoted to finding and eliminating such hazards.

Industrial safety, area of safety engineering and public health that deals with the protection of workers' health, through control of the work environment to reduce or eliminate hazards. Industrial accidents and unsafe working conditions can result in temporary or permanent injury, illness, or even death. They also take a toll in reduced efficiency and loss of productivity. Annually in the United States, about 6.5 of every 100 full-time workers in private industry experience a work-related injury or illness. Although most of these incidents are minor, approximately 2.8 million cases each year involve lost work time, and about 6,000 American workers die each year because of work-related injuries or accidents.

In the United States before 1900 the safety of workers was of little concern to employers. Only with the passage of the Workmen's Compensation Laws and related labor statutes between 1908 and 1948 did U.S. employers start to pay attention to industrial safety; making the work environment safer was less costly than paying compensation. Labor shortages during World War II (1939—1945) focused renewed attention on industrial safety and on the losses incurred by industrial accidents. During the 1960s a number of industry-specific laws were enacted, such as the Metal and Nonmetallic Mine Safety Act, the Coal Mine Health and Safety Act, and the Construction Safety Act. A new national policy was established in 1970, when for the first time all industrial workers in businesses affected by interstate commerce were covered by the Occupational Safety and Health Act. Under this act, the National Institute for Occupational Safety and Health (NIOSH) was given responsibility for conducting research on occupational health and safety standards, and the Occupational Safety and Health Administration (OSHA) was charged with setting and enforcing appropriate standards in industry.

Various external sources, such as chemical, biological, or physical hazards, can cause work-related injury. Hazards may also result from the interaction between worker and environment; these so called ergonomic hazards can cause physiological or psychological stress. Chemical hazards can arise from the presence of poisonous or irritating gas, mist, or dust in the workplace. Hazard elimination may require the use of alternative and less toxic materials, improved ventilation, leakage control, or protective clothing. Biological hazards arise from bacteria or viruses transmitted by animals or unclean equipment and tend to occur primarily in the food-processing industry. The source of the contamination must be eliminated or, when that is not possible, protective equipment must be worn. Common physical hazards include ambient heat, burns, noise, vibration, sudden pressure changes, radiation, and electric shock. Industrial safety engineers attempt to eliminate hazards at their source or to reduce their intensity. If this is impossible, workers are required to wear protective equipment. Depending on the hazard, this equipment may include safety glasses, earplugs or earmuffs, face masks, heat or radiation protection suits, boots, gloves, and helmets. To be effective, however, the protective equipment must be appropriate, properly maintained, and worn by the worker. If the physical, psychological, or environmental demands on workers exceed their capabilities, ergonomic hazards arise. This type of hazard frequently occurs in the area of materials handling, where workers must lift or carry heavy loads. Poor working posture or improper design of the workplace often results in muscle strains, sprains, fractures, bruises, and back pain. These injuries account for 25 percent of all occupational injuries, and their control requires designing the job so that workers can perform it without overexerting themselves.

In recent years engineers have attempted to develop a systems approach (termed safety engineering) to industrial accident prevention. Because accidents arise from the interaction of workers and their work environments, both must be carefully examined to reduce the risk of injury. Injury can result from poor working conditions, the use of improperly designed equipment and tools, fatigue, distraction, lack of skill, and risk taking. The systems approach examines the following areas: all work locations to eliminate or control hazards, operating methods and practices, and the training of employees and supervisors. The systems approach, moreover, demands a thorough examination of all accidents and "near misses". Key facts about accidents and injuries are recorded, along with the history of the worker involved, to check for and eliminate any patterns that might lead to hazards.

The systems approach also pays special attention to the capabilities and limitations of the working population. It recognizes large individual differences among people in their physical and physiological capabilities. The job and the worker, therefore, should be appropriately matched whenever possible.

Vocabulary

unintended *(n)*	**interaction** *(n)*	**earmuff** *(n)*
unforeseen *(n)*	**ergonomic** *(n)*	**handling** *(n)*
injury *(n)*	**leakage** *(n)*	**materials handling** *(n)*
negligence *(n)*	**contamination** *(n)*	**posture** *(n)*
carelessness *(n)*	**ambient** *(n)*	**muscle strain** *(n)*
inspection *(n)*	**fracture** *(n)*	**industrial engineer** *(n)*
casualty *(n)*	**industrial safety** *(n)*	**accident prevention** *(n)*
hazard *(n)*	**safety engineer** *(n)*	**industrial accident** *(n)*
eliminate *(v)*	**earplug** *(n)*	**system approach** *(n)*
distraction *(n)*	**lack** *(n)*	**fatigue** *(n)*

Ex. 2. Suggest the Russian equivalents to the English ones.

Unintended, unforeseen, injury, negligence, enforce, designate, surroundings, shortage, incur, setting, casualty, hazard, eliminate, appropriate, industrial safety, industrial engineer, safety engineer, earplug, earmuff, exceed, derive, assist, storage tank, materials handling, posture, muscle strain, fracture, bruise, occupational injury, perform, exert, accident prevention, industrial accident, systems approach, fatigue, distraction, lack of skill.

Ex. 3. Suggest the English equivalents to the Russian ones.

Непреднамеренный, повреждение (ущерб), окружающая среда, опасность (вредный фактор), устранять (ликвидировать), непредвиденный, небрежность, недобросовестность, осмотр, страхование, заставлять, несчастный случай, временный, потери (жертвы), испытывать, незначительный, дорогостоящий, назначать цену (возлагать, наполнять), нехватка (недостаток), вытекать, соответствующий (подходящий), взаимодействие, эргономичный, течь (утечка, протечка), загрязнение (заражение), окружающая (внешняя) среда, инженер по организации производства, техника безопасности на производстве, инженер по технике безопасности, наушники, превышать, способствовать, свободный, в значительной степени, осанка, погрузка-разгрузка материалов, непригодный (неподходящий), растяжение мышц, перелом, ушиб, производственная травма, выполнять (совершать), приводить в действие (влиять), техника безопасности, несчастный случай на производстве, усталость, отвлечение внимания, отсутствие опыта, идти на риск, трудящиеся.

Ex. 4. Are these statements true or false?

1. Accidents usually result in an individual's carelessness and negligence.

2. The basic causes of accidents are unsafe conditions of machinery, equipment or surrounding and unsafe actions of persons that are caused by ignorance or neglect of safety principles.

3. Organized methods for prevention accidents began only at the end of XX century.

4. Germany was the first country to adopt factory-inspection laws.

5. Fire insurance and accident insurance companies were established to grant licenses.

6. Factory inspector and inspectors from fire insurance and casualty insurance companies cared on a campaign against negligence.

7. A new branch of engineering devoted to industrial safety, developed in the beginning of the XX century.

8. Industrial safety, area of safety engineering and public health deals with the protection of workers' health.

9. Area of safety engineering, industrial safety control the work environment to reduce and eliminate hazards.

10. Industrial accidents and unsafe working conditions can result in property damage.

11. In the United States working conditions in private industry are of great concern, that there aren't any work-related accidents.

12. In the USA before 1900 the safety of workers was of little concern to employers.

13. Employers in USA stated to pay attention to industrial safety making the work environment safer.

14. Work-related injury can be caused by natural events.

15. Hazards may result from interaction between a worker and an environment.

16. Physiological or psychological stress can be caused ergonomic hazards.

17. Chemical hazards can be caused by pollution from chemical plants.

18. Special equipment is required to eliminate hazards.

19. Common physical hazards include ambient heat, burns, noise, vibration, sudden pressure, changes radiation and electric shock.

20. Industrial safety engineers attempt to protect workers from negligence.

21. Protective equipment depends on the hazards.

22. Ergonomic hazards arise if the physical, psychological or environmental demands on workers exceed the capabilities.

23. Materials handling is the area where occupational injures never occurs.

24. A system approach to industrial accidents has been developed in recent years. Work-related injures can result from accidents.

Ex. 5. Answer the questions.

1. What is called an accident?
2. What are the reasons of accidents?
3. When and where did the prevention of an accident begin?
4. What was the task of insurance companies?
5. What can be the reason of an injury, illness or death at work place?
6. What happens to full-time workers in private industry in the USA?
7. Did employees take care of safety of the workers before 1900?
8. When did the employees start to pay attention to industrial safety?

9. Why was it profitable to make environment safer?
10. What can cause work related injury?
11. What are ergonomic hazards called?
12. What can chemical hazard arise from?
13. What protection measures are used against chemical hazards?
14. How does biological hazard arrive?
15. Where do biological hazards tend to occur?
16. What must be done with the source of contamination?
17. What are common physical hazards?
18. What is the industrial safety engineers' task?
19. What does protective equipment include?
20. When do ergonomic hazards arise?
21. What injuries can workers get in the area of materials handlings?
22. What should be done to avoid occupational injuries?
23. What have engineers attempt to do in recent years?
24. Why do accidents occur?
25. What must be done to reduce the risk of injury?
26. What can injury result from?
27. What does the system approach do?
28. Why are key facts about accidents and injuries recorded?
29. What does the system approach pay attention to?

Ex. 6. Give a summary of the text.

Text B. Earthquake. Part 1

Ex. 1. Read the text and translate it into Russian.

Earthquake, shaking of the Earth's surface caused by rapid movement of the Earth's rocky outer layer. Earthquakes occur when energy stored within the Earth, usually in the form of strain in rocks, suddenly releases. This energy is transmitted to the surface of the Earth by earthquake waves. The study of earthquakes and the waves they create is called seismology (from the Greek *seismos* — "to shake"). Scientists who study earthquakes are called seismologists.

The destruction an earthquake causes depends on its magnitude and duration, or the amount of shaking that occurs. A structure's design and the materials used in its construction also affect the amount of damage the structure incurs. Earthquakes vary from small, imperceptible shaking to large shocks felt over thousands of kilometers. Earthquakes can deform the ground, make buildings and other structures collapse, and create tsunamis (large sea waves). Lives may be lost in the resulting destruction.

Earthquakes, or seismic tremors, occur at a rate of several hundred per day around the world. A worldwide network of *seismographs* (machines that record movements of the Earth) detects about 1 million small earthquakes per year. Very large earthquakes, such as the 1964 Alaskan earthquake, which caused millions of dollars in damage, occur worldwide once every few years. Moderate earthquakes, such as the 1989 tremor in Loma Prieta, California, and the 1995 tremor in Kōbe, Japan, occur about 20 times a year. Moderate earthquakes also cause millions of dollars in damage and can harm many people.

In the last 500 years, several million people have been killed by earthquakes around the world, including over 240,000 in the 1976 T'ang-Shan, China, earthquake. Worldwide, earthquakes have also caused severe property and structural damage. Adequate precautions, such as education, emergency planning, and constructing stronger, more flexible, safely designed structures, can limit the loss of life and decrease the damage caused by earthquakes.

Seismologists examine the parts of an earthquake, such as what happens to the Earth's surface during an earthquake, how the energy of an earthquake moves from inside the Earth to the surface, how this energy causes damage, and the slip of the fault that causes the earthquake. Faults are cracks in Earth's crust where rocks on either side of the crack have moved. By studying the different parts and actions of earthquakes, seismologists learn more about their effects and how to predict and prepare for their ground shaking in order to reduce damage.

Most earthquakes are caused by the sudden slip along geologic faults. The faults slip because of movement of the Earth's tectonic plates. This concept is called the elastic rebound theory. The rocky tectonic plates move very slowly, floating on top of a weaker rocky layer. As the plates collide with each other or slide past each other, pressure builds up within the rocky crust. Earthquakes occur when pressure within the crust increases slowly over hundreds of years and finally exceeds the strength of the rocks. Earthquakes also occur when human activities, such as the filling of reservoirs, increase stress in the Earth's crust.

Fault rupture is not the only cause of earthquakes; human activities can also be the direct or indirect cause of significant earthquakes. Injecting fluid into deep wells for waste disposal, filling reservoirs with water, and firing underground nuclear test blasts can, in limited circumstances, lead to earthquakes. These activities increase the strain within the rock near the location of the activity so that rock slips and slides along pre-existing faults more easily. While earthquakes caused by human activities may be harmful, they can also provide useful information. Prior to the Nuclear Test Ban treaty, scientists were able to analyze the travel and arrival times of P waves from known earthquakes caused by underground nuclear test blasts. Scientists used this information to study earthquake waves and determine the interior structure of the Earth.

Scientists have determined that as water level in a reservoir increases, water pressure in pores inside the rocks along local faults also increases. The increased pressure may cause the rocks to slip, generating earthquakes. Beginning in 1935, the first detailed evidence of reservoir-induced earthquakes came from the filling of Lake Mead behind Hoover Dam on the Nevada-Arizona state border. Earthquakes were rare in the area prior to construction of the dam, but seismographs registered at least 600 shallow-focus earthquakes between 1936 and 1946. Most reservoirs, however, do not cause earthquakes.

Seismologists have been monitoring the frequency and locations of earthquakes for most of the 20th century. Seismologists generally classify naturally occurring earthquakes into one of two categories: interplate and intraplate. Interplate earthquakes are the most common; they occur primarily along plate boundaries. Intraplate earthquakes occur where the crust is fracturing within a plate. Both interplate and intraplate earthquakes may be caused by tectonic or volcanic forces.

Seismologists use global networks of seismographic stations to accurately map the focuses of earthquakes around the world. After studying the worldwide distribution of earthquakes, the pattern of earthquake types, and the movement of the Earth's rocky crust, scientists proposed that plate tectonics, or the shifting of the plates as they move over another weaker rocky layer, was the main underlying cause of earthquakes. The theory of plate tectonics arose from several previous geologic theories and discoveries. Scientists now use the plate tectonics theory to describe the movement of the Earth's plates and how this movement causes earthquakes. They also use the knowledge of plate tectonics to explain the locations of earthquakes, mountain formation, and deep ocean trenches, and to predict which areas will be damaged the most by earthquakes. It is clear that major earthquakes occur most frequently in areas with features that are found at plate boundaries: high mountain ranges and deep ocean trenches. Earthquakes within plates, or intraplate tremors, are rare compared with the thousands of earthquakes that occur at plate boundaries each year, but they can be very large and damaging.

Earthquakes that occur in the area surrounding the Pacific Ocean, at the edges of the Pacific plate, are responsible for an average of 80 percent of the energy released in earthquakes worldwide. Japan is shaken by more than 1,000 tremors greater than 3.5 in magnitude each year. The western coasts of North and South America are very also active earthquake zones, with several thousand small to moderate earthquakes each year.

Intraplate earthquakes are less frequent than plate boundary earthquakes, but they are still caused by the internal fracturing of rock masses. The New Madrid, Missouri, earthquakes of 1811 and 1812 were extreme examples of intraplate seismic events. Scientists estimate that the three main earthquakes of this series were about magnitude 8.0 and that there were at least 1,500 aftershocks.

Ground shaking leads to landslides and other soil movement. These are the main damage-causing events that occur during an earthquake. Primary effects that can accompany an earthquake include property damage, loss of lives, fire, and tsunami waves. Secondary effects, such as economic loss, disease, and lack of food and clean water, also occur after a large earthquake.

Another post-earthquake threat is fire, such as the fires that happened in San Francisco after the 1906 earthquake and after the devastating 1923 Tokyo earthquake. In the 1923 earthquake, about 130,000 lives were lost in Tokyo, Yokohama, and other cities, many in firestorms fanned by high winds. The amount of damage caused by post-earthquake fire depends on the types of building materials used, whether water lines are intact, and whether natural gas mains have been broken. Ruptured gas mains may lead to numerous fires, and fire fighting cannot be effective if the water mains are not intact to transport water to the fires. Fires can be significantly reduced with pre-earthquake planning, fire-resistant building materials, enforced fire codes, and public fire drills.

Along the coasts, sea waves called tsunamis that accompany some large earthquakes centered under the ocean can cause more death and damage than ground shaking. Tsunamis are usually made up of several oceanic waves that travel out from the slipped fault and arrive one after the other on shore. They can strike without warning, often in places very distant from the epicenter of the earthquake. Tsunami waves are sometimes inaccurately referred to as tidal waves, but tidal forces do not cause them. Rather, tsunamis occur when a major fault under the ocean floor suddenly slips. The displaced rock pushes water above it like a giant paddle, producing powerful water waves at the ocean surface. The ocean waves spread out from the vicinity of the earthquake source and move across the ocean until they reach the coastline, where their height increases as they reach the continental shelf, the part of the Earth's crust that slopes, or rises, from the ocean floor up to the land. Tsunamis wash ashore with often disastrous effects such as severe flooding, loss of lives due to drowning, and damage to property.

Earthquakes can also cause water in lakes and reservoirs to oscillate, or slosh back and forth. The water oscillations are called seiches (pronounced saysh). Seiches can cause retaining walls and dams to collapse and lead to flooding and damage downstream.

Catastrophic earthquakes can create a risk of widespread disease outbreaks, especially in underdeveloped countries. Damage to water supply lines, sewage lines, and hospital facilities as well as lack of housing may lead to conditions that contribute to the spread of contagious diseases, such as influenza (the flu) and other viral infections. In some instances, lack of food supplies, clean water, and heating can create serious health problems as well.

Vocabulary

magnitude *(n)*
shaking *(n)*
collapse *(n)*
tremor *(n)*
tidal wave *(n)*
precaution *(n)*
drowning *(n)*
emergency *(n)*
slip *(n)*
fault *(n)*
crust *(n)*
tectonic *(a)*
plate *(n)*
collide *(v)*
tidal force *(n)*
rupture *(n)*
strain *(n)*
shallow focus *(n)*
monitoring *(n)*
facture *(n)*
aftershock *(n)*
landslide *(n)*
devastating *(a)*
moderate earthquake *(n)*
build up pressure *(n)*
disastrous effects *(n)*
emergency planning *(n)*
earthquake *(n)*
outbreak *(n)*

Ex. 2. Suggest the Russian equivalents to the English ones.

Rocky, outer, strain, release, transmit, magnitude, duration, shaking, imperceptible, deform, collapse, tremor, moderate earthquake, ham precaution, emergency,

emergency planning, worldwide ship, crack, fault, crust, effect rebound, floating, collide, slide build up pressure, stress, rupture, infect, fluid, waste disposal, firing, nuclear test, firing test, limited circumstances strain, nuclear test ban treaty, generate, shallow focus earthquake, monitoring, tidal wave, tidal forces, displace, vicinity, slope, disastrous effects, drowning, back and force, slosh, outbreak, water supply, supply line, sewage line, hospital facilities contagious, viral infection, after-shock, landslide, accompany, intact, gas main, ruptured, water main, code, fire drill, make up.

Ex. 3. Suggest the English equivalents to the Russian ones.

Каменистый, внешний, напряжение (нагрузка), освобождать, передавать, сила землетрясения, продолжительность, толчок, портить (обезображивать), разрушаться (обваливаться), умеренное землетрясение, ущерб, мера предосторожности, проектные аварии, непредвиденный случай (авария), гибкий, распространенный во всем мире, сдвиг (скольжение), разлом, земная кора, рикошет, подвижный, сталкиваться, увеличить давление, сила, прорыв (трещина), вводить (закачивать), удаление отходов (сточных вод), сжигание (разжигание) топлива, ядерный взрыв, испытание ядерного оружия, стесненные обстоятельства, договор о запрещении ядерных испытаний, движение (распространение), нормальное землетрясение, трещина (гидравлический разрыв пласта), приливная волна, приливные силы, перемещать, толчок (давление), соседство (близость), уклон, катастрофические последствия, взад и вперед, сохранение (удерживание), выход пласта на поверхность, водоснабжение, подводящий трубопровод, городская канализация, оснащение больницы, заразный (инфекционный), распространение, толчок после основного землетрясения, обвал, разрушительный, раздувать, нетронутый, газопровод, пожарные учения.

Ex. 4. Are these statements true or false?

1. Earthquake is the result of human activities.
2. The weather conditions influence on the destruction an earthquake causes.
3. There are several types of earthquakes.
4. Earthquake deforms only the ground.
5. One cannot feel the moderate earthquake.
6. Nothing can limit the loss of life and decrease the damage caused by earthquakes.
7. Seismologists study actions of the earthquake to predict it.
8. The faults sleep because of movement of the Earth’s tectonic plates. This concept is called the elastic rebound theory.
9. Earthquakes occur as a result of pressure within the crust.
10. Fault rupture is the only case of earthquakes.
11. Human activities can’t be harmful for interior structure of the Earth.
12. Earthquakes are divided into one of two categories.
13. After studying the interior structure of the Earth scientists explained the main cause of earthquakes.

14. The plate tectonics theory is used to describe the movement of the Earth's plate and now this movement causes earthquakes.
15. Earthquakes can occur in every area.
16. Ground shaking leads to landslides and other soil movement.
17. An earthquake can cause little property damage.
18. Fire can be caused by an earthquake.
19. Earthquakes that centered under the ground cause more death and damage.
20. Catastrophic earthquakes can create a risk of widespread diseases.

Ex. 5. Answer the questions.

1. How does an earthquake occur?
2. What do seismologists do?
3. What word does the word seismology derive from?
4. What does the destruction caused by an earthquake come from?
5. What happens during the earthquakes?
6. What do seismologists examine?
7. What concept is called the elastic rebound theory?
8. What are the causes of earthquakes?
9. How can human activities cause the earthquake?
10. What information did the scientists use to study the earthquake waves and determine the interior structure of the Earth?
11. What categories do seismologists classify naturally occurring earthquakes?
12. How do seismologists clear up the focuses of earthquakes around the world?
13. How do scientists use the plate tectonic theory?
14. What are the most active earthquake zones?
15. What do ground shaking lead to?
16. What effects can accompany an earthquake?
17. What is the post earthquake threat?
18. What are Tsunamis called?
19. What can Tsunami cause?
20. How does Tsunami occur?
21. What can catastrophic earthquake create?

Ex. 6. Give a summary of the text.

Text C. Earthquake. Part 2

Ex. 1. Read the text and translate it into Russian.

Earthquakes cannot be prevented, but the damage they cause can be greatly reduced with communication strategies, proper structural design, emergency preparedness planning, education, and safer building standards. In response to the tragic loss of life and great cost of rebuilding after past earthquakes, many countries have established earthquake safety and regulatory agencies. These agencies require codes for engineers to use in order to regulate development and construction. Buildings built according to these codes survive earthquakes better and ensure that earthquake risk is reduced.

Tsunami early warning systems can prevent some damage because tsunami waves travel at a very slow speed. Seismologists immediately send out a warning when evidence of a large undersea earthquake appears on seismographs. Tsunami waves travel slower than seismic P and S waves — in the open ocean, they move about ten times slower than the speed of seismic waves in the rocks below. This gives seismologists time to issue tsunami alerts so that people at risk can evacuate the coastal area as a preventative measure to reduce related injuries or deaths. Scientists radio or telephone the information to the Tsunami Warning Center in Honolulu and other stations.

Engineers minimize earthquake damage to buildings by using flexible, reinforced materials that can withstand shaking in buildings. Since the 1960s, scientists and engineers have greatly improved earthquake-resistant designs for buildings that are compatible with modern architecture and building materials. They use computer models to predict the response of the building to ground shaking patterns and compare these patterns to actual seismic events.

Geologists and engineers use risk assessment maps, such as geologic hazard and seismic hazard zoning maps, to understand where faults are located and how to build near them safely. Engineers use geologic hazard maps to predict the average ground motions in a particular area and apply these predicted motions during engineering design phases of major construction projects. Engineers also use risk assessment maps to avoid building on major faults or to make sure that proper earthquake bracing is added to buildings constructed in zones that are prone to strong tremors. They can also use risk assessment maps to aid in the retrofit, or reinforcement, of older structures.

In urban areas of the world, the seismic risk is greater in non-reinforced buildings made of brick, stone, or concrete blocks because they cannot resist the horizontal forces produced by large seismic waves. Fortunately, single-family timber-frame homes built under modern construction codes resist strong earthquake shaking very well. Such houses have laterally braced frames bolted to their foundations to prevent separation. Although they may suffer some damage, they are unlikely to collapse because the strength of the strongly jointed timber-frame can easily support the light loads of the roof and the upper stories even in the event of strong vertical and horizontal ground motions.

Earthquake education and preparedness plans can help significantly reduce death and injury caused by earthquakes. People can take several preventative measures within their homes and at the office to reduce risk. Supports and bracing for shelves reduce the likelihood of items falling and potentially causing harm. Maintaining an earthquake survival kit in the home and at the office is also an important part of being prepared.

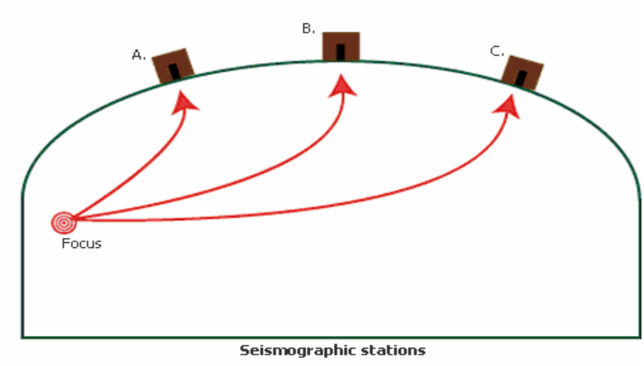
In the home, earthquake preparedness includes maintaining an earthquake kit and making sure that the house is structurally stable. The local chapter of the American Red Cross is a good source of information for how to assemble an earthquake kit. During an earthquake, people indoors should protect themselves from falling objects and flying glass by taking refuge under a heavy table. After an earthquake, people should move outside of buildings, assemble in open spaces, and prepare themselves for aftershocks. They should also listen for emergency bulletins on the radio, stay out of severely damaged buildings, and avoid coastal areas in the event of a tsunami.

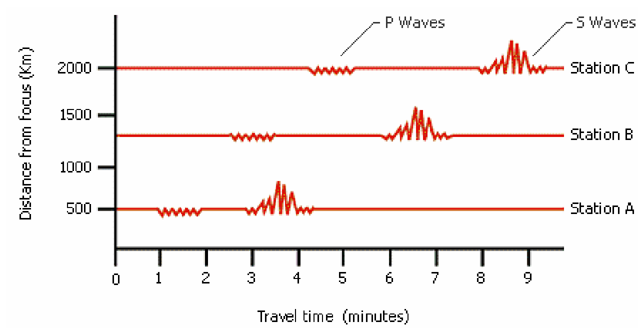
In many countries, government emergency agencies have developed extensive earthquake response plans. In some earthquake hazardous regions, such as California, Japan, and Mexico City, modern strong motion seismographs in urban areas are now linked to a central office. Within a few minutes of an earthquake, the magnitude can be determined, the epicenter mapped, and intensity of shaking information can be distributed via radio to aid in response efforts.

Seismologists measure earthquakes to learn more about them and to use them for geological discovery. They measure the pattern of an earthquake with a machine called a seismograph. Using multiple seismographs around the world, they can accurately locate the epicenter of the earthquake, as well as determine its magnitude, or size, and fault slip properties.

An analog seismograph consists of a base that is anchored into the ground so that it moves with the ground during an earthquake, and a spring or wire that suspends a weight, which remains stationary during an earthquake. In older models, the base includes a rotating roll of paper, and the stationary weight is attached to a stylus, or writing utensil, that rests on the roll of paper. During the passage of a seismic wave, the stationary weight and stylus record the motion of the jostling base and attached roll of paper. The stylus records the information of the shaking seismograph onto the paper as a seismogram. Scientists also use digital seismographs, computerized seismic monitoring systems that record seismic events. Digital seismographs use rewriteable, or multiple-use, disks to record data. They usually incorporate a clock to accurately record seismic arrival times, a printer to print out digital seismograms of the information recorded, and a power supply. Some digital seismographs are portable; seismologists can transport these devices with them to study aftershocks of a catastrophic earthquake when the networks upon which seismic monitoring stations depend have been damaged.

There are more than 1,000 seismograph stations in the world. One way that seismologists measure the size of an earthquake is by measuring the earthquake’s seismic magnitude, or the amplitude of ground shaking that occurs. Seismologists compare the measurements taken at various stations to identify the earthquake’s epicenter and determine the magnitude of the earthquake. This information is important in order to determine whether the earthquake occurred on land or in the ocean. It also helps people prepare for resulting damage or hazards such as tsunamis. When readings from a number of observatories around the world are available, the integrated system allows for rapid location of the epicenter. At least three stations are required in order to triangulate, or calculate, the epicenter. Seismologists find the epicenter by comparing the arrival times of seismic waves at the stations, thus determining the distance the waves have traveled. Seismologists then apply travel-time charts to determine the epicenter. With the present number of worldwide seismographic stations, many now providing digital signals by satellite, distant earthquakes can be located within about 10 km (6 mi) of the epicenter and about 10 to 20 km (6 to 12 mi) in focal depth. Special regional networks of seismographs can locate the local epicenters within a few kilometers.





All magnitude scales give relative numbers that have no physical units. The first widely used seismic magnitude scale was developed by the American seismologist Charles Richter in 1935. The *Richter scale* measures the amplitude, or height, of seismic surface waves. The scale is logarithmic, so that each successive unit of magnitude measure represents a tenfold increase in amplitude of the seismogram patterns. This is because ground displacement of earthquake waves can range from less than a millimeter to many meters. Richter adjusted for this huge range in measurements by taking the logarithm of the recorded wave heights. So, a magnitude 5 Richter measurement is ten times greater than a magnitude 4; while it is 10 × 10, or 100 times greater than a magnitude 3 measurement.

Today, seismologists prefer to use a different kind of magnitude scale, called the moment magnitude scale, to measure earthquakes. Seismologists calculate moment magnitude by measuring the seismic moment of an earthquake, or the earthquake’s strength based on a calculation of the area and the amount of displacement in the slip. The moment magnitude is obtained by multiplying these two measurements. It is more reliable for earthquakes that measure above magnitude 7 on other scales that refer only to part of the seismic waves, whereas the moment magnitude scale measures the total size. The moment magnitude of the 1906 San Francisco earthquake was 7.6; the Alaskan earthquake of 1964, about 9.0; and the 1995 Kobe, Japan, earthquake was a 7.0 moment magnitude; in comparison, the Richter magnitudes were 8.3, 9.2, and 6.8, respectively for these tremors.

Earthquake size can be measured by seismic intensity as well, a measure of the effects of an earthquake. Before the advent of seismographs, people could only judge the size of an earthquake by its effects on humans or on geological or human-made structures. Such observations are the basis of earthquake intensity scales first set up in 1873 by Italian seismologist M. S. Rossi and Swiss scientist F.A. Forel. These scales were later superseded by the Mercalli scale, created in 1902 by Italian seismologist Giuseppe Mercalli. In 1931 American seismologists H. O. Wood and Frank Neumann adapted the standards set up by Giuseppe Mercalli to California conditions and created the *Modified Mercalli scale*. Many seismologists around the world still use the Modified Mercalli scale to measure the size of an earthquake based on its effects. The Modified Mercalli scale rates the ground shaking by a general description of human reactions to the shaking and of structural damage that occur during a tremor. This information is gathered from local reports, damage to specific structures, landslides, and peoples' descriptions of the damage.

Seismologists try to predict how likely it is that an earthquake will occur, with a specified time, place, and size. Earthquake prediction also includes calculating how a strong ground motion will affect a certain area if an earthquake does occur. Scientists can use the growing catalogue of recorded earthquakes to estimate when and where strong seismic motions may occur. They map past earthquakes to help determine expected rates of repetition. Seismologists can also measure movement along major faults using global positioning satellites (GPS) to track the relative movement of the rocky crust of a few centimeters each year along faults. This information may help predict earthquakes. Even with precise instrumental measurement of past earthquakes, however, conclusions about future tremors always involve uncertainty. This means that any useful earthquake prediction must estimate the likelihood of the earthquake occurring in a particular area in a specific time interval compared with its occurrence as a chance event.

Scientists have measured other changes along active faults to try and predict future activity. These measurements have included changes in the ability of rocks to conduct electricity, changes in ground water levels, and changes in variations in the speed at which seismic waves pass through the region of interest. None of these methods, however, has been successful in predicting earthquakes to date.

Seismologists also study earthquakes to learn more about the structure of the Earth's interior. Earthquakes provide a rare opportunity for scientists to observe how the Earth's interior responds when an earthquake wave passes through it. Measuring depths and geologic structures within the Earth using earthquake waves is more difficult for scientists than is measuring distances on the Earth's surface. However, seismologists have used earthquake waves to determine that there are four main regions that make up the interior of the Earth: the crust, the mantle, and the inner and outer core.

Vocabulary

emergency preparedness *(n)*
early warning system *(n)*
alert at risk *(n)*
preventive radio *(n)*
seismic map *(n)*
bracing *(n)*
aid *(n)*
reinforcement bolt *(n)*
survival kit *(n)*
refuge *(n)*
response plans *(n)*
map *(n)*
observation track *(n)*
relative movement *(n)*
conduct electricity *(n)*

Ex. 2. Suggest the Russian equivalents to the English ones.

Emergency preparedness, in response, development, early warning system, evidence, issue, alert, preventive radio, withstand, compatible, seismic event, risk assessment, seismic map, bracing, retrofit, reinforcement, single-family, under construction code, preparedness, likely hood, survival kit, chapter, refuge, stay out, severely damaged, response plans (planning), hazardous, linked, map, measure, multiple, attach, anchored, wire, spring, suspend, writing utensil (-s), passage of seismic wave, jostle, monitoring system, seismic monitoring, power supply, portable, apply, chart, focal, tenfold, adjust, magnitude scale, amount, displacement, reliable, observation, supersede, track, relative movement, precise, occurrence, conduct electricity, date, mantle, core.

Ex. 3. Suggest the English equivalents to the Russian ones.

Готовность к аварийным ситуациям, свод законов, система раннего оповещения, признак, выпускать, сигнал тревоги, в опасности, предупредительная мера, оповещать, противостоять, вибрация, сейсмическая волна, оценка (степени риска), сейсморазведочная карта, крепление (держатель), помощь, переоборудование, односемейный дом, скреплять (привинчивать), неприкосновенный аварийный запас, убежище, отделение, пересидеть, сильное повреждение, непредвиденный (аварийный) случай, опасный (рискованный), соединенный (связанный), оценивать, надежно-закрепленный (закреплять), подвешивать, прикреплять, письменные принадлежности, прохождение сейсмической волны, система контроля, энергоснабжение, схема (чертеж), перемещение, регулировать (устанавливать), сдвиг (смещение), надежный, наблюдение, прослеживать, вероятность, стержень (сердцевина).

Ex. 4. Are these statements true or false?

1. The damage earthquakes cause is so great, that nothing can reduce it.

2. Earthquake safety and regulatory agencies have been established in many countries to help people in the case of emergency.

3. Tsunami can’t be prevented.

4. Special materials that can withstand shaking in buildings are used in the construction.

5. Engineers use geologic hazard, seismic hazard zoning maps under the construction of buildings.

6. Engineers use risk assessment maps so that people at risk can be evacuated from their area.

7. The seismic risk is greater in non-reinforced buildings.

8. There are some houses built under modern construction codes resist strong earthquake shaking they are made of special building material.

9. Death and injury caused by earthquakes can be reduced by taking several preventative measures within people's houses.

10. Seismograph is used to prevent earthquakes.

11. Seismologists compare the measurements taken at stations to identify the earthquake's epicenter and determine the magnitude of the earthquake.

12. Nothing can predict earthquakes.

13. Seismologists study earthquakes to learn more about the structure of the Earth's interior.

Ex. 5. Answer the questions.

1. How can the damage earthquakes cause be reduced?
2. Why have earthquake safety and regulatory agencies been established?
3. What do these agencies require?
4. What can prevent damage?
5. How do seismologists warn about tsunami?
6. Why do seismologists managed to warn about tsunami?
7. What is done to minimize earthquake damage to buildings?
8. What do geologists and engineers use risk assessment maps, geologic hazards and seismic hazard zoning maps for?
9. Are there any houses that can resist strong earthquake shaking well?
10. What can reduce death and injury caused by earthquakes?
11. How should people act during and after an earthquake?
12. What is the task of earthquake response plans?
13. How does seismograph work?
14. How do seismologists determine where the earthquake occurs (on land or in the ocean)?
15. Who was the first seismic magnitude scale developed by?
16. How do seismologists calculate moment magnitude?
17. How is the moment magnitude obtained?
18. What do seismologists use the growing catalogue of recorded earthquakes for?
19. What information may help predict earthquakes?
20. Why do seismologists study earthquakes?

Ex. 6. Give a summary of the text.

Text D. Flood

Ex. 1. Read the text and translate it into Russian.

When it rains or snows, some of the water is retained by the soil, some is absorbed by vegetation, some evaporates, and the remainder, which reaches stream channels, is called runoff. Floods occur when soil and vegetation cannot absorb all the water; water then runs off the land in quantities that cannot be carried in stream channels or retained in natural ponds and constructed reservoirs. About 30 percent of all precipitation is runoff, and this amount may be increased by melting snow masses. Periodic floods occur naturally on many rivers, forming an area known as the flood plain. These river floods often result from heavy rain, sometimes combined with melting snow, which causes the rivers to overflow their banks; a flood that rises and falls rapidly with little or no advance warning is called a flash flood. Flash floods usually result from intense rainfall over a relatively small area. Coastal areas are occasionally flooded by unusually high tides induced by severe winds over ocean surfaces, or by tsunamis caused by undersea earthquakes.

Floods not only damage property and endanger the lives of humans and animals, but have other effects as well. Rapid runoff causes soil erosion as well as sediment deposition problems downstream. Spawning grounds for fish and other wildlife habitat are often destroyed. High-velocity currents increase flood damage; prolonged high floods delay traffic and interfere with drainage and economic use of lands. Bridge abutments, bank lines, sewer outfalls, and other structures within floodways are damaged, and navigation and hydroelectric power are often impaired. Financial losses due to floods are commonly millions of dollars each year.

The basic methods of flood control have been practiced since ancient times. These methods include reforestation and the construction of levees, dams, reservoirs, and floodways (artificial channels that divert floodwater). The ancient Chinese built levees to raise the banks of the Huang He (Yellow River) on the supposition that the confined river would then deepen its channel to contain the maximum flow. The result, however, was a raising of the riverbed, because the sedimentary deposit of alluvial soil previously distributed over the entire flood plain during annual flooding was confined to the river bottom. In 4000 years the level of the river rose as high as 21 m (70 ft) above the surrounding plain. In 1887 one of the worst floods in recorded history occurred when the Huang He broke through the levees, killing more than a million people. Levees were constructed during the Middle Ages on the Po, Danube, Rhine, Rhône, and Volga rivers and have been supplemented in modern times by reforestation and by storage reservoirs. Levees are still in extensive use, notably on the Mississippi, where the river has been confined to a narrow channel to provide the depth necessary for navigation. Maintaining that depth has required repeated dredging of the channel, adding to the already large cost of sustaining the levee system.

Floods in the Mississippi Valley have demonstrated that levees alone do not provide sufficient protection against flooding on a large river, and other methods of flood control, including dams and floodways, are now in use on the Mississippi River. However, flood-control measures failed to contain the great flood of the summer of 1993, one of the worst in United States history. Swelled by record spring rains, the Mississippi and Missouri rivers and many of their tributaries overflowed their banks, inundating an estimated 8 million acres by early August. The raging floodwaters also inflicted major damage on levees, dams, and floodways, ruined an additional 12 million acres of cropland, and caused over $10 billion in damage. At its height, the Missouri river crested almost 15 m (almost 50 ft) above its banks; south of Illinois and Missouri, where the riverbed is very wide and lined with levees, there was only minor damage.

Although dams have been used for many centuries, their primary purposes were to build up water reservoirs for irrigation and other domestic uses and to create power. Only recently have they been constructed specifically for flood control. An effective method of controlling floodwaters is to construct coordinated groups of dams and reservoirs on the headwaters of the streams that lead into the main rivers, so that water can be stored during periods of heavy runoff and released gradually during dry seasons. The Hoover Dam on the Colorado River, the reservoirs in the Miami Conservancy District, and dams of the Tennessee Valley Authority (TVA) have demonstrated the value of this method. When the tributaries on which these dams are located are at their normal level, the dams operate solely to produce power and provide water for various purposes. During time of high water the dams operate to slow down the flow. The dams closest to the origins of the tributaries restrain the floodwaters while the dams farther down slowly release their normal reservoirs and are drained. Then the floodwaters are released to each succeeding dam and are finally emptied into the main river, the capacity of which has been increased by straightening and deepening. In other countries, one remarkable flood-control project is the Delta Plan, a Netherlands effort begun in 1958 and completed in 1985. The project consists of a series of giant dams that link islands in the deltas of the Rhine, Maas, and Schelde (Escaut) rivers. A huge storm-surge barrier 9 km (5.6 mi) long is lowered only when a sea flood is anticipated; at other times, tides move freely through the passage. Another such project, on a somewhat smaller scale, was completed across the Thames River a short distance below London in 1983.

Through the centuries people have created a flood problem by cutting down trees and digging up the vegetable cover of the soil, thus increasing soil erosion. Cultivation decreases the ability of the soil to retain water and increases runoff. Vast land areas along the headwaters of rivers throughout the world have been laid waste by intensive cultivation and subsequent erosion. Flood control in these areas has been directed to restoring vegetation and instituting efficient methods of soil management, such as crop rotation and contour plowing.

Another method of flood control is the construction of floodways on the lower reaches of rivers to divert floodwaters. The rivers are widened at certain points and allowed to overflow. Inundation of certain confined areas prevents the flooding of other areas. The Egyptians have used regulated flooding for thousands of years. Many areas in the Nile Valley depend for their continued fertility on periodic flooding because the soil deposited by sedimentation from floodwater is very rich.

Clean-up activities following floods often pose hazards to workers and volunteers involved in the effort. Potential dangers include: water polluted by mixing with and causing overflows from sanitary sewers, electrical hazards, carbon monoxide exposure, musculoskeletal hazards, heat or cold stress, motor vehicle-related dangers, fire, drowning, and exposure to hazardous materials. Because flooded disaster sites are unstable, clean-up workers might encounter sharp jagged debris, biological hazards in the flood water, exposed electrical lines, blood or other body fluids, and animal and human remains. In planning for and reacting to flood disasters, managers provide workers with hard hats, goggles, heavy work gloves, life jackets, and watertight boots with steel toes and insoles.

There are many disruptive effects of flooding on human settlements and economic activities. However, floods (in particular the more frequent/smaller floods) can bring many benefits, such as recharging ground water, making soil more fertile and providing nutrients in which it is deficient. Flood waters provide much needed water resources in particular in arid and semi-arid regions where precipitation events can be very unevenly distributed throughout the year. Freshwater floods in particular play an important role in maintaining ecosystems in river corridors and are a key factor in maintaining floodplain biodiversity. Flooding adds a lot of nutrients to lakes and rivers which leads to improved fisheries for a few years, also because of the suitability of a floodplain for spawning (little predation and a lot of nutrients). Fish like the weather fish make use of floods to reach new habitats. Together with fish also birds profit from the boost in production caused by flooding. Periodic flooding was essential to the well-being of ancient communities along the Tigris-Euphrates Rivers, the Nile River, the Indus River, the Ganges and the Yellow River, among others. The viability for hydrological based renewable sources of energy is higher in flood prone regions.

While flood modelling is a fairly recent practice, attempts to understand and manage the mechanisms at work in floodplains have been made for at least six millennia. The recent development in computational flood modelling has enabled engineers to step away from the tried and tested "hold or break" approach and its tendency to promote overly engineered structures. Various computational flood models have been developed in recent years either 1D models (flood levels measured in the channel) and 2D models (flood depth measured for the extent of the floodplain). HEC-RAS, the Hydraulic Engineering Centre model, is currently among the most popular if only because it is available for free. Other models such as TUFLOW combine 1D and 2D components to derive flood depth in the floodplain. So far the focus has been on mapping tidal and fluvial flood events but the 2007 flood events in the UK have shifted the emphasis onto the impact of surface water flooding.

Vocabulary

retain *(v)*
absorb *(v)*
evaporate *(v)*
runoff *(n)*
stream channel *(n)*
precipitation *(n)*
overflow *(n)*
advance warning *(n)*
deposition *(n)*
spawning ground *(n)*
habitat *(n)*
drainage *(n)*
delay *(n)*
bridge abutment *(n)*
sewer outfall *(n)*
divert *(n)*
flood-control *(n)*
tributary *(n)*
inundate *(v)*
floodwater *(v)*
irrigation *(n)*
headwaters *(n)*
drain *(n)*
storm surge *(n)*

flash flood *(n)*
tide *(n)*
endanger *(v)*
erosion *(n)*
fertility *(n)*
sanitary sewer *(n)*
electrical hazards *(n)*
exposure *(n)*
disaster *(n)*
riverbed *(n)*
sedimentary *(a)*
alluvial *(n)*
storage reservoir *(n)*
dredging *(n)*
benefit *(n)*
clean-up activity *(n)*
recharge *(n)*
watertight *(a)*
barrier *(n)*
lay waste *(v)*
corporation *(n)*
disruptive effect *(n)*
sedimentation *(n)*
ground water *(n)*
debris *(n)*
biological hazard *(n)*

Ex. 2. Suggest the Russian equivalents to the English ones.

Retain, absorb, vegetation, evaporate, remainder, runoff, stream channel, precipitation, flood plain, overflow, advance, warning, flash flood, tide, induce, endanger, sediment, deposition, spawning ground, habitat, delay, drainage, bridge abutment, sewer outfall, impair, reforestation, divert, supposition, confine, contain, riverbed, sedimentary, deposit, alluvial, supplement, storage reservoir, sustain, swell, tributary, inundate, estimate, inflict, cropland, irrigation, headwaters, restrain, storm surge, barrier, anticipate, lay waste, plowing, fertility, clean-up activities, sanitary sewer, electrical hazard, carbon monoxide, exposed, hard hat, gaggle, watertight, disruptive effect, benefit, ground water, deficient, biodiversity, profit, boost, well-being, flood region.

Ex. 3. Suggest the English equivalents to the Russian ones.

Удерживать, поглощать, растительность, испарять, остатки, избыток воды (потоп), русло реки, разливаться, заблаговременное предупреждение, сильный паводок, прилив и отлив, вызывать (приводить к чему-либо), подвергать опасности, осадок (осадочная порода), отложение, нерестилище, среда обитания, продолжительный, препятствовать, опора моста, канализационный выпуск, снижать (повреждать, ухудшать), лесонасаждение, дамба, отводить, ограничивать, вмещать, осадочные горные породы, месторождение (осаждать), наносной, пополнять, водохранилище, поддерживать, затраты, противопаводочные мероприятия, увеличивать, приток, затоплять, оценивать, наносить, орошение, головное водохранилище, ожидать, опустошать, плодородие, коллектор для коммунально-бытовых и промышленных сточных вод, опасность поражения электрическим током, угарный газ, бедствие, обломки, биологическая опасность, водонепроницаемый, разрушающее действие, выгода, грунтовая вода, биологическое разнообразие, благосостояние.

Ex. 4. Are these statements true or false?

1. All water from rains and snows evaporates.

2. Floods are the result of precipitation.

3. A flash flood is a flood that rises and falls rapidly with little or no advance warning.

4. High tide induced by severe winds over ocean surface cause coastal areas flooding.

5. Floods bring only benefits.
6. There are methods of flood control.
7. The experience shows that the construction of levels alone provides protection against flooding.
8. The main purpose of dam construction is to build up water reservoirs for irrigations and other domestic uses and to create power.
9. The Hoover Dam on the Colorado River, the reservoirs in the Miami Conservancy District, and dams of the Tennessee's Valley authority have demonstrated the value of the method of controlling floodwaters. (Prove).
10. The flood problem is caused by nature activities.
11. Floods can't be controlled.
12. Clean-up actives are harmless enough.

Ex. 5. Answer the questions.

1. Where does water go when it rains or snows?
2. When do flood occur?
3. What is flood plain?
4. What does river floods result from?
5. What is coastal areas flooding caused by?
6. What are the consequences of floods?
7. What are the basic methods of flood control?
8. How long have the basic methods of flood control been practiced?
9. What was the result of building levees in ancient China?
10. Can levees alone provide sufficient protection against flooding?
11. What were the primary purposes of dams?
12. What purposes have dams been recently constructed for?
13. What is an effective method of controlling floodwaters?
14. What dams have demonstrated the value of the method that controls floodwaters? (Prove).
15. How have people created a flood problem through the centuries?
16. What are the methods of flood control?
17. Why are the dangers of clean-up activities following floods?
18. What are the benefits of flood?
19. What is the role of freshwater floods?
20. How does flood influence on fish?

Ex. 6. Give the summary of the text.

Text E. Chernobyl accident

Ex. 1. Read the text and translate it into Russian.

Chernobyl Accident, accident at the Chernobyl nuclear power plant in the Ukrainian republic of the Union of Soviet Socialist Republics (USSR) that produced a plume of radioactive debris that drifted over parts of the western USSR, Eastern Europe, and Scandinavia. The accident, which occurred on April 26, 1986, was the worst nuclear power accident in history. Large areas of the Ukrainian, Belorussian, and Russian republics of the USSR were contaminated, resulting in the evacuation and resettlement of roughly 200,000 people. The accident raised concerns about the safety of the Soviet nuclear power industry, slowing its expansion for a number of years, while forcing the Soviet government to become less secretive. The now independent countries of Ukraine and Belarus have been burdened with continuing and substantial costs for decontamination and health care because of the Chernobyl accident.

The Chernobyl nuclear power plant was one of the largest in the USSR. It was located just outside of the town of Pripyat, about 18 km (11 mi) northwest of the town of Chernobyl. The plant was only 16 km (10 mi) from the border between the Ukrainian and Belorussian republics and roughly 110 km (70 mi) north of Kyiv (Kiev), the capital and largest city of Ukraine. Construction of the plant began in the 1970s, with reactor No. 1 commissioned in 1977, followed by No. 2 (1978), No. 3 (1981), and No. 4 (1983). Each reactor had an electricity-generating capacity of 1,000 megawatts, and the four together produced about 10 percent of Ukraine's electricity at the time of the accident. Two more reactors (No. 5 and No. 6, also capable of producing 1,000 megawatts each) were under construction at the time of the accident.

In the early morning hours of April 26, 1986, reactor No. 4 was operating at very low capacity (6 to 7 percent) during a planned shutdown. Plant personnel intended to monitor the performance of turbine generators, which supplied electric power for the plant's own operation, during a changeover from standard to a backup source of power. The reactor's design made it unstable at low power, and the operators were careless about safety precautions during the test. After a sudden power surge, two explosions destroyed the reactor core and blasted a large hole in the roof of the reactor building. Radioactive debris moved up through this hole to heights of 1 km (0.6 mi), carried by a strong updraft. Fires caused by the explosion and the heat of the reactor core fed the updraft.

An estimated 100 to 150 million curies of radiation (primarily radioactive isotopes of iodine and cesium) escaped into the atmosphere before cleanup crews were able to bring the fires under control and stabilize the situation some two weeks later. Initially, prevailing winds carried the radioactivity northwest from the plant across Belorussia and into Poland and Sweden, where heightened radiation levels detected on April 28 first brought the accident to the world's attention. Subsequently, from May 1 to 5, wind patterns shifted so that the bulk of radioactivity was carried more directly north and northeast, over Belorussia and southwestern Russia.

After the explosion, firefighters and other workers arrived on the scene in an attempt to contain the blast. To reduce emissions, the team bombarded the reactor with 5,000 metric tons of shielding material consisting of lead, boron, sand, and clay. A second concrete foundation was constructed under the reactor to prevent contamination of groundwater. Finally, workers erected an enormous concrete-and-steel shell or "sarcophagus" over the damaged reactor to prevent radioactive materials, including gases and dust, from escaping. Initially, Soviet officials placed the death toll at 2 (both workers killed during the explosion at the No. 4 reactor) but by mid-August revised the figure to 31, reflecting deaths of workers from acute radiation exposure during the cleanup.

By mid-July, roughly three months after the accident, containment and cleanup had proceeded to the point where the plant's management had moved back into the administration building just 300 m (about 1,000 ft) from the No. 4 reactor. In addition to reducing the radiation threat, a key objective to the cleanup effort was resumption of electric power generation at Chernobyl before the onset of winter. The No. 1 and No. 2 reactors, in fact, were returned to service in November 1986 and the slightly damaged No. 3 unit was restarted in December 1987.

More than 100,000 people were evacuated during the first few weeks after the accident. Evacuation of Pripyat (where 35,000 people lived at the time of the accident) and the immediate surrounding area began roughly 36 hours after the accident, on the afternoon of April 27. Evacuation within a larger, officially designated evacuation zone of 2800 sq km (1100 sq mi), including parts of Belorussia began on May 3. That area became known as the "30-km zone" because it is a circle with a 30-km (19-mi) radius from Pripyat. At least 50,000 people were relocated in Ukraine and 25,000 in Belorussia during this second-stage evacuation, which continued into June.

As officials, especially in Belorussia, determined that areas of serious contamination extended well beyond the official evacuation zone, additional people were relocated. Fifty thousand people were evacuated from areas outside the 30-km zone in Belorussia in 1986 and 1987, over 30,000 more between 1991 and 1993, and roughly 50,000 in Ukraine over the period from 1991 to 1996. The total number of people evacuated in Ukraine and Belorussia as a result of Chernobyl now appears to exceed 200,000.

The principal environmental effect of the Chernobyl accident has been the accumulation of radioactive fallout in the upper layers of soil, where it has destroyed important farmland. The second most important impact has been the threat to surface water and groundwater. The cleanup in some of the most heavily contaminated areas within the evacuation zone, such as Pripyat, involved the stripping and burying of topsoil and vegetation, the sealing of wells, and the building of structures designed to prevent surface water from entering streams and rivers that drain into the Dnieper River system, which provides Kyiv's water supply.

By most measures, the country most seriously affected by the accident is Belarus (which changed its name from Belorussia after it, along with the other Soviet republics, became independent with the collapse of the USSR in 1991). Almost 20 percent of the republic's farmland was removed from production during the years immediately after the accident. Half of the vast 27,850-sq km (10,750-sq mi) area described as being "seriously contaminated" by radiation (with levels of radioactive cesium in topsoil exceeding 5 curies) is in Belarus. The regions commonly identified as experiencing the greatest contamination include the oblasts (regions) of Homyel, Mahilyow, and Brest in southern and eastern Belarus; Kyiv, Zhytomyr, and Chernihiv in northern Ukraine; and Bryansk in southwestern Russia.

Effects on public health have been more difficult to determine and are subject to considerable controversy. It is not always clear which health problems are caused directly by radiation and which are caused by poor nutrition, the general low level of health, and the anxiety and stress produced by fear of radiation exposure. These issues surround the debate over the causes of higher death rates among the more than half a million workers who participated in the Chernobyl cleanup.

However, at least one type of cancer can be attributed directly to Chernobyl. There has been a significant rise in the incidence of thyroid cancer among children in the areas where radiation levels are highest. Thyroid cancer rates in Homyel Oblast, for example, increased 22-fold from 1986 through 1990 compared to the period from 1981 through 1985.

Many observers have argued that the accident at Chernobyl accelerated the transformation of the USSR toward a more open society. Soviet officials, unable to conceal the accident from the world, reluctantly acknowledged the accident during an evening news telecast in Moscow on April 28 and in brief newspaper accounts on April 30. This was followed by regular coverage focused on the cleanup efforts in the months that followed. This reporting sharply contrasts to the lack of cove-rage of previous catastrophic events (an accident at a nuclear weapons plant in the Ural Mountains in 1957 and major earthquakes in Central Asia in 1948 and 1964).

Also, after the accident several key officials in the Soviet nuclear power industry were dismissed, punished, or both, and a new Ministry of Nuclear Power was created in 1986. Before then, officials in the general electric power ministry had overseen nuclear power. Chernobyl also called into question the basic safety of nuclear power in both the USSR and several Eastern European countries whose power plants contained reactors based on the RBMK reactor design used at Chernobyl. As a consequence, international organizations, such as the International Atomic Energy Agency, became involved in programs to improve safety procedures and upgrade the design of RBMK reactors in the USSR and Eastern Europe.

The accident, coupled with a general economic decline that set in during the final years of the USSR, also resulted in a dramatic scaling back of Soviet plans to use nuclear power to generate the bulk of electric power in Soviet regions remote from oil and gas energy resources. In Ukraine, opposition to further nuclear construction in the immediate post-Chernobyl years was particularly intense. In August 1990, for example, the Ukrainian parliament declared a moratorium on nuclear power plant construction. This ban was subsequently lifted in 1993 because of severe energy shortages in Ukraine.

Earlier in 1990 the Ukrainian parliament had voted to close the Chernobyl plant permanently within five years, but closure was repeatedly postponed because of the country's shortage of electricity-generating capacity. After a turbine fire in October 1991, the No. 2 reactor at Chernobyl was shut down, leaving only two of the original four reactors at the plant in service. Reflecting mounting safety concerns in the international community, an agreement was concluded in April 1996 between the Ukrainian government and the G-7 countries (Group of Seven major industrial nations) to decommission the Chernobyl plant by the year 2000. In conjunction with the agreement, the G-7 countries pledged $300 million to finance programs to strengthen the sarcophagus, which some fear may collapse, and for additional cleanup work. In November 1996, as part of the schedule for the decommissioning, the No. 1 reactor at Chernobyl was taken out of service, leaving only the third unit operational. Finally, in December 2000 the plant was totally shut down.

Vocabulary

safety *(n)*
blast *(n, v)*
emission *(n)*
contaminate *(v)*
power surge *(n)*
cause *(n, v)*
escaping *(n)*
resumption *(n)*
health care *(n)*
safety concern *(n)*
energy shortage *(n)*
destroy *(v)*
explosion *(n)*
cleanup crew *(n)*
radiation threat *(n)*
evacuation zone *(n)*
nutrition *(n)*
decommission *(v)*
shielding material *(n)*
nuclear power accident *(n)*
firefighter *(n)*
safety procedures *(n)*
nuclear power plant *(n)*
radioactive debris *(n)*
radiation exposure *(n)*
radioactive fallout *(n)*
decontamination *(n)*
turbine generator *(n)*

Ex. 2. Suggest the Russian equivalents to the English ones.

Substantial costs, resettlement, roughly, raise, concerns, safety, expansion, burden with, drift, occur, monitor, performance, supply, changeover, backup source, unstable, shutdown, intend, cause, updraft, escape, prevailing wind, heightened radiation level, detect, shift, bulk, scene, attempt, reduce, bombard, prevent, erect, enormous, damage, acute, death toll, cleanup, proceed, onset, evacuate, surrounding area, relocate, second-stage, extend beyond, accumulation, upper layers of soil, impact, threat, surface water, stripping, topsoil, burying, sealing, well, drain into, environmental effect, stream, affect, remote, public health, controversy, anxiety, fear, participate, surround, attribute, rate, conceal, reluctantly, acknowledge, decline, scaling, strengthen, decommission, fission, postpone, closure, upgrade, schedule.

Ex. 3. Suggest the English equivalents to the Russian ones.

Обременять, закрытие предприятия, наблюдать, переделка, запас, взрывать, пик мощности, отходы, повышенный уровень, обнаруживать, груда, выделение, засыпать, защитный материал, жертвы, сильный, сдерживание, продолжить движение, возобновление, начало, указывать, накопление, осадки, сдирание, загрязнять, герметизация, дебаты, питание, страх, степень, скрывать, сознавать, сфера действия, атомная энергия, защитная оболочка, чрезмерный, масштаб, списывать, соединение, залог.

Ex. 4. Answer the questions.

1. What did Chernobyl accident produce?
2. Where did radioactive debris drift over?
3. What are the consequences of Chernobyl' accident?
4. How did the population save?
5. What kind of concerns did the accident raise?
6. What have the now independent countries of Ukraine and Belarus been burdened with?
7. Where was the Chernobyl nuclear power plant located?
8. How can you prove this fact that the Chernobyl' nuclear power plant was one of the largest in the USSR?
9. What did plant personnel intend to do on April 26, 1986?
10. Why were the operators of the plant careless about safety precautions during the test?
11. How did the explosions happen?
12. What happened before cleanup crews were able to bring the fires under control and stabilize the situation?
13. How far did prevailing winds carry the radioactivity?
14. What brought the accident to the world's attention?
15. What did firefighters and other workers do to reduce emissions?
16. What is the principal environmental effect of the Chernobyl accident?
17. What did the cleanup in contaminated areas involve?
18. What are effects of Chernobyl accident on public health and farmland?
19. Where else did the accident result in?
20. Why was the shutdown of the Chernobyl nuclear power plant repeatedly postponed?

Ex. 5. Give a summary of the text.

Text F. Japan earthquake: Explosion at Fukushima nuclear plant

Ex. 1. Read the text and translate it into Russian.

A powerful explosion has hit a nuclear power station in north-eastern Japan which was badly damaged Friday's devastating earthquake and tsunami. A building housing a reactor was destroyed, but authorities said the reactor itself was intact. The government sought to play down fears of a meltdown at the Fukushima 1 plant. But officials later announced the cooling system of a second reactor at the plant had failed. The news sparked fears of the risk of a further explosion or leak of radioactive material. A huge rescue and relief operation is under way in the region after the earthquake and subsequent tsunami, which are thought to have killed more than 1,000 people.

Tokyo Electric Power said four of its workers had been injured in Saturday's blast at Fukushima, 250 km (155 miles) north of Tokyo, but that their injuries were not life-threatening. An evacuation zone around the damaged nuclear plant has been extended to 20 km (12.4 miles) from 10km, and a state of emergency declared. An estimated 200,000 people have been evacuated from the area, the International Atomic Energy Agency says. The government has urged residents to remain calm and is preparing to distribute iodine to anyone affected.

Tests showed at least three patients evacuated from a hospital near the plant had been exposed to radiation, public broadcaster NHK quoted local government officials as saying. They were among a group of people waiting outside the hospital for rescue helicopters when the explosion hit the plant. Government spokesman Yukio Edano said the force of the explosion had destroyed the concrete roof and walls of a building around the plant's number one reactor, but a steel container encasing the reactor had not been ruptured. Mr Edano said radiation levels around the plant had fallen after the explosion. He added that sea water was being pumped into the site to lower temperatures.

Before the explosion, Japan's nuclear agency had said that radioactive caesium and iodine had been detected near the number one reactor. The agency said this could indicate that containers of uranium fuel inside the reactor may have begun melting. Air and steam, with some level of radioactivity, was earlier released from several of the reactors at both plants in an effort to relieve the huge amount of pressure building up inside.

The tsunami that followed the 8.9-magnitude earthquake wreaked havoc along a huge stretch of on Japan's north-east coast, sweeping far inland and devastating a number of towns and villages. The BBC's Damian Grammaticas in the coastal city of Sendai, in Miyagi prefecture, says the scenes of devastation there are astonishing — giant shipping containers have been swept inland and smashed against buildings, and fires are still burning close to the harbour. Police said between 200 and 300 bodies were found in just one ward of the city.

The town of Rikuzentakada, Iwate, was reported as largely destroyed and almost completely submerged. NHK reported that soldiers had found up to 400 bodies there. NHK reports that in the port of Minamisanriku, Miyagi, the authorities say that about 7,500 people were evacuated to 25 shelters after Friday's quake but they have been unable to contact the town's other 10,000 inhabitants.

A local official in the town of Futaba, Fukushima, said more than 90 % of the houses in three coastal communities had been washed away by the tsunami. "The tsunami was unbelievably fast," said Koichi Takairin, a 34-year-old truck driver who was inside his four-ton rig when the wave hit Sendai. "Smaller cars were being swept around me. All I could do was sitting in my truck".

Tens of thousands of troops backed by ships and helicopters have been deployed on rescue and relief missions. More than 215,000 people are said to be living in 1,350 temporary shelters in five prefectures. International disaster relief teams are being sent to Japan, with the United Nations helping to co-ordinate the operation. President Barack Obama has pledged US assistance. One US aircraft carrier that was already in Japan will help with rescue and relief efforts, and a second is on its way. Japan's worst previous earthquake was of 8.3 magnitude and killed 143,000 people in Kanto in 1923. A magnitude 7.2 quake in Kobe killed 6,400 people in 1995.

Vocabulary

leak *(n)*	**encasing** *(n)*	**pump** *(v)*
expose *(v)*	**wreak** *(v)*	**havoc** *(n)*
hit *(v)*	**disaster relief** *(n)*	**assistance** *(n)*
sweep away *(v)*	**meltdown** *(n)*	
rescue *(v, n)*	**affected** *(a)*	

Ex. 2. Suggest the Russian equivalents to the English ones.

Meltdown, leak, expose to radiation, rescue, hit, pump, devastation, wreak, havoc, sweep away, smash, submerged, disaster relief, assistance.

Ex. 3. Suggest the English equivalents to the Russian ones.

Опустошительный (разрушительный), корпус, неповрежденный, предпринимать попытку, преуменьшить, авария на АЭС, полным ходом, утечка, взрыв, пораженный (болезнью), подвергаться облучению, спасать, поражать, обшивка (упаковывать), разрывать, выкачивать, служить признаком (означать), опустошение (разорение), причинять вред, наносить серьезный ущерб, уничтожать, нарушить, затопленный, помощь при массовых бедствиях.

Ex. 4. Answer the questions.

1. What happened in north-eastern Japan?
2. Was the reactor destroyed?
3. What is under way in the region after earthquake?
4. Did anyone expose to radiation?
5. What were the consequences of the explosion?
6. What was radiation level around the plant?
7. What purpose was sea water being pumped for?
8. What were the consequences of the tsunami?

Ex. 5. Give a summary of the text.

UNIT 2

Text A. History of fire

Ex. 1. Read the text and translate it into Russian.

Fire, reaction involving fuel and oxygen that produces heat and light. Early humans used fire to warm themselves, cook food, and frighten away predators. Sitting around a fire may have helped unite and strengthen family groups and speed the evolution of early society. Fire enabled our human ancestors to travel out of warm, equatorial regions and, eventually, spread throughout the world. But fire also posed great risks and challenges to early people, including the threat of burns, the challenge of controlling fire, the greater challenge of starting a fire, and the threat of wildfires.

As early civilizations developed, people discovered more uses for fire. They used fire to provide light, to make better tools, and as a weapon in times of war. Early religions often included fire as a part of their rituals, reflecting its importance to society. Early myths focused on fire's power. One such myth related the story of Vesta, the Roman goddess of the hearth. To honor Vesta, the high priest of the Roman religion periodically chose six priestesses, called Vestal Virgins, to keep a fire going in a community hearth. Keeping a controlled fire burning played a central part in communal life. Before the invention of modern implements, star-ting a fire, especially in adverse weather, usually required much time and labor to generate sufficient friction to ignite kindling. If people let their fire go out, they had to spend considerable time to start it again before they could eat and get warm.

The earliest use of fire by humans may have occurred as early as 1.4 million years ago. Evidence for this was found in Kenya — a mound of burned clay near animal bones and crude stone tools, suggesting a possible human campsite. However, this fire could have resulted from natural causes. Homo erectus, a species of human who lived from about 1.8 million to about 30,000 years ago, was the first to use fire on a regular basis. Evidence of a fire tended continuously by many generations of Homo erectus, dating to about 460,000 years ago, has been found in China. Scientists have also found evidence of tended hearths dating back as many as 400,000 years in several parts of France.

Homo erectus was the first human species to leave equatorial Africa in large numbers and spread to other continents. Many scientists believe that the use of fire enabled Homo erectus to adapt to new environments by providing light, heat, and protection from dangerous animals. Tending fires probably helped foster social behavior by bringing early humans together into a small area. Fires may have tightened family groups as the families congregated around a fire to protect their young. Homo erectus may have used fire to cook food.

The use of fire became widespread throughout Africa and Asia about 100,000 years ago. By this time anatomically modern humans, Homo sapiens, had evolved and existed alongside their near relatives, the Neandertals (Homo neanderthalensis). Clear indications of hearths have been found in Israel in Neandertal settlements that date from 60,000 years ago. The Neandertals died out about 24,000 years ago.

Sometime after people began to use stone for tools, they found that by rubbing together pieces of flint they could produce sparks that would set fire to wood shavings. Scientists have found evidence that people used pieces of flint and iron to produce sparks for fires 25,000 to 35,000 years ago.

Early people also learned to make fires by rubbing together pieces of wood until the wood produced a hot powder that could light kindling. Later, people made fires by using wood devices that had been developed for other purposes. The fire drill was an adaptation of the bow and the drill. It consisted of a block of wood and a stick that was fixed in the looped string of a small, curved bow. The fire builder moved the bow in a sawing motion, with one end of the stick against the block of wood. This motion rotated the stick rapidly against the wood block, creating friction between the end of the stick and the block of wood. The friction produced a glowing wood powder that could be fanned into a flame and used to light a fire.

Early people of southeastern Asia produced fire another way. They used a wood piston to compress air inside a bamboo tube that contained wood shavings. The compressed air became increasingly hotter, eventually igniting the shavings.

The people of ancient civilizations improved on methods of fire-making. Glassmaking among the Greeks led to the development of lenses, which the Greeks used to focus sunlight on, and thereby ignite, bundles of dry sticks. As the use of metals in toolmaking increased, people developed the tinderbox. This moisture-proof, metal carrying case held tinder, usually charred cotton or linen cloth, and pieces of steel and flint. Striking the steel and flint together produced a spark that lighted the tinder. Later the Japanese devised a tinderbox that operated like a present-day cigarette lighter, in which the rotary motion of a metal wheel against flint set off sparks in tinder. Finally, in the mid-19th century, a reliable form of the phosphorus match was developed.

Today people naturally focus not on starting fires but on using fire productively and on preventing or extinguishing unwanted fires. We use fire to cook food and to heat our homes. Industries use fire to fuel power plants that produce electricity. At the same time, fire remains a potentially destructive force in people’s lives. Natural fires started by lightning and volcanoes destroy wildlife and landscapes. Careless disposal of cigarettes and matches or carelessness with campfires leads to many wildfires. Fires in the home and workplace damage property and cause injury and death. Fires usually cost the United States and Canada more each year than floods, tornadoes, and other natural disasters combined.

Scientists and fire protection engineers work together to help people use fire safely and productively. Smoke detectors and automatic sprinklers in homes and the workplace have reduced property loss, deaths, and injuries due to fire. Engineers continue to develop more fire-resistant materials for use in furniture, buildings, automobiles, subway cars, and ships. The development of new engineering approaches and new building codes and standards has led to safer buildings without dramatically increasing costs of construction.

Vocabulary

fire *(v, n)*
reaction *(n)*
fuel *(n, v)*
oxygen *(n)*
warm *(v, n)*
burn *(v, n)*
wildfire *(n)*
ignite *(v)*
kindling *(n)*
heat *(n, v)*
lightning *(n)*
flood *(n)*
smoke detector *(n)*
sprinkler *(n)*
fire-resistant *(a)*
protection *(n)*
flint *(n)*
spark *(n)*
wood shaving *(n)*
saw *(v)*
power *(v, n)*
glow *(v, n)*
fan *(v)*
lighter *(n)*
match *(n)*
piston *(n)*
friction *(n)*
rub *(v)*
fire builder *(v)*
flame *(v, n)*
campfire *(n)*
extinguish *(v)*

Ex. 2. Suggest the Russian equivalents to the English ones.

Predator, unite, speed, keep a fire, ancestors, spread, community hearth, throughout, pose, challenge, burn, reflect, focus, relate, hearth, implements, adverse, friction, mound, crude, campsite, widespread, tighten, congregate, careless disposal, evolve, bow, looped string, sawing motion, bundle, tinderbox, char, rotary motion, unwanted fire, natural cause, set fire, light a fire, wood powder, fire drill, engineering approach, date back, tending fires, foster, social behavior.

Ex. 3. Suggest the English equivalents to the Russian ones.

Представлять собой, сложная задача, угроза, распространяться, отражать, иметь отношение, инвентарь, отапливать, объединять, ускорить, позволить, пожар, разводить пожар, воспламенение, погаснуть, предотвращать, молния, разжигать огонь, оставаться, ландшафт, пользование, вызывать, повреждение, имущество, потеря, пожарный извещатель, инженерный подход, вагон метро, строительные нормы и правила, случаться, насыпь, лагерь, причина, возникнуть, факты, окружающие условия, растить, развивать, связывать, раздуть огонь, трение, пламя, воспламенять, стебель, обжечься.

Ex. 4. Are these statements true or false?

1. As early civilizations developed, people discovered less uses for fire.
2. Sitting around a fire may have slowed down the evolution of early society.
3. Fire protection engineers work together to help people use fire destructively.
4. Smoke detectors in homes have increased property loss, deaths, and injuries due to fire.
5. The development of new engineering approaches and new building codes and standards has led to more dangerous buildings.

6. Caring disposal of cigarettes and matches leads to many wildfires.
7. The earliest fires could have resulted from natural causes.
8. The use of fire enabled people to adapt to new environments.
9. Tending fires probably helped lose social behavior.
10. Fires may have tightened family groups as the families congregated around a fire to protect their young.
11. Early people were able to set fires by rubbing together pieces of cloth.
12. Early people produced fire by compressing air inside a bamboo empty tube.
13. The people of ancient civilizations declined methods of fire-making.
14. The Greeks ignited bundles of dry sticks with the help of lenses.
15. Striking the steel and flint together produced a spark that lighted the tinder.

Ex. 5. Answer the questions.

1. What is fire?
2. What did early humans use fire for?
3. What may have speed the evolution of early society?
4. What did fire allow ancestors to do?
5. Why did fire pose great risks and challenges to early people?
6. Why did starting a fire require much time and labor to ignite kindling?
7. When did ancient people have to start fire again?
8. What do people focus on nowadays?
9. What do industries use for?
10. Why does fire remain a destructive force in people's lives?
11. What causes natural fires?
12. What has reduced property loss, deaths, and injuries due to fire?
13. Where can fire-resistant materials be used?
14. What has led to safer buildings without increasing costs of construction?
15. When did the earliest use of fire by humans occur?
16. What enabled people to adapt to new environments?
17. How did tending fires probably help foster social behavior?
18. What did people find using stone for tools?
19. What did people use to produce sparks for fires?
20. How did people learn to make fires?
21. How did people of southeastern Asia produce fire?
22. What did glassmaking lead to?
23. Why did people develop the tinderbox?
24. How did people light the tinder?
25. What device operated like a present-day cigarette lighter?

Ex. 6. Give the summary of the text.

Text B. Fire and advance of civilization

Ex. 1. Read the text and translate it into Russian.

As early people began to live in larger communities and to develop more advanced technologies, fire became a central part of their lives. Fire continues to be essential to humans today, although its presence may be hidden in gas-fired ovens and furnaces and thus less noticeable than before.

Thousands of years ago hunter-gatherers (people who lived by hunting and gathering wild food) developed a number of valuable uses for fire. With fire they could remain active after the sun set, protect themselves from predators, warm themselves, cook, and make better tools.

People began using fire as a source of light by taking advantage of the glow of wood-burning fires to continue their activities after dark and inside their dwellings, which were usually natural caves. Eventually people learned to dip branches in pitch to form torches. They created crude lamps by filling a hollowed out piece of stone with moss soaked in oil or tallow (a substance derived from animal fat).

By cooking with fire, prehistoric people made the meat of the animals they killed more palatable and digestible. They learned to preserve meat by smoking it over a fire, vastly decreasing the danger of periodic starvation. Cooking also enabled them to add some formerly inedible plants to their food supplies.

Fire enabled people to make better weapons and tools. In prehistoric times, hunters formed spears from tree branches by burning the tips of the branches and then scraping the charred ends into a point. They used fire to straighten and harden tools made of green wood. People eventually learned to control the spread of a fire by blowing at it through reed pipes. They then used this technique to burn hollows in logs to create cradles, bowls, and canoes.

When prehistoric people developed the ability to cultivate crops and raise animals, they began to form permanent communities. These communities amassed food surpluses, enabling some people to devote their time to becoming skilled artisans. The artisans first used fire to make pottery and bricks. The first potters worked around 6500 B.C. in Mesopotamia, one of the earliest centers of civilization, located in modern-day Iraq and eastern Syria. They placed wet clay vessels in open fires to harden and waterproof them. By 3000 B.C. Egyptian potters used fire in earthen kilns, or ovens, to bake bricks out of a mixture of mud and straw. Later, potters in Babylonia and Assyria, in the area now known as Iraq, used fire in stone kilns to create high temperatures that produced extremely durable pottery.

Fire became the center of daily life in the ancient civilizations. Most of the mud, thatch, or wood houses in which ancient people lived contained a hearth, or fireplace, in the center. Smoke escaped through a hole directly overhead in the roof. Some of the houses, as well as tenements in crowded cities such as Rome and Athens, were heated by braziers (metal pans that held charcoal fires). The large houses of the rich in the Roman Empire were heated by movable stoves, or even furnaces, from which hot air flowed to a heat chamber under some of the rooms. Modern household stoves and furnaces stem from these developments.

Ancient peoples developed improved devices for using fire to provide light. By 2000 B.C. they began using candles made of yarn or dry rushes dipped in animal fat. The Egyptians and Greeks introduced more advanced forms of the oil lamp, filling a shell or carved stone with animal or vegetable oil and introducing a floating wick. Later people began to use pottery or metal dishes with a spout for the wick. Lamps remained the basic source of light, with gas and kerosene later being used as fuel, until the development of the electric bulb in the 19^{th} century.

Fire was essential in metalworking, which developed after 4000 B.C. At this time Sumerian artisans, who preceded the Babylonians, melted copper ore for casting tools and weapons in a fire over an earthen hearth. The hearth contained a hole to collect the hot, liquid metal. Later, artisans lined the hearth hole with stone, creating the first furnace. Eventually, to increase the heat, they used bellows to force air into the fire and developed the first blast furnace. People also found they could create a hotter fire by burning carbonized (partially burned) sticks and twigs. They eventually produced charcoal, a compact, efficient fuel, by slowly smoldering wood in an oven with little air.

The history of people's use of fire includes many difficulties involved in controlling fire. Early cities were often ravaged by fires. The ancient city of Troy, located in present-day Turkey, was destroyed several times by fire, perhaps due to war, perhaps to accident. One of the world's greatest losses was caused by a fire in the great library in Alexandria, Egypt, in 48 B.C. This fire destroyed the world's most complete collection of ancient Greek and Roman writings.

Fire continues to be a basic, everyday element of most people's lives. Any home appliance that uses methane, propane, or oil relies on fire to operate. These appliances include gas- or oil-fired (but not electrically operated) water heaters, boilers, hot air furnaces, clothes dryers, stoves, and ovens. Many people use wood or, sometimes, coal in fireplaces or stoves to supplement the main heating system in their homes. In the countryside, people destroy leaves and brush by burning them. People also make outdoor fires to cook food in barbecues and over campfires. Today, many people enjoy sitting around a campfire, keeping warm and telling stories, just as people have for tens of thousands of years.

Industries use fire to manufacture products and dispose of waste. Companies use heating and drying appliances similar to, but often much larger than, the ones in homes. Large industrial incinerators destroy garbage, including household, medical, and industrial waste. Fire can render toxic waste harmless when it burns such waste in special incinerators. This waste often cannot be destroyed in any other way. Fires also heat large boilers to generate steam, which then powers large turbines. These turbines generate electricity that provides power and heat to industries and homes. Large power plants may generate electricity using fuels such as coal, gas, and even wood or garbage to create fires.

In some parts of the world, people use fire to prepare land for growing crops. Farmers in developed countries may burn plant material after a harvest to clear fields and return nutrients to the soil. Small-scale farmers in tropical regions sometimes practice slash-and-burn agriculture, in which wild plants and trees are burned to clear patches of land for cultivation and to quickly enrich nutrient-poor tropical soils. In recent decades widespread use of slash-and-burn agriculture has caused significant damage to the world's rainforests.

People use fire as a weapon in times of war. Armies use napalm, a highly flammable substance, to spread fire. The fire can either directly kill enemy soldiers or destroy foliage, making enemy soldiers easier to find.

Vocabulary

gas-fired *(a)*	**smolder** *(v)*	**outdoor fire** *(n)*
furnace *(n)*	**blast furnace** *(n)*	**wick** *(n)*
kiln *(n)*	**napalm** *(n)*	**appliance** *(n)*
charcoal *(n)*	**torch** *(n)*	

Ex. 2. Suggest the Russian equivalents to the English ones.

Dip, activity, pitch, torch, hollow, moss, tallow, palatable, digestible, preserve, vastly, decrease, starvation, enable, inedible, supplies, tip, scrape, straighten, harden, formerly, pipe, cradle, bowl, cultivate, amass, surplus, artisan, pottery, potter, kiln, mud, straw, thatch, overhead, movable stoves, furnace, chamber, household stoves, precede, melted copper, cast tools, earthen hearth, stick, twig, smolder, spout, wick, ravage, loss, appliance, outdoor fire, reed pipe.

Ex. 3. Suggest the English equivalents to the Russian ones.

Община, необходимый, газовые плиты, очаг, достойный внимания, собиратель, впалый, замачивать, заимствовать, легко усваиваемый, чрезвычайно, запасы еды, погружать, копье, обугливать, выпрямлять, делать твердым, тростник, свежесрубленная древесина, сосуд, многоквартирный дом, заход солнца, хищник, фонарь, жилище, смола, жир, позволять, накапливать, тлеть.

Ex. 4. Are these statements true or false?

1. Fire became a central part of early people.
2. People created crude lamps by filling a hollowed out piece of stone with moss soaked in oil or tallow.
3. Permanent communities amassed food surpluses, enabling some people to devote their time to go hunting.
4. Egyptian potters used fire in earthen kilns to bake bricks out of a mixture of mud and straw.
5. Fire became the center of daily only nowadays.
6. Modern household stoves and furnaces stem from the achievements of ancient Romans.
7. Lamps remained the basic source of light until the development of the electric bulb in the 19th century.
8. The Egyptian artisans melted copper ore for casting tools and weapons in a fire over an earthen hearth.
9. An efficient fuel was produced by smoldering wood in an oven without air.
10. Ancient cities were damaged by fires.
11. Many home appliances are only oil-fired.
12. Fire is widely used only in homes nowadays.

13. Fire can render toxic waste harmless when it burns such waste in special incinerators.
14. Power plants may generate electricity using different kinds of fuel.

Ex. 5. Answer the questions.

1. Why did fire become a central part of people's lives?
2. Is fire essential to humans now?
3. What valuable uses for fire did people develop?
4. How did people begin using fire as a source of light?
5. How did people manage to keep fire?
6. What influence did fire make on cooking?
7. How did people create torches and crude lamps?
8. How did prehistoric people make the meat of the animals more palatable and digestible?
9. How did hunters form spears?
10. How did people eventually learn to control the spread of a fire?
11. When did prehistoric people develop the ability to cultivate crops?
12. What did communities enable some people to do?
13. How can you prove that fire is an everyday element of most people's lives?
14. Where is wood and coal used nowadays?
15. How can power plants generate electricity?
16. What devices can destroy garbage?
17. Why do farmers practice slash-and-burn agriculture?

Ex. 6. Give the summary of the text.

Text C. Chemistry of fire

Ex. 1. Read the text and give the titles to the parts of the text.

Fire results from a rapid chemical reaction between a fuel, such as wood or gasoline, and oxygen. Reactions that involve oxygen and other elements are called oxidation reactions. Chemists use the word combustion to refer to the oxidation reaction that produces fire. Combustion generates light, heat, gases, and soot.

Several important factors need to be present for combustion to occur. The first requirements are fuel and oxygen. Fuel for a fire may range from trees in a forest to furniture in a home to gasoline in an automobile. The oxygen in the reaction usually comes from the surrounding air. The next requirement for combustion is an initiating energy source, or source of ignition. Ignition sources may be in the form of a spark, a flame, or even a very hot object. The ignition source must provide enough energy to start the chemical reaction. Finally, a chemical chain reaction (reaction that continuously fuels itself) must occur between the fuel and oxygen for combustion to take place.

Most combustible fuels begin as solids, such as wood, wax, and plastic. Many fuels that people burn for energy, including gasoline and methane (natural gas), begin as either a liquid or a gas. Any fuel must be in a gaseous state (so that it can react with oxygen) before a fire can occur. Heat from the fire's ignition source, and later from the fire itself, decomposes solid and liquid fuels, releasing flammable gases called volatiles. Some solids, such as the wax in a candle, melt into a liquid first. The liquid then evaporates, giving off volatiles that may then burn. Other solids, such as wood and cotton, decompose and evaporate directly. In a wood fire, gases given off by the decomposing wood enter the flame, combine with oxygen from the surrounding air, and ignite. The heat from the flame decomposes more wood, thus adding more flammable gases to the flame and creating a self-supporting process.

Most common fuels consist of compounds containing the elements carbon and hydrogen. Fuels often also contain oxygen, nitrogen, chlorine, and sulfur. Cellulose is the principle combustible compound in wood, paper, and cotton. It contains carbon, hydrogen, and oxygen. Plastics that burn, such as polyvinylchloride (PVC), polystyrene, polymethyl methacrylate (PMMA), nylon, and polyurethane, are composed mostly of carbon and hydrogen. Liquid fuels include oil and gasoline, while gaseous fuels include methane, propane, and hydrogen. All of these fuels (except pure hydrogen) contain both carbon and hydrogen.

A fire can start when a fuel becomes so hot that it releases sufficient flammable gases for combustion to occur. At this temperature, called the fuel's piloted ignition temperature, a spark or flame will start the combustion reaction. One source of piloted ignition is an open flame, such as that from a match or lighter. Sparks, such as those generated by electricity, may also ignite a fire. Engineers and scientists usually use the term piloted ignition to refer to solid fuels. Liquid fuels have, instead, a flash point temperature. At a liquid's flash point, an ignition source will cause a flame to flash across the surface of the liquid.

The unpiloted ignition temperature of a fuel, also called its spontaneous ignition temperature, is the temperature the fuel must reach to ignite on its own. It is higher than the piloted ignition temperature, because a flame or spark is not present to provide the extra heat needed to kick-start the chemical reaction. Heat within the fuel provides this energy. Some fuels do not have a spontaneous ignition temperature because they break down into other substances before they can ignite on their own. Flammable gases have just one ignition temperature. They will ignite at this temperature if they are present in the right concentrations.

Ignition depends not only on a fuel's ignition temperature but also on the way the fuel absorbs heat. This absorption determines how heat will affect the fuel's temperature. A fuel's capacity to absorb heat depends on the type of fuel involved and its arrangement. Thick logs, for example, can absorb a large amount of heat before they reach their ignition temperature. Small twigs, however, need just a small amount of heat to reach the same ignition temperature. Fuels also need to absorb heat at or above a certain rate for ignition to occur. At the minimum absorption rate, the fuel will eventually reach its ignition temperature. A piece of wood will never ignite if the ignition source produces heat at a rate slower than the minimum rate required for ignition.

The final requirement for a fire is a chemical chain reaction. The heat of the ignition source starts the reaction, and heat from the fire's flame continues the reaction. The flame needs to heat the fuel and make it release enough flammable gases to continuously support the chemical reaction. A common example of combustion is the burning of wood. When an ignition source heats wood to a sufficient temperature, about 260 °C (500 °F), the cellulose in the wood decomposes, producing volatile gases and char. The average composition of the gases can be represented by the compound CH_2O, where C stands for carbon, H stands for hydrogen, and O stands for oxygen. Under ideal conditions, CH_2O reacts with oxygen in the air and produces carbon dioxide (CO_2) and water vapor (H_2O). In the real world conditions are not ideal, so fires often produce other products as well, such as carbon monoxide (CO) and soot.

Different kinds of fires burn at different rates — one fire may slowly smolder, while another may quickly use up its fuel. The rate at which a fire burns depends on the composition of the fuel, the surface area of the fuel, and the amount of oxygen that is available.

Most plastics burn at twice the rate of cellulose fuels, such as wood and leaves, because of the different chemical reactions involved. The burning rate of the same fuel, however, can also vary depending on how much of the fuel's surface is exposed to the air. As the exposed surface of a fuel increases in comparison to its volume, the burning rate of the fuel increases as well. When the fuel's gases have more surface area from which to escape, they can come into contact with more air. The increased exposure to air increases the amount of oxygen available for combustion. For example, people often use small twigs and pieces of wood called kindling to start a campfire. Kindling has a large amount of surface area compared to its volume. Its relatively large surface area to volume ratio also means that kindling heats and ignites more easily than thicker pieces of wood. Once ignited, kindling burns very quickly.

The products that a fire releases, and the rate at which it releases them, depend on the fuel and on the fire's burning rate. Some fuels will produce more heat than others as they burn, and some will produce different kinds of gases. A fire that burns slowly may produce different products than one that burns quickly. The burning rate also affects the rate at which a fire releases products.

Once a material ignites, a flame forms. The flame consists of volatile gases moving upward, and it is the region in which the combustion reaction occurs. The gases in the flame move upward because they are hotter — and therefore lighter — than the surrounding air. The colors in the flame come from unburned carbon particles that glow and travel upward as the flame heats them.

The flame continues to burn as the volatile gases streaming from the fuel combine with oxygen from the surrounding air. Different parts of the flame have different temperatures. Most common fuels are compounds called hydrocarbons, and they produce about the same flame temperature, roughly 1200 °C (2200 °F). The maximum theoretical flame temperature for most hydrocarbons is about 1300 °C (2400 °F).

Different fuels produce varying amounts of heat. The rate at which a fire generates heat is equal to the burning rate of the fuel (measured in grams per second, or g/s) multiplied by the amount of heat produced by the combustion reaction. This second factor is called the effective heat of combustion, and scientists measure it in units of kilojoules per gram (kJ/g). When a gram of wood burns, for example, it produces 8 kJ of heat energy. Wood's effective heat of combustion is therefore 8 kJ/g. Polyurethane's effective heat of combustion is about 18 kJ/g. Polyurethane's burning rate is also about twice that of wood under similar conditions. Multiplying the burning rates for these two substances by their effective heats of combustion, one finds that polyurethane fires produce heat at about 4.5 times the rate of wood fires under similar conditions.

Fires can produce a number of different gases, including some that are harmless and some that are toxic. Carbon dioxide (CO_2) and water vapor (H_2O) are two relatively harmless gases produced by fires. Toxic gases from fires include carbon monoxide (CO), hydrogen cyanide (HCN), sulfur dioxide (SO_2), and hydrogen chloride (HCI).

The specific gases and the amount of gas a fire produces depend on the type of fuel involved and the environment surrounding the fire. Different fuels will react differently in the combustion reaction, producing gases and amounts of gas specific to that type of fuel. For example, in well-ventilated conditions, polyurethane foam produces ten times more carbon monoxide for each gram burned than wood. Fires that burn in an oxygen-rich environment will also produce less carbon monoxide than fires that burn where little oxygen is present. A well-ventilated fire has plenty of oxygen, so nearly all of the fuel's volatile gases can take part in the combustion reaction, combining with oxygen in the air to produce carbon dioxide and water vapor. These fires produce less carbon monoxide because there is less carbon and oxygen left over from the initial combustion reaction to form carbon monoxide.

Fires that occur in an environment lacking sufficient oxygen will burn incompletely and smolder. These fires produce increasing amounts of carbon monoxide. For example, in an enclosed room, a fire will use up oxygen from the air as it progresses, decreasing the amount of oxygen in the room over time. Without sufficient oxygen, the volatile gases from the fire cannot fully take part in the combustion reaction. Some of the gases instead react to form carbon monoxide, which requires less oxygen than combustion. Eventually, the amount of oxygen decreases below the level necessary for continued combustion, causing the fire to self-extinguish. Depending on the type of fuel, most fires self-extinguish at an oxygen concentration between 12 and 14 percent (by volume). By contrast, normal atmospheric air has an oxygen concentration of 21 percent.

As fires produce light, heat, and gases, they also produce soot, consisting of mostly carbon particles. Smoke may be defined either as just the soot particles given off by a fire, or as both the soot and the gaseous products of combustion.

The amount of soot produced by a fire depends on the type of fuel, the fuel's burning rate, and environmental conditions. Most plastic fuels produce more soot than wood and other cellulose fuels. Plastics also usually burn more quickly than wood. Under similar conditions, for example, a slab of polyurethane will burn almost twice as fast as a slab of wood. The composition of plastic and plastic's more rapid burning rate cause it to produce about 2.7 times as much soot as does wood. Fires also tend to produce more soot when they smolder and less soot when they burn freely in a well-ventilated area, with plenty of oxygen available.

Soot Production Table

Fuel	Approximate Soot Production (mass of soot produced per mass of fuel burned)
Acetone	0.014
Acrylic	0.022
Ethanol	0.008
Gasoline	0.038
Polystyrene	0.20
Polyurethane foam	0.2
Wood	0.015

Vocabulary

decompose *(v)*
volatile *(a)*
varying *(a)*
well-ventilate *(p)*
compound *(n)*
hydrogen *(n)*
ignition temperature *(n)*
kick-start *(n)*
hydrocarbon *(n)*
substance *(n)*
sufficient *(a)*
soot *(n)*
kindle *(v)*
burning rate *(n)*
multiply *(v)*
harmless *(a)*
self-extinguishing *(p)*

Ex. 2. Suggest the Russian equivalents to the English ones.

Result, oxidation, soot, ignition, solid, gaseous, decompose, volatile, give off, flammable, self-supporting, compound, hydrogen, nitrogen, chlorine, sulfur, methane, propane, refer, flash temperature, kick-start, capacity, combustion, composition, carbon dioxide, vapor, kindling wood, steaming, hydrocarbon, cyanide, hydrogen chloride.

Ex. 3. Suggest the English equivalents to the Russian ones.

Происходить в результате, окисление, производить, сажа, искра, сухое вещество, газовый, разлагать на составные части, освобождение, летучий, выделять, огнеопасный, самостоятельный, температура вспышки, давать импульс, объем (способность), уровень (скорость, норма), возгорание, вспышка, пар, копоть, подвергать воздействию, излучающий, свет (теплота, сиять).

Ex. 4. Are these statements true or false?

1. Soot, light, heat, gases are generated by combustion.
2. One factor needs to be present for combustion to occur.
3. The ignition source provides energy to start the chemical reaction.
4. A hot object is enough for combustion to take place.
5. Most combustible fuels begin as liquids.
6. All fires burn at the same rate.
7. Fires produce harmless and toxic gases

8. People use large logs to start a camp fire. Kindling wood doesn't burn very quickly.

9. The products that a fire releases depend on an amount of a burning area.

10. The flame consists of volatile gases.

11. All fuels produce similar amounts of heat.

12. Different fuels will react differently in the combustion reaction.

13. Fires that occur in the area with lack of oxygen burn brightly.

14. A fire decreases the amount of oxygen in an enclosed room.

15. The fire doesn't need sufficient oxygen to take part in the combustion reaction.

16. Fires produce only light and heat.

17. Only the type of fuel influences on the amount of soot produced by a fire.

Ex. 5. Answer the questions.

1. What does fire result from?
2. What reactions are called oxidation reactions?
3. What does combustion generate?
4. What factors need for combustion to occur?
5. Where does the oxygen in the reaction come from?
6. What can ignition sources be?
7. What must occur for combustion to take place?
8. What state must fuel be in that it can react with oxygen?
9. What is called volatiles?
10. How may the wax in a candle burn?
11. How does a wood fire occur?
12. What do most common fuels consist of?
13. What is the principle combustible compound in wood, paper and cotton? And what does it contain?
14. What do liquid fuels and gaseous fuels include?
15. When can a fire start?
16. Why don't some fuels have a spontaneous ignition temperature? Give examples.
17. What does fuel need for ignition to occur?
18. Does a peace of wood ignite at any rate?
19. What chemical chain reaction takes place for a fire to start? Give an example.
20. What rate do fires burn at?
21. What does the rate at which fire burns depend on?
22. Why do most plastics burn at twice the rate such as wood, leaves?
23. What does the burning rate of the fuel depend on?
24. What do the products, that a fire releases and the rate at which it releases depend on?
25. What does the flame consist of?
26. Why do the gases in flame move upward?
27. Where do the colors in the flame come from?
28. What happens if a fire takes place in an enclosed room?
29. What do fires produce?

30. What does the amount of soot produced by a fire depend on?
31. What burns quickly?
32. What do fires tend to produce more or less soot?

Ex. 6. Give the summary of the text.

Text D. Destructive force of fire

Ex. 1. Read the text and give the titles to the parts of the text.

Destructive fires can occur wherever fuel and oxygen are available, including in office buildings, homes, vehicles, and forests. According to the National Fire Protection Association, a fire broke out in a building or structure every 61 seconds in the United States in 1998. Three-quarters of all structure fires in the United States and Canada occur in people's homes. In 1998 there were about 1,756,000 fires in the United States. These fires led to 4,000 deaths, 23,000 injuries, and $9 billion in property damage. Every 76 seconds a motor vehicle fire occurred, for a total of 413,500 such fires. In 1995, the most recent date for which Canadian statistics are available, Canada had about 64,000 fires. These fires resulted in 400 deaths, 3,600 injuries, and $1 billion (Canadian) in direct property damage.

Extinguishing a fire involves removing one of the requirements for combustion. Firefighters may physically remove the fuel from the fire by taking a burning item outside a structure. They can remove heat by cooling the fire with water or remove oxygen by smothering the fire with chemicals or a fire blanket. Interrupting the chemical chain reaction is more difficult but is typically done by applying special chemicals, such as halogenated compounds, to the fire. These halogenated compounds are being used less often as they cause damage to the atmosphere's ozone layer.

Many people worry about being trapped in a hotel fire or a fire at their school or workplace. Yet about 80 percent of all U.S. and Canadian fire fatalities are caused by fires in the home. In 1998 house fires accounted for 381,500, or 21 percent, of all fires that occurred in the United States. In Canada 25,747 house fires occurred in 1995 — about 40 percent of all Canadian fires that year. Most house fires result from cooking accidents in the kitchen. Cigarettes, however, cause the majority of house fires that turn deadly. Smoking-related fires tend to smolder before they are discovered. Once a fire breaks out, it can envelop a room within minutes. Temperatures in the room may exceed 600 °C (1100 °F). While this heat alone would be deadly, the toxic gas in the smoke causes the majority of deaths and injuries. Almost half of all fatalities from fires are due to carbon monoxide poisoning, and more than a third are due to cardiopulmonary complications.

People protect themselves from the dangers of house fires in several ways. Fire extinguishers in homes enable people to put out fires before they become dangerous, while smoke detectors alert residents that a fire has broken out in the fire's early stages. Communities support either a local fire department or a volunteer force, so people can call a phone number to summon firefighters to their home. The furniture, clothing, and building industries help prevent fires in the home by making products out of nonflammable materials or by treating materials with chemicals to make them less flammable.

Dangerous work conditions and arson can lead to fires in the workplace. Industries that produce chemicals often deal with extremely flammable materials, while metalworking industries deal with materials at very high temperatures. Companies prevent fires by training employees in the handling of dangerous materials and by hiring specialists, called fire protection engineers, to design safe workspaces. Sprinkler systems can limit property damage, and the establishment of clear exit routes for employees can limit injury caused by fire. In the United States, the leading cause of fires in office buildings is arson. Office buildings often include security systems, such as locked doors and camera surveillance of entrances and exits, to prevent potentially dangerous people from entering the building.

Wildland fires occur in undeveloped areas of land and are fueled by forest or grassland vegetation. The leading causes of wildland fires are lightning and human caused ignitions, including those from equipment exhaust, abandoned campfires, cigarettes, and arson. Such fires destroy forested areas as well as homes and property bordering these areas. Small-scale, periodic wildland fires can actually improve the health, resilience, and productivity of an ecosystem. When these fires do not occur often enough, however, flammable vegetation can build up, leading to a large-scale fire that harms plant and animal species. Education and regular patrols of campgrounds help prevent or control many of the fires caused by people. Intentionally setting controlled, small-scale fires prevents fuel from building up.

To battle dangerous wildland fires, firefighters use airplanes to apply chemicals from the air and trucks and pumps to apply water at the ground level. They also remove vegetation surrounding the fire to create a border that lacks fuel. The destruction caused by a wildland fire, and the effectiveness of firefighters in extinguishing it, depend on the terrain, the type of vegetation in the area, weather conditions, and the availability of firefighting resources.

Vocabulary

destructive *(a)*	**fire blanket** *(n)*	**fire fatality** *(n)*
break out *(v)*	**exceed** *(v)*	**cooking accident***(n)*
property damage *(n)*	**poisoning** *(n)*	**smoking-related** *(p)*
removing *(n)*	**put out** *(v)*	**toxic gas** *(n)*
envelope *(v)*	**summon** *(v)*	**complication** *(n)*
fire extinguisher *(n)*	**arson** *(n)*	**fire's early stage** *(n)*

treat *(v)*
surveillance *(n)*
resilience *(n)*
availability *(n)*
cooling *(n)*
smother *(v)*
entrance *(n)*
large-scale *(a)*
campground *(n)*
surrounding *(n)*
ozone layer *(n)*
trap *(n)*
clear exit route *(n)*
wildland fire *(n)*
equipment exhaust *(n)*
harm *(n, v)*
patrol *(n)*

Ex. 2. Suggest the Russian equivalents to the English ones.

Smother, fatality, deadly, envelope, extinguisher, put out, resident, community, summon, arson, safe, property damage, establishment, security system, surveillance, exhaust, abandoned, resilience, patrol, terrain, availability.

Ex. 3. Suggest the English equivalents to the Russian ones.

Вред, тушить, смесь, несчастный случай со смертельным исходом, окутывать, огнетушитель, индикатор дыма, тревога, жилец, безопасный, ущерб частой собственности, заброшенный, гибкость, местность.

Ex. 4. Are these statements true or false?

1. Destructive fires occur wherever fuel and oxygen are available.
2. The consequences of fires can be deaths, injures, property damage.
3. Firefighters use water to extinguish a fire.
4. Halogenated compounds are often used by firefighters.
5. Smoking-related fires are discovered very quickly.
6. Most house fires result from cooking accidents.
7. Half of all fatalities from fires are due to heat, toxic gas in the smoke.
8. Unfortunately nothing can protect people from fires.
9. There are industries dealing with extremely flammable materials and in the case of a fire employees can only call a phone number to summon firefighters.
10. The leading causes of wildland fires are lighting and human caused ignitions.

Ex.5. Answer the questions.

1. Where can destructive fire occur?
2. What are consequences of fires?
3. What does extinguishing a fire involve?
4. What is more difficult in extinguishing a fire?
5. Why are the halogenated compounds being used less often?
6. What do many people worry about?
7. What do most house fires result from?
8. What do smoking-related fires tend to?
9. What does a fire do with a room?
10. What temperature can be in the room where a fire occurs?
11. What harm can a fire do to people?
12. How do people protect themselves from the dangers of house fires?
13. What can lead to fires in the work places?
14. How does one prevent fires in the work place?

15. How does a fire occur in the open air (in the forest and so on)?
16. What can small-scale, periodic, wildland fires do?
17. What kind of fires do harm to plant and animal species?
18. What helps prevent fires caused by people?
19. How are wildfires extinguished?

Ex. 6. Give the summary of the text.

Text E. Fire departments

Ex. 1. Read the text and translate it into Russian.

The Roman emperor Augustus is credited with instituting a corps of fire-fighting vigiles ("watchmen") in 24 B.C. Regulations for checking and preventing fires were developed. In the preindustrial era most cities had watchmen who sounded an alarm at signs of fire. The principal piece of fire-fighting equipment in ancient Rome and into early modern times was the bucket, passed from hand to hand to deliver water to the fire. Another important fire-fighting tool was the ax, used to remove the fuel and prevent the spread of fire as well as to make openings that would allow heat and smoke to escape a burning building. In major conflagrations long hooks with ropes were used to pull down buildings in the path of an approaching fire to create firebreaks. When explosives were available, they would be used for this same purpose. Following the Great Fire of London in 1666, fire brigades were formed by insurance companies. The government was not involved until 1865, when these brigades became London's Metropolitan Fire Brigade. The first modern standards for the operation of a fire department were not established until 1830, in Edinburgh, Scotland. These standards explained, for the first time, what was expected of a good fire department.

After a major fire in Boston in 1631, the first fire regulation in America was established. In 1648 in New Amsterdam (now New York) fire wardens were appointed, thereby establishing the beginnings of the first public fire department in North America.

In the modern sense, fire departments constitute a comparatively recent development. Their personnel are either volunteer (nonsalaried) or career (salaried). Typically, volunteer fire fighters are found mainly in smaller communities, career fire fighters in cities. The modern department with salaried personnel and standardized equipment became an integral part of municipal administration only late in the 19^{th} century. In some cities a fire commissioner administers the department; other cities have a board of fire commissioners with a fire chief as executive officer and head of the uniformed force; in still other cities a safety director may be in charge of both police and fire departments. The basic operating unit of the fire department is the company, commanded by a captain. A captain may be on duty on each shift, although in some fire departments lieutenants and sergeants command companies when the captain is off duty. Fire companies are usually organized by types of apparatus: engine companies, ladder companies, and squad or rescue companies.

Fire-alarm systems came into existence with the invention of the telegraph. Today many communities are served either with the telegraph-alarm system or with telephone call boxes. Most fires, however, are reported from private telephones. Many large cities have removed all or many of their street alarm boxes because of problems associated with maintenance and with false alarm transmissions. Some boxes have been replaced with telephones. All alarms are then transmitted to the fire stations. In large cities, alarms are received at a central dispatch office and then transmitted to fire stations, frequently with the use of mobile teleprinters and computers. Apparatus is dispatched according to the nature of the alarm and location of the fire. Many modern departments are now equipped with computer-aided dispatch systems that can track the status of all units and provide vital information about the buildings where fires occur. Typically, on a first alarm, more apparatus is sent to industrial sections, schools, institutions, and theaters than to neighborhoods of one-family dwellings. Additional personnel, volunteer or off duty, is called as needed. Fires that cannot be brought under control by the apparatus responding to the first alarm are called multiple-alarm fires, with each additional alarm bringing more fire fighters and apparatus to the scene. Special calls are sent for specific types of equipment. Mutual aid and regional mobilization plans are in effect among adjacent fire departments for assisting each other in fighting fires.

Perhaps more important than fire fighting itself in many modern industrial countries is fire prevention. In Russia and Japan, for example, fire prevention is treated as a responsibility of citizenship. Fire fighters in the U.S. are trained in basic fire-prevention methods, and fire companies are assigned inspection districts in which they attempt to prevent or correct unsafe conditions. Fire departments are charged with enforcement of the local fire-prevention code and of state fire laws and regulations.

A fire-prevention bureau in the fire department usually directs fire prevention activities. It handles the more technical fire-prevention problems, maintains appropriate records, grants licenses and permits, investigates the causes of fires, and conducts public education programs. All commercial or multiple-dwelling buildings are inspected at regular intervals, and orders are issued for the correction of violations of fire laws. If necessary, court action is taken to compel compliance.

In some communities protected by volunteer or part-time paid fire departments, fire prevention is the responsibility of a state or county fire marshal or of a professional fire staff in an otherwise voluntary organization. In addition, fire departments usually inspect commercial buildings for what is called prefire planning. Private dwellings may also be inspected as part of a fire department's educational program to impress the importance of fire safety on the inhabitants and to check for any unsafe conditions.

Many modern fire departments spend a decreasing amount of overall activity in fighting fires. Instead, fire fighters typically respond to all kinds of emergencies. For example, in the U.S. approximately 70 percent of all emergency medical calls are handled by the fire service. The same is true in many other countries.

The enormous increase in transportation of hazardous materials or dangerous goods has resulted in intensified training for fire fighters, and their departments often provide them with chemical protective clothing and monitoring equipment.

Fire departments also prepare and equip their members to handle emergencies that result from earthquakes, plane crashes, and violent storms. In addition, fire fighters handle incidents that require extricating trapped people from fallen structures, from cave-ins, and from other situations.

Although fire fighting is largely a matter of local jurisdiction in the U.S., many countries have more centralized fire departments. Italy has a National Fire Service (Corpo Nazionale-Vigili del Fuoco) organized into 92 provinces, administered from 12 regional centers. In the United Kingdom, local fire departments are organized into county, borough, and special district departments, all under a chief ins-pector of fire services. In France, fire protection is administered in sectors, except in Paris, where the fire department is operated by the Sapeurs-Pompiers, a brigade of the French army, and in Marseille, where it is administered by the navy. The Japanese government administers 43 regional and 3 metropolitan fire departments. In Denmark, local governments contract for fire-fighting services with companies under supervision of the Ministry of Justice. In Germany, professional fire brigades operate in large cities; volunteer brigades serve the small towns.

In all industrial countries fire fighters undergo training, beginning with probationary fire fighters' school and continuing throughout a fire fighter's career. Great Britain has several fire training centers. In Russia, fire schools are in Moscow and Saint Petersburg; Sweden and Denmark have similar schools. In some European countries fire protection and fire fighting are among the courses included in teaching safety engineering.

International fire service and fire protection associations bring together leaders of the fire services of many nations. In Europe Comité Technique International de Prevention et d'Extinction du Feu (CTIF, International Technical Committee for the Prevention and Extinction of Fire) has over 30 member nations, including Russia. The Organización Iberoamericana de Protección Contra Incendios (OPCI, Ibero-American Fire Protection Association) brings together the fire service leaders of all Latin American countries. The Asia-Pacific region is served by the Asian Pacific Fire Safety Association (APAC).

Vocabulary

sign of fire *(n)*
fire-fighting tool *(n)*
pull down *(v)*
fire regulation *(n)*
fire prevention *(n)*
fire staff *(n)*
rescue companies *(n)*
fire-alarm system *(n)*
transmission *(n)*
fire station *(n)*
unsafe conditions *(n)*
prefire planning *(n)*
protective clothing *(n)*
dispatch office *(n)*
multiple-alarm fire *(n)*
safety engineering *(n)*
cause of fire *(n)*
fire safety *(n)*
fire training centre *(n)*

Ex. 2. Suggest the Russian equivalents to the English ones.

Personnel, respond, mutual aid, fire prevention, assign, charge, enforcement, fire-alarm, maintenance, alarm box, false alarm, dispatch office, warden, commissioner, board, safety director, executive officer, be in charge, operating, fire-fighting, sound an alarm, conflagration, pull down, available, insurance company, fire department, extricate, safety engineering, direct, handle, grant license, investigate, explosive, firebreak, to be credited with.

Ex. 3. Suggest the English equivalents to the Russian ones.

Персонал, пожарник, взаимная помощь, помогать, реагировать, содержание и техническое обслуживание, команда, относиться (подвергать воздействию), назначать (определять, устанавливать), пытаться, сигнал ложной тревоги, управлять (руководить), управлять (приказывать, справляться), расследовать, выдавать лицензию, поручать, диспетчерская, начальник, уполномоченный, руководить (вести дела, управлять), руководитель службы, должностное лицо, пожаротушение, сыграть тревогу, руководить, разрушительный пожар, сносить, противопожарный разрыв, взрывчатый, опасный, авария (аварийная ситуация).

Ex. 4. Are these statements true or false?

1. In the preindustrial era citizens themselves sounded an alarm at signs of fire.
2. In ancient Rome there was special equipment for fire- fighting.
3. Log hooks with ropes were used to pull down buildings in major conflagrations.
4. The modern fire department became an integral part of municipal in 19 century.
5. There was a fire alarm system in ancient Rome.
6. There are a lot of alarm boxes in the streets of many large cities.
7. Alarms are received at a central dispatch and then transmitted to fire stations with the computer.
8. All alarms are received by administration of the city and then transmitted to a fire station.
9. Many fire departments are lack of modern equipment.
10. Fires that can’t be brought under control by the apparatus responding to the first alarm are called multiple-alarm fires.
11. Each fire department works on its own.
12. Fire departments respond only to fire-alarms.
13. In the U.S.A. 70 percent of all emergency medical calls are handed by the fire service.
14. Fire departments prepare and equip their members to handle fire emergencies.
15. Many countries have more centralized fire departments.
16. Fire fighters have special training.
17. Fire protection and fire fighting are among the courses included in teaching safety engineering.

Ex. 5. Answer the questions.

1. When were crops of fire-fighting watchmen instituted?
2. Who was the first who instituted crops of fire-fighting watchmen?
3. Who sounded an alarm at signs of fire?
4. How was a fire extinguished in ancient Rome?
5. What equipment was used to extinguish a fire?
6. Why did people use long hooks in major conflagrations?
7. How were fire brigades formed during The Great Fire of London?
8. When and where was the first fire regulation established?
9. When did the modern fire department become an integral part of municipal administration?
10. Who administers the department in the cities?
11. When did fire alarm systems come into existence?
12. Why have the street alarm boxes been removed?
13. How do fire brigades receive fire alarm?
14. How are modern departments equipped and how do they work?
15. What is called a multiple-alarm fire?
16. How is fire prevention treated in Russia and the U.S.A?
17. What is the activity of a fire-prevention bureau?
18. Do fire fighters respond only a fire-alarm?
19. What are fire departments responsible for?
20. Whom are fire departments administrated in the U.S.A., Italy, the U.K., Japan, France?
21. What education do fire fighters get?

Ex. 6. Give a summary of the text.

Text F. Fighting fire

Ex. 1. Read the text and translate it into Russian.

Most fire fighting consists of applying water to the burning material, cooling it to the point at which combustion is no longer self-sustaining. Fires involving flammable liquids, certain chemicals, and combustible metals often require special extinguishing agents and techniques. With some fuels the use of water may actually be dangerous.

The first fire engines, which appeared in the 17th century, were simply tubs carried on runners, long poles, or wheels; water was still supplied to the fire site by bucket brigade. The tub functioned as a reservoir and sometimes housed a hand-operated pump that forced water through a pipe or nozzle to waiting buckets. The invention of a hand-stitched leather hosepipe in the Netherlands about 1672 enabled fire fighters to work closer to the fire without endangering their engines and to increase the accuracy of water placement. At about the same time the development of pumping devices made it possible to draw water from rivers and ponds.

In the early 19th century copper rivets replaced the stitching on hoses, and 15-m (50-ft) lengths coupled with brass fittings enabled fire fighters to convey water through narrow passages, up stairways, and into buildings, while the pumps operated in the street. Cotton-covered rubber hose was developed around 1870. The steam-pump fire engine, introduced in London in 1829 by John Ericsson and John Braithwaite, was used in many large cities by the 1850s. Most steam pumpers were equipped with reciprocating piston pumps, although a few rotary pumps were used. Some were self-propelled, but most used horses for propulsion, conserving steam pressure for the pump. Steam fire engines were used in fighting the Chicago fire of 1871.

With the development of the internal-combustion engine early in the 20^{th} century, pumpers became motorized. Because of problems in adapting geared rotary gasoline engines to pumps, the first gasoline-powered fire engines had two motors, one to drive the pump and the other to propel the vehicle. The first pumper using a single engine for pumping and propulsion was manufactured in the United States in 1907. By 1925 the steam pumper had been completely replaced by motorized pumpers. The pumps were originally of the piston or reciprocating type, but these were gradually replaced by rotary pumps and finally by centrifugal pumps, used by most modern pumpers.

At the same time, the pumper acquired its main characteristics: a powerful pump that can supply water in a large range of volumes and pressures; several thousand feet of fire hose, with short lengths of large-diameter hose for attachment to hydrants; and a water tank for the initial attack on a fire while fire fighters connect the pump to hydrants, and for areas where no water supply is available. In rural areas, pumpers carry suction hose to draw water from rivers and ponds.

Current standards for pumper fire apparatus require that a fire pump have a minimum capacity of 2840 liters (750 gallons) per minute at a pump pressure of 10.35 bar (150 psi). They also call for a water tank capacity of at least 1893 liters (500 gallons).

Auxiliary vehicles are equipped with specialized equipment for effecting rescue, ventilating buildings, and salvage. Aerial ladders that typically extend to 30.5 m (100 ft) are carried on “hook and ladder” vehicles that also hold various kinds of tools and equipment, including heavy-duty jacks and air bags, extrication tools, oxyacetylene torches, self-contained breathing apparatus, and resuscitators. Other more basic equipment includes axes, shovels, picks, battering rams, power saws, hooks, and wrenches. Elevating platform trucks can raise fire fighters and equipment, including the water delivery system, as high as 30.5 m (100 ft). Rescue trucks carry a wide assortment of specialized emergency equipment, including the type that might be used in building collapses and cave-ins. Field communications units carry sophisticated electronic equipment for use in managing fire and emergency operations. Salvage trucks carry implements for reducing water damage, including large waterproof covers, dewatering devices, and tools for shutting off water flow from sprinkler heads. Hazardous materials response units are staffed with specially trained personnel equipped with protective clothing and monitoring devices for use at chemical spills and similar incidents.

Shipboard fires present special problems ranging from small fires in cabin cruisers to tanker fires involving thousands of metric tons of oil. Some of the special problems include complicated ship layouts, the danger of capsizing, and the difficulty of pinpointing and gaining access to the source of the fire. Fireboats, in sizes ranging from small, high-speed, jet-propelled rescue craft to large fire tugs, carry substantially all the fire-fighting equipment found on land apparatus. These include pumps, ladders, and rescue equipment, as well as special equipment necessary for marine fire fighting and water rescues, including rotating and angled nozzles, portable pumps, floating booms, foam-making apparatus, and special extinguishers such as carbon dioxide systems.

The basic tactics of fighting a fire can be divided into the following categories: rescue operations, protection of buildings exposed to the fire, confinement of the fire, extinguishing the fire, and salvage operations. The officer in charge, usually designated as the fireground commander, surveys the area and evaluates the relative importance of these categories. The commander also estimates what additional assistance or apparatus may be needed. Rescue operations are always given priority. Fire fighter safety has assumed increasing importance.

Once the fireground commander has appraised the situation, fire fighters and equipment are deployed. Pumper, ladder, and other truck companies, as well as rescue squads, are assigned to different areas of the fire, usually in accordance with the number and types of hose streams the fireground commander considers necessary to control the fire and prevent its spread.

In accordance with standard procedure for first alarms, fire companies go immediately to their assigned locations without waiting for specific orders. Special plans cover contingencies such as a fire covering a large area, a large building, or a particularly hazardous location. Usually on a first alarm one of the pumpers attacks the fire as quickly as possible, using preconnected hose lines supplied by the water tank in the truck, while larger hose lines are being attached to the hydrants. Members of the ladder and rescue companies force their way into the building, search for victims, ventilate the structure — break windows or cut holes in the roof to allow smoke and heat to escape — and perform salvage operations. Ventilating the structure helps to advance the hose lines with greater safety and ease, and also serves to safeguard persons who may still be trapped in the building.

Temperatures within a burning building may exceed 815 °C (1500 °F). Brightly burning fires principally generate heat, but smoldering fires also produce combustible gases that need only additional oxygen to burn with explosive force. The hazards to which fire fighters and occupants of a burning building are exposed include the breathing of superheated air, toxic smoke and gases, and oxygen-deficient air, as well as burns, injuries from jumping or falling, broken glass, falling objects, or collapsing structures. Handling a hose is difficult even before the line is charged with water under pressure. Nozzle reaction forces can amount to several hundred pounds, requiring the efforts of several people to direct a stream of water.

Various nozzles are capable of projecting solid, heavy streams of water, curtains of spray, or fog. Fire trucks carry a selection of nozzles, which are used according to the amount of heat that must be absorbed. Nozzles can apply water in the form of streams, spray, or fog at rates of flow between 57 liters (15 gallons) to more than 380 liters (more than 100 gallons) per minute. Straight streams of water have greater reach and penetration, but fog absorbs heat more quickly because the water droplets present a greater surface area and distribute the water more widely. Fog nozzles may be used to disperse vapors from flammable liquids, although foam is generally used to extinguish fires in flammable liquids.

A variety of chemicals may be added to water to improve its ability to extinguish fires. Wetting agents added to water can reduce its surface tension. This makes the water more penetrating and facilitates the formation of small drops necessary for rapid heat absorption. By adding foam-producing chemicals and liquids to water, a fire-blanketing foam is produced. Foam is used to extinguish fires in combustible liquids, such as oil, petroleum, and tar, and for fighting fires at airports, refineries, and petroleum distribution facilities.

A chemical additive can expand the volume of foam 1000 times. This high-expansion foam-water solution is useful in fighting fires in basements and other difficult-to-reach areas because the fire can be smothered quickly with relatively little water damage.

This term refers to the methods by which fire fighters protect merchandise, household goods, and the interiors of buildings from smoke and water damage. Objects are covered with waterproof covers, and water is removed by water vacuums, mops, squeegees, water chutes, and portable pumps. Almost all fire departments carry salvage equipment in their apparatus. Fire departments in some large cities maintain special salvage companies.

Forest fires, often called wildland fires, are spread by the transfer of heat, in this case to grass, brush, shrubs, and trees. Because it is frequently difficult to extinguish a forest fire by attacking it directly, the principal effort of forest fire fighters is often directed toward controlling its spread by creating a gap, or firebreak, across which fire cannot move. Firebreaks are made, and the fire crews attempt to stop the fire by several methods: trenching, direct attack with hose streams, aerial bombing, spraying of fire-retarding chemicals, and controlled back-burning. As much as possible, advantage is taken of streams, open areas, and other natural obstacles when establishing a firebreak. Wide firebreaks may be dug with plows and bulldozers. The sides of the firebreaks are soaked with water or chemicals to slow the combustion process. Some parts of the fire may be allowed to burn themselves out. Fire-fighting crews must be alert to prevent outbreaks of fire on the unburned side of the firebreaks.

Fire-fighting crews are trained and organized to handle fires covering large areas. They establish incident command posts, commissaries, and supply depots. Two-way radios are used to control operations, and airplanes are employed to drop supplies as well as chemicals. Helicopters serve as command posts and transport fire fighters and their equipment to areas that cannot be reached quickly on the ground. Some severe wildfires have required more than 10,000 fire fighters to be engaged at the same time.

The U.S. Forest Service maintains research laboratories, which develop improved fire-fighting equipment and techniques, and a school that trains fire fighters in the latest fire-fighting techniques. International conferences on wildland fire prevention and fire fighting have been held with greater frequency in recent years.

Vocabulary

burning *(n, p)*	**gasoline** *(n)*	**extinguishing agent** *(n)*
combustible *(a)*	**cool** *(v, a)*	**dewatering device** *(n)*
chemical *(n, a)*	**tub** *(n)*	**breathing apparatus** *(n)*
water placement *(n)*	**reservoir** *(n)*	**hand-operated pump** *(n)*
fire engine *(n)*	**nozzle** *(n)*	**fire-retarding chemical** *(n)*
bucket brigade *(n)*	**hydrant** *(n)*	**flammable liquid** *(n)*
air bag *(n)*	**conserve** *(v)*	**aerial ladder** *(n)*
pumping device *(n)*	**salvage** *(n, v)*	**hand-stitched leather** *(n)*
stairway *(n)*	**resuscitator** *(n)*	**emergency equipment** *(n)*
propulsion *(n)*	**hosepipe** *(n)*	**waterproof cover** *(n)*
piston pump *(n)*	**disperse** *(v)*	**distribution facilities** *(n)*
water flow *(n)*	**spread** *(n, v)*	**contingency** *(n)*
self-sustaining *(p)*	**fire covering** *(n)*	**superheated** *(p. p.)*
occupant *(n)*	**penetration** *(n)*	**fire-fighting equipment** *(v)*
first alarm *(n)*	**facilitate** *(v)*	**foam-producing** *(v)*
hose line *(n)*	**additive** *(n)*	**difficult-to-reach areas** *(n)*
wetting agent *(n)*	**unburned** *(p. p.)*	**back-burning** *(p)*
ladder *(n)*	**confinement of fire** *(n)*	**fire-fighting crew** *(n)*
chute *(n)*	**initial attack on fire** *(n)*	**handle fire** *(n)*

Ex. 2. Suggest the Russian equivalents to the English ones.

Combustible, self-sustaining, extinguishing agent, house, nozzle, hosepipe, draw, convey, passage, reciprocating piston, rotary pump, self-propelled, propulsion, conserve, internal-combustion engine, adopt, propel, acquire, salvage, aerial, heavy duty, sophisticated, implement, capsize, gain, access, evaluate, deploy, squad, contingency, safeguard, smolder, additive, superheat, curtain, disperse, fire retarding, obstacle.

Ex. 3. Suggest the English equivalents to the Russian ones.

Преграда, огнезадерживающий, воспламеняемый, добавка, завеса, взрывная сила, подвергать (опасности), перегревать, устанавливать, вращать, проводить опрос, пожаробезопасность, оборудование, получать доступ, спасение имущества, крушение, сложный, приспосабливать, охранять, применять, горение, самоподдерживающий, средство, рассеивать, высокий коэффициент, передвижной насос, непредвиденное обстоятельство, тлеющий огонь, горючий газ, ожог, наполнять.

Ex. 4. Are these statements true or false?

1. All fires require only water for extinguishing.
2. The first fire engines were self-proppelled and equipped with hosepipes.
3. The steam-pump fire engine was introduced in the U.S.A.
4. Most steam pumpers were equipped with reciprocating piston pumps.
5. Pumpers became motorized with the development of the internal-combustion engine.

6. The first gasoline-powered fire engines had one motor.
7. There is no equipment to lift fire fighters.
8. There are some ordinary problems with shipboard fires.
9. All fireboats are very large with all necessary equipment.
10. The basic tactics of fighting a fire can be divided into several categories.
11. The officer in charge, the commander and the fire-ground commander take part in extinguishing the fire.
12. Fire companies go to their assigned locations of the fire after special order.
13. There aren't any hazards to (for) fire fighters o r occupants of a burning building.
14. Foam is used to extinguish fire in flammable liquids.
15. In all cases only pure water is used to extinguish fires.
16. A fire-blanketing foam is produced by adding foam-producing chemicals and liquids to water.
17. Nothing can save household goods and the interiors from water damage.
18. Extinguishing of a forest fire is carried out by attacking it directly.
19. Firebreaks are made and the fire crews attempt to stop the fire several methods.

Ex. 5. Answer the questions.

1. How is fire fighting carried out?
2. What does fire fighting consist of?
3. Do all fires require using only water?
4. What did the invention of hand-stitched leather hosepipe enable fire fighters?
5. Whom was the steam-pump fire engine invented by?
6. What were steam pumps equipped with?
7. How did steam-pump fire engine move?
8. When did pumpers become motorized?
9. What pumper was manufactured in the U.S.A?
10. What were the main characteristics of the pumper?
11. How did fire fighters get water in rural areas?
12. What are vehicles equipped with?
13. How are fires extinguished in high buildings?
14. What problems do shipboard fires present?
15. What are fireboats equipped with?
16. What is the basic tactics of fighting a fire?
17. Who is in charge of a fire fighting operation?
18. What are the officer's and commander's activities?
19. What is the fire ground commander's task?
20. What is standard procedure for first alarms?
21. What are the hazards to which fire fighters and occupants of a burning building include?
22. What is added to water?
23. Why is wetting agents added to water?

24. What can expand the volume of foam?
25. Where is high-expansion foam- water solution useful?
26. How is the interior of the building protected from smoke and water damage?
27. What are the methods of extinguishing of forest fires?
28. What cases are helicopters used in?

Ex. 6. Give a summary of the text.

Text G. Private fire protection

Ex. 1. Read the text and translate it into Russian.

Commercial and industrial buildings usually have some sort of internal, or private, fire-protection system installed. A sprinkler system is an integrated system of underground and overhead piping, designed in accordance with fire protection engineering standards, and connected to one or more automatic water supplies. The system is usually activated by heat from a fire, and the sprinkler heads then discharge water over the fire area. Sprinkler systems are nearly 100 percent effective. Many sprinkler systems are supervised electrically from a central station, and alarms are transmitted to a fire department whenever the sprinklers operate or when a valve in the sprinkler system closes for any reason. If a fire-fighting unit arriving at a fire finds that the sprinkler system is not receiving sufficient water and pressure, a pumper is connected to the sprinkler system to supply additional water.

Many high-rise or other large buildings have an internal system of water mains (standpipes) connected to fire-hose stations. Trained occupants or employees of the building management operate the hoses until the fire department arrives. Fire fighters can also connect their hoses to outlets near the fire.

Buildings may also be equipped with detection systems that will transmit an alarm. Some detectors are designed to respond to smoke, and others to heat. In many jurisdictions, detection systems are required in public buildings, apartment houses, and sometimes even in private homes.

Two major types of smoke detectors are available. One is an ionization device that contains a small radioactive source for ionizing the air molecules between a pair of electrodes, permitting a very small current to flow between the pair. If smoke particles from a fire enter this space, they reduce the flow of current by adhering to the ionized molecules. The drop in current sets off a buzzer or other alarm. The second type of smoke detector uses a photoelectric cell. In some of these detectors, smoke that enters obscures a steady beam of light; in others, the smoke scatters a light ray from a diode so that the cell can detect it. In either case the change sets off an alarm. The alarm may sound locally, or it may be designed to alert a central station with notification to the fire department. Photoelectric detectors are slower than ionization detectors, and sometimes both principles are combined. Both types can be run by batteries or by building current.

Vocabulary

sprinkler system *(n)*	**outlet** *(n)*	**buzzer** *(n)*
fire protection *(n)*	**detection system** *(n)*	**photoelectric cell** *(n)*

discharge *(v)*	**ionization device** *(n)*	**obscure** *(a, v)*
fire-fighting unit *(n)*	**current** *(n)*	**scatter** *(v, n)*
set off *(v)*	**adhere** *(v)*	

Ex. 2. Suggest the Russian equivalents to the English ones.

Sprinkler system, integrated system, activate, discharge, supervise, fire-hose, outlet, detection system, jurisdiction, set off, buzzer, photoelectric cell, obscure, steady, beam of light, scatter, notification, adhere.

Ex. 3. Suggest the English equivalents to the Russian ones.

Извещение (сообщение, предупреждение), тревога (сигнал), прилипать (приклеиваться, хвататься), движение, побуждать, затемнять, рассеивать (разбрасывать, рассыпать), гудок, встроенная система, приводить в действие (включать, активизировать), водопроводная магистраль, наблюдать (управлять), пожарный шланг, выходное отверстие, система обнаружения, правосудие, доступный, пригодный, фотоэлемент.

Ex. 4. Are these statements true or false?

1. Fire-protection system is installed in commercial and industrial buildings.
2. Sprinkler system is activated by a person.
3. Sprinkler system is designed in accordance with peculiarities of the building.
4. Many sprinkler systems are supervised by a special employees who then calls (informs) to a fire departments.
5. In the case of a fire in large buildings occupants or employees call a fire department and leave the building waiting for fire-fighters.
6. There are detection systems that transmit an alarm.
7. There is only one type of smoke detectors.

Ex. 5. Answer the questions.

1. Do buildings have fire-protection system?
2. How does fire-protection system operate?
3. How are the sprinkler systems supervised?
4. What is done if the sprinkler system isn't receiving sufficient water and pressure?
5. How is the fire extinguished in large buildings before fire fighters' arrival?
6. How does the detection system work and where is it used?
7. What are two types of smoke detections?
8. How are two types of smoke detectors run?

Ex. 6. Give a summary of the text.

UNIT 3

First aid

Ex. 1. Read the text and translate it into Russian.

First aid, emergency care for a victim of sudden illness or injury until more skillful medical treatment is available. First aid may save a life or improve certain vital signs including pulse, temperature, a patent (unobstructed) airway, and breathing. In minor emergencies, first aid may prevent a victim's condition from worsening and provide relief from pain. First aid must be administered as quickly as possible. In the case of the critically injured, a few minutes can make the difference between complete recovery and loss of life.

First-aid measures depend upon a victim's needs and the provider's level of knowledge and skill. Knowing what not to do in an emergency is as important as knowing what to do. Improperly moving a person with a neck injury, for example, can lead to permanent spinal injury and paralysis.

Despite the variety of injuries possible, several principles of first aid apply to all emergencies. The first step is to call for professional medical help. Determine that the scene of the accident is safe before attempting to provide first aid. The victim, if conscious, should be reassured that medical aid has been requested, and asked for permission to provide any first aid. Next, assess the scene, asking bystanders or the injured person's family or friends about details of the injury or illness, any care that may have already been given, and preexisting conditions such as diabetes or heart trouble. The victim should be checked for a medical bracelet or card that describes special medical conditions. Unless the accident scene becomes unsafe or the victim may suffer further injury, do not move the victim.

First aid requires rapid assessment of victims to determine whether life-threatening conditions exist. One method for evaluating a victim's condition is known by the acronym ABCs, which stands for:

A — Airway — is it open and unobstructed?

B — Breathing — is the person breathing? Look, listen, and feel for breathing.

C — Circulation — is there a pulse? Is the person bleeding externally? Check skin color and temperature for additional indications of circulation problems.

Once obvious injuries have been evaluated, the injured person's head should be kept in a neutral position in line with the body. If no evidence exists to suggest potential skull or spinal injury, place the injured person in a comfortable position. Positioned on one side, a victim can vomit without choking or obstructing the airway.

Before treating specific injuries, protect the victim from shock — a depression of the body's vital functions that, left untreated, can result in death. Shock occurs when blood pressure (pressure exerted against blood vessel walls) drops and the organs do not receive enough blood, depriving them of oxygen and nutrients. The symptoms of shock are anxiety or restlessness; pale, cool, clammy skin; a weak but rapid pulse; shallow breathing; bluish lips; and nausea. These symptoms may not be apparent immediately, as shock can develop several hours after an accident. To prevent shock, the victim should be covered with blankets or warm clothes to maintain a normal body temperature. The victim's feet should be elevated. Because of the danger of abdominal injuries, nothing should be administered by mouth.

Asphyxiation. Asphyxiation occurs when air cannot reach the lungs, cutting off the supply of oxygen to circulating blood. This can cause irreparable damage to the brain. Among the causes of asphyxiation are drowning, gas poisoning, overdose of narcotics, electrocution, choking, and strangulation. Victims may collapse, be unable to speak or breathe, and have bluish skin. Most people will suffer brain death within four to six minutes after breathing ceases unless first aid is administered.

Stand or kneel behind the person choking. Place one arm around her waist with the fist positioned between the navel and ribcage. The thumb should be inward

Place the other hand over the first.

Use the outer hand to increase the force as you press inward and upward, quickly forcing air out of the victim's lungs. If this fails to eject the obstruction, repeat the maneuver as many as 4 times.

In the case of choking, a procedure known as the Heimlich maneuver can be used to clear the windpipe of food or other objects. In this procedure quick upward thrusts are applied to the victim's abdomen to eject the object blocking the windpipe. The first-aid provider stands behind the victim with both arms around the victim's waist. One fist is placed slightly above the navel and below the rib cage with the thumb against the victim's body. The other hand is used to hold the fist and apply pressure. The abdomen is then pressed quickly inward and upward, forcing air from the lungs to eject the object from the windpipe. If the victim is too large to hold while standing, or becomes unconscious, the maneuver can be accomplished by laying the person down face up and using the heel of one hand in the same manner as above. The person performing the maneuver must be careful not to apply pressure on the rib cage to avoid breaking ribs, especially in children and the elderly. For obese or pregnant choking victims, the providers hands should be placed over the lower half of the sternum (breastbone) and pressure applied as described above.

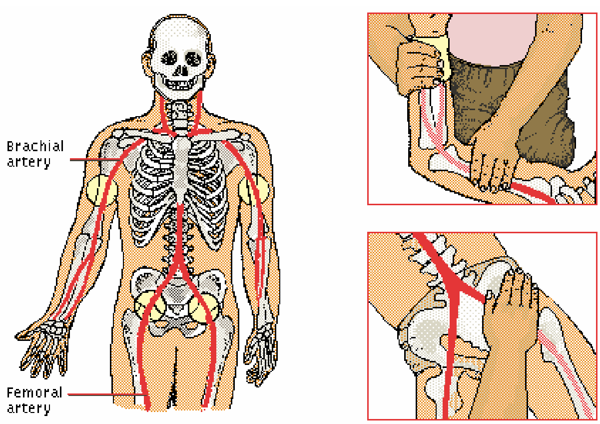
For victims of other types of asphyxiation, the most practical method of artificial respiration is the mouth-to-mouth technique in which the first-aid provider forcefully exhales air into the victim's lungs after first clearing the airway of any obstruction. The provider tilts the victim's head backward by placing one hand under the victim's chin and lifting while the other hand presses down on the victim's forehead. At this point, the mouth and airway can be checked for foreign objects, which can be removed with the fingers. To begin mouth-to-mouth resuscitation, gently pinch the victim's nostrils together to prevent air from escaping out the nose. Take normal breaths, seal the victim's mouth with a pocket mask or mouth, and exhale into the mouth. When performed properly the victim's chest should rise visibly. The provider then listens for the victim to exhale; if using a pocket mask, it need not be removed. This process is repeated at a rate of about 12 times per minute (one breath every five seconds) for adults and about 20 times per minute for children, using less pressure and volume for children. Once beginning artificial respiration, the first-aid provider should continue until the victim begins to breathe or medical help arrives.

In cases of drowning, artificial respiration should be attempted even if the victim appears dead. People submerged in cold water for more than 30 minutes who appeared blue have responded to first-aid efforts and recovered with no brain damage.

Cardiopulmonary arrest. Cardiopulmonary resuscitation (CPR) is used to restore the heartbeat in a victim whose heart has stopped — a condition known as cardiac arrest. Symptoms of this life-threatening condition may include crushing pain or pressure behind the breastbone; pain in the arms, neck, or shoulder; anxiety and a feeling of impending doom; difficulty breathing; heavy perspiration; weakness; nausea; and loss of consciousness. The American Red Cross recommends that CPR be performed only by individuals who have received special training in the recognition of cardiac arrest and proper performance of CPR skills.

CPR combines the techniques of artificial respiration with the application of external heart massage to keep blood flowing through the victim's body. The first-aid provider positions the victim face up on a firm surface and clears the airway of any obstructions. To maintain an open airway, the head is tilted back and the chin lifted forward. The provider then gives the victim two breaths by mouth or mask. If no pulse is detected at the carotid artery (located in groove beside windpipe in the neck), the first-aid provider kneels next to victim, placing the heel of one hand on top of the other over the lower half of the sternum. The provider depresses the chest about 5 cm (2 in), forcing blood from the heart through the victim's arteries. When the pressure is released, blood flows into the heart. The first-aid provider applies the pressure in short, rhythmic thrusts about 15 times every ten seconds. This cycle of two breaths followed by 15 chest compressions is repeated until the victim revives or professional medical help arrives.

Severe bleeding. The presence of blood over a considerable area of a person's body does not always indicate severe bleeding. The blood may ooze from multiple small wounds or be smeared, giving the appearance of more blood than is actually present. The rate at which blood is lost from a wound depends on the size and kind of blood vessel ruptured. Bright red, spurting blood indicates injury to an artery while welling or steadily flowing, dark red blood indicates injury to a vein.



Welling or spurting blood is an unmistakable sign of severe bleeding. If a major artery ruptures, a person may bleed to death within a minute. Injuries to veins and minor arteries bleed more slowly but may also be fatal if left unattended. Shock usually results from loss of fluids, such as blood, and must be prevented as soon as the loss of blood has been stopped.

To stop the bleeding, apply pressure directly over the wound and, when possible, elevate the bleeding body part. The first-aid provider should use bandages to hold a sterile dressing or clean cloth firmly over the wound. Dressings that become saturated with blood should not be removed but should be reinforced with additional layers. If an arm or leg wound bleeds rapidly and cannot be controlled by dressings and bandages, the first-aid provider can apply pressure to the artery at a point adjacent to the bleed called the pressure point. Arteries pass close to the skin at these points and can be compressed against underlying bone to stop arterial bleeding. The pressure point for the femoral artery, which supplies blood to the leg, is located on the front center of the leg's hinge, the crease of the groin area where the artery crosses the pelvic bone. The pressure point for the brachial artery, which supplies blood to the arm, is located halfway between the elbow and armpit on the inner side of the arm.

Fainting, seizures, and coma. Fainting, a sudden, temporary loss of consciousness, occurs when the brain does not receive enough blood. Just before fainting, a person's skin may appear pale and clammy or sweaty. To restore blood flow to the brain, a first-aid provider should elevate the unconscious person's feet or position the individual's head below the level of the heart. The victim's airway and breathing should be closely monitored. A fainting victim must also be kept warm to prevent shock. If the victim does not fully recover after five minutes, medical help should be requested.

Seizures, sudden brief episodes of intense neurological activity, may result from a variety of causes, including epilepsy, a neurological disorder, and head injuries. First aid for seizures consists of protecting the victim from accidental injury during the seizure. The first-aid provider should not put any objects in a seizing person's mouth or try to hold the tongue. If the victim has medical identification indicating epilepsy, an ambulance need not be called unless the person experiences multiple seizures or one seizure lasts more than five minutes. Otherwise, once the seizure stops, question the person about the need for a hospital evaluation. If no medical identification exists the first-aid provider should request medical assistance.

A deep state of unconsciousness due to illness or injury is known as a coma. Comatose individuals cannot be awakened. Heart failure, stroke, epilepsy, diabetes, or traumatic brain injury can cause comas and a medical alert tag on the victim may identify a possible cause of the coma. If the person is breathing, first aid is limited to providing comfort until medical assistance arrives. If the victim is not breathing, the first-aid provider should administer mouth-to-mouth or mask-to-mouth resuscitation.

Poisoning and drug overdose. A poisonous substance introduced into the body through the mouth or nose causes symptoms such as nausea, cramps, and vomiting. Poisons include toxic medications, herbicides, insecticides, rodenticides, household disinfectants, and noxious gases.

In a case of poisoning, the first-aid provider should remove the victim from a toxic environment, then contact the poison control center listed in most United States phone books. If the number is unavailable, the provider should call a physician or hospital emergency department. If possible, the provider should try to identify the poison, either by questioning the victim or searching for suspicious containers. Containers of many poisonous substances list the antidote, or remedy, on the label. Burns or stains on the skin or a characteristic odor on the breath may also help the first-aid provider recognize the poison.

Unless instructed to do so by the poison control center, the first-aid provider should never give a poisoning victim anything to eat or drink. Vomiting should not be induced unless the poison control center recommends it. If the victim vomits, the first-aid provider should turn the individual on the side and clear the airway. Before clearing the victim's mouth of any obstructions, however, the provider should first put on clean first-aid gloves or wrap a cloth around his or her fingers. If the person who ingested the poison is unconscious, the airway, breathing, and circulation should be checked and CPR started if necessary.

A drug overdose occurs when an individual takes too large a dose of a drug or takes a dose that is stronger than the person can tolerate. A drug overdose can be difficult to diagnose because the signs and symptoms vary widely and often mimic other illnesses or injuries. Symptoms of a drug overdose include unusually dilated or contracted pupils, vomiting, difficulty in breathing, hallucinations, and in severe cases unconsciousness and slow, deep breathing. If an overdose is not treated, the individual may die. Victims of overdose should be taken immediately to a hospital emergency room.

Burns. A burn is an injury to the skin caused by exposure to fire, hot liquids or metals, radiation, chemicals, electricity, or the sun's ultraviolet rays. Burns are classified according to the depth of tissue damage and extent of the burn. A first-degree, or superficial, burn, which involves only the surface of the skin, is characterized by reddening. A second-degree burn extends beneath skin surface and causes blistering and severe pain while a third-degree, or full-thickness, burn causes charring and destruction of the cell-producing layer of skin. The severity of a burn depends also on the area involved, expressed as a percentage of the total body surface area. Severe burns cause shock and loss of body fluids. A person suffering third-degree burns over more than 10 percent of body surface area should be hospitalized as soon as possible.

First aid for burns involves removing the source of the burn as soon as possible. The burn should be cooled immediately with cold water. A clean, cold wet towel or dressing can be placed on less serious burns to ease pain and protect the burn from contamination. Continuously bathe chemical burns with running water for at least 20 minutes to dilute the substance. Any powder should be carefully brushed off with gloved or protected hands before washing. Wet dressings or ointments should never be used for burns. Instead, the first-aid provider should gently apply dry, sterile dressings held in place by bandages and seek immediate medical attention.

Electric shock. Contact with electrical current is potentially fatal. Electricity passing through the body can cause injury to the skin and internal organs. If electricity passes through the heart, the heart muscle may be damaged and the heart's rhythm interrupted, leading to cardiac arrest. The signs and symptoms of electric shock include tingling, burns on the skin where the current entered or exited, muscle pain, headache, loss of consciousness, irregular breathing or lack of breathing, and cardiac arrest. The severity of the injury depends on the strength of the electric current and the path the current takes through the body. The person providing first aid to a victim of electric shock should not touch the individual's body until the source of the shock is turned off. Because of the potential for internal injuries, victims of electrical injury should not be moved unless they are in immediate danger. The first-aid provider should monitor the victim for symptoms of shock. If the victim has stopped breathing and has no pulse, CPR should be performed after the airway, breathing, and circulation have been checked. When the victim's vital signs are stable, the site of the burn should be treated using the same methods used for other burns.

Animal bites and stings. Animals such as snakes, dogs, cats, small rodents like squirrels, certain insects, and spiders may bite humans with dangerous consequences. Many snakebites are caused by nonvenomous (nonpoisonous) snakes and do not require treatment beyond cleaning the wound. Bites inflicted by venomous snakes require immediate first-aid measures. The victim should be taken as soon as possible to the nearest emergency medical facility. In the interim, the first-aid provider should not cut the area around the bite, attempt to suck out the venom, or apply ice to the wound. The focus of first aid should be to prevent the venom from spreading rapidly through the individual's bloodstream. The victim should be kept quiet to avoid stimulating circulation of the venom. In addition, the bite area should be kept at a lower level than the rest of the body. The wound should be washed thoroughly with soap and water, blotted dry, and loosely covered with a sterile dressing.

Bites from other animals should be thoroughly washed, treated with an antibiotic ointment, and bandaged. The victim should seek medical attention if the bite is severe, if rabies (an infectious viral disease) is suspected, or if the bite becomes infected. Bites from other humans are particularly prone to serious bacterial infection and should be treated by a medical professional. Victims of any animal or human bite whose immunizations are not current may need a shot for tetanus, an often fatal infectious disease affecting the muscles of the neck and jaw.

Biting insects include fleas, mosquitoes, bedbugs, lice, chiggers, and gnats. Bites from these insects should be washed to prevent infection, and cold compresses or topical medications applied to alleviate itching and pain. Bites from some species of ticks can cause serious illnesses including lyme disease and Rocky Mountain spotted fever. When a tick bites a person, it may attach itself to the body by burrowing into the skin. As a result, a tick should be removed by carefully pulling it straight out with tweezers so as not to leave its head behind. The tick should not be squeezed when it is removed. Bites from most spiders can be treated like those of other biting insects. Bites from black widow spiders and other poisonous spiders require medical help. They are treated similarly to poisonous snakebites.

Heat illnesses. Exposure to excessive heat may cause heat exhaustion or heatstroke. Heat exhaustion results from excessive loss of body fluids and body salts. Symptoms include pale and clammy skin, heavy perspiration, a weak pulse, and shallow breathing. Headache and vomiting may also occur. In heat exhaustion the internal body temperature remains close to normal.

Heatstroke, a malfunction of the heat-control centers in the body, occurs less frequently than heat exhaustion and is much more serious. It commonly affects the elderly. The symptoms of heatstroke are hot and flushed skin, absence of perspiration, a rapid but weak pulse, rapid breathing, and a high body temperature. The affected person may feel dizzy and lose consciousness.

Victims of heat exhaustion should rest in a cool area with their feet elevated. Further cooling can be achieved with cool water compresses and a fan. The victim should never be given medications used to treat fever, such as aspirin. The person suffering from heat exhaustion may feel nauseous at first, but after resting for a period, he or she may be able to sip minimally salty water or an electrolyte solution to replenish salt lost from perspiration. In serious cases, medical care is required. First-aid measures for heatstroke are similar to those for heat exhaustion, but the victim should be more aggressively and rapidly cooled, should not be given anything by mouth, and the feet should not be raised if breathing difficulties are observed. The heatstroke victim must be taken immediately to an emergency care center.

Cold injuries. Exposure to cold can lead to hypothermia, a condition in which the body's internal temperature drops below normal. The first-aid provider should seek medical help first, if possible, and rewarm a hypothermic individual by whatever means available, including body warmth. If the victim is alert, warm, sweet fluids may be given. If the victim is breathing at a rate less than six breaths per minute, mouth-to-mouth or mask-to-mouth resuscitation can be started. CPR should not be performed because a hypothermic person may have a heartbeat even when the pulse is undetectable and any CPR may cause cardiac arrest.

Frostbite is a condition in which the skin freezes, initially causing pain and redness in the affected area, which may develop into numbness and whiteness. The first-aid provider should rewarm frozen areas (usually extremities) of the victim's body slowly by using skin to skin contact, immersing frozen part in warm, not hot, water, or using warm compresses. Avoid massaging the affected area, which may cause tissue damage. The first-aid provider should not thaw frozen areas that may refreeze before the victim reaches a medical facility.

Head, eye, and nose injuries. Injuries to the head may involve the scalp, skull, or brain. If the victim has a head wound, the first-aid provider should not apply pressure to it, as this may damage the brain. The victim's airway should be kept clear from obstructions, such as vomitus, which is common in cases of head injury. If the victim has a seizure, a sudden spasm of the body, the head must be protected with cushions to prevent further injury. All individuals with head injuries should be evaluated by a physician.

Medical attention should be sought for all eye injuries as well. In the case of foreign material in the eye, especially caustic substances, or those that can burn, corrode, or dissolve tissues, the eye should be flushed immediately with a cool, sterile saline solution, if available, or plain tap water for 15 to 30 minutes. The first-aid provider should not attempt to remove embedded objects from the eye.

The most common injuries to the nose involve nosebleeds, objects lodged in the nasal passages, and broken nasal bones. The victim of a simple nosebleed should sit down, lean forward, and gently pinch together the soft part of the nose for 15 minutes. A cold compress can also be placed on the bridge of the nose. If material lodged in the nose cannot be forced out by gently blowing the nose, the victim should request medical help. In the case of a broken nose, the first-aid provider should apply a cold compress to the bridge of the nose and seek medical attention.

Sprains and fractures. A sprain, the painful stretching or tearing of ligaments (tissues that connect bones at joints), occurs when a bone is suddenly wrenched at the joint. A fracture, a break or crack in a bone, is caused by sudden, violent pressure against the bone. Great pain and swelling characterize both a sprain and a fracture, but inability to move the affected part, a deformed appearance, and pain or tenderness at a specific point usually indicate a fracture. Sprains and fractures should be treated in the same way by a first-aid provider since it can be difficult to diagnose a fracture without an X ray of the affected bone.

Because the slightest movement of the affected part may cause the injured person great pain and increase the damage, no attempt should be made to straighten or move sprained or broken limbs until medical help arrives. If the injured person must be transported to a hospital, rigid splints should be used to immobilize the broken part and adjacent joints or bones. Splints can be improvised from light, smooth boards or folded cardboard and tied to the broken part with wide strips of cloth or improvised material.

If a person is found with the head or body in an unnatural position, a fracture of the spinal column may have occurred. Other signs of a broken spinal column are severe pain in the back or neck and lack of movement of the lower extremities. The first-aid provider should not attempt to straighten or move the injured person's body as this may cause permanent paralysis or death. If the victim must be transported, his or her body should be immobilized by placing it on a flat board. However, moving such a victim should not be attempted without prior training.

Vocabulary

heat exhaustion *(n)*	**consciousness** *(n)*	**treatment** *(n)*
perspiration *(n)*	**sprain** *(n, v)*	**vomit** *(n)*
tetanus *(n)*	**heatstroke** *(n)*	**pain** *(n)*
suffer *(v)*	**victim** *(n)*	**bite** *(v)*
resuscitation *(n)*	**blot** *(n, v)*	**charring** *(n)*
emergency room *(n)*	**pressure** *(n)*	**noxious** *(a)*
shock *(n, v)*	**poison control center** *(n)*	**breathing** *(n)*
wound *(n, v)*	**ambulance** *(n)*	**care** *(n, v)*
weakness *(n)*	**bleeding** *(n)*	**asphyxiation** *(n)*
cardiac arrest *(n)*	**nausea** *(n)*	**sting** *(n, v)*

Ex. 2. Suggest the Russian equivalents to the English ones.

Emergency care, medical, treatment, sudden illness, vital signs, patent airway, worsening, administer, relief, critically, permanent, spinal, assess, bystander, preexisting condition, medical bracelet, unsafe, assessment, life-threatening, circulation, bleeding, skull, vomit, choking, obstruct, blood pressure, blood vessel, deprive, nutrient, restlessness, clammy skin, shallow breathing, bluish, nausea, abdominal, asphyxiation, electrocution, windpipe, thrust, eject, navel, rib cage, thumb, press, maneuver, accomplish, sternum, breastbone, respiration, forceful, exhale, obstruction, tilt, backward, chin, forehead, foreign object, resuscitation cardiac arrest, restore, crushing, impending doom, perspiration, kneel, ooze, wound, smear, welling, rupture, bleed to death, minor, bandage, dressing, saturated elbow, armpit, fainting, seizures, accidental injury, heat failure, insecticide, noxious gas, poison control center, list, antidote, remedy, odor, wrap, ingest, mimic, superficial, reddening, charring, dilute, second degree burn, blot, rabies, flea, bedbug, louse, chiggers, alleviate, itch, excessive heating, heatstroke, flushed skin, dizzy, sip, frostbite, numbness, immerse, flush, dissolve, sprain, wrench, swelling, splint, immobilize, extremity.

Ex. 3. Suggest the English equivalents to the Russian ones.

Скорая медицинская помощь, внезапное заболевание, опытный, лечение, основные показатели состояния организма, свободная проходимость дыхательных путей, ухудшение, облегчение, помогать (обеспечивать), опасная (серьезная, тяжелая) травма, спинной мозг, определить место происшествия, свидетель (очевидец), предшествующее состояние, проверять, опасный (ненадежный), оценка, опасный для жизни, кровообращение, кровотечение, симптом, рвота, удушье, кровяное давление, оказывать давление, кровеносный сосуд, лишать, питательное вещество, беспокойство, липкая кожа, неглубокое дыхание, синеватый, брюшной, поражение электрическим током, горло, грудная клетка, большой палец руки, проводить искусственное дыхание, выдыхать, препятствие, наклонять, посторонний предмет, возвращение к жизни, остановка сердца, восстановить, сильный, обреченность, стоять на коленях, сочиться, смазывать, рана, умереть от потери крови, перевязочный материал, повязка, локоть, подмышка, обморок, припадок, опознание, повреждение в результате несчастного случая, сердечная недостаточность, токсичный газ, противоядие, лекарство, запах, покраснение, загрязнение, ожог второй степени, промокать, бешенство, столбняк, вошь, блоха, клещ, клоп, зуд, перегрев, тепловой удар, испытывающий головокружение, пить маленькими глотками, обмороженный участок, окоченение, промывать, растянуть связки, вывихнуть, опухоль (выпуклость), болезненность, шина, конечность.

Ex. 4. Are these statements true or false?

1. A victim of sudden illness or injury needs only skillful medical treatment.
2. First aid may improve certain vital signs, prevent a victim's condition from worsening and provide relief from pain.
3. There are several principles of first aid apply to all emergencies (name them).
4. First aid requires rapid assessment of victims to determine whether he (or she) is alive or dead.
5. An injured person should be kept lying until more skillful medical treatment is available.
6. The victim should be protected from shock before treating injuries.
7. Shock occurs when blood pressure rises rapidly.
8. There aren't special symptoms of shock.
9. Asphyxiation occurs when air cannot reach the lungs.
10. In the case of chocking the first-aid provider forcefully exhales air into the victim's lungs.
11. In the case of asphyxiation and drowning artificial respiration is applied.
12. Cardiopulmonary resuscitation in used to restore the heartbeat.
13. Any person can apply first aid for cardiopulmonary resuscitation.
14. Loss of consciousness is an unmistakable sign of severe bleeding.

15. To stop the bleeding the first-aid provider should use bandages to hold a sterile dressing over the wound.

16. Fainting, seizure and coma occur when the brain doesn't receive enough blood.

17. The first aid provider should administer mount-to-mount resuscitation for painting, seizures and coma.

18. In a case of poisoning the first aid provider should remove the victim from a toxic environment.

19. A drug overdose can be easily to diagnose.

20. Burns are classified according to the depth of tissue damage and extent of the burn.

21. There are several burn degrees (name them).

22. First aid for burns depends on burn degree (prove).

23. Electricity passing through the body can cause injury to the skin and internal organs.

24. The severity of the injury depends on the strength of the electric current.

25. Bites from animals, snakes, rodents, insects, spiders can be dangerous for humans.

26. All bites should be washed, treated with an antibiotic ointment and bandages.

27. Heat illnesses are caused by heat exhaustion or heatstroke.

28. Clammy skin, heavy perspiration, a weak pulse and shallow breathing, headache and vomiting are symptoms of heat illnesses.

29. Frigorism causes cold injures.

30. First aid for frigorism is to warm a victim.

31. A fracture is caused by sudden, violent pressure against the bone.

32. Skillful medical treatment is needed for sprains and fractures.

Ex. 5. Answer the questions.

1. How can first aid be helpful?
2. What does first-aid depends upon?
3. What are several principles of first aid apply to all emergencies?
4. How is a victim's condition determined?
5. How should the injured person's head kept?
6. What should be done before treating?
7. When does shock occur and what are its symptoms?
8. How should shock be prevented?
9. How does asphyxiation occur?
10. What procedure can be used in the case of choking?
11. How is artificial respiration applied?
12. What should be administered in cases of drowning?
13. What condition is known as cardiac arrest?
14. What are symptoms of this life-threatening condition?
15. Who must cardiopulmonary resuscitation administer?
16. What maneuvers are applied for cardiopulmonary arrest?

17. What are signs of severe bleeding?
18. When may a person bleed to death within a minute?
19. What bleeding may be fatal if left unattended?
20. What does shock results from?
21. How is bleeding stopped?
22. When does fainting occur?
23. What is a person condition before fainting?
24. What is a provider's first-aid for fainting?
25. What do seizures result from?
26. What does first aid for seizures consist of?
27. What can cause comas?
28. What are symptoms of poisoning and drug overdose?
29. What is first aid for poisoning?
30. What is a burn?
31. How are burns classified?
32. What are the signs and symptoms of electric shock?
33. What does the severity of the injury depends on?
34. What does the first-aid provider administer?
35. What are first-aid measures for animal bites and sting?
36. What does heat exhaustion result from?
37. What are heat illnesses and their symptoms and what is first aid for heat illnesses?
38. What is cold injures and first aid?
39. When do sprains and fractures occur?
40. How should sprains and fractures be treated by a first-aid provider?

Ex.6. Give a summary of the text.

SUPPLEMENTARY READING

Text A. Mountain climbing

Mountain climbing, ascending mountains, most commonly as a recreational activity. Mountain climbing is popular worldwide, wherever hills rise high enough to provide challenge. The activity's rewards include the physical exertion it requires,

the satisfaction of overcoming difficulties by working with others, the thrill of reaching a summit, and the unobstructed view from a mountaintop. Exploration and research are other reasons that people climb mountains.

Ascents can be either *nontechnical* (a hike up a path or a scramble over rocks, not requiring the safety of a rope), or *technical* (a climb up more difficult terrain that requires the use of rope and other specialized equipment). This article focuses on technical climbs, which involve all the elements of simple hikes but also require advanced knowledge and equipment. Making technical climbs is also known as *mountaineering.*

Since ancient times, people have viewed mountain peaks as towering objects of myth, spiritual inspiration, and romantic beauty. Early peoples made ascents only to hunt game, to rescue lost or strayed animals, or to gain a military advantage over an enemy. Eventually, the unknown and inaccessible ceased to be something to be feared and avoided, and the conquest of the major mountain peaks and ranges of the world began. Mountaineering as a sport was born on August 8, 1786, with the first ascent of Mont Blanc (4807 m/ 15,771 ft), one of Europe's tallest peaks. Since that ascent, mountain climbing has evolved into three related sports: alpine climbing, ice climbing, and rock climbing. These sports require the same fundamental techniques.

Experienced climbers prepare for a climb by buying a topographical map and a regional guidebook with charts of the expected terrain and descriptions of the mountain's approach trails. Climbers begin major ascents by hiking to the base of the mountain, where they set up an overnight camping spot, known as a *base camp.* Early the next morning, they begin their ascent. On climbs that last only one day, experienced climbers attempt to reach the summit by noon, before afternoon thunderstorms, lightning, hail, and rain increase the danger of the climb. Climbers also make sure they have enough daylight to *rappel* (slide in a controlled fashion down climbing ropes) back to the mountain's base and reach base camp before dark. On rare occasions climbers are caught in the dark and must resort to headlamps or flashlights to find their way back to camp. On ascents that last more than one day, an early start gives climbers enough time to set up their next camp on the mountain before nightfall. If there is snow on the route, starting early means that the frozen surface will not melt before the climbers cross it.

Because mountain climbers surmount dangerous terrain by using ropes and other equipment, they almost always climb in teams. The basic team is composed of two people, the leader and the second. Each has one end of the climbing rope tied into his or her *climbing harness,* a device that secures the climber to the rope in case of a slip. The leader's job is to lead the climb by following a natural line or path to each successive ledge or resting spot. The leader also places climbing equipment known as *hardware* in cracks, snow, and ice at various points along the ascent. When attached to the climbing rope, the hardware becomes a series of anchors that hold a climber in the event of a fall.

The second feeds out rope as the leader progresses upwards. Paying out the rope (or conversely, pulling it in) is called *belaying.* The second also passes the rope around his or her waist or through a friction device that attaches to the climbing harness. Should the leader fall, the second can hold tightly to the rope, which creates enough friction to stop the rope's movement and break the leader's fall.

After the leader reaches a ledge and secures several pieces of hardware for a belay anchor, the second begins climbing, following the leader's route and gathering the hardware. When the second reaches the leader, the team rests and then proceeds by climbing another rope length, or *pitch.* Because leading is stressful and tiring, the leader and the second sometimes switch positions, a process called *swinging leads.*

An accident while mountain climbing generally has unexpected and negative consequences. A seemingly small mistake, such as twisting an ankle in loose rocks, can quickly turn into a dangerous situation if the climber is on difficult terrain and is still some distance from the base camp. Climbers can minimize the consequences of these mistakes by traveling in groups, carrying first aid equipment, and being cautious in their route planning. Alpine climbers are also exposed to perils beyond their control, such as hidden crevasses and avalanches, and because of the inhospitable environment of most mountains, they risk exposing themselves to hypothermia and altitude sickness. Experienced mountaineers plan ahead for all contingencies and let others know their destination and planned return time.

Crevasses are deep ice fissures or large cracks within a glacier. Many times crevasses are hidden under a covering of snow, making them difficult to identify. Their steep, slippery sides make them almost impossible to climb out of without assistance. For this reason, climbers always rope together and secure themselves to each other when traveling on glaciers and snowfields. Should one partner fall in a crevasse, the other can break the fall and then pull the first out.

Avalanches are sudden flows of a large mass of snow or ice down a slope or cliff, sometimes at speeds exceeding 160 km/h (100 mph). They occur when heavy snowfall accumulates on steep slopes and the underlying snow pack cannot support the new snow's weight. Mountaineers can minimize avalanche dangers by staying aware of rapid changes of weather, especially increases in temperature and wind. They should also avoid steep, narrow chutes that provide ideal channels for avalanches.

Hypothermia occurs when the body becomes too chilled to generate enough warmth for vital organs such as the heart and lungs. Most climbers understand that hypothermia is a danger during extremely cold weather, but it also can occur when temperatures are well above freezing. In fact, most cases occur when the outside temperature is between 7 and 10 °C (45 and 50 °F). Avoiding hypothermia requires several simple precautions. Mountain climbers should stay dry and avoid cotton clothing, which dries slowly and sucks away body warmth as it does dry. They should eat, drink water, and rest frequently, helping them maintain energy levels.

Altitude sickness, also known as mountain sickness, is caused by insufficient oxygen at high elevations. It causes dizziness, shortness of breath, and confusion, and it can strike climbers at any elevation above 2400 m (about 8000 ft). Mountaineers who ascend to higher altitudes often take a day or two to become accustomed to their new environment. They climb slowly when going above 4500 m (15,000 ft). If climbers develop symptoms of altitude sickness, they should descend immediately to a lower altitude, before the condition worsens.

Mountaineers need to be in excellent physical shape, and many people train for mountain climbing by running, hiking, and bicycling. While climbing, mountaineers must remain relaxed and focused in tense situations, such as when they are having trouble picking the correct route up or down a mountain, when a storm is approaching, or when night is falling.

Traditionally, beginning mountaineers learned safe climbing skills through a mountain apprenticeship. Older, more experienced climbers and guides accompanied beginners on a number of ascents and acted as mentors, demonstrating techniques and providing encouragement. Today, beginners can follow the apprenticeship route or learn these skills from a qualified friend or from climbing schools or guide services that are certified by such organizations as the American Mountain Guides Association (AMGA).

Text B. Alpine climbing

The style of mountaineering under which these basic climbing techniques developed is called alpinism, or alpine climbing, and this style encompasses much of the equipment, technique, and safety precautions that form the basis for ice climbing and rock climbing. Alpine climbing began in the European Alps in the late 18th century and is now practiced in all mountain ranges of the world. The most popular alpine climbing areas in the United States are the Colorado Rocky Mountains, the Sierra Nevada range in California, and the Alaska Range in the vicinity of Mount

McKinley (6194 m/20,320 ft). Alpine climbing involves the continuous ascent of a mountain peak over a period of one to several days by a team of at least two alpinists. Teams may consist of as many as four climbers. The climbers carry all the equipment they need — a camping stove and fuel, sleeping bags, sleeping mats, a tent or bivouac sack, first aid gear, a water bottle, and food. Each night the climbers *bivouac,* or spend the night on a mountain ledge, before continuing upward.

Alpine climbers try to stay warm and dry, so proper clothing is essential. They avoid using cotton clothing because once wet, it conducts heat away from the body. Instead, many mountaineers use synthetic underwear; fleece hats, jackets, and pants; and jackets and snow pants made of waterproof-breathable material such as Gore-Tex. These types of clothing allow sweat and water vapor to escape from the skin through the clothing. By keeping warm and dry, mountaineers avoid the dangers of severely chilling their body core, which can lead to hypothermia. Preferred mountaineering footwear is either heavy-duty, stiff-soled boots made of leather or synthetic material, or lightweight plastic boots that are completely water-proof. Mountaineers wear fiberglass or high-strength plastic helmets to protect their heads from falling pieces of rock or ice, as well as from head injuries if they fall themselves.

Mountain climbers use many different tools. The most basic of these are climbing harnesses, climbing ropes, ice axes, and crampons. Climbers also use a variety of types of hardware to anchor themselves to the mountainside.

A climbing harness is an adjustable set of straps that buckle around the waist and thighs of a climber. Most harnesses also come with special, easy-to-reach loops for attaching hardware and other climbing tools. The harness serves as an anchor for one end of the climbing rope. In the event of a fall, the anchors set in the mountainside halt the fall, and the harness holds the climber tight but does not restrict movement or breathing.

Climbing ropes are specially made lines of a high-strength nylon called *Perlon.* Ropes that measure 45 m (148 ft) in length and 11 mm (7/16 in) in diameter are standard for rock climbing. Ropes 60 m (197 ft) in length and 9 mm (1/3 in) in diameter are preferred for alpine and ice climbing; these ropes are usually waterproof, or *everdry,* so that they will not freeze and become stiff in cold or wet conditions.

Ice axes have either a metal or fiberglass shaft. One end of the shaft is a pointed metal spike. The other end is topped with a head that has a metal pick with serrated teeth on one side, and a straight, flat, metal blade called an *adze* on the other. Ice axes have many uses. One of the most common is to help the climber stay balanced on steep slopes. The climber swings the axe with a short, quick movement to lodge the pick in snow or ice, creating a secure anchor. If a climber should slip and begin sliding down a snowfield, a *self-arrest* can be performed by turning face down on the snow and burying the pick in the snow surface. The climber’s weight over the pick and firm grip on the ice axe usually stop any downward movement. Mountaineers also use the axe to chop steps in snow or ice. Longer axes are used as walking sticks and for probing crevasses during glacier travel.

Alpine climbers gain a foothold on steep and snowy slopes by using crampons. Invented in 1908 by British climber Oscar Eckenstein, crampons are frameworks of sharp metal teeth that fasten to mountaineering boots and grip the snow and ice. They attach to the boots with straps that lace around the ankles or by snaps that connect to the boot sole. Basic mountaineering crampons are hinged between the sole and the heel, have straps, and have 10 or 12 points. More technical crampons have two teeth pointing forward. These teeth, called *front points,* allow a climber to kick straight into the ice or snow on especially steep slopes.

When attached to a climber's rope, hardware provides anchors to steep slopes. Hardware can include such items as *nuts* and *chocks,* which are wedge-shaped or hexagonal pieces of aluminum alloy attached to a wire cable or a Perlon sling. Climbers can wedge these high-strength pieces of metal into cracks and fissures in the rock. Hardware also includes *pitons,* which are blades or U-shaped spikes made from a durable metal called chromolly steel. Pitons come in sizes from 10 to 15 cm (4 to 6 in), and climbers drive them into cracks with a special rock hammer. Other types of hardware include *ice screws,* which are threaded, aluminum alloy tubes with sharp teeth that are screwed directly into ice. *Snow pickets* are used in snow. These devices are lightweight metal stakes that climbers hammer into the snow.

In the eye (or hole) at the end of each of these devices the climber clips in a *carabiner,* an oval-shaped, spring-loaded metal link. The link attaches to a short length of nylon webbing and another carabiner, through which the climbing rope attaches. Should the climber slip, this series of anchors, carabiners, and webbing acts as a shock absorber. It distributes the pressure of the fall to each of the climber's anchors and reduces the risk of a long and dangerous drop.

All mountaineers also carry several other items: a compass; topographic maps that indicate elevations, place names, and geographical formations in the area; and an altimeter, which calculates altitude above sea level. Altimeters, which work on barometric principles, can also be used to anticipate weather changes.

In recent years, well-publicized successes and tragedies in mountaineering activities, and improvements in climbing equipment, have given rise to an increased number of mountain climbers worldwide. The sport's popularity has led some countries to require mountaineers to purchase climbing permits. Himalayan expeditions must also pay an environmental bond to guarantee that they will remove all of their waste at the conclusion of their trip.

Environmental efforts are underway at many rock climbing areas, where local climbers participate in an annual cleanup day to maintain approach trails, wash gymnastic chalk off the rock, and pick up litter. In the United States, placement of pitons and other hardware that damage the rock is regulated on state and federal lands. The Access Fund is the national organization that helps climbers gain access to climbing areas and also assists with environmental problems associated with cliffs in the United States.

Since the 1980s indoor rock climbing gyms have played a key role in introducing large numbers of people to climbing in a controlled setting, on short climbs. However, making the transition to climbing outside is not always easy. New skills and judgment calls are required outdoors, because real cliffs are subject to bad weather and other hazards such as loose rock and falling stones.

In the late 20th century, climbing competitions became popular with rock climbers and ice climbers of all ages and skill levels. Regular competition climbing is judged on how high the climber can ascend within a specified period of time. Speed climbing competitions pit climbers against a clock to see how fast they can scale a wall. Local climbing gyms and clubs sponsor competitions, as do national organizations such as the American Sport Climbing Federation.

Internationally, mountaineers, ice climbers, and rock climbers are represented by the *Union Internationale d'Alpinism et Alpinists* (UIAA, Internationale Mountaineering and Climbing Rederation). Since its founding in 1932, the UIAA has grown to represent about 80 associations in about 60 countries. As mountain climbing's popularity rose dramatically in the 1980s and 1990s, the UIAA's role in mountain safety, education, and environmental policy also increased. In the United States, the American Alpine Club, the Appalachian Mountain Club, the Colorado Mountain Club, and the Sierra Club are only a few of the organizations that have also addressed these issues. These organizations also offer instructional programs in climbing and provide an opportunity to meet fellow enthusiasts.

Text C. Ice and rock climbing

Ice climbing grew out of traditional mountaineering, and ice climbers use the basic equipment, techniques, and safety precautions that alpinists do, with certain specialized changes to account for the added difficulties of ascending vertical sheets of ice. In 1932 French climber Laurent Grivel added two extra front points to Eckenstein's ten-point crampons. This enabled mountaineers to ascend more difficult and steeper climbs over icy routes. In the early 1970s, American mountaineer and inventor Yvon Chouinard designed curved ice axe picks, which made it easier to drive axes into ice and secure them there. Ice climbers later created more radically drooped ice axe picks and ergonomically designed ice axe shafts, allowing them to venture onto continuously vertical, and even overhanging, frozen waterfalls.

Climbers encounter two natural forms of ice: alpine ice and water ice. Mountaineers and alpinists look out for alpine ice, while ice climbers deliberately search for water ice. Alpine ice is composed of large sheets of snow on mountainsides that over time have melted and refrozen. Water ice occurs at lower altitudes on frozen waterfalls, where it can take the shape of toothy icicles, steep curtains and pillars, freestanding columns, and thin veneers over rock. Whereas alpine climbers regard ice as an obstacle to be overcome in the course of making a longer ascent, ice climbers seek out ice to pit themselves against its verticality and physical difficulty. Ice climbs are therefore shorter than alpine ascents, but they can be more taxing.

Ice climbers use an array of sharply pointed tools, notably 12-point rigid-frame crampons, two ice axes, and ice screws. An ice climber begins an ascent by kicking and securing the front points of each crampon in the ice. The climber then centers his or her body weight over the front points and concentrates on securing the ice axes. The climber swings one axe overhead and lodges it firmly into the ice, then does the same with the other. Then the climber pulls up and resecures the crampons slightly higher. The climber repeats this technique over and over, moving higher with each step.

To protect against falls, ice climbers anchor an ice screw every 5 to 10 m (16 to 33 ft), attaching their rope to the ice screw. They hand-screw the ice screws or twist them in using an axe pick. The ice screw anchors and the rope work together to reduce the danger of falls. For safety, climbers try to avoid breaking off large pieces of brittle ice with the ice axe. These ice chunks and shards can be sharp and can cause injuries.

As alpine climbing developed in the European Alps in the early 20th century, French and German mountaineers sought out new challenges by training on cliffs and boulders near their homes. The earliest documented rock climb done for sport (not for military reconnaissance or scientific inquiry) was the 35-m (115-ft) high Nape's Needle in the Lake District of England, which W. P. Hasket-Smith climbed alone on June 27, 1886. The first documented rock climb in North America was made in 1910 on a portion of Mount Washington in the White Mountains of New Hampshire, although the mountain itself had been climbed much earlier.

Rock climbing is now practiced on cliffs ranging from 10 to 1000 m (33 to 3300 ft) in height. Areas may be relatively small crags of rock, large canyon sidewalls, or immense mountain faces. Granite, limestone, sandstone, and metamorphosed schist and gneiss are the four most popular rock types for climbing.

Rock climbers train by *bouldering,* which means practicing difficult climbing moves on large boulders or small outcroppings of rock that lie only several feet above the ground. Bouldering is relatively safe because climbers can jump back onto solid ground at any moment. Difficult and strenuous movements can therefore be rehearsed without the use of ropes and hardware.

When ascending cliffs that are less than 50 m (164 ft) high, climbers use a technique called *top-roping.* On a top-rope belay, the climber is anchored from above, so he or she is protected against a serious fall. Rock climbers generally use a standard 45-m or 50-m rope. Rock climbs higher than 50 m thus require more than one *pitch,* or rope length, to be scaled; this type of climbing is termed *multipitch* or *continuous climbing.*

Specific types of rock climbing movements include friction climbing (moving up smooth, relatively low-angled rock slabs); face climbing (holding onto flakes, knobs and edges to ascend a sheer wall); crack climbing (jamming fingers, hands, arms, legs, feet, and toes into fissures in the rock); and overhang climbing (expending quick, calculated bursts of energy and muscle to swing past overhangs).

Strength is a major aspect of rock climbing, but it is not the most important physical requirement. Experienced climbers focus more on endurance, muscle coordination, flexibility, finesse, and excellent balance. On vertical and overhanging cliffs, moving smoothly up the rock, staying relaxed, and being mentally confident are equally vital to success.

There are two main types of rock climbing: free climbing and aid climbing. In its most basic form, a free climb is the unsupported ascent of a cliff face. Climbers use their fingers to grip flakes, edges, and cracks in the surface, while sticky rubber-soled shoes give support. The climber employs rope, plus other forms of protection such as nuts and pitons, but only as a precaution to prevent a serious fall. The rope and the individual pieces of protection are never used to rest on, or for advancement. As soon as a climber uses equipment for support, he or she is no longer free climbing. The climber will then descend again to the last resting point where no support was used and reclimb the problematic section.

In aid climbing (also known as *artificial* climbing), climbers ascend pitches while using rope and hardware to support their body weight. Aid climbers also use a number of tools, including pulleys to move gear up the rock wall and *etriers,* or slings, to rest in. On climbs that require two or more days, climbers also use a *portaledge.* This easy-to-assemble device made of poles and shock-cords forms a rigid nylon floor and waterproof tent. The portaledge hangs from anchors placed in the rock wall and enables climbers to sleep and rest in a comfortable position, even though they may be hundreds or thousands of feet off the ground.

Rock climbing routes are named and assigned a difficulty rating by the first team of climbers to ascend a particular route. In the United States, free climbs are graded using *decimal ratings,* which range from 5.0 (easiest) to 5.14 (most difficult). In guidebooks the climb's name is also accompanied by a *commitment ra-ting,* which indicates the climb's seriousness and how many hours or days it will take a team of two average-ability climbers to complete the route. Commitment ratings are given in Roman numerals from I (several hours) to VI (difficult climbs in remote locations). A similar scale (A1 to A5) is used when evaluating aid climbing routes.

Rock climbing shoes resemble toughened ballet slippers, made of supple leather or synthetic materials. They have sticky rubber soles, and toes and heel-liners made of rubber. All climbing shoes and slippers should be fitted snugly around the foot. Climbers use gymnastic chalk (magnesium carbonate) to dry sweat from their hands and fingers while climbing. The white powder is carried in a small pouch called a *chalk bag* that is attached to the climber's harness.

Because rock climbing requires plenty of innovative, supple movements, clothing should be lightweight, comfortable, and nonrestricting. T-shirts, shorts, and tights made of cotton, Lycra-cotton blends, and other synthetic materials are popular. Rock climbers also use athletic tape to protect fingers, knuckles, and wrists during difficult climbs.

Text D. Whitewater rafting

Whitewater Rafting, recreational activity in which people row or paddle an inflatable raft down a fast-running, turbulent river. The term *whitewater* refers to the burbling foam created when fast-moving water spills over and around rocks or other obstructions.

Whitewater rafting has become a popular recreational pastime around the world, especially in the United States.

It offers the thrill and challenge of threading between rocks and over waves in a small, open boat. Most rafting trips provide an exciting ride, with the raft plunging and bucking and occasionally dousing the occupants with water. Rafting is also a convenient way to travel into beautiful, remote areas that may otherwise be difficult to reach.

Because it has numerous safety issues and logistical demands, whitewater rafting is primarily done by commercial services that offer trips for paying customers. These excursions range from one-hour thrill rides to three-week expeditions.

Whitewater runs are selected primarily for the size and variety of rapids, as well as the beauty of the surrounding countryside. Logistical considerations — such as convenient areas to put in and take out the rafts and suitable camping spots along the way — also play a role.

There are two basic kinds of whitewater rafts: oar boats and paddle boats. In an oar boat, passengers merely hang on while the guide, sitting in the center of the boat and typically facing downstream, maneuvers the raft with two long oars. No special skill or knowledge is required of the passengers, who are essentially just along for the ride. However, during a large wave or heavy rapids, they may be called upon to quickly shift their weight to the high side of the boat (*high-siding*) to keep it from flipping over.

In a paddle boat, passengers are part of the crew. Working as a team under the command of the guide, everyone vigorously paddles to propel and steer the raft. The guide's commands, often shouted over the roar of rushing water, include "Forward!" "Backpaddle!" and "Stop!" To turn the raft, the guide shouts "Left!" (in which case paddlers on the left side backpaddle, while those on the right paddle forward) and "Right!" (vice versa). The front paddler on each side of the raft sets the cadence, while the paddlers behind synchronize their strokes to the leaders. Novice paddlers can usually pick up the basics quickly enough to negotiate easy rapids, but to get through large, powerful rapids safely, paddlers must have well-practiced skills as well as reasonable upper-body strength and endurance. In all cases, teamwork and coordination are essential. A more recent development is the hybrid oar-and-paddle boat, in which the guide rows while everyone else paddles. Oar-and-paddle boats, when operated by a competent group, are exceptionally maneuverable for their size.

Most whitewater rafters go on half-day or one-day trips, in which the thrill of "shooting the rapids" is the primary focus. Multi-day raft trips into remote areas, however, expand the focus to the broader outdoor experience. Rafters stop each night at a camping spot on a beach or level area along the shore. While the guides set up tents and prepare dinner, rafters may hike, fish, swim, or watch wildlife.

Whitewater rafts generally range from 10 ft (3 m) to 18 ft (5.5 m) in length and carry anywhere from 4 to 13 people. A typical 14-ft (4.3-m) raft carries 6 passengers plus a guide. Smaller rafts are used on narrow rivers with tight rapids that demand high maneuverability. Longer boats are necessary on large rivers with high waves, or to carry more people.

Rafts are constructed from large inflatable tubes made of nylon or polyester fabric covered by layers of a rubber-like material called Hypalon or a plastic material such as polyvinyl chloride (PVC) or urethane. The tubes are inflated to a pressure of two to six pounds per square inch (psi). Rafts typically have six or seven separate air chambers, so that in case of a puncture the raft will remain afloat. A recent design innovation is the self-bailing floor, which is itself inflatable and is vented to allow water to quickly drain out. Oar boats have removable aluminum frames to support the oarlocks, a raised guide seat, and in some cases waterproof cargo boxes. Paddle boats do not have frames.

Safety equipment carried on the raft typically includes a radio, first-aid kit, whistles, and *throw-lines* (long lines with floats attached for easy grasping) in case someone falls overboard. All rafters wear life preservers at all times. The standard whitewater rafting vest, classified by the U.S. Coast Guard as Type V, has more flotation and attaches more securely than the Type III vests normally used in pleasure boating. Helmets may be worn in demanding rapids, especially in shallow, rocky rivers.

Rafters often wear special clothing to keep warm and dry. Waterproof paddle jackets and pants have tight closures around the neck and wrists, as well as mesh pockets that will not fill up with water. Polypropylene long underwear provides insulation when wet. If the water is cold, neoprene wet suits or dry suits may be worn. Footwear consists of water sandals or neoprene wet shoes. Paddling gloves keep the hands warm and prevent blisters.

On a multi-day trip into a remote area, whitewater rafters must take along camping gear, cooking equipment, and adequate food, as well as extra clothing and personal gear. These are carried, often by a separate cargo raft, in watertight boxes or *dry bags*, special rubber bags with watertight closures.

A *rapid* is a part of a river that flows swiftly and turbulently through shallows and narrows, or past boulders or other obstacles. Rapids are characterized by waves, which form when water passes around or over an obstacle such as a boulder. A *wave train* is a series of several waves spaced at regular intervals. *Holes* are violent and potentially dangerous vertical whirlpools that form just downstream from underwater obstructions, in which the water falls back on itself. A *chute* is a smooth, fast flow that drops sharply between two obstacles. An *eddy* is a relatively calm area of slowly swirling water that flows upstream behind an obstruction or near the shore, and functions as a place of refuge for rafters. The *eddy line* is the boundary between the eddy and the passing current.

The organization American Whitewater rates rapids from Class I through VI, according to their difficulty and potential danger. Class I (Easy) is lightly riffled water, not really a rapid at all. Class II (Novice) rapids require occasional simple maneuvering, and present little danger should a mishap occur. A Class III (Intermediate) rapid may have large, irregular waves that require some complex maneuvering. Anyone thrown from the boat can usually make it to shore without help. A Class IV (Advanced) rapid is intense and powerful, demanding quick and accurate maneuvers to avoid dangerous hazards. Swimmers are in some danger. Class V (Advanced) rapids are long, obstructed, and very violent, demanding the most expert skills and best equipment. Swimmers must be rescued immediately or risk serious injury or drowning. A Class VI (Extreme and Exploratory) rapid is considered unrunnable by rafts.

In planning a trip, rafters take into account more than just the difficulty rating of the rapids. Cold water can greatly increase the potential risk of a raft trip, because of the potential for hypothermia. The water level of the river is also an important factor. High water levels, triggered by rain, melting snow, or the release of water from a dam upstream, can drastically change a rapid and alter its rating. Generally, higher water levels make a rapid more difficult. Sometimes, though, rapids are trickier at lower levels, because obstacles that were previously below the surface become exposed.

A competent raft guide must be able to "read" the river — to recognize dangerous holes, see complex flow patterns well ahead of time, and visualize where the current will take the raft. He then must maneuver the raft to steer it safely past the obstacles. On commercial trips, guides typically know the rapids by heart and employ a carefully choreographed sequence of maneuvers for each one.

In Class IV and V rapids, mistakes in judgment or rowing technique are potentially hazardous. The raft may hit a boulder and lodge tightly against it, locked in place by the pressure of the current. This is called wrapping. A raft may also hit an obstruction or a wave and capsize, spilling its occupants into the water. Swimmers in Class IV and V rapids face a number of hazards. They may become trapped underneath the upturned raft. "Keeper" holes may repeatedly pull them under the water for long periods. A swimmer may be pinned underwater against a strainer (fallen tree or bush) or an undercut rock (boulder or rock wall with a flat, downward-facing surface). In shallow water a swimmer may suffer foot entrapment, in which the foot gets wedged between rocks while the body is held under water by the force of the current.

To minimize these kinds of hazards, novice rafters are given safety briefings before a trip. As a further safety measure, rafts typically travel in groups, so that quick assistance is always nearby. In Class V rapids, rafts are sometimes escorted by rescue kayaks or *catarafts*, small, highly maneuverable and stable pontoon craft that can quickly pluck swimmers from the water. Sometimes, on an expeditionary trip down an unfamiliar river or because of changing water levels, it may be necessary to scout a rapid — to pull over and examine it from shore. If the rapid appears too dangerous, rafters must walk around it along the riverbank. The empty rafts can be dealt with in one of three ways: *lined* through the rapids, by attaching them to ropes and pulling them along from the shore; *ghost-boated* — that is, cast adrift to float through willy-nilly, then recovered at the end of the rapid; or *portaged*, dragging or carrying them around the rapid along the shoreline. Steep canyon walls, dense trees, or poor footing can make portaging extremely difficult or impossible. In some cases, helicopters are used to portage around unrunnable rapids.

Despite the potential hazards, fatalities in commercial whitewater rafting are rare. In a typical year, out of an estimated 3 million rafters on more than 200 rivers in the United States, about half a dozen people drown on commercial rafting trips.

However, the safety record of private, noncommercial raft trips is not as good. An estimated two dozen people drown each year out of a much smaller group of participants.

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