

МІНІСТЕРСТВО ОСВІТИ І НАУКИ, МОЛОДІ ТА СПОРТУ УКРАЇНИ
ХАРКІВСЬКА НАЦІОНАЛЬНА АКАДЕМІЯ
МІСЬКОГО ГОСПОДАРСТВА

ЗБІРНИК ТЕКСТІВ І ЗАВДАНЬ
ДЛЯ ОРГАНІЗАЦІЇ ПРАКТИЧНОЇ РОБОТИ
З ДИСЦИПЛІНИ
«ІНОЗЕМНА МОВА (ЗА ПРОФЕСІЙНИМ
СПРЯМУВАННЯМ)»
(англійська мова)

*(для студентів I курсу заочної форми навчання
за напрямом підготовки 6.060101 - «Будівництво»,
спеціальність «Теплогазопостачання і вентиляція »)*

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Збірник текстів і завдань для організації практичної роботи з дисципліни «Іноземна мова (за професійним спрямуванням)» (англійська мова) (для студентів 1 курсу заочної форми навчання напряму підготовки 6.060101- “Будівництво”, спеціальності “Теплогазопостачання і вентиляція”)/ Харк. нац. акад. міськ. госп-ва; уклад.: Н. С. Кладько. – Х.: ХНАМГ, 2012 – 55 с.

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Методичні вказівки призначені для організації практичної роботи студентів у першому та другому семестрах згідно з затвердженою робочою програмою навчальної дисципліни «Іноземна мова за професійним спрямуванням», укладеної відповідно освітньо-кваліфікаційним вимогам до знань і вмінь студентів напряму підготовки 6.060101 «Будівництво», спеціальності “Теплогазопостачання і вентиляція”, які в майбутньому будуть працювати у сфері будівництва.

Затверджено на засіданні кафедри іноземних мов,
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INTRODUCTION

These educational materials are designed for the students of the 1 course of speciality ” Gas and Heating Supply and Ventilation Systems “ to develop their knowledge and skills in English language according to their profession. The purpose of the instructions is to present systematically texts and to drill them in a wide variety of exercises.

The manual is based on the authentic texts concerning the Heating, Ventilation and Gas Supplying problems. It also has the tasks for reading, translating, lexical and grammar tasks, texts for self-study. It has seven units. Each unit contains:

- a) text selected for reading and study in class. Students have to read and to translate the text under the supervision of the teacher;
- b) keywords, mostly taken from the texts. A group of words is presented as the core vocabulary;
- c) a number of varied comprehension drills.

The manual can be also recommended for student’ self-study. It is expected to teach students working at English texts on their own, to increase the level of their knowledge and to form foreign communicative competence.

UNIT ONE. ENGLISH IN OUR LIFE

Make sure you know these words:

definition	– определение
ape	– обезьяна, примат
utter	– издавать звук; произносить
lack	– испытывать недостаток
tit	– синица

1. Read the Text 1 and answer the following questions.

What Is Language?

A language is a signalling system which operates with symbolic vocal sounds, and which is used by a group of people for the purposes of communication.

Let us look at this definition in more detail because it is language, more than anything else, that distinguishes man from the rest of the animal world.

Other animals, it is true, communicate with one another by means of cries: for example, many birds utter warning calls at the approach of danger; apes utter different cries, such as expressions of anger, fear and pleasure. But these various means of communication differ in important ways from human language. For instance, animals' cries are not articulate. This means, basically, that they lack structure. They lack, for example, the kind of structure given by the contrast between vowels and consonants. They also lack the kind of structure that enables us to divide a human utterance into words.

We can change an utterance by replacing one word in it by another: a good illustration of this is a soldier who can say, e.g., 'tanks approaching from the north', or he can change one word and say 'aircraft approaching from the north' or 'tanks approaching from the west'; but a bird has a single alarm cry, which means 'danger!'

This is why the number of signals that an animal can make is very limited: the great tit is a case in point; it has about twenty different calls, whereas in human language the number of possible utterances is infinite. It also explains why animal cries are very general in meaning.

1. What is a language?
2. What is the main role of any language?
3. What other means of communication are there?
4. Why is language universal?

Make sure you know these words:

jumbo jet	– реактивный лайнер
worldwide	– во всем мире
radio and television	
broadcasting	– радио и телевидение
retrieval	– поиск информации, поиск данных, информационный поиск
infiltration	– проникновение
abolition	– отмена, аннулирование
eradicate	– искоренять, истреблять

2. Read the Text 2 and decide if the statements after it are true (T) or false (F).

English As a World Language

English is losing its political and cultural associations and becoming the property of all cultures. Over 70 countries in the world use English as the official or semi-official language, and in 20 more English occupies an important position. It is the main foreign language taught within most school systems worldwide, many newspapers are published in English and it is the language of much radio and television broadcasting. English is the language of international business, the main language of airports, air traffic control and international shipping. It is the language of science, technology and medicine, and it is estimated that two-thirds of all scientific papers today are first published in English. It is the language of diplomacy and sport; it is one of the working languages of the United Nations and the language used by the International Olympic Committee. International pop culture and advertising are also dominated by English. 70% of the world's mail is written in English, and 80% of all information in electronic retrieval systems is stored in English.

English infiltration of foreign languages is often regarded with horror. One of the Presidents of France, Pompidou, recommended a return to totally unpolluted French with an abolition of all Anglicisms. In official documents 'fast food' and 'jumbo jet' were to be referred to by French expressions instead. But it would be difficult to eradicate the use of such familiar French terms as 'le weekend', 'le sandwich', or 'le parking'. French is not the only 'polluted' language. In German we find 'der Babysitter', 'der Bestseller' and 'der Teenager'. 'Il weekend' turns up again in Italian, where we can also find 'la pop art' and 'il popcorn'. 'Jeans' is found in almost every language of the world, and in Spanish we also have 'pancakes', and 'sueter' (sweater). Russian young people like to wear the latest trainer-style 'shoozy'. But this invasion is not one-sided. Other languages have quietly been getting their own back for a long time. Native English speakers may think they are speaking 'pure' English when they talk about the alphabet, the

traffic, a mosquito, a sofa, a garage, their pyjamas or their boss, but Greek, Italian, Arabic, French, Hindi and Dutch speakers know better!

1. English is losing its importance for the world culture. ()
2. More than 90 countries in the world use English as their official and semi-official language. ()
3. English is one of the main languages for mass media. ()
4. English is the working language of all international airlines. ()
5. All scientific papers today are first published in English. ()
6. The staff of all foreign embassies should know English. ()
7. English is the only language that ‘pollutes’ other languages. ()
8. It is impossible to preserve language purity in the age of computer technologies. ()

UNIT TWO. EDUCATION

Make sure you know these words:

guild	– организация
scholar	– ученик
grant	– грант
donation	– денежное пожертвование
funding	– финансирование

1. Read the Text 1.

The Development of Universities.

The word ‘university’ comes from the Latin word ‘universitas’, meaning ‘the whole’. Later, in Latin legal language ‘universitas’ meant ‘a society, guild or corporation’. Thus, in mediaeval academic use the word meant an association of teachers and scholars. The modern definition of a university is ‘an institution that teaches and examines students in many branches of advanced learning, awarding degrees and providing facilities for academic research’.

The origins of universities can be traced back to the Middle Ages, especially the 12 – 14th centuries. In the early 12th century, long before universities were organised in the modern sense, students gathered together for higher studies at certain centres of learning. The earliest centres in Europe were at Bologna in Italy,

for law, founded in 1088; Salerno in 1115, Italy for medicine; and Paris, France, for philosophy and theology, founded in 1150. Other early ones in Europe were at Prague, Czechoslovakia, founded in 1348; Vienna, Austria, founded in 1365; and Heidelberg, Germany, founded in 1386.

The first universities in England were established at Oxford in 1185 and at Cambridge in 1209. The first Scottish university was founded at St. Andrews in 1412. By comparison, the oldest universities in the U.S.A. are at Harvard, founded in 1636, and Yale, established in 1701.

In the 15th and 16th centuries, three more universities were founded in Scotland: at Glasgow in 1415, Aberdeen in 1494, and Edinburgh in 1582. The next English university to be founded was not until the 19th century – London, in 1836. This was followed, later in the 19th and early 20th centuries, by the foundation of several civic universities. These had developed from provincial colleges which were mainly situated in industrial areas. Manchester, for example, received its charter in 1880, and Birmingham in 1900. In addition, the federal University of Wales was established in 1893 comprising three colleges.

Several other civic universities were founded in the 1940s and 1950s, such as Nottingham in 1948, Southampton in 1954 and Exeter in 1957. However, it was in the 1960s that the largest single expansion of higher education took place in Britain. This expansion took three basic forms: existing universities were enlarged; new universities were developed from existing colleges; and seven completely new universities were founded. The latest, Kent University, in south-east England, and Warwick, in the Midlands, were both founded in 1965. Like the other new universities, they are situated 45 kilometres away from town centres and are surrounded by parkland and green fields.

Finance for universities comes from the three sources, namely grants from the government (the largest), fees paid by students, and donations from private sources. All the British universities, except one, receive some government funding. The exception is Buckingham, which is Britain's only independent university, and which received the Royal Charter in 1983.

One of the latest university developments was the foundation in 1969 of the Open University. It is a non-residential university which provides part-time degree and other courses. It uses a combination of correspondence courses, television and radio broadcasts, and summer schools organized on a regional basis.

2. Reading Comprehension.

A. Answer the following questions.

1. When were the first universities in Europe organised?
2. What is the oldest university in Great Britain?
3. What are the sources where finance for universities comes from?
4. What is Open University?

B. Choose the following most suitable words to fill the gaps in the sentences below.

education educator educated educational educative educated(v)

- a. Those who receive training are lesser than those who receive _____.
- b. Young people need to be _____ in new ways to be employable.
- c. The approach of classroom testing against the hearing norms has a long tradition among _____ and researchers.
- d. The boy came from a good home, was well _____ and had every advantage.
- e. The _____ process needs to begin early in a child's life.
- f. The American _____ system is in need of reform.

C. Find out what is 'a degree'. Fill in the gaps with one of the words given in the box and read the short text about a degree.

Bachelors Master Doctor degree final exam research qualification thesis
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A Degree

A degree is an academic (1) _____ awarded at most universities and colleges upon completion of a higher education course (a first (2) _____) or a piece of (3) _____ (higher degree). If students pass their (4) _____ at the end of a three-year course, they get their first degree. Students with first degree become (5) _____ of Arts or Science (B.A. or B.S.). If they want to go a step further and become (6) _____ of Arts or Science, they have to write an original paper, or (7) _____, on some subject based on short period of research, usually soon after graduation. If students wish to teach in a university, they will work for higher degree of a (8) _____ of Philosophy – a Ph.D. For this they will have to carry out some important research work.

3. Read the Text 2 about Kharkiv National Municipal Academy.

Kharkiv National Municipal Academy

Kharkiv National Municipal Academy is a modern scientific and educational complex, that trains specialists in all fields of educational and specialization standards: from junior specialist, Bachelor and Master to Candidates and Doctors of Sciences on the basis of higher education.

Academy trains specialists for municipal construction management, transport, electric and energy supply, water and gas supply industries; urban

economics; hotel management and tourism; improvement of urban ecology and population areas ecology.

Academy trains more than 16000 students, 300 students are citizens of 30 countries of the world. The branches of Academy successfully work in Greece and Israel. Academy has close scientific and business contacts with higher educational establishments, scientific and research institutions from 11 countries of the world, among them are France, Germany, Finland, the USA, Great Britain, Sweden, Netherlands, Israel, etc.

The staff of Academy enumerates 500 teachers, 70 Professors and Doctors of Sciences, more than 300 PhD lecturers. 8 world standard schools, which are headed by Doctors of Sciences, Professors, Candidates of Sciences, and PhD lecturers, successfully work in Academy.

Academy has 6 educational corps, a library with the stock of 882000 volumes, a student campus with 6 hostels, a sport centre with many large and small game halls, halls for track and fields athletics, gymnastics, bodybuilding and boxing. There is a student sanatorium, dining halls and numerous cafes.

Kharkiv National Municipal Academy trains students at 11 departments such as Town Planning and Development, Economics and Entrepreneurship, Management, Urban Engineering Ecology, Power Supply and City Lighting, City Electric Transport, Correspondence Department, Foreign Students Department, Postgraduate and Distant Learning Department, Upgrading Skills and Retraining Department and Preparatory Department.

According to the level of training the Academy graduates get the diplomas of Bachelor Degree, Specialist Degree and Master Degree in the following specialties as

Industrial and Civil Construction, Labour Safety in Construction, Urban Construction and Economy, Technical Maintenance, Engineering and Reconstruction of Buildings, Geo-Information Systems and Technologies on the Town Planning and Development Department.

The academic year starts on September, 1. The students' training is carried out according to the academic curriculum and programmes, approved by the Ministry of Education and Science of Ukraine.

After acquiring Master's Degree the students can continue their education at the post-graduate course in 21 specialties. The term of training at the post-graduate course is 3 years.

A. Make up questions about Kharkiv National Municipal Academy and ask the group mates.

- 1) _____ ?
- 2) _____ ?
- 3) _____ ?

- 4) _____ ?
- 5) _____ ?
- 6) _____ ?
- 7) _____ ?
- 8) _____ ?
- 9) _____ ?
- 10) _____ ?

B. Fill in the gaps in the sentences given below, using the words from the list.

*** Bachelor * construction * establishment * urban * foreign * supplies
* received * research * provide * maintenance of**

- 1) A _____ of Education course lasts three or four years.
- 2) The problem of air pollution is especially serious in _____ areas.
- 3) The company _____ fish to local shops and restaurants.
- 4) Recent _____ has shown that human language is much older than we previously thought.
- 5) It is amazing how dominant the educational _____ has been for so long, which is totally unacceptable.
- 6) _____ competition provides consumers with a greater variety of goods.
- 7) He _____ his degree at eighteen, the youngest graduate in Thiel history.
- 8) The purpose of the UN is the _____ international peace and security.
- 9) About 3,000 housing units are under _____ in the city.
- 10) The university should _____ more facilities for disabled students.

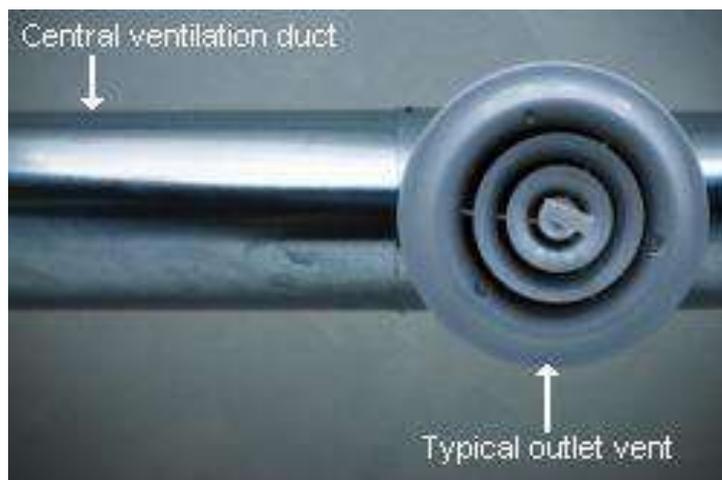
UNIT THREE. WHAT IS *HVAC*?

Make sure you know these words:

indoor	- домашний, комнатный
fluid mechanics	- механика жидкости
humidity	- сырость, влажность
interrelated	- взаимосвязанный
installation	- установка; сборка
distribution	- распределение; раздача
permit	- позволение, разрешение
code-compliance	- юридич. одобрение, согласие

1. Read the Text 1.

HVAC (pronounced either "H-V-A-C" or "aitch-vak") is an acronym that stands for the closely related functions of "Heating, Ventilating, and Air Conditioning"- the technology of indoor environmental comfort. HVAC system design is a major subdiscipline of mechanical engineering, based on the principles of thermodynamics, fluid mechanics, and heat transfer. Refrigeration is sometimes added to the field's abbreviation as HVAC&R or HVACR, or ventilating is dropped as in HACR (such as the designation of HACR-rated circuit breakers). HVAC is particularly important in the design of medium to large industrial and office buildings such as skyscrapers and in marine environments such as aquariums, where safe and healthy building conditions are regulated with temperature and humidity, as well as "fresh air" from outdoors.



Background.

The invention of the components of HVAC systems went hand-in-hand with the industrial revolution, and new methods of modernization, higher efficiency, and system control are constantly introduced by companies and inventors all over the world. The three central functions of heating, ventilating, and air-conditioning

are interrelated, providing thermal comfort, acceptable indoor air quality, within reasonable installation, operation, and maintenance costs. HVAC systems can provide ventilation, reduce air infiltration, and maintain pressure relationships between spaces. How air is delivered to, and removed from spaces is known as room air distribution.

In modern buildings the design, installation, and control systems of these functions are integrated into one or more HVAC systems. For very small buildings, contractors normally "size" and select HVAC systems and equipment. For larger buildings, building services designers and engineers, such as mechanical, architectural, or building services engineers analyze, design, and specify the HVAC systems, and specialty mechanical contractors build and commission them. Building permits and code-compliance inspections of the installations are normally required for all sizes of buildings.

A. Choose the following most suitable words to fill the gaps in the sentences below.

*** reasonable * equipment * skyscrapers * scientist * indoor * quality
* inspection**

1. The hotel has a heated _____ swimming pool.
2. Franklin was a _____, an inventor, and a statesman.
3. You should check all your electrical _____ regularly.
4. Close _____ of the plane's engines revealed several small defects.
5. The recent hot, humid weather is affecting air _____.
6. His office looked out on the other _____ of downtown Dallas.
7. Do you think it's _____ to expect people to work more than 60 hours a week?

2. Read the Text 2 about HVAC industry and standards.

North America.

In the United States, HVAC engineers generally are members of the *American Society of Heating, Refrigerating, and Air-Conditioning Engineers* (ASHRAE). ASHRAE is an international technical society for all individuals and organizations interested in HVAC. The Society, organized into Regions, Chapters, and Student Branches, allows exchange of HVAC knowledge and experiences for the benefit of the field's practitioners and the public. ASHRAE provides many opportunities to participate in the development of new knowledge via, for example, research and its many Technical Committees. These committees meet typically twice per year at the ASHRAE Annual and Winter Meetings. A popular product

show, the AHR Expo, is held in conjunction with each Winter Meeting. The Society has approximately 50,000 members and has headquarters at Atlanta, Georgia, USA.

American design standards are legislated in the Uniform Mechanical Code or International Mechanical Code. In certain states, counties, or cities, either of these codes may be adopted and amended via various legislative processes. These codes are updated and published by the **International Association of Plumbing and Mechanical Officials (IAPMO)** or the **International Code Council (ICC)** respectively, on a 3-year code development cycle. Typically, local Building Permit Departments are charged with enforcement of these standards on private and certain public properties.

United Kingdom.

The Chartered Institute of Building Services Engineers is a body that covers the essential Service (systems architecture) that allow buildings to operate. It includes the electrotechnical, heating, ventilating, air conditioning, refrigeration and plumbing industries. To train as a building services engineer, the academic requirement is **GCSEs** (General Certificate of Secondary Education) (A-C) / Standard Grades (1-3) in Maths and Science, which are important in measurements, planning and theory. Employers will often want a degree in a branch of engineering, such as building environment engineering, electrical engineering or mechanical engineering.

Within the construction sector, it is the job of the building services engineer to design and oversee the installation and maintenance of the essential services such as gas, electricity, water, heating and lighting, as well as many others. These all help to make buildings comfortable and healthy places to live and work in. Building Services is part of a sector that has over 51,000 businesses and employs over 500,000 people. This sector has an annual turnover of £19.3 billion which represents 2%-3% of the GDP.

The most recognized standards for HVAC design is based on ASHRAE data. ASHRAE is the American Society of Heating, Refrigerating and Air-Conditioning Engineers. The ASHRAE Handbook's most general volume, of four, is Fundamentals; it includes heating and cooling calculations. Each volume of the ASHRAE Handbook is updated every four years. The design professional must consult ASHRAE data for the standards of design and care as the typical building codes provides little to no information on HVAC design practices; such codes, such as the UMC and IMC, do include much details on installation requirements, however. Other useful reference materials include items from SMACNA, ACCA, and technical trade journals.

A. Complete the table.

North America.	United Kingdom.

B. Read the text again and write down the correct endings of the sentences.

1. The Society, organized into Regions, Chapters, and Student Branches, allows...
.....
2. ASHRAE provides many opportunities
3. American design standards are legislated in
4. Within the construction sector, it is the job of the
5. Building Services is part of a sector that has over
6. Each volume of the ASHRAE Handbook is
7. The design professional must consult ASHRAE data for



3. Read the Text 3 Some facts about ASHRAE

ASHRAE logo

-the **American Society of Heating, Refrigerating and Air Conditioning Engineers**

(ASHRAE; pronounced /æf.reɪ/) is an international technical society for all individuals and organizations interested in **heating, ventilation, air-conditioning, and refrigeration (HVAC&R)**. The Society, organized into Regions, Chapters, and Student Branches, allows exchange of HVAC&R knowledge and experiences for the benefit of the field's practitioners and the public. ASHRAE provides many opportunities to participate in the development of new knowledge via, for example, research and its many Technical Committees. These committees meet typically twice per year at the ASHRAE Annual and Winter Meetings. A popular product show, the AHR Expo, is held in conjunction with each Winter Meeting. The Society has approximately 50,000 members and has headquarters at Atlanta, Georgia, USA.

History of ASHRAE.

ASHRAE was founded in 1894 at a meeting of engineers in New York City. It has held an annual meeting since 1895. Until 1954 it was known as the **American Society of Heating and Ventilating Engineers (ASHVE)**; in that year it changed its name to the **American Society of Heating and Air-Conditioning Engineers (ASHAE)**. Its current name and organization came from the 1959 merger of ASHAE and the **American Society of Refrigerating Engineers (ASRE)**. The result, ASHRAE, despite having 'American' in its name, is an influential international organization. Amongst other international activities, it helps organize international events.

A. Answer the following questions.

1. What is **ASHRAE**?
2. What opportunities does **ASHRAE** provide?
3. How often do committees meet?
4. When and how was changed the name of the technical society?
5. Is **ASRE** an American or International organization?

4. Read the Text 4 . Heating / Central heating.

Make sure you know these words:

furnace	- очаг, топка
heat pump	- тепловой насос
mounted	- водруженный на платформу, возвышение
circulate	- циркулировать
ductwork	- система каналов; система труб; трубопровод
resistance	- сопротивление; отпор
filament	- нить накала
baseboard	- плинтус
offset	- возмещать, компенсировать
vent	- входное или выходное отверстие; отдушина
buoyant	- плавучий; способный держаться на поверхности
subjectively	- субъективно, индивидуально
air ducts	- вентиляционный канал, воздуховод

There are different types of standard heating systems. Central heating is often used in cold climates to heat private houses and public buildings. Such a system contains a boiler, furnace, or heat pump to heat water, steam, or air, all in a central location such as a furnace room in a home or a mechanical room in a large building. The system also contains either ductwork, for forced air systems, or piping to distribute a heated fluid and radiators to transfer this heat to the air. The term radiator in this context is misleading since most heat transfer from the heat exchanger is by convection, not radiation. The radiators may be mounted on walls or buried in the floor to give under-floor heat.

In boiler fed or radiant heating systems, all but the simplest systems have a pump to circulate the water and ensure an equal supply of heat to all the radiators. The heated water can also be fed through another (secondary) heat exchanger inside a storage cylinder to provide hot running water.

Forced air systems send heated air through ductwork. During warm weather the same ductwork can be used for air conditioning. The forced air can also be filtered or put through air cleaners.

Heating can also be provided from electric, or resistance heating using a filament that becomes hot when electricity is caused to pass through it. This type of heat can be found in electric baseboard heaters, portable electric heaters, and as backup or supplemental heating for heat pump (or reverse heating) system.

The heating elements (radiators or vents) should be located in the coldest part of the room, typically next to the windows to minimize condensation and offset the convective air current formed in the room due to the air next to the window becoming negatively buoyant due to the cold glass. Devices that direct vents away from windows to prevent "wasted" heat defeat this design intent. Cold air drafts can contribute significantly to subjectively feeling colder than the average room temperature. Therefore, it is important to control the air leaks from outside in addition to proper design of the heating system.

The invention of central heating is often credited to the ancient Romans, who installed a system of air ducts called a hypocaust in the walls and floors of public baths and private villas.

A. Read the Text 4 and decide if the statements after it are true (T) or false (F).

1. Central heating is seldom used in cold climates to heat private houses and public buildings. ()

2. The radiators may be mounted on walls or buried in the floor to give under-floor heat. ()

3. The cold water can also be fed through another (secondary) heat exchanger inside a storage cylinder to provide hot running water. ()

4. During warm weather the same ductwork cannot be used for air conditioning.()

5. Heating can also be provided from electric. ()

6. The heating elements (radiators or vents) shouldn't be located in the coldest part of the room, typically next to the windows. ()

7. It is important to control the air leaks from outside in addition to proper design of the heating system.()

B. Write down some sentences about the article “Heating / Central heating” beginning the phrases below.

The headline of the article is

It deals with

The article widely covers the problem of

It carries information on

The paper describes

In conclusion

UNIT FOUR. VENTILATING

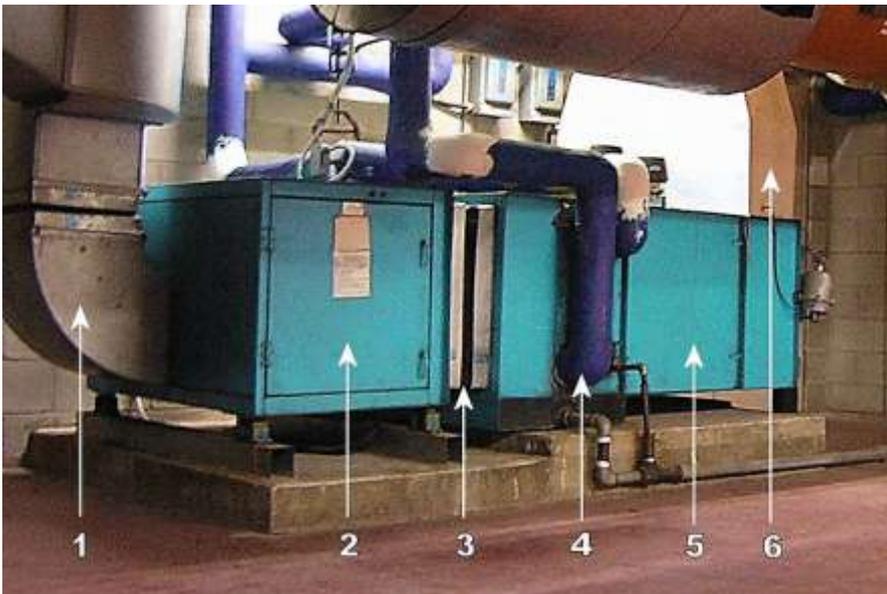
Make sure you know these words:

moisture	- влажность, сырость
odor	- запах; аромат
airborne	- переносимый или перевозимый по воздуху
stagnation	- застой
duct	- трубопровод; труба
fan	- вентилятор
coil	- кольцо, катушка
hybrid	- разнородный; смешанный

1. Read the Text 1.

What is Ventilating?

Ventilating is the process of "changing" or replacing air in any space to control temperature or remove moisture, odors, smoke, heat, dust and airborne bacteria. Ventilation includes both the exchange of air to the outside as well as circulation of air within the building. It is one of the most important factors for maintaining acceptable indoor air quality in buildings. Methods for ventilating a building may be divided into mechanical/forced and natural types. Ventilation is used to remove unpleasant smells and excessive moisture, introduce outside air, and to keep interior building air circulating, to prevent stagnation of the interior air.



An air handling unit is used for the heating and cooling of air in a central location.

Typical AHU(an air handling unit) components:

- 1 - Supply duct
- 2 - Fan compartment
- 3 - Flexible connection
- 4 - Heating and/or cooling coil
- 5 - Filter compartment
- 6 - Return and fresh air duct

Ventilation includes both the exchange of air to the outside as well as circulation of air within the building. It is one of the most important factors for maintaining acceptable indoor air quality in buildings. Methods for ventilating a building may be divided into *mechanical/forced* and *natural types*.

2. Read the Text 2. Types of ventilation:

- 1) ***Mechanical or forced ventilation:*** through an air handling unit or direct injection to a space by a fan.
- 2) ***Natural ventilation*** occurs when the air in a space is changed with outdoor air without the use of mechanical systems, such as a fan.
- 3) ***Mixed Mode Ventilation or Hybrid ventilation:*** utilizes both mechanical and natural ventilation processes.
- 4) ***Infiltration*** is separate from ventilation, but is often used to provide ventilation air.

1.) Mechanical or forced ventilation.

A. Match the following words with their definitions.

1. moisture	a) a pipe on a car or machine that waste gases pass through
2. condensation	b) small amounts of water that are present in the air, in a substance, or on a surface
3. occupant	c) the inner surface of the top part of a room
4. ceiling	d) a larger amount of something than is allowed or needed
5. reduce	e) the flat surface that you stand on inside a building
6. exhaust (pipe)	f) a machine with turning blades that is used to cool the air in a room by moving it around
7. floor	g) o make something smaller or less in size, amount
8. fan	h) someone who lives in a house, room
9. excess	i) small drops of water that are formed when steam or warm air touches a cold surface

"Mechanical" or "forced" ventilation is used to control indoor air quality. Excess humidity, odors, and contaminants can often be controlled via dilution or replacement with outside air. However, in humid climates much energy is required to remove excess moisture from ventilation air.

Kitchens and bathrooms typically have mechanical exhaust to control odors and sometimes humidity. Factors in the design of such systems include the flow rate (which is a function of the fan speed and exhaust vent size) and noise level. If the ducting for the fans traverse unheated space (e.g., an attic), the ducting should be insulated as well to prevent condensation on the ducting. Direct drive fans are available for many applications, and can reduce maintenance needs.

Ceiling fans and table/floor fans circulate air within a room for the purpose of reducing the perceived temperature because of evaporation of perspiration on the skin of the occupants. Because hot air rises, ceiling fans may be used to keep a room warmer in the winter by circulating the warm stratified air from the ceiling to the floor. Ceiling fans do not provide ventilation as defined as the introduction of outside air.

B. Choose the following most suitable words to fill the gaps in the sentences below.

*** available * climate * quality * floor * condensation * design * preheated**

1. Cody spilled his milk on the kitchen_____.
2. Los Angeles has a warm, dry_____.
3. _____may develop on walls where moisture is a problem.

4. Remove all the packaging from the pizza and place it in a _____ oven.
5. The success of the product was largely due to good_____.
6. We need someone to work on this job immediately. Who's_____?
7. She always insists that her writing paper is of good_____.

Make sure you know these words:

supplying	- снабжающий, подводящий
external	- внешний, наружный
stack vent	- вентиляционный канал; вентиляционная труба
operable	- действующий, работающий
permit	- позволение, разрешение
occupant	- житель; жилец; обитатель
via solely	- посредством единственно, исключительно, только
damper	- увлажнитель

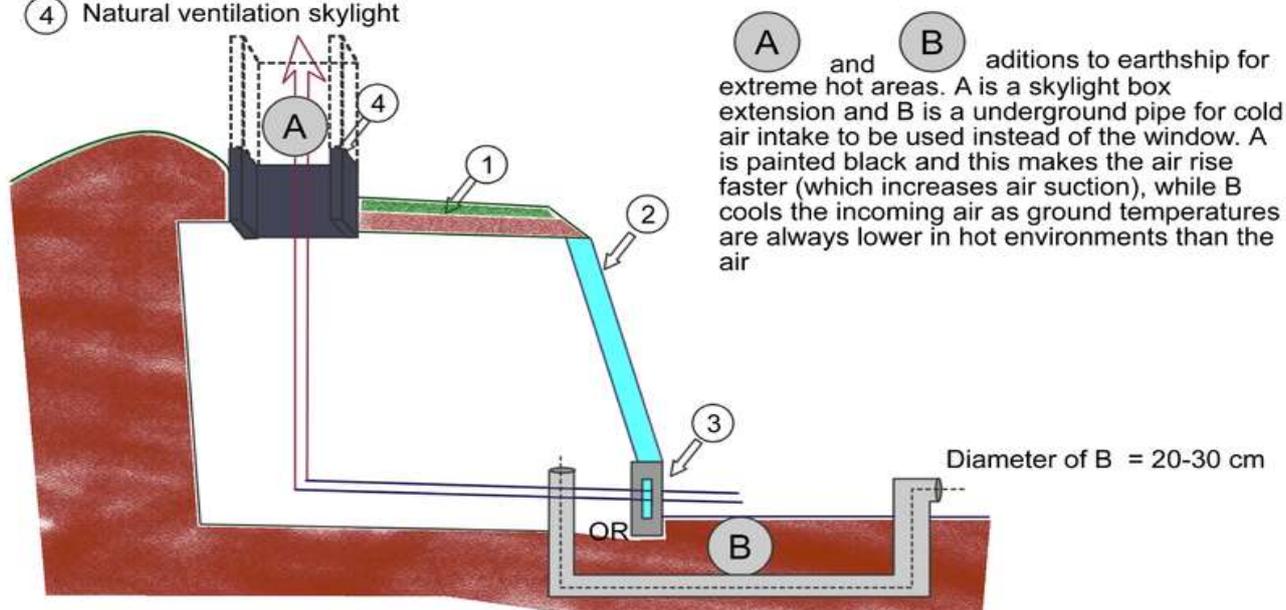
2.) Natural ventilation-

-is the process of supplying and removing air through an indoor space by natural means without using mechanical systems. It refers to the flow of external air to an indoor space as a result of pressure or temperatures differences. There are **two types of natural ventilation** occurring in buildings: **wind driven ventilation** and **stack ventilation**. The majority of buildings employing natural ventilation rely primarily on wind driven ventilation, but stack ventilation has several benefits. The most efficient design for a natural ventilation building should implement both types of ventilation.

Natural ventilation is the ventilation of a building with outside air without the use of a fan or other mechanical system. It can be achieved with operable windows or trickle vents when the spaces to ventilate are small and the architecture permits. In more complex systems warm air in the building can be allowed to rise and flow out upper openings to the outside (stack effect) thus forcing cool outside air to be drawn into the building naturally through openings in the lower areas. These systems use very little energy but care must be taken to ensure the occupants' comfort. In warm or humid months, in many climates, maintaining thermal comfort via solely natural ventilation may not be possible so conventional air conditioning systems are used as backups. Air-side economizers perform the same function as natural ventilation, but use mechanical systems' fans, ducts, dampers, and control systems to introduce and distribute cool outdoor air when appropriate.

Earthship with natural ventilation

- ① Earthsheltered building
- ② Window
- ③ Natural ventilation window (size 47 cm x 63.5cm)
- ④ Natural ventilation skylight



A. Read the text again and write down the correct endings of the sentences.

1. Natural ventilation refers to the flow
2. The majority of buildings employing
3. It can be achieved with operable
4. In more complex systems warm air in the building
5. In warm or humid months, in many climates,
6. Use mechanical systems' fans, ducts, dampers, and control systems to introduce

Read the Text 2.1 about Natural ventilation of boiler rooms and industrial buildings.

Match the following words and translations.

1. load	построенная по специальному заказу
2. warehouse	решетка, сетка
3. overhead (doors)	прочный, крепкий
4. manually	увеличивать, усиливать, улучшать
	Щит, сетка от

5. to enhance	вручную
6. (bird) screen	нагрузка, загруженность
7. custom-made grille	Верхний, надземный
8. solid (doors)	товарный склад

Due to high internal heat loads, natural ventilation of boiler rooms, warehouses, and other similar spaces is often employed. Often, conventional or overhead doors are manually opened to provide ventilation. When natural ventilation does not suffice alone, large box fans are often employed to enhance air movement.

But to provide security, and cooling-by-ventilation, some buildings have two sets of overhead doors in hot boiler and equipment rooms. The second set of doors are custom-made grilles with bird screens, similar to the security grilles used by some stores at indoor shopping malls. Some of the custom grilles have solid slats in the lowest section to reduce the amount of trash that might blow into the rooms. During hot weather the grilles help secure the opening while the solid doors are fully open. During cool and cold weather the solid doors can be partially or fully closed.

A. Read the text 2.1 and decide if the statements after it are true (T) or false (F).

1. Due to high internal heat loads, mechanical ventilation of boiler rooms, warehouses, and other similar spaces is often employed. ()
2. Overhead windows are manually opened to provide ventilation. ()
3. To provide security, and cooling-by-ventilation, some buildings have five sets of overhead doors in hot boiler and equipment rooms.()
4. The second set of doors are custom-made grilles with bird screens, similar to the security grilles. ()
5. During hot weather the grilles help secure the opening while the solid doors are fully close. ()

Make sure you know these words:

- | | |
|------------------------|---|
| whenever | - всякий раз когда; когда бы ни |
| feasible | - реальный, выполнимый |
| desirable | - желательный |
| conjunction | - сцепление, соединение |
| unpredictable external | - непредсказуемый внешний, наружный |
| internal conditions | - внутренние условия |
| be met | - удовлетворять, соответствовать
(желаниям, требованиям) |
| to restrict | - ограничивать |

3.) Mixed Mode Ventilation –

-refers to a hybrid approach to space conditioning that uses a combination of natural ventilation from operable windows (either manually or automatically controlled), and mechanical systems that include air distribution equipment and refrigeration equipment for cooling. A well-designed mixed-mode building begins with intelligent facade design to minimize cooling loads. It then integrates the use of air conditioning when and where it is necessary, with the use of natural ventilation whenever it is feasible or desirable, to maximize comfort while avoiding the significant energy use and operating costs of year-round air conditioning.

The mechanical and natural components may be used in conjunction with each other or separately at different times of day. The natural component, sometimes subject to unpredictable external weather conditions may not always be adequate to ventilate the desired space. The mechanical component is then used to increase the overall ventilation rate so that the desired internal conditions are met. Alternatively the mechanical component may be used as a control measure to regulate the natural ventilation process, for example, to restrict the air change rate during periods of high wind speeds.

A. Find the necessary ending to the following sentences.

1. A well-designed mixed-mode building begins with	a) comfort while avoiding the significant energy use and operating costs of year-round air conditioning.
2. The use of natural ventilation whenever it is feasible or desirable, to maximize	b) conditions may not always be adequate to ventilate the desired space.
3. The mechanical and natural components may be used in	c) air distribution equipment and refrigeration equipment for cooling.
4. The natural component, sometimes subject to unpredictable external weather	d) to increase the overall ventilation rate.
5. The mechanical component is then used	e) conjunction with each other or separately at different times of day.
6. Mechanical systems that include	f) a control measure to regulate the natural ventilation process.
7. The mechanical component may be used as	g) intelligent facade design to minimize cooling loads.

Make sure you know these words:

Infiltration	- просачивание, проникновение
unintentional	- непреднамеренный, ненамеренный
leakage	- течь, просачивание
exfiltration	- эксфильтрация (воздуха через стены или стыки); постепенное просачивание
stack effect	- самотяга ; образование тяги
accomplished	- законченный, полный
via	- через, сквозь
pressurize	- герметизировать

4.) Infiltration.

Infiltration is the unintentional or accidental introduction of outside air into a building, typically through cracks in the building envelope and through use of doors for passage. Infiltration is sometimes called air leakage. The leakage of room air out of a building, intentionally or not, is called exfiltration. Infiltration is caused by wind, negative pressurization of the building, and by air buoyancy forces known commonly as the stack effect.

Infiltration as ventilation air.

In many smaller buildings, 'forced' or 'mechanical' ventilation is not used to introduce ventilation air. Instead, natural ventilation, via operable windows and other openings, exhaust fans, and infiltration are used to provide ventilation air. Typically, at least one-third air change per hour is considered the minimum. Recently, **ASHRAE** (*American Society of Heating, Refrigerating and Air Conditioning Engineers*) Standard 62.2 has been adopted (2004); it clarifies the ventilation air requirements for low-rise residences. The Standard specifies that forced ventilation is required in houses with infiltration less than 0.35 **ACH** (*air changes per hour*). This is typically accomplished with heat recovery ventilation or exhaust fans running constantly or periodically.

Controlling infiltration.

Because infiltration is uncontrolled, and admits unconditioned air, it is generally considered undesirable except for ventilation air purposes. Typically, infiltration is minimized to reduce dust, to increase thermal comfort, and to decrease energy consumption. For all buildings, infiltration can be reduced via sealing cracks in a building's envelope, and for new construction or major renovations, by installing continuous **air retarders** (*vapor barrier or vapour barrier*) . In buildings where forced ventilation is provided, their HVAC designers typically choose to slightly pressurize the buildings by admitting more outside air than exhausting so that infiltration is dramatically reduced.

A. Answer the following questions.

1. Is infiltration the unintentional or accidental introduction of outside air into a building?
2. What is called exfiltration?
3. What is the stack effect?
4. What ventilation is used in many smaller buildings?
5. Is infiltration controlled?

UNIT FIVE. Ventilation equipment

- 5.1. Fume hood
- 5.2. Biological safety cabinet
- 5.3. Dilution ventilation
- 5.4. Room air distribution
- 5.5. Heat recovery ventilation

5.1) A fume hood or fume cupboard is a type of local ventilation device that is designed to limit exposure to hazardous or noxious fumes, vapors or dusts. A fume hood is typically a large piece of equipment enclosing five sides of a work area, the bottom of which is most commonly located at a standing work height.

Two main types exist, **ducted** and **recirculating**. The principle is the same for both types: air is drawn in from the front (open) side of the cabinet, and either expelled outside the building or made safe through filtration and fed back into the room.

Other related types of local ventilation devices include: clean benches, biosafety cabinets, glove boxes and snorkel exhausts. All these devices address the need to control airborne hazards or irritants that are typically generated or released within the local ventilation device. All local ventilation devices are designed to address one or more of **three primary goals**:

- 1) protect the user (fume hoods, biosafety cabinets, glove boxes);
- 2) protect the product or experiment (biosafety cabinets, glove boxes);
- 3) protect the environment (recirculating fume hoods, certain biosafety cabinets, and any other type when fitted with appropriate filters in the exhaust airstream).

Secondary functions of these devices may include explosion protection, spill containment, and other functions necessary to the work being done within the device.

Fume hoods typically protect only the user, and are most commonly used in laboratories where hazardous or noxious chemicals are released during testing, research, development or teaching. They are also used in industrial applications or

other activities where hazardous or noxious vapors, gases or dusts are generated or released.

Construction and location.

Fume hoods were originally manufactured from timber, but now epoxy coated mild steel is the main construction material. Fume hoods (fume cupboards) are generally available in 5 different widths; 1000 mm, 1200 mm, 1500 mm, 1800 mm and 2000 mm.[2] The depth varies between 700 mm and 900 mm, and the height between 1900 mm and 2700 mm. These can accommodate from one to three operators. They are generally set back against the walls and are often fitted with infills above, to cover up the exhaust ductwork. Because of their shape they are generally dim inside, so many have internal lights with vapor-proof covers. The front is a movable sash, usually in glass, able to move up and down on a counterbalance mechanism. On educational versions, the sides of the unit are often also glass, so that several pupils can gather around a fume hood at once



A common modern fume hood.

Fume hood exhaust options

****Auxiliary air***

This method is outdated technology. The premise was to bring non-conditioned outside air directly in front of the hood so that this was the air exhausted to the outside. This method does not work well when the climate changes as it pours frigid or hot and humid air over the user making it very uncomfortable to work or affecting the procedure inside the hood. This system also uses additional ductwork which can be costly.

****Constant air volume (CAV)***

This hood allows air to be pulled through a "bypass" opening from above as the sash closes. The bypass is located so that as you close the sash and reduce the sash opening, the bypass opening gets larger. The air going through the hood

maintains a constant volume no matter where the sash is positioned and without changing fan speeds.

***Variable air volume (VAV)**

This hood works with sash positioning controls to let the HVAC system know how much the sash is being opened. The controls then let the system know to reduce or increase the fan speed and thus the volume of air that needs to be exhausted.

5.2. Biological safety cabinet

A ***biosafety cabinet*** (BSC) — also called ***biological safety cabinet*** or ***microbiological safety cabinet*** — is an enclosed, ventilated laboratory workspace for safely working with materials contaminated with (or potentially contaminated with) pathogens requiring a defined biosafety level. Several different types of BSC exist, differentiated by the degree of biocontainment required. BSCs first became commercially available in 1950.

The primary purpose of a BSC is to serve as the primary means to protect the laboratory worker and the surrounding environment from pathogens. All exhaust air is HEPA-filtered as it exits the biosafety cabinet, removing harmful bacteria and viruses.



A microbiologist performing influenza research within a biosafety cabinet.

5.3. Dilution ventilation.

Dilution is a reduction in the concentration of a chemical (gas, vapor, solution). It is the process of reducing the concentration of a solute in solution, usually simply by mixing with more solvent. To dilute a solution means to add more solvent without the addition of more solute.

5.4. Room air distribution.

Characterizing how air is introduced to, flows through, and is removed from spaces is called room air distribution. HVAC airflow in spaces generally can be classified by two different types:

-mixing (or dilution) ---mixing systems generally supply air such that the supply air mixes with the room air so that the mixed air is at the room design temperature and humidity. In cooling mode, the cool supply air, typically around 55 °F (13 °C) (saturated) at design conditions, exits an outlet at high velocity. The high velocity supply air stream causes turbulence causing the room air to mix with the supply air;

-displacement--- displacement ventilation systems supply air directly to the occupied zone. The air is supplied at low velocities to cause minimal induction and mixing. This system is used for ventilation and cooling of large high spaces, such as auditoria and atria, where energy may be saved if only the occupied zone is treated rather than trying to control the conditions in the entire space. The displacement outlets are usually located at or near the floor with the air supply designed so the air flows smoothly across the floor. Where there is a heat source (such as people, lighting, computers, electrical equipment, etc.) the air will rise, pulling the cool supply air up with it and moving contaminants and heat from the occupied zone to the return or exhaust grilles above. By doing so, the air quality in the occupied zone is generally superior to that achieved with mixing room air distribution.

5.5. Heat recovery ventilation (HRV).

HRV or *mechanical ventilation heat recovery, or MVHR*, is an energy recovery ventilation system using equipment known as a heat recovery ventilator, heat exchanger, air exchanger, or air-to-air heat exchanger which employs a counter-flow heat exchanger (countercurrent heat exchange) between the inbound and outbound air flow. HRV provides fresh air and improved climate control, while also saving energy by reducing heating (and cooling) requirements.

A. Complete the table.

Type of ventilation equipment	<i>Function</i>	<i>Using</i>

B. Make up a summary of the article “Ventilation equipment” completing the phrases below.

1. The headline of the article is
2. The paper -is about.....
 - carries information on
 - informs the reader of
3. The article widely covers the problem of
4. The author starts by telling the reader
5. The article characterizes analyses, explains, describes, presents
6. In conclusion the paper point out that
7. The paper surveys briefly (presents some interesting facts about).....

UNIT SIX. Air conditioning.

Make sure you know these words:

appliance	- прибор, приспособление, устройство
refrigeration cycle	- холодильный цикл
vehicle	- транспортное средство, автомобиль
aqueduct	- акведук, водопровод
cistern	-бак; емкость, резервуар
large-scale	- крупномасштабный
volatile liquid	-быстро испаряющаяся жидкость
liquefy (ammonia)	-превращаться в жидкость (аммиак)
impact	- сильное воздействие; влияние
leak	-течь, утечка
refrigerant	-охлаждающее вещество, охладитель

1. Read the Text 1. Air conditioning .

History of Air conditioning.

Air conditioning is the removal of heat from indoor air for thermal comfort.

In another sense, the term can refer to any form of cooling, heating, ventilation, or disinfection that modifies the condition of air. An air conditioner (often referred to as AC or air con.) is an appliance, system, or machine designed to change the air temperature and humidity within an area (used for cooling as well

as heating depending on the air properties at a given time), typically using a refrigeration cycle but sometimes using evaporation, commonly for comfort cooling in buildings and motor vehicles.

The concept of air conditioning is known to have been applied in Ancient Rome, where aqueduct water was circulated through the walls of certain houses to cool them down. Other techniques in medieval Persia involved the use of cisterns and wind towers to cool buildings during the hot season. Modern air conditioning emerged from advances in chemistry during the 19th century, and the first large-scale electrical air conditioning was invented and used in 1902 by Willis Haviland Carrier.

The 2nd-century Chinese inventor Ding Huan of the Han Dynasty invented a rotary fan for air conditioning, with seven wheels 3 m (9.8 ft) in diameter and manually powered.

In the 17th century, Cornelius Drebbel demonstrated "turning Summer into Winter" for James I of England by adding salt to water

In 1758, Benjamin Franklin and John Hadley, a chemistry professor at Cambridge University, conducted an experiment to explore the principle of evaporation as a means to rapidly cool an object. Franklin and Hadley confirmed that evaporation of highly volatile liquids such as alcohol and ether could be used to drive down the temperature of an object past the freezing point of water.

In 1820, British scientist and inventor Michael Faraday discovered that compressing and liquefying ammonia could chill air when the liquefied ammonia was allowed to evaporate. In 1842, Florida physician John Gorrie used compressor technology to create ice, which he used to cool air for his patients in his hospital.

In 1902, the first modern electrical air conditioning unit was invented by Willis Haviland Carrier in Buffalo, New York. He found a job at the Buffalo Forge Company. While there, Carrier began experimenting with air conditioning as a way to solve an application problem for the Sackett-Wilhelms Lithographing and Publishing Company in Brooklyn, New York, and the first "air conditioner," designed and built in Buffalo by Carrier, began working on 17 July 1902.

In 1906, Stuart W. Cramer of Charlotte, North Carolina was exploring ways to add moisture to the air in his textile mill. He combined moisture with ventilation to "condition" and change the air in the factories, controlling the humidity so necessary in textile plants. Willis Carrier adopted the term and incorporated it into the name of his company. This evaporation of water in air, to provide a cooling effect, is now known as evaporative cooling.

The first air conditioners and refrigerators employed toxic or flammable gases, such as ammonia, methyl chloride, and propane, that could result in fatal accidents when they leaked. Thomas Midgley, Jr. created the first chlorofluorocarbon gas, Freon, in 1928.

Innovation in air-conditioning technologies continues, with much recent emphasis placed on energy efficiency and on improving indoor air quality. Reducing climate-change impact is an important area of innovation because, in addition to greenhouse-gas emissions associated with energy use, CFCs, HCFCs, and HFCs are, themselves, potent greenhouse gases when leaked to the

1. Some of the stolen _____ was discovered in an empty warehouse.
2. Only 373,804 _____ were sold despite a massive £50million ad blitz by the industry.
3. James plans _____ offers from other companies before making a decision.
4. Your bank should be able to _____ financial advice.
5. I was _____ as a night-watchman by the local hospital.
6. U.S. _____ of carbon dioxide are still increasing.
7. Half a decade on, global _____ has become the biggest environment story.

C. Write down some sentences about the article “History of Air conditioning” beginning the phrases below.

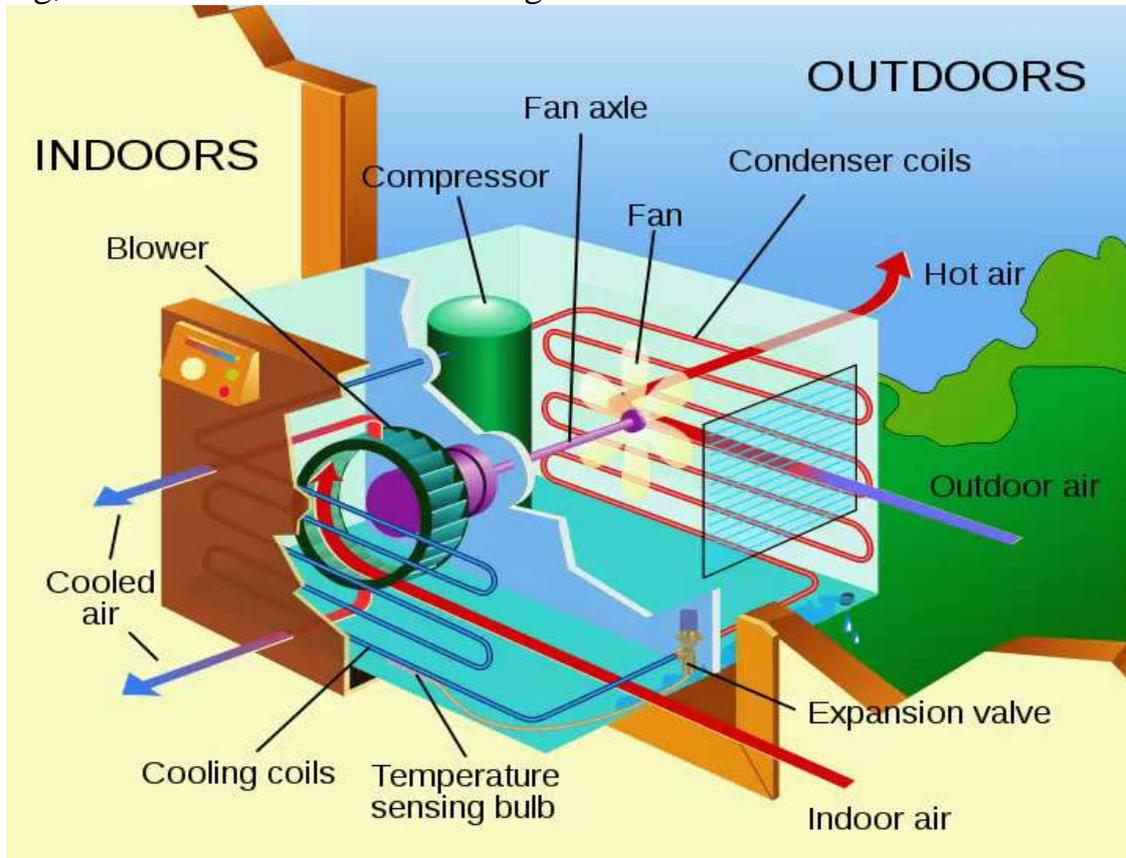
- The headline of the article is
- It deals with
- The article widely covers the problem of
- It carries information on
- The paper describes
- In conclusion

Read the Text 2. Air conditioner.

Make sure you know these words:

dehumidify	- осушать, сушить
expansion valve	-регулирующий вентиль (для жидкого холодильного агента)
heat pump	- тепловой насос
wet pad	- мокрая, влажная подкладка
unreliable	- ненадежный
modular fashion	- модулярная форма, очертания
occupant	-житель; жилец; обитатель
require	-нуждаться (в чем-л.); требовать
to empty	-выливать, высыпать, освобождать
maintain	-поддерживать, содержать

An air conditioner (often referred to as AC) is a home appliance, system, or mechanism designed to dehumidify and extract heat from an area. The cooling is done using a simple refrigeration cycle. In construction, a complete system of heating, ventilation and air conditioning is referred to as "HVAC".



Types of air conditioner equipment.

1. Window and through-wall units
2. Evaporative coolers
3. Absorptive chillers
4. Portable air conditioners

1) Window and through-wall units

Room air conditioners come in two forms: **unitary and packaged terminal PTAC systems**:

-**Unitary systems**, the common one room air conditioners, sit in a window or wall opening, with interior controls. Interior air is cooled as a fan blows it over the evaporator. On the exterior the air is heated as a second fan blows it over the condenser. In this process, heat is drawn from the room and discharged to the environment. A large house or building may have several such units, permitting each room be cooled separately;

-**PTAC systems** which are frequently used in hotels have two separate units (terminal packages), the evaporative unit on the interior and the condensing unit on the exterior, with tubing passing through the wall and connecting them. This minimizes the interior system footprint and allows each room to be adjusted independently. PTAC systems may be adapted to provide heating in cold weather,

either directly by using an electric strip, gas or other heater, or by reversing the refrigerant flow to heat the interior and draw heat from the exterior air, converting the air conditioner into a heat pump. While room air conditioning provides maximum flexibility, when cooling many rooms it is generally more expensive than central air conditioning.

2) Evaporative coolers

In very dry climates, evaporative coolers, sometimes referred to as swamp coolers or desert coolers, are popular for improving coolness during hot weather.

An evaporative cooler is a device that draws outside air through a wet pad, such as a large sponge soaked with water. The temperature of dry air can be dropped significantly through the phase transition of liquid water to water vapor, which requires much less energy than refrigeration. In extremely dry climates, it also has the added benefit of conditioning the air with more moisture for the comfort of occupants. Unlike refrigeration, it requires a water source, and must continually consume water to operate.



An evaporative cooler, used in the drier parts of the American West to provide economical cooling.

3) Absorptive chillers

An absorption refrigerator is a refrigerator that uses a heat source (e.g., solar, kerosene-fueled flame, waste heat from factories or district heating systems) to provide the energy needed to drive the cooling system. Absorption refrigerators are a popular alternative to regular compressor refrigerators where electricity is unreliable, costly, or unavailable, where noise from the compressor is problematic, or where surplus heat is available (e.g., from turbine exhausts or industrial processes, or from solar plants). Absorptive refrigeration can also be used to air-condition buildings using the waste heat from a gas turbine or water heater. This use is very efficient, since the gas turbine produces electricity, hot water and air-conditioning (called trigeneration).

4) Portable air conditioners

Portable air conditioners are movable units that can be used to cool a specific region of a building or home in a modular fashion, not requiring permanent installation. They are used for much the same purposes and in much the

same ways as traditional "window a/c" units (cooling an overly hot room, cooling rooms in older homes without central a/c).

Portable a/c units provide a cleaner looking end product (no bulky unit hanging out of the windows). Older portable a/c units also required periodic emptying of a condensate water tank (basically the water/humidity removed from the air) but modern units are designed in such a way that they rarely need to be emptied or maintained other than periodically cleaning the air filter.

Most portable air conditioners are refrigeration based rather than evaporative.

A. Complete the table.

Type of air conditioner	Function	Using

B. Find the necessary ending to the following sentences.

1. The cooling is done using	a) each room be cooled separately.
2. Interior air is cooled	b) using an electric strip, gas or other heater
3. A large house or building may have several such units, permitting	c) electricity is unreliable, costly, or unavailable, where noise from the compressor is problematic.
4. PTAC systems may be adapted to provide heating in cold weather, either directly by	d) as a fan blows it over the evaporator.
5. The temperature of dry air can be dropped significantly through the phase transition of	e) a cleaner looking end product (no bulky unit hanging out of the windows).
6. Absorption refrigerators are a popular alternative to regular compressor refrigerators where	f) liquid water to water vapor, which requires much less energy than refrigeration.
7. Absorptive refrigeration can also be used	g) need to be emptied or maintained other than periodically cleaning the air filter.
8. Portable a/c units provide	h) a simple refrigeration cycle.
9. Modern units are designed in such a way that they rarely	i) to air-condition buildings using the waste heat from a gas turbine or water heater.

C. Choose the following most suitable words to fill the gaps in the sentences below.

*** district * unreliable * electricity * environment * experiment * portable * wasting**

1. The purpose of the _____ is to find better ways of treating battlefield wounds.
2. Paying regular bills such as gas and _____ is much easier this way.
3. However, _____ water filters provide another simple alternative.
4. Telephone service in most of the country is _____.
5. Don't leave the light on - you're _____ electricity.
6. Blaine works in the financial _____.
7. We have tried to create a working _____ in which everyone can develop their skills.

Read the Text 3. Home air conditioning systems around the world.

Make sure you know these words:

split type	- модель из фракции, сектами
to forgo	- отказываться, воздерживаться от чего-л.
proliferation	- распространение
in lieu of (in place of)	- вместо
common	- общепринятый, распространенный

This especially applies to capitals and urbanized areas in hot parts of the world where most of the population lives in small high-rise flats. Japanese-made domestic air conditioners are usually window or split types, the latter being more modern and expensive. In Israel, virtually all residential systems are split types.

In the United States of America, home air conditioning is very common. Central air systems are most common in the United States of America, and increasingly a standard design factor.

In Canada, home air conditioning is less common than in the United States, but it still quite prevalent. This is especially true of the Great Lakes regions of Southern Ontario and Southern Quebec, where there are especially high humidity levels. The majority of modern urban high-rise condominiums built in Canadian cities have air conditioning systems. While energy is comparatively cheap in Canada, the large size of the average Canadian home and cold winters make heating and cooling one of the largest household expenses. Canadian summers are often hot, but rarely reach the dangerous temperatures experienced in the southern United States. As such, some Canadians, especially in older homes, simply choose to forgo air conditioning in lieu of simple fans and evaporative coolers.

In Europe, home air conditioning is generally less common. Southern European countries such as Greece have seen a wide proliferation of home air-conditioning units in recent years. In another southern European country, Malta, it is estimated that around 55% of households have an air conditioner installed.

A. Read the Text 3 and decide if the statements after it are true (T) or false (F).

1. This especially applies to capitals and urbanized areas in cold parts of the world where most of the population lives in small high-rise flats. ()
2. Japanese-made domestic air conditioners are usually window or split types, the latter being more modern and cheap. ()
3. In Canada, home air conditioning isn't common than in the United States, but it still quite prevalent. ()
4. The majority of modern urban high-rise condominiums built in Canadian cities have air conditioning systems. ()
5. While energy is very expensive in Canada, the large size of the average Canadian home and cold winters make heating and cooling one of the largest household expenses. ()
6. Some Canadians, especially in older homes, simply choose to forgo air conditioning in lieu of simple fans and evaporative coolers.
7. Southern European countries such as Greece have seen a wide proliferation of home air-conditioning units since 1987.

UNIT SEVEN. Central heating.

Make sure you know these words:

multiple	- составной; со сложной структурой
furnace room	- печной цех; печной зал
fossil fuel	- ископаемое топливо
distribution system	- система распределения
occur	- встречаться, попадаться
resistance heating	- электрический обогрев; электроотопление
generating plant	- электростанция, ЭС

Read the Text 1 Central heating. And decide if the statements after it are true (T) or false (F).

A central heating system provides warmth to the whole interior of a building (or portion of a building) from one point to multiple rooms. When combined with other systems in order to control the building climate, the whole system may be a HVAC (heating, ventilation and air conditioning) system.

Central heating differs from local heating in that the heat generation occurs in one place, such as a furnace room in a house or a mechanical room in a large building (though not necessarily at the "central" geometric point). The most common method of heat generation involves the combustion of fossil fuel in a furnace or boiler. The resultant heat then gets distributed: typically by forced-air through ductwork, by water circulating through pipes, or by steam fed through pipes. Increasingly, buildings utilize solar-powered heat sources, in which case the distribution system normally uses water circulation.

In much of northern Europe and in urban portions of Russia, where people seldom require air conditioning in homes due to the temperate climate, most new housing comes with central heating installed. Such areas normally use gas heaters, district heating, or oil-fired systems. In the western and southern United States natural-gas-fired central forced-air systems occur most commonly; these systems and central-boiler systems both occur in the far northern regions of the USA. Steam-heating systems, fired by coal, oil or gas, feature in the USA, Russia and Europe: primarily for larger buildings. Electrical heating systems occur less commonly and are only practical with low cost electricity or when geothermal heat pumps are used. Considering the combined system of central generating plant and electric resistance heating, the overall efficiency will be less than for direct use of fossil fuel for space heating.



Central heating unit.

1. A central heating system doesn't provide warmth to the whole interior of a building (or portion of a building) from one point to multiple rooms. ()
2. Central heating differs from local heating in that the heat generation occurs in one place, such as a furnace room in a house or a mechanical room in a small building. ()
3. Increasingly, buildings utilize solar-powered heat sources, in which case the distribution system normally uses air circulation. ()
- 4 In urban portions of Russia, where people never require air conditioning in homes due to the temperate climate, most new housing comes with central heating installed. ()
- 5 In the western and southern United States natural-gas-fired central forced-air systems occur most commonly; these systems and central-boiler systems both occur in the far northern regions of the USA. ()

A. Match the following words with their definitions.

1. warmth	a) such as coal or oil that is produced by the very gradual decaying of animals or plants over millions of years
2. heating	b) the act of sharing things among a large group of people in a planned way
3. fossil fuel	c) a machine for forcing liquid or gas into or out of something
4. combustion	d) a system for making a room or building warm
5. distribution	e) relating to towns and cities (\neq rural)
6. pump	f) the heat something produces, or when you feel warm
7. urban	g) the process of burning

B. Choose the most suitable words from ex.A above to fill the gaps in the sentences below.

1. The Government was also strongly backing an international trading system for _____emissions.
2. My friends were wearing two and three sweaters and had beach towels draped around their shoulders for extra_____.
3. An obvious and technically achievable alternative to fossil fuel _____is nuclear fission.
4. An alternative method is to attach an electric drill water _____attachment to the tap.
5. Economic disparity between rural and _____areas is not limited to South Carolina.
6. In the summer, open windows and in the winter, turn on the _____so it is warm and welcoming.
7. The conference called for a more equitable _____of wealth and power among nations.

Read the Text 2 History.

Cities in ancient Greece used central heating systems, conducting air heated by furnaces through empty spaces under the floors and out of pipes in the walls — a system known as a hypocaust. A similar system of central heating was used in ancient Korea, where it is known as ondol. It is thought that the ondol system dates back to the Koguryo or Three Kingdoms (37 BC-AD 668) period when excess heat from stoves were used to warm homes.

The hypocaust continued to be used in the Mediterranean region during late Antiquity and by the Umayyad caliphate. By the 12th century, Muslim engineers in Syria introduced an improved central heating system, where heat travelled through underfloor pipes from the furnace room, rather than through a hypocaust. This central heating system was widely used in bath-houses throughout the medieval Islamic world.

In the 13th century, the Cistercian monks revived central heating in Christian Europe using river diversions combined with indoor wood-fired furnaces. The well-preserved Royal Monastery of Our Lady of the Wheel (founded 1202) on the Ebro River in the Aragon region of Spain provides an excellent example of such an application.

By about 1700 Russian engineers had started designing hydrologically based systems for central heating. The Summer Palace (1710–1714) of Peter the Great in Saint Petersburg provides the best extant example. Slightly later, in 1716, came the first use of water in Sweden to distribute heat in buildings. Martin Triewald, a Swedish engineer, used this method for a greenhouse at Newcastle upon Tyne. Jean Simon Bonnemain (1743–1830), a French architect, introduced the technique to industry on a cooperative, at Château du Pêcq, near Paris.

Angier March Perkins developed and installed some of the earliest steam-heating systems in the 1830s. The first was installed in the home of Governor of the Bank of England John Horley Palmer so that he could grow grapes in England's cold climate.

A. Match the following words with their definitions.

1. empty	a) better than before
2. ancient	b) a tube through which a liquid or gas flows
3. improved	c) having nothing inside
4. to) distribute	d) someone whose job is to design buildings
5. pipe	e) one of a number of small round green or purple fruits that grow together on a vine
6. architect	f) belonging to a time long ago in history, especially thousands of years ago (≠ modern)
7. grape(s)	g) to share things among a group of people, especially in a planned way

B. Choose the most suitable words from ex.A above to fill the gaps in the sentences below.

- Aid agencies are calling for local volunteers to help them _____ food and medicine.
- I think there's an _____ seat in the back row.
- Garrett believes the new system will allow him to lower prices and provide _____ service to customers.
- St Paul's Cathedral was designed by the famous _____, Sir Christopher Wren.
- Rome is famous for its _____ monuments.

6. There were peaches, and bunches of _____, entwined with leaves of varying shades and textures.

7. Let a little water run in your sink so that your _____ doesn't freeze.

Read the Text 3. Water heating.

Make sure you know these words:

supply	- снабжение, поставка
propane tank	- бак с пропаном
district heating	-теплофикация;централизованное отопление района
wall-mounted	- смонтированный, установленный у стены
tap	-кран (водопроводный, газовый)
resistance heating	-электрический обогрев; электроотопление
furnace	-печь, топка
resistance coil	-катушка сопротивления
air duct	-вентиляционный канал, воздуховод
baseboard heater(baseboard radiator)	-плинтусный радиатор
blower	-вентилятор (любое устройство для создания тока воздуха); воздухозаборник

Common components of a central heating system using water-circulation include:

***Gas supply lines** (sometimes including a propane tank), oil tank and supply lines or **district heating** supply lines

***Boiler** (or a heat exchanger for district heating) — heats water in a closed-water system

***Pump** — circulates the water in the closed system

***Radiators** — wall-mounted panels through which the heated water passes in order to release heat into rooms

Engineers in the United Kingdom and in other parts of Europe commonly combine the needs of room heating with hot-water heating and storage. These systems occur less commonly in the USA. In this case, the heated water in a sealed system flows through a heat exchanger in a hot-water tank or hot-water cylinder where it heats water from the normal water supply before that water gets fed to hot-water outlets in the house. These outlets may service hot-water taps or appliances such as washing machines or dishwashers.

Text 4. Electric and gas-fired heaters

Electric heating or resistance heating converts electricity directly to heat. Electric heat is often more expensive than heat produced by combustion appliances like natural gas, propane, and oil. Electric resistance heat can be provided by baseboard heaters, space heaters, radiant heaters, furnaces, wall heaters, or thermal storage systems.

Electric heaters are usually part of a fan coil which is part of a central air conditioner. They circulate heat by blowing air across the heating element which is supplied to the furnace through return air ducts. Blowers in electric furnaces move air over one to five resistance coils or elements which are usually rated at five kilowatts. The heating elements activate one at a time to avoid overloading the electrical system.

A. Read the Text 3-4 and decide if the statements after it are true (T) or false (F).

1. Engineers in the United Kingdom and in other parts of Europe never combine the needs of room heating with hot-water heating and storage. ()
2. These systems occur less commonly in the USA. ()
3. Electric heat is often less expensive than heat produced by combustion appliances like natural gas, propane, and oil. ()
4. Electric heaters are normally part of a fan coil which is part of a central air conditioner.
5. Blowers in electric furnaces move air over one to five resistance coils or elements which are normally rated at five kilowatts. ()

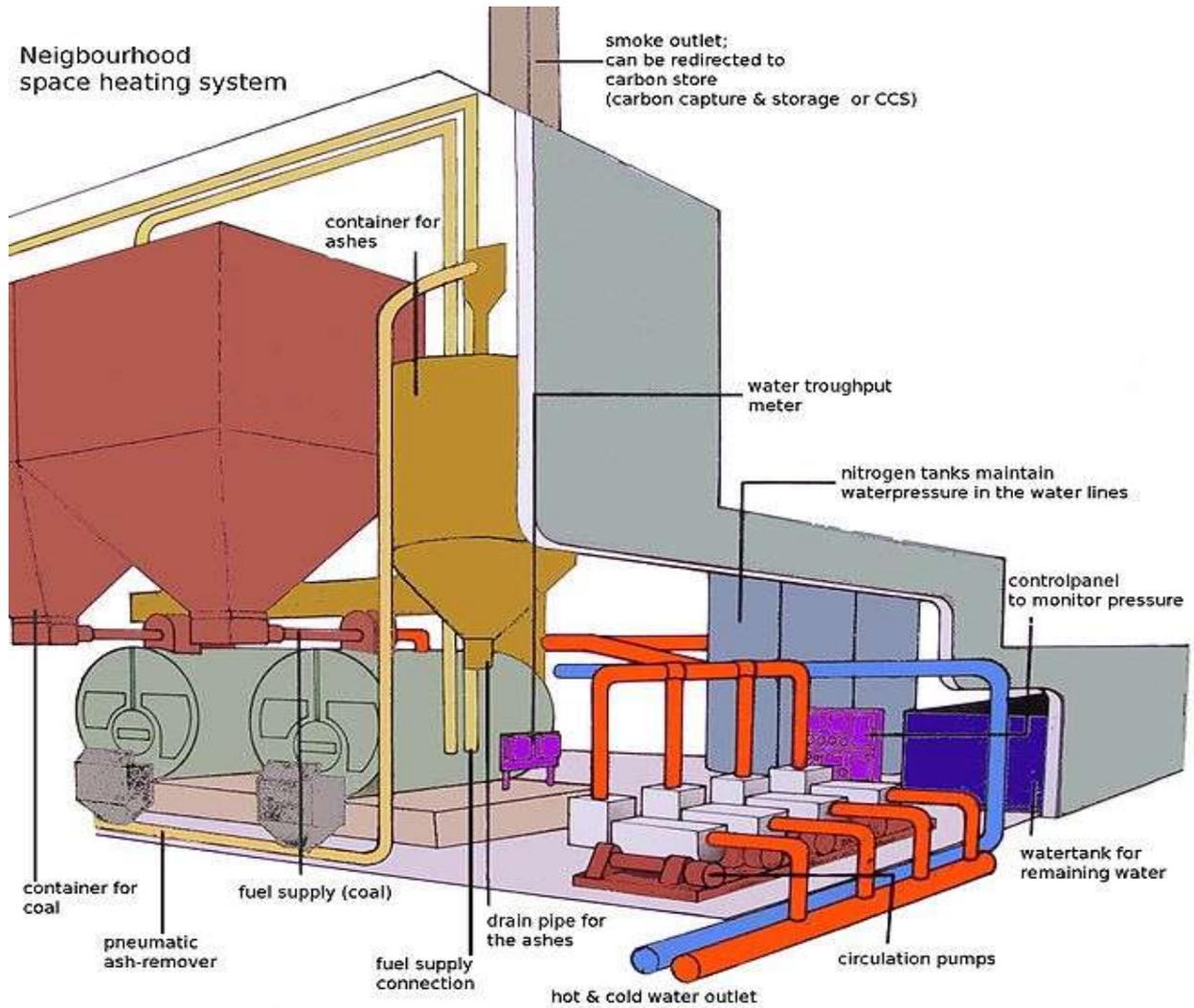
B. Find the necessary ending to the following sentences.

1.The heated water in a sealed system flows through a heat exchanger in a hot-water tank where	a) resistance heating converts electricity directly to heat.
2.These outlets may service hot-water taps or	b) baseboard heaters, space heaters, radiant heaters, furnaces, wall heaters, or thermal storage systems.
3. Electric heating or	c) the heating element which is supplied to the furnace through return air ducts.
4.Electric resistance heat can be provided by	d) it heats water from the normal water supply before that water gets fed to hot-water outlets in the house.
5. They circulate heat by blowing air across	e) appliances such as washing machines or dishwashers.

Text 5. District heating

-is a system for distributing heat generated in a centralized location for residential and commercial heating requirements such as space heating and water

heating. The heat is often obtained from a cogeneration plant burning fossil fuels but increasingly biomass, although heat-only boiler stations, geothermal heating and central solar heating are also used, as well as nuclear power. District heating plants can provide higher efficiencies and better pollution control than localized boilers. According to some research, District Heating with Combined Heat and Power - CHPDH is the cheapest method of cutting carbon, and has one of the lowest carbon footprints of all fossil generation plants.



A. Complete the table.

Type of heating	Function	Using

UNIT EIGHT. Radiator (heating).

Make sure you know these words:

notwithstanding	- несмотря на, вопреки
copper	- медь (металл)
fin	-ребро, пластина (радиатора)
inherently	- по сути, в своей основе
unwanted (heat loss)	- нежелательная (потеря тепла)
inevitably	- неизбежно, неминуемо
to retrofit	- модифицировать (модель)
reliability	- надежность
(metal) tubing	- трубы; трубопровод
via	- через, сквозь

Read the Text 1. Radiators and convectors.

Radiators and **convectors** are heat exchangers designed to transfer thermal energy from one medium to another for the purpose of space heating. In practice, the term "radiator" refers to any of a number of devices in which a fluid circulates through exposed pipes (often with fins or other means of increasing surface area), notwithstanding that such devices tend to transfer heat mainly by convection and might logically be called convectors.

The term "convector" refers to a class of devices in which the source of heat is not directly exposed. As domestic safety and the supply from water heaters keeps temperatures relatively low, radiation is inefficient in comparison to convection.

Types of radiators:

1) Hot water-

hot-water radiator consists of a sealed hollow metal container filled with hot water by gravity feed, a pressure pump, or convection. As it gives out heat the hot water cools and sinks to the bottom of the radiator and is forced out of a pipe at the other end. Anti-hammer devices are often installed to prevent or minimize knocking in hot water radiator pipes.

2) Hot water baseboard-

Traditional cast iron radiators are no longer common in new construction, replaced mostly with forced hot water baseboard style radiators. Copper pipes which have aluminum fins to increase their surface area. In the U.K., modern domestic radiators tend to be of sheet steel construction (often with steel fins), though copper/aluminium is often found in industrial Air Handling System heat exchangers.



A cast iron household radiator.

3) *Steam*

Steam has the advantage of flowing through the pipes under its own pressure without the need for pumping. For this reason, it was adopted earlier, before electric motors and pumps became available. Steam is also far easier to distribute than hot water throughout large, tall buildings like skyscrapers. However, the higher temperatures at which steam systems operate make them inherently less efficient, as unwanted heat loss is inevitably greater.

Steam pipes and radiators are prone to producing banging sounds often incorrectly called water hammer. The bang is created if condensate fails to drain properly; this is often caused by buildings settling and the resultant pooling of condensate in pipes and radiators that no longer tilt slightly back towards the boiler.



Single-pipe steam radiator.

4) *Fan assisted heat exchanger*

A fan-assisted radiator contains a heat exchanger fed by hot water from the heating system. A thermostatic switch energises an electric fan which blows air over the heat exchanger to circulate it in a room.

5) *Underfloor heating.* The current trend in radiant heating is towards underfloor heating, where a network of pipes, tubing or heating cables is buried in or attached beneath a floor, allowing a gentle heat to rise into the room. Best results are had with conductive flooring materials such as tile. The large surface area of such room-sized radiators allows them to be kept just a few degrees above desired room temperature, minimizing convection. Such systems offer a high level of comfort, but are more expensive in new construction than less efficient systems and generally difficult to retrofit into existing buildings.

The Roman hypocaust employed a similar principle of operation.

Its advantages are small relative size and even distribution of heat. Disadvantages are fan noise and the need for both a source of heat and a separate electrical supply.



In underfloor heating, tubing is placed on the floor throughout the room and later covered with a concrete layer during construction.

6) Electric baseboard

Similar in configuration to forced hot water baseboard - low profile units running along the base of a wall with a central heating element surrounded by radiating fins - electric baseboard heaters are inexpensive to produce and install. They offer instant heat and great reliability, but may be more or less cost-effective relative to other forms of heat depending on electricity prices.

7) Portable

Electrically powered portable radiators come in two basic forms:

*Electric elements, which either heat directly or radiate heat to a heat-conducting solid such as quartz

*Liquid filled, which employ an electric element to warm a fluid such as oil held within metal tubing, which circulates via convection.

A. Complete the table.

Type of radiator	Function	Using

B. Write down some sentences about the article “Radiator (heating)” beginning the phrases below.

The headline of the article is

It deals with

The article widely covers the problem of

It carries information on

The paper describes

In conclusion

Read the Text 2. Sealed water-circulating system.

Make sure you know these words:

sealed (system)	- герметически закрытая
valve	- клапан; золотник; затвор
safety valve	- предохранительный клапан
to replenish	- (снова) наполнять(ся), пополнять(ся)
pressure vessel	- баллон (со сжатым газом); сосуд высокого давления; автоклав
Hydronics	- гидроника (применение жидкостей для охлаждения и нагрева)
embedded (in the floor)	- вставленный, вмурованный; встроенный
closed loop	- закрытый контур
to extract	- извлекать (from)
supplemental (heating)	- добавочный, дополнительный
domestic	- домашний ,внутренний

A sealed system provides a form of central heating in which the water used for heating usually circulates independently of the building's normal water supply. A pressure vessel contains compressed gas, separated from the sealed-system water by a diaphragm. This allows for normal variations of pressure in the system. A safety valve allows water to escape from the system when pressure becomes too high, and a valve can open to replenish water from the normal water supply if the pressure drops too low. Sealed systems offer an alternative to open-vent systems, in which steam can escape from the system, and gets replaced from the building's water supply via a feed and central storage system.

Hydronic and steam systems

Hydronic heating systems are systems that circulate a medium for heating. Hydronic radiant floor heating systems use a boiler or district heating to heat up hot water and a pump to circulate the hot water in plastic pipes installed in a concrete slab. The pipes, embedded in the floor, carry heated water that conducts warmth to the surface of the floor where it broadcasts energy to the room.

Hydronic systems circulate hot water for heating. Steam heating systems are similar to heating water systems, except steam is used as the heating medium instead of water.

Hydronic heating systems generally consist of a boiler or district heating heat exchanger, hot water circulating pumps, distribution piping, and a fan coil unit or a radiator located in the room or space. Steam heating systems are similar except no circulating pumps are required.

Hydronic systems are closed loop: the same fluid is heated and then reheated. Hydronic heating systems are also used with antifreeze solutions in ice and snow melt systems for walkways, parking lots and streets. They are more commonly used in commercial and whole house radiant floor heat projects, while electric radiant heat systems are more commonly used in smaller "spot warming" applications.

Heat pumps

In mild climates a heat pump can be used to air condition the building during hot weather, and to warm the building using heat extracted from outdoor air in cold weather. Air-source heat pumps are generally uneconomic for outdoor temperatures much below freezing. In colder climates, geothermal heat pumps can be used to extract heat from the ground. For economy, these systems are designed for average low winter temperatures and use supplemental heating for extreme low temperature conditions. The advantage of the heat pump is that it reduces the purchased energy required for building heating; often geothermal source systems also supply domestic hot water. Even in places where fossil fuels provide most electricity, a geothermal system may offset greenhouse gas production since most of the energy furnished for heating is supplied from the environment, with only 15–30% purchased.

A. Read the Text 2 and decide if the statements after it are true (T) or false (F).

1. A sealed system provides a form of central heating in which the gas used for heating usually circulates independently of the building's normal water supply. ()
2. Sealed systems offer an alternative to open-vent systems and gets replaced from the building's water supply via a feed and central storage system. ()
3. Steam heating systems aren't similar to heating water systems. ()

4. Hydronic systems aren't closed loop: the different fluid is heated and then reheated. ()
5. In mild climates a heat pump can be used to air condition the building during hot weather. ()
6. Air-source heat pumps are generally economic for outdoor temperatures much below freezing.
7. The disadvantage of the heat pump is that it reduces the purchased energy required for building heating. ()

B. Answer the following questions

1. What does a sealed system provide?
2. What does a safety valve allow?
3. What for do Hydronic radiant floor heating systems use a boiler and a pump?
4. Are the pipes embedded in the walls or in the floor?
5. Why Hydronic systems are called "closed loop"?
6. Where are Hydronic heating systems also used?
7. Where and why can geothermal heat pumps be used?

C. Choose the following most suitable words to fill the gaps in the sentences below.

**** independent * outdoor * environment * similar to * purchase * extreme
* embedded in***

1. Microscopic examinations show that crystals of zinc are _____the eutectic mixture.
2. The program of _____activities includes skiing, climbing, and hiking.
3. In fact, many buy snow insurance as a hedge against _____weather.
4. Foreign investors are not permitted to _____land.
5. We have tried to create a working _____in which everyone can develop their skills.

6. Tom's voice is very _____ his brother's.
7. The research center is on Harvard's campus, but is _____ of the university.

Read the Text 3. Environmental aspects.

Make sure you know these words:

to phase out	- постепенно (поэтапно) свести на нет, постепенно ликвидировать
standpoint	- позиция, точка зрения
virtually eliminate	- практически устранять(ликвидировать)
future-proofing	- перспективность
fireplace	- камин, очаг

From an energy-efficiency standpoint considerable heat gets lost or goes to waste if only a single room needs heating, since central heating has distribution losses and (in the case of forced-air systems particularly) may heat some unoccupied rooms without need. In such buildings which require isolated heating, one may wish to consider non-central systems such as individual room heaters, fireplaces or other devices. Alternatively, architects can design new buildings to use low-energy building techniques which can virtually eliminate the need for heating, such as those built to the Passive House standard.

However, if a building does need full heating, combustion central heating offers a more environmentally friendly solution than electric-air central heating or than other direct electric heating devices. This stems from the fact that most electricity originates remotely using fossil fuels, with up to two-thirds of the energy in the fuel lost (unless utilized for district heating) at the and in transmission losses. In Sweden proposals exist to phase out direct electric heating for this reason. Nuclear and hydroelectric sources reduce this factor.

In contrast, hot-water central heating systems can use water heated in or close to the building using high-efficiency condensing boilers, biofuels, or district heating. Wet underfloor heating has proven ideal. This offers the option of relatively easy conversion in the future to use developing technologies such as heat pumps and solar combining systems, thereby also providing future-proofing.

Typical efficiencies for central heating are: 85-97% for gas fired heating; 80-89% for oil-fired, and 45-60% for coal-fired heating.

A. Read the text again and write down the correct endings of the sentences.

1. In such buildings which require isolated heating, one may wish to
-

2. Architects can design new buildings to use
3. If a building does need full heating, combustion central heating offers a more
4. Hot-water central heating systems can use water heated in
5. Wet underfloor heating has proven ideal. This offers the option

B. Match the following words with their definitions.

1. eliminate	a) covered in or full of water or another liquid (\neq dry)
2. fireplace	b) a machine for making air or water hotter
3. fossil fuel	c) to make something smaller or less in size, amount, or price
4. wet	d) to completely get rid of something that is unnecessary or unwanted
5. reduce	e) a special place in the wall of a room, where you can make a fire
6. heater	f) a building where electricity is produced to supply a large area
7. power station	g) such as coal or oil that is produced by the very gradual decaying of animals or plants over millions of years

C. Choose the most suitable words from ex.B above to fill the gaps in the sentences below.

1. A fire was burning in the ancient _____.
2. Never hang clothes on a dryer in front of a fire or an open _____.
3. An obvious and technically achievable alternative to _____ combustion is nuclear fission.
4. Research will never _____ risk, but it minimizes it.
5. Certainly there is no one controlling it, as a man might control a _____ by moving switches.
6. He noticed the floor of the kitchen was soaking _____.
7. Stopping smoking can significantly _____ your risk of suffering a heart attack.

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для організації практичної роботи
з дисципліни

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