МИНИСТЕРСТВО ОБРАЗОВАНИЯ РЕСПУБЛИКИ БЕЛАРУСЬ

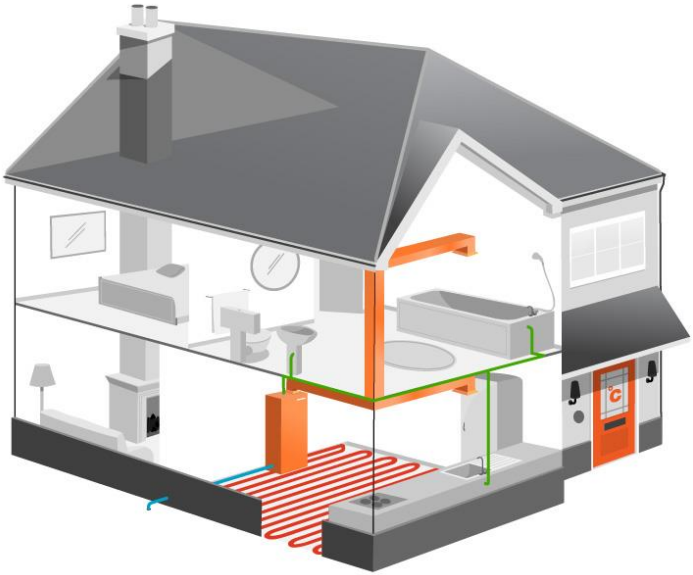
Белорусский национальный технический университет

Кафедра английского языка № 2

Е. В. Трухан
О. Н. Кобяк

HEAT AND GAS SUPPLY, VENTILATION AND AIR-CONDITIONING

Теплогазоснабжение, вентиляция и кондиционирование воздуха



Минск
БНТУ
2015

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Пособие по английскому языку
для студентов специальности 1-70 04 02 «Теплогазоснабжение, вентиляция и охрана воздушного бассейна»

Рекомендовано учебно-методическим объединением по образованию в области строительства и архитектуры

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Т80 Теплогазоснабжение, вентиляция и кондиционирование воздуха : пособие по английскому языку для студентов специальности 1-70 04 02 «Теплогазоснабжение, вентиляция и охрана воздушного бассейна» / Е. В. Трухан, О. Н. Кобяк. – Минск : БНТУ, 2015. – 99 с.
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Пособие написано в соответствии с типовой программой по иностранным языкам для неязыковых вузов и состоит из четырех разделов, направленных на развитие коммуникативных умений и навыков в профессиональной сфере.

Материалом послужили оригинальные тексты, которые предназначены как для аудиторного чтения, так и для самостоятельной работы.

Пособие предназначено для студентов специальности 1-70 04 02 «Теплогазоснабжение, вентиляция и охрана воздушного бассейна», а также для магистрантов и аспирантов при подготовке к сдаче кандидатского экзамена.

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ПРЕДИСЛОВИЕ

Пособие предназначено для студентов специальности 1-70 04 02 «Теплогазоснабжение, вентиляция и охрана воздушного бассейна», имеющих базовую подготовку по английскому языку, т. е. владеющих определенным объемом лексических единиц и речевых моделей, знакомых с основными грамматическими категориями. Пособие подготовлено в соответствии с требованиями типовой программы по иностранным языкам для высших учебных заведений.

Целью пособия является совершенствование и систематизация знаний и умений студентов, обогащение их словарного запаса по предлагаемой тематике, формирование навыков понимания, перевода и реферирования текстов по специальности, развитие навыков монологического высказывания на основе письменного текста, что позволяет формировать коммуникативную компетенцию в различных профессионально ориентированных видах речевой деятельности выпускников данной специальности.

Пособие имеет оригинальную авторскую структуру и состоит из четырех разделов: «Отопление», «Вентиляция», «Увлажнение», «Кондиционирование». Базой для составления пособия послужили оригинальные тексты. Наряду с текстами в каждом разделе предлагается комплекс упражнений, способствующих активному усвоению профессиональной лексики, правильному употреблению терминов, повторению некоторых аспектов грамматики, а также позволяющих проверить общее понимание прочитанного, закрепить приобретенные лексические навыки, стимулировать говорение на базе прочитанного текста. В конце каждого раздела предусмотрены задания на развитие навыков монологической речи с привлечением дополнительных источников информации, что способствует формированию у студентов навыков самостоятельной деятельности и развивает навыки общения с аудиторией и ведения дискуссии на английском языке.

Авторы выражают благодарность всем тем, кто способствовал созданию данного пособия.

Авторы

UNIT I

HEATING

START HERE

1. Answer the following questions.

1) What energy sources do you remember?
2) What is the main classification of energy sources?
3) What energy sources can be applied in heating systems?

2. Match the terms with their definitions.

a) boiler	*d) convection*	*g) combustion*
b) conduction	*e) humidifier*	*h) leakage*
c) infrared radiation	*f) insulators*	*i) valve*

1) the transfer of heat energy through a material – without the material itself moving;
2) the transfer of heat energy through a moving liquid or gas;
3) electromagnetic radiation emitted from a hot object;
4) a device for increasing or controlling the water vapour in a room, building, etc;
5) a closed vessel or arrangement of enclosed tubes in which water is heated to supply steam to drive an engine or turbine or provide heat;
6) poor conductors of heat;
7) the accidental admission or escape of a fluid or gas through a hole or crack;
8) a device for controlling the passage of fluid through a pipe or duct in one direction only;
9) the process of burning something.

3. Choose the right word.

1) Here are three easy things to know about the way heat flows: there *has to/can* be a temperature difference. Energy only flows as heat if there

is a temperature difference. Energy as heat flows from a *higher / lower* temperature to a *higher / lower* temperature. The *greater / smaller* the difference in temperature, the faster the energy flows.
2) *Dark / light* matt surfaces are better at absorbing heat energy than *dark / light* shiny surfaces.
3) Metals are *good / poor* conductors of heat, but non-metals and gases are usually *good / poor* conductors of heat. Heat energy is conducted from the *hot / cold* end of an object to the *hot / cold* end.

ACTIVE VOCABULARY

4. Give Russian equivalents of the following words and phrases. Try to memorize them.

Nouns and noun phrases

chimney	radian heat	electric current
draught	steam radiator	path
quartz heater	hot-water radiator	ray
resistance-type electric heater		
energy efficiency		

Verbs and verbal phrases **Adjectives**

to vent	red hot

5. Choose the contextual meanings of the words written in bold in Text 1.

1) enclosure

a) камера
b) конструкция
c) оболочка
d) ограждение

2) draught

a) тяга
b) сквозняк
c) усилие
d) энергия

3) adequate

a) соответствующий
b) достаточный
c) пригодный

6. Form the verbs from the following nouns.

accumulation → …
provision → …
circulation → …
resistance → …
combustion → …
reduction → …
ventilation → …
comparison → …

7. Fill in the correct prepositions, translate the phrases, then choose any five items and make up the sentences of your own.

1) heating comes ___ fireplaces; 2) the open fire ___ an enclosure; 3) to put ___ one side of a room; 4) to provide ___ a chimney; 5) gases pass ___ the chimney; 6) the front ___ the fireplace; 7) to use ___ adequate ventilation; 8) to pass an electric current ___ a series of wires; 9) to compare ___ radiators; 10) ___ this reason; 11) to warm anyone ___ the path ___ heat rays; 12) to travel ___ the air.

READING TASK: Text 1

8. What was the earliest type of local heating system? Read the text below to check your answer.

Local Heating Systems

Local heating is in common use in many countries. Such heating comes from fireplaces, or room heaters.

The earliest type of local heating system was the open fire within an **enclosure**, such as a cave or a tent. Such a fire is not satisfactory because the area heated can accumulate smoke.

If a fireplace is put at one side of a room and provided with a chimney, the smoke and combustion gases will pass up the chimney. The chimney provides a **draught** by which the air enters the front of the fireplace and passes up the chimney to aid the burning of the fuel. However, this draught reduces the energy efficiency of a fireplace.

Some room heaters burn gas to produce heat. These can be placed in a corner of the room and used with a fan to circulate the heated air. Such heaters should not be used without **adequate** ventilation to the outside because combustion gases can be harmful to the occupants of the room. Other room heaters burn paraffin and must also be vented.

Electric room heaters pass an electric current through a series of wires. These wires resist the electricity and become red hot. Such electric heaters give off heat by radiation and convection.

Most local sources of heat are relatively hot, compared with steam and hot-water radiators. For this reason they produce a larger proportion of radiant heat. When such large amounts of radiant heat are used, the temperature of the air in the room needs not become so hot. For example, a resistance-type electric heater called a quartz heater warms anyone in the path of its heat rays. But the heat rays do not significantly warm the air through which they travel.

COMPREHENSION CHECK

9. Complete the following sentences according to the text.

1) Local heating is in … in many countries.
2) The smoke and combustion gases will pass up the chimney if …
3) A draught is …
4) … burn gas to produce heat.
5) Electric room heaters pass an electric current through ...
6) Electric heaters give off heat by … and ...
7) … produce a larger proportion of radiant heat.
8) A resistance-type electric heater is called …

10. Correct the following statements if necessary.

1) A draught is provided by the chimney.
2) A draught increases the energy efficiency of a fireplace.
3) Room heaters must be used with a fan to circulate the heated air.
4) Adequate ventilation to the outside should be provided in the case of the room heater usage.
5) Steam and hot-water radiators are hotter than most local sources of heat.
6) A quartz heater warms anyone in the path of its heat rays as well as the air.

11. Answer the following questions and give examples.

1) What does local heating come from?
2) Why is an open fire unsatisfactory?
3) What does a draught do?

4) Where can room heaters be placed?
5) Why must room heaters be vented?
6) What do the wires in electric room heaters resist?
7) Do the heat rays of a quarts heater increase the temperature of the air through which they travel?

12. Write a summary of Text 1.

OVER TO YOU

13. Find out additional information about the history of heating. Discuss it with your groupmates or in pairs.

ACTIVE VOCABULARY

14. Give Russian equivalents of the following words and phrases. Try to memorize them.

Nouns and noun phrases

direct system	furnace	humidifier
indirect system	duct	moisture
convector	blower	valve
condensate pump	boiler	network
converter	surface	ceiling
breathing level	attempt	loop
skirting board	shield	outlet
resistance heating	thermostat	inlet
central air-conditioning unit		
radiant electric heating		

Verbs and verbal phrases

to distribute	to give off	to deliver
to circulate	to expose	to equalize
to condense	to install	to raise
to affect	to resist	to force

Adjectives	**Adverbs**
uniform	evenly

15. Combine the words from the column on the left with the suitable nouns from the column on the right. Translate them into Russian.

1) electric	a) boards
2) continuous	b) cable
3) uniform	c) area
4) surface	d) unit
5) condensed	e) loop
6) skirting	f) blower
7) electrically driven	g) heating
8) (in)direct	h) air
9) hot-water	i) height
10) automatic	j) valves
11) knee	k) systems
12) breathing	l) level
13) air-conditioning	m) heater
14) cool	n) steam

16. Form the nouns from the following verbs.

to distribute → …	to circulate → …	to deliver → …
to condense → …	to expose → …	to equalize → …
to affect → …	to install → …	to convert → …
to force → …	to resist → …	to provide → …

17. Match the terms with their definitions.

a) convector	*d) furnace*	*g) thermostat*
b) filter	*e) pump*	*h) cable*
c) duct	*f) radiator*	*i) current*

1) a passage through which air can flow, as in air conditioning;
2) an enclosed chamber in which heat is produced to generate steam, destroy refuse, smelt or refine ores, etc;
3) a device for filtering particles from the air passing through it, especially one protecting the air inlet of an internal-combustion engine;
4) a space-heating device from which heat is transferred to the surrounding air by convection;

5) any device for compressing, driving, raising, or reducing the pressure of a fluid, esp by means of a piston or set of rotating impellers;
6) a device for heating a room, building, etc., consisting of a series of pipes through which hot water or steam passes;
7) a flow of electric charge through a conductor;
8) a strong thick rope, usually of twisted hemp or steel wire;
9) a device that maintains a system at a constant temperature. It often consists of a bimetallic strip that bends as it expands and contracts with temperature, thus breaking and making contact with an electrical power supply.

18. Fill in the correct prepositions, translate the phrases, then choose any five items and make up the sentences of your own.

1) to differ ___ the way; 2) to circulate steam ___ pipes; 3) to give ___heat; 4) to warm the air ___ a furnace; 5)to force air ___ a system of pipes ___each room; 6) to carry air ___the rooms back ___the furnace; 7) to remove dust particles ___ the air; 8) to have certain advantages ___ smth.; 9) a network ___ pipes; 10) the air ___ knee height, ___the ceiling and ___ floor level; 11) to equalize temperature ___ a room; 12) to be installed ___ the skirting boards of a room; 13) to limit the temperature difference ___ the floor and the ceiling ___ only a few degrees; 14) to produce heat ___ passing electricity ___ a material; 15) to produce heat ___ electricity; 16) to be controlled ___ thermostats.

READING TASK: Text 2

19. Read the title of the following text. What can this text deal with? What are the main central heating systems? Read the text and check.

Central Heating Systems

There are two main kinds of central heating systems direct and indirect. They differ in the way they distribute heat. A direct system circulates the warm air throughout the area being heated. An indirect system circulates steam or hot water through pipes to convectors or radiators, which give off heat.

A warm-air heating system (WAHS) warms the air in a furnace and then forces it through a system of ducts (pipes) to each room. Another

system of ducts carries cool air from the rooms back to the furnace. An electrically driven blower in the furnace moves the air through the ducts, and filters remove dust particles from the air. The ducts and blower can be used as part of a central air-conditioning unit.

Steam and hot-water heating systems (SHWHS) are used in many large buildings. These systems cost more than warm-air systems, but they have certain advantages over them. The pipes carrying steam or hot water are smaller than warm-air ducts and thus take up less space. Automatic valves can control the amount of hot water or steam flowing to convectors more easily than they can control warm air. Thus, it is easier to control the temperature in different rooms with these systems than with warm-air heating.

A steam heating system requires a boiler, and a hot-water heating system has a hot-water heater, also called a boiler. Fuel burning in the boiler produces heat for the system. The system also has a network of pipes and convectors. In steam heating, a condensate pump forces the condensed steam back to the boiler. In hot-water heating, a pump circulates the water through the system.

The convectors of a steam or hot-water system, often called radiators, give off most of their heat by convection and radiation. The amount of heat given off by radiation depends on the temperature of the converter and its surface area. The more metal that is exposed, the more heat is given off.

One difficulty in heating with high temperature convectors is that the air near the ceiling becomes warmer than the air in other parts of the room. For example, the air at knee height may be 16°C, the air at breathing level may be 20°C, and the air at the ceiling may be 24°C.

Radiant heating is a method of equalizing temperature within a room. A continuous loop of hot-water pipe or electric cable is installed in the ceiling or floor. Heat leaves the pipe or cable by radiation, which does not directly raise the temperature of the air within a room. Radiation affects only the objects it strikes, and so it produces more uniform heating than convection does.

Radiant heating may also be installed along the skirting boards of a room. All radiant heating systems limit the temperature difference between the floor and the ceiling to only a few degrees.

Electric heating differs from other central systems because it requires no combustion of fuel in the building being heated. The fuel used to make electricity is burned at an electric power plant that may be far

away. Electric heat is produced by electric heating units. Such units produce heat by passing electricity through a material that resists the flow of current. This type of heating, called resistance heating, produces much radiant heat. Such heat warms the surface of the skin and clothing and makes people feel comfortable even in a cool room. Radiant electric heating uses a cable that produces heat from electricity. An electric heating unit can be placed in the ceiling, skirting boards, floor, or wall. The temperature can be controlled by thermostats in each room, or area.

COMPREHENSION CHECK

20. Decide whether the following statements are true or false according to Text 2.

1) There are two types of heating systems which differ in the way they circulate the warm air.
2) A direct system and indirect system both circulate the warm air.
3) A direct system circulates steam or hot water to convectors or radiators.
4) SHWHS are cheaper than WAHS.
5) SHWHS are used mainly in private homes.
6) It is easier to control the temperature with SHWHS than with warm-air heating.
7) Radiators give off heat in two ways.
8) The amount of heat given off by a convector depends upon the temperature of the convector.
9) Electric heating doesn't differ from other central systems.
10) The fuel is burned at an electric power plant that must be situated close to the building being heated.
11) The temperature can be controlled by thermostats in electric heating.
12) An electric heating unit can not be placed in walls.

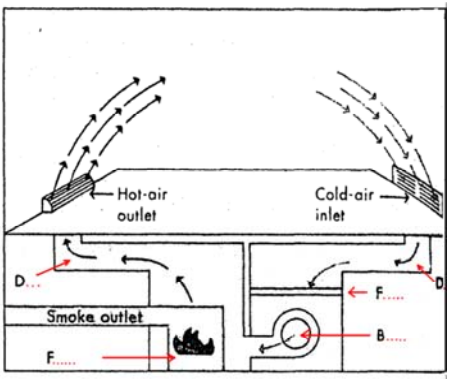
21. Choose the main advantages of the radiant heating system.

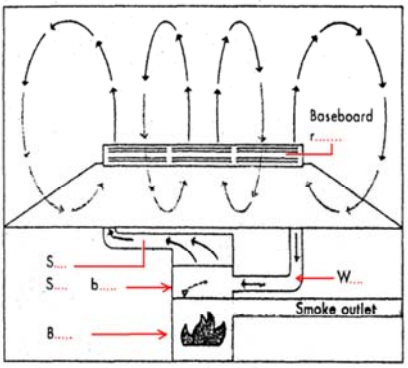
1) it affects only the objects it strikes;
2) it can be combined with air-conditioning system;
3) it provides comfort at a lower room temperature than other heating systems;
4) it distributes heat evenly;
5) it removes dust particles from the air.

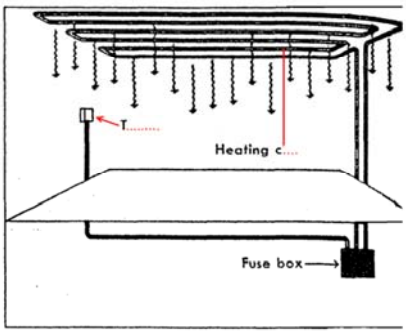
22. Answer the following questions and give examples.

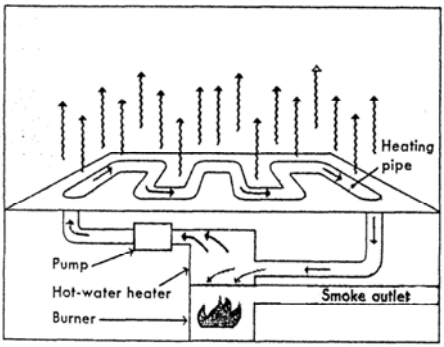
1) Where does a warm-air heating system (WAH) warm the air?
2) How does it transmit warm air to each room?
3) What is the function of filters?
4) Can WAH be used as a part of an air-conditioning unit?
5) What are the main parts of a steam and hot-water heating system?
6) What is the function of a radiator?
7) What is radiant heating?
8) Why does electric heating differ from other central systems?
9) What are the peculiarities of electric heating?

23. What types of heating are pictured? Fill in the schemes with the correct words from the text.









24. Fill in the following table summarizing the whole information of Text 2.

Type of Heating	Necessary Equipment	Advantages	Description
1)			
2)			
…			
…			

25. Write a summary of Text 2.

OVER TO YOU

26. Discuss with your groupmates or in pairs: what central heating systems are commonly used in Belarus? Where are they used? What heating system is the most suitable / advantageous for you?

ACTIVE VOCABULARY

27. Give Russian equivalents of the following words and phrases. Try to memorize them.

Nouns and noun phrases

fixtures	liner	sacrificial anode rod
water-on-demand	foam	pressure relief valve
drum	dip tube	drain valve
faucet	sediment	heat-out pipe
shell	gas burner	shut-off valve

Verbs and verbal phrases

to consign	to empty	to deliver
to exploit	to suspend	to exit

Adjectives

reliable	protective	incoming
ingenious	insulating	outgoing

28. Match the English and Russian equivalents.

1) tank	a) термостат
2) dip tube	b) подводящая труба
3) shut-off valve	c) предохранительный клапан
4) anode rod	d) отсечной клапан
5) heating mechanism	e) нагревательный элемент
6) drain valve	f) спускной кран
7) pressure relief valve	g) анодный стержень
8) thermostat	h) бак

29. Make sure you know the verbs formed from the following nouns.

exploitation → …	suspension → …	replacement → …
container → …	allowance → …	protection → …
location → …	exit → …	delivery → …

30. Combine the words from the column on the left with the suitable nouns from the column on the right. Translate them into Russian.

1) familiar	a) material
2) metal	b) principle
3) heat rising	c) design
4) ingenious	d) fixtures
5) insulating	e) foam
6) polyurethane	f) cylinders
7) shut-off	g) limits
8) save	h) valve
9) anode	i) cover plate
10) protective	j) rod

31. Match the words with their synonyms.

1) faucet	6) interior	*a) coat*	*f) clever*
2) shell	7) to save	*b) tap*	*g) inner*
3) separate	8) to retard	*c) enclosure*	*h) safe*
4) device	9) ingenious	*d) individual*	*i) to protect*
5) liner	10) reliable	*e) unit*	*j) to delay*

32. Fill in the correct prepositions, translate the phrases, then choose any five items and make up the sentences of your own.

1) ___ favor of water-on-demand; 2) a drum filled ___ water; 3) to be equipped ___ a heating mechanism; 4) to deliver hot water right ___ your faucet; 5) to enter the water heater ___ the dip tube; 6) to have a separate thermostat ___ each element; 7) to move the tank ___ another location; 8) to keep the pressure inside the water heater ___ safe limits; 9) to provide ___ hot water; 10) to rely ___ the principle.

READING TASK: Text 3

33. What are the main parts of a water heater? Read the text below to check your answer.

Inside a Water Heater

Water heaters are familiar fixtures in most homes. They typically look like big metal cylinders, tall drums that are often consigned to a laundry room or basement. Newer styles have some interesting features, like losing the tank completely in favor of water-on-demand, but the old, reliable water heater design that's most widely used today is really a pretty simple appliance; it's basically a drum filled with water and equipped with a heating mechanism on the bottom or inside. Even though they lack drama and complexity, water heaters are still pretty amazing. What makes them interesting is that they exploit the heat rising principle to deliver hot water right to your faucet with a minimum of fuss. Water heaters have an ingenious design on the inside for something that looks so ordinary on the outside.

Let's take a quick look at the components that work together in your water heater:

- **Tank** – The inner shell of a water heater is a heavy metal tank containing a water protective liner that holds 151 to 227 liters of hot water at around 50 to 100 pounds per square inch (PSI), within the pressure range of a typical residential water system. The exterior of the tank is covered in an insulating material like polyurethane foam. Over that, there's a decorative outer shell and possibly an additional insulating blanket.
- **Dip tube** – Water enters the water heater through the dip tube at the top of the tank and travels to the tank bottom where it's then heated.

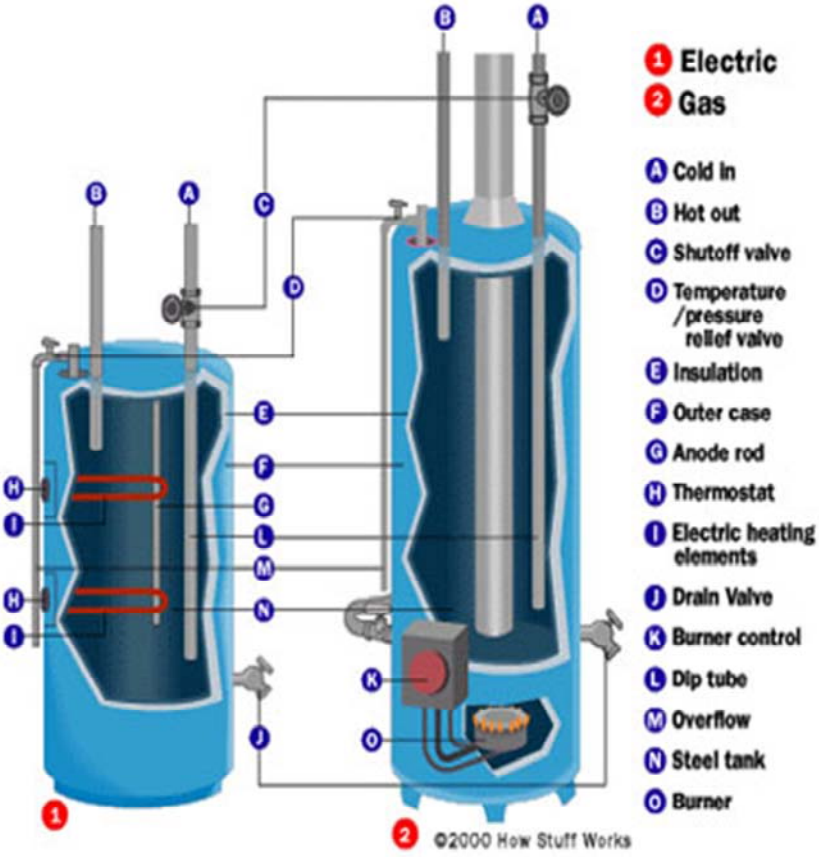
- **Shut-off valve** – The shut-off valve stops water flow into the water heater. It's a separate component from the heater located outside and above the unit.
- **Heat-out pipe** – Suspended toward the top of the tank's interior, the heat-out pipe allows the hot water to exit the water heater.
- **Thermostat** – This is a thermometer- and temperature-control device. Some electric water heaters have a separate thermostat for each element.
- **Heating mechanism** – Electric water heaters have heating elements inside the tank to heat the water. Gas water heaters use a burner and chimney system instead.
- **Drain valve** – Located near the bottom of the exterior housing, the drain valve makes it easy to empty the tank to replace the elements, remove sediment or move the tank to another location.
- **Pressure relief valve** – This safety device keeps the pressure inside the water heater within safe limits.
- **Sacrificial anode rod** – Made of magnesium or aluminum with a steel core, the sacrificial anode rod is suspended in the water heater tank to help retard corrosion.

Now, let's see how all these parts work together to provide you with hot water.

A water heater's **thermostat** controls the temperature of the water inside the tank. Normally, you can set the temperature anywhere between 49 to 82 degrees Celsius. The water temperature setting recommended by most manufacturers is between 49 to 60 degrees Celsius. This is hot enough to be efficient for household use, but not so hot that it can pose a scalding risk. If there are children living in your home, it's wise to stay closer to the lower end of the range.

Setting your water heater to a lower temperature saves energy, too. Usually, the thermostat is located underneath a protective cover plate and has a knob or dial you can turn to set the temperature.

The **dip tube** feeds cold water from your home's water lines to the bottom of the tank's interior, where the water starts to warm up. The **heating mechanism**, either a burner or an element, stays on until the water reaches temperature. As the water heats, it rises to the top of the tank. The **heat-out pipe** is located near the top of the tank. Water exiting the water heater at the top is always the hottest in the tank at any given moment because it's the nature of hot water to rise above denser, cold water.



A gas heater looks like an electric unit, except that it doesn't contain the two heating elements. It has a gas burner at the bottom, with the chimney running up through the middle of the tank.

The secret to a water heater's design for separating cold, incoming water from hot, outgoing water is that it relies on the principle that heat rises to do the hard part. The position of the heat-out pipe at the top of the tank does the rest.

COMPREHENSION CHECK

34. Complete the following sentences according to Text 3.

1) Water heaters typically look like …
2) Water heaters exploit the heat rising principle to deliver …
3) The inner shell of a water heater is …
4) Water enters the water heater through …
5) The heat-out pipe allows the hot water to …
6) The drain valve is located …
7) Pressure relief valve keeps the pressure inside the water heater within…
8) You can set the temperature anywhere between …
9) The thermostat is located …

35. Decide whether the following statements are true or false according to Text 3.

1) The old, reliable water heater design includesa drum filled with water and equipped with a heating mechanism on the bottom or inside.
2) The exterior of the tank is covered in a protective material.
3) The shut-off valve is located inside and above the unit.
4) Electric water heaters have a burner and chimney system inside the tank to heat the water.
5) Sacrificial anode rod helps to retard corrosion.
6) The secret to a water heater's design for separating cold water from hot relies on the heat rising principle.

36. Answer the following questions and give examples.

1) What interesting features have newer styles of water heaters?
2) How many liters of hot water does a tank hold?
3) What stops water flow into the water heater?
4) What is a thermostat?
5) What are the functions of a drain valve?
6) What is a sacrificial anode rod made of?

7) What is the water temperature setting recommended by most manufacturers?
8) What are the advantages of setting your water heater to a lower temperature?

37. Fill in the table according to Text 3.

Components	Location	Functions
Dip tube		
Shut-off valve		
…		

OVER TO YOU

38. Discuss with your groupmates or in pairs: How do all parts of a water heater work together to provide us with hot water?

ACTIVE VOCABULARY

39. Give Russian equivalents of the following words and phrases. Try to memorize them.

Nouns and noun phrases

chamber	must	coil
convenience	purchasing cost	decomposer
average life expectancy	fuse blow-off	copper

Verbs and verbal phrases

to handle	to release

Adjectives

bulky	gradual

40. Combine the words from the column on the left with the suitable nouns from the column on the right. Translate them into Russian.

1) copper	a) monoxide
2) energy	b) conservation
3) carbon	c) coil
4) life	d) expectancy
5) long	e) life
6) operational	f) crisis
7) energy	g) danger
8) potential	h) cost
9) fuse	i) gas price
10)increasing	j) blow-off

41. Complete the chains of synonyms with words from Text 4.

1) level, degree, rate, …
2) considerable, large-scale, wide, …
3) quantity, percentage, …
4) to regulate, to condition, to adjust, …
5) effective, efficient, high-performance, …
6) costly, dear, high-priced, …
7) velocity, rate, pace, …
8) benefit, priority, preference, …
9) exploitation, running, working, …
10) setting, mounting, placing, …

42. Find in Text 4 the opposites of the following words.

Artificial, solid, gradually, drawback, insignificant, to diminish, unusual, cheap, secondary, discomfort.

43. Make sure you know the nouns formed from the following verbs.

to transform → …	to reduce → …	to emit → …
to convert → …	to produce → …	to expect → …
to require → …	to install → …	to combust → …

READING TASK: Text 4

44. Study the following table and get ready to speak about the advantages and disadvantages of gas and electric water heaters.

GAS WATER HEATER	ELECTRIC WATER HEATER
As the name suggests, gas heaters primarily use natural gas to heat water. A small chamber filled with water is heated with the help of burning natural gas or liquid petroleum gas.	Electric water heaters have become very common due to the convenience that they offer. The principle of heating is simple and is used commonly throughout the world. A copper coil is used to transform electricity into heat energy.
ADVANTAGES	
Gas water heaters are basically quite convenient for a large family. The heating is gradual, and hence, supports energy conservation. If you use the hot water immediately, then you are successful in saving a huge amount of heat energy. The user is able to control the rate of heating and also the extent of heating. No electricity is required to run this water heater. These heaters can run on household LPG cylinders as well as on pipeline natural gas. Fixing common problems in gas water heaters is actually quite easy. They have reduced usage cost. They are quite productive and have a long life.	These water heaters can be installed almost anywhere. They are easier to handle. The energy source required to heat the water is less expensive. As there is no combustion of fuel, there is no emission of carbon monoxide, and there happens to be no need of ventilation. The basic advantage of electric water heaters is that the speed of heating is extremely fast. The average life expectancy of an electric heater is more than that of a gas heater. They are quite productive and have a long life.

DISADVANTAGES	
Gas water heaters result in a considerable amount of pollution, as a reasonable amount of carbon monoxide is released into the air while burning the natural gas. In addition to the pollution, the operational cost of these heaters is getting higher day by day, owing to the energy crisis and increasing gas prices. These heaters are also pretty bulky, and occupy a considerable amount of space in the bathroom. If you have installed the heater in a house or bungalow with multiple bathrooms, then the piping and related mechanism also adds to the installation cost. In case of gas heaters operated by biogas, the installation cost of the decomposer is very high, and also requires a lot of space.	Electricity is a must for its operation. The purchasing cost of this water heater is more than the gas water heaters. The cost incurred in operating an electric water heater is more expensive than a gas water heater. There can also be a potential danger of a short circuit or a fuse blow-off.

OVER TO YOU

45. Discuss with your groupmates or in pairs: What water heater would you choose for your own usage or would you advise to your relatives? Why?

ACTIVE VOCABULARY

46. Give Russian equivalents of the following words and phrases. Try to memorize them.

Nouns and noun phrases

complaint	malfunction	thermocouple
pilot burner	assembly	deposition
scale	flushing	gas utility

Verbs and verbal phrases

to ignite	to gauge	to hinder
to persist	to trash	to fix
to extinguish	to repair	to secure

Adjectives

faulty	insoluble

47. Make your own sentences using the following words.

Malfunction, scale, utility, assembly, to persist, to repair, to hinder, to fix, to secure, faulty.

48. Complete the following sentences with the words from the box.

Optimum, accumulation, obvious, to ensure, sufficient, corrosion, pressure, leakage

1) It was ____ some changes were necessary.
2) It will be ____ to describe those forms with which the most important work has been done, or which have survived the tests of time and experience.
3) You can achieve ____ performance with recycled paper.
4) The accuracy of Aircrete blocks used in thin joint construction helps minimize air ____.
5) We anticipate that these results should reveal important insights into the regulation of lignin ____.
6) Galvanic ____ can be even worse underneath the tire in cycles used all winter.
7) The positive air ____ of the room holds the valve down as well as the spring.
8) I was ____ that the computer was packed safely.

49. Fill in the table with appropriate derivatives if possible.

Noun	Verb	Adjective	Adverb
		faulty	
	to ignite		
assembly			
		changeable	
			properly
leakage			
		correct	

READING TASK: Text 5

50. Read the following guide and do the task below.

Gas Water Heaters Troubleshooting Guide

Common Problems

Heater does not heat the water	Probably the most fundamental and obvious complaint about a water heater, this has an equally fundamental solution. If the water heater is not producing hot water, it can be due to a malfunction in the thermostat: The thermostat in water heaters is a thermoelectric device known as thermocouple, and is made up of a strip of two metals. It checks the temperature of the flame from a pilot burner, and shuts off the gas supply if the temperature is not sufficient to ignite it. A faulty thermocouple could cause the gas supply remaining shut off despite the heaters being in perfect condition. Pilot burner: The flame from the pilot burner is directed onto the thermocouple, thus enabling it to gauge the temperature of the flame. Insufficient heat from the pilot burner could cause the thermostat to keep the gas supply shut off. If the pilot burner and the thermostat are positioned in a way such that the flame does not reach the thermostat at full intensity, reposition the assembly accordingly.

	Ensure that both of these components are free from sediment or grime. If it is obvious which component is at fault (for example, if the pilot burner does not light at all), replace it. Otherwise, get a pro to make his diagnosis. Some heaters have closed thermostat chambers. If you have a heater with one of these, don't try to repair them yourself, and call a pro right away.
Heater works inefficiently	Incomplete burning operation and improper ventilation cause problems in air combustion, which can hinder the heater's function. Various depositions in the heater, usually due to hard water or dust, affect the heating capacity of the heater. Removing these depositions can solve the problem. If the heater still doesn't work, your pilot burner-thermocouple pairing may be at fault. Ensure that the thermostat is set at the correct temperature, and not a few degrees colder than usual. Check if the heater is equipped to heat the amount of water you need. If it is under-equipped, it may result in the water being lukewarm. If so, reduce the water flow. Check if the gas supply is blocked in some way. Gas water heaters need optimum supply of gas at all times. If the gas line is blocked, remove the blockage. If there is even the tiniest gas leakage, replace the gas line immediately. Check that the hot and cold water lines are not crossing at some point. If so, get a plumber to properly separate them.
Heater produces noise while heating	Deposition and consequent accumulation of insoluble scale in the tank can result in a popping noise when the heater is in operation. Flushing the tank should take care of the problem. If some noise is coming from a tank-less heater, call a pro immediately.

Water from the heater stinks	Some water heaters use magnesium rod for heating the water. When these rods react to the bacteria present in the water, they produce hydrogen sulfide, which has a characteristic smell of rotten eggs. Clean the tank with chlorine bleach (preferably flush afterwards). If the problem persists, change the rods to zinc.
Leakage from the heater tank	This is a terminal problem, and can only be solved by replacing the heater. But if you are baulked by the price, do consult a pro before making the decision to trash it, but don't go for some quick-fix.
Heater produces rust-colored water	Corrosion due to electrochemical reactions inside the tank can result in rusty-colored water. In some cases, it also indicates that the anode heating rod needs to be changed. Like in the case of the 'rotten eggs smell', change the anode rods to ones made of zinc.
Leakage from the pressure release valve	High temperatures of water can cause this problem. It can be resolved by turning down the thermostat. At times, it also indicates valve failure; in that case, you need to replace the valve.
Pilot light of the heater does not stay lit	Ensure that the pilot burner is covered properly, since a gust of wind can extinguish it. In many cases, this problem is thermocouple related. This problem may arise if the thermocouple in the thermostat assembly is displaced due to some reason. It can be solved by adjusting its position, or replacing it.

CAUTION: Do NOT keep a heater running while making ANY repairs. Disconnect the gas supply if possible. If you smell gas at any time except momentarily when removing the gas line, make sure the gas supply is properly turned off. If the smell persists, call your gas utility at once.

Replace and repair the parts of the water heater with caution. Make sure that the pilot control valve of the heater is turned off before you start repairing. Secure the water supply to the heater and drain the heater. Always refer to the user manual for troubleshooting tips, it can solve the problem more often than not. If you think the problem is too difficult to handle, or some operation too risky, it probably is. Consult a pro in such cases.

Although gas water heaters are common devices, accidents involving gas can go horribly wrong in a moment. Do not ignore early signs of a problem. Be safe!

Role play a phone call between service staff and a customer with a complaint. Imagine that you *(Student A)* have one of the mentioned in the text problems with your heater, consult a pro *(Student B)* to fix the problem. What precautions must be taken while repairing?

Model:
— Good morning! Customer service. My name is … . How can I help you?
— Yes, good morning. I wish to complain about a heater I bought from you.
— Oh, I'm sorry to hear that. What exactly is the problem?
— …
— …
— And I'm glad to say that we are going to give you five percent discount off your next purchase.
— That's very reasonable. Thank you.

ACTIVE VOCABULARY

51. Give Russian equivalents of the following words and phrases. Try to memorize them.

Nouns and noun phrases

arrangement	feed pipe	bleed valve
suspended floor	fall pipe	loop

floorboard	doorway	pressure relief valve
riser	frame	by-pass valve
joist	loft	manifold
micro bore	scope	fitting
sediment	lime scale	additive
water softening device		

Verbs and verbal phrases

to circulate	to insulate	to incorporate
to impose	to branch off	to feed
to bend	to be prone to	to wear

Adjectives

single	adjacent	previous

52. Unjumble the words *(Model: yesmst → system).*

1) gliesn → …	3) lavev → …	5) lmifonad → …
2) ropwkiep → …	4) oreb → …	6) aslec → …

53. Form the nouns from the following verbs.

installation → …	incorporation → …	dependence → …
support → …	allowance → …	protection → …
avoidance → …	supply → …	requirement → …
insulation → …	branch → …	container → …

54. Form the verbs from the following nouns.

circulation → …	to restrict → …	to add → …
to arrange → …	limitation → …	to resist → …
to conserve → …	to feed → …	to build → …
to connect → …	to illustrate → …	to size → …

55. Choose the contextual meanings of the words written in bold in Text 6.

1) frame
a) придавать форму
b) каркас
c) коробка
d) корпус

2) mean
a) способ
b) приспособление
c) значить
d) неприятный

3) branch
a) ветвь
b) иметь последствия
c) отрасль
d) отходить в сторону

4) run
a) простираться
b) расстояние
c) действие
d) эксплуатация

5) wear
a) износ
b) одежда
c) изнашиваться
d) эрозия

6) device
a) прибор
b) способ
c) механизм
d) схема

56. Fill in the correct prepositions, translate the phrases, then choose any five items and make up the sentences of your own.

1) a number ___ different arrangements; 2) to install ___ the radiators; 3) to pass ___ holes; 4) to cut ___ the top of the joists; 5) high level feed pipe ___ fall pipe; 6) to install ___ above; 7) to run the feed pipes ___ the top of the wall ___ the ceiling ___ fall pipes; 8) to run ___ the boiler and return ___ the boiler; 9) radiator connections made ___ the same pipe; 10) to rise ___ the radiator displacing cooler water back ___ the pipe; 11) to be fitted ___ a single pipe loop; 12) because ___ the restriction; 13) a pump ___ domestic use; 14) ___ the return side; 15) due ___ internal sediment; 16) to be prone ___ wear.

READING TASK: Text 6

57. What does a water central heating system consist of? What are the basic arrangements for the pipework? Read the text below to check your answers.

Water Central Heating – The Pipework

A water central heating system consists of basically the boiler, the radiators and the interconnecting piping. The boiler heats the water and (normally) a pump circulates the water through the pipework and radiators and back to the boiler. There are a number of different arrangements of boiler, pipework and supply to the radiators; each system has its own advantages and drawbacks.

There are 3 basic arrangements for the pipework connecting the boiler to the radiators:

- Single pipe loop
- Feed and return pipes
- Microbore

General practice is for the pipework to be installed below the radiator. With suspended timber floors, this is no great problem as the pipes can be installed below the floorboards with the risers to each radiator passing through holes in the floorboards. The pipework is normally either run between the joists or across the joists through cut-outs cut in the top of the joists. Except for microbore, the pipework should be supported below the floor boards to avoid excessive weight having to be supported by the pipework itself.

This method of installation is impractical where the building uses solid floors. Such installations normally have high level feed pipes with fall pipes feeding single or adjacent radiators. Where the ceiling of the room is suspended, the pipework is normally installed between the joists of the ceiling from above, this may not be possible where each floor is a separate dwelling.

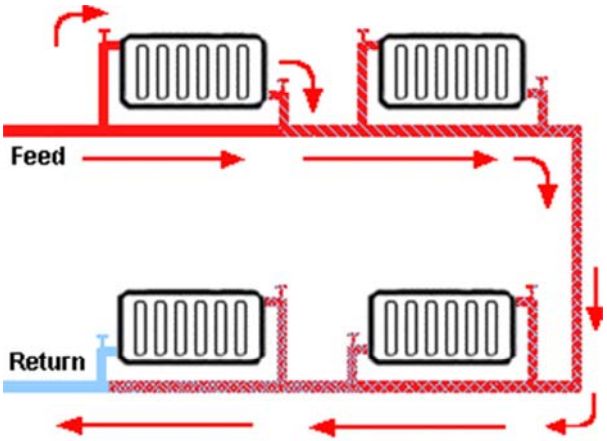
A third alternative is to run the feed pipes around the top of the wall just below the ceiling with fall pipes. It is never really desirable to run the feed pipes at floor level, problems arise where the pipes have to cross doorways, although the pipes could be taken up and around the door **frame** or be buried under the floor.

Where high level feed pipes need to be installed in a loft, the pipework must be insulated. It is not normally considered necessary to insulate pipework below suspended floors however there is potentially (general small) scope for energy conservation if it were to be.

Where the level of the circulating pipework is above the radiators, the pipework needs to incorporate bleed valves to allow any air in the system to be released.

Single pipe loop

A single pipe loop arrangement has, as the name implies, a single loop of pipework running from the boiler and returning to the boiler. Each radiator 'sits' upon the pipe with both radiator connections made to the same pipe. As the heated water from the boiler is fed along the pipe, natural convection (hot water rises) causes the heated water to rise into the radiator displacing cooler water back into the pipe.



A major disadvantage of this arrangement is that the first radiator gets hotter than the second one etc. and the last radiator will be considerable cooler as the water will have given up most of its heat to the previous radiators along the pipe run.

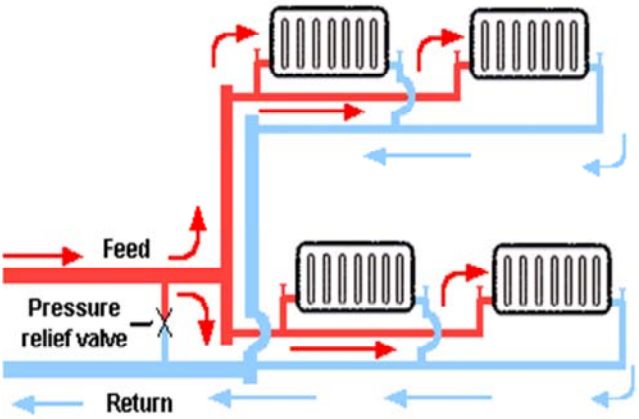
In principal the number of radiators which can be fitted to a single pipe loop is unlimited, but the more radiators fitted, the greater the cooling between the first and last radiators.

These systems are often used in industrial buildings where the loop pipe may be extremely large, the systems can still be found in older domestic premises but they are generally old installation and are not considered efficient.

Feed and return pipes

This system is more efficient than the single pipe loop. The heated water from the boiler is fed to one side of every radiator (the feed pipe) while the other end of each radiator is connected to a separate common return pipe. This **means** that the temperature of the water entering each radiator is more or less the same so each radiator should heat the local environment by the same amount.

A pressure relief valve (or automatic by-pass valve) is connected between the feed and return pipes, this allows the pump to circulate the water from the boiler if all the radiators should be shut off.



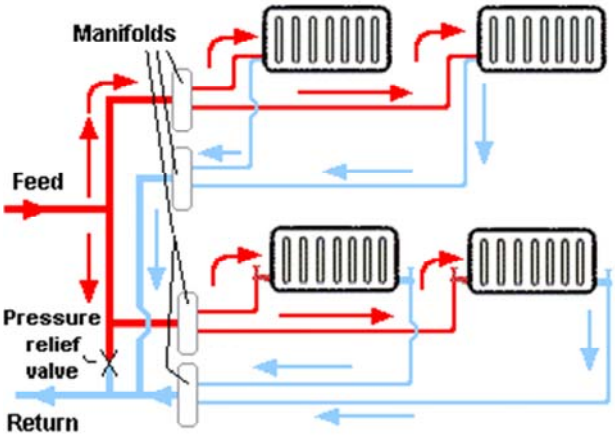
Because of the restriction of flow imposed by the radiators, the number of radiators is limited basically by the size of circulating pump. A standard pump for domestic use will probably be able to supply up to 12 radiators.

Another limitation is caused by the size of the pipework – normally the main pipes to and from the boiler are large (at least 22mm) and smaller pipework (15mm) is **branched** off to feed a number of radiators. The number of radiators which can be fed through these 15mm pipes will depend upon the length of the 15mm pipe runs – the longer the **run**, the fewer radiators. The illustration above shows two branches each feeding two radiators.

Micro Bore pipework

The micro bore system uses normal pipework for the feed from the boiler to manifolds and from manifolds back to the boiler on the return side. From each manifold, small pipework (normally 8mm) is connected to a number of radiators. The pipework between the manifolds and each radiator is normally kept below 5 metres.

Special radiator fitting may be used so that both the feed and return micro bore pipes are connected to the same end of each radiator (as upper 2 radiators in the illustration). Alternatively, the pipework may feed into the two ends of the radiators (as lower 2 radiators in the illustration).



Again, there is a pressure relief valve (or automatic by-pass valve) between the boiler feed and return pipes to protect the boiler should all the radiators be turned off.

The advantage of the micro bore system is that the smaller pipes contain less water so less heat is lost along each pipe run. In addition, the micro bore pipework can be easily bent during installation and does not require the same number of joints.

The disadvantages are than being very small, the pipes can easily become blocked due to internal sediment and the pump needs to overcome increased resistance when circulating the water from the boiler so the pump is more prone to **wear**.

In hard water areas, lime scale can build-up in any circulating pipework, this especially effects micro bore circulation systems and a suitable additive or water softening **device** is essential.

COMPREHENSION CHECK

58. Complete the following sentences according to the text.

1) A water central heating system consists of ...
2) Where the ceiling of the room is suspended, the pipework is installed …

3) The pipework must be insulated where…
4) A major disadvantage of single pipe loop arrangement is that …
5) In feed and return pipe system the heated water from the boiler is fed to …
6) The micro bore system uses normal pipework for …
7) In micro bore pipework special radiator fitting may be used so that …

59. Correct the following statements if necessary.

1) The boiler heats the water and circulates the water through the pipework and radiators and back to the boiler.
2) The pipework is usually run between the joists or across the joists through cut-outs cut in the top of the joists.
3) A single pipe loop arrangement has only one loop of pipework running from the boiler and returning to the boiler.
4) Natural convection causes the cooler water to rise into the radiator displacing heated water back into the pipe.
5) Single pipe loop systems can still be found in older domestic premises and they are generally considered efficient.
6) In feed and return pipe system the size of circulating pump limits the number of radiators.
7) The pipework between the manifolds and each radiator is usually more than 5 metres.
8) In micro bore pipework pumps are usually more prone to wear.

60. Answer the following questions and give examples.

1) Where are the pipes installed?
2) Why should the pipework be supported below the floor boards?
3) What are the main methods of pipework installations?
4) Why is it never really desirable to run the feed pipes at floor level?
5) Where does the pipework need to incorporate bleed valves?
6) Where is a single pipe loop arrangement used?
7) Where is a pressure relief valve installed? Why?
8) What does the number of radiators in feed and return pipe system depend upon?
9) What is the advantage of the micro bore system?
10) When are suitable additives or water softening devices used?

61. Fill in the table using the information from Text 7.

System	Features	Advantages	Disadvantages	Usage
1) single pipe loop				
2) feed and return pipes				
3) micro bore pipework				

62. Write a summary of Text 6.

OVER TO YOU

63. Work in pairs: choose one of pipework systems. Don't tell you partner which one. Describe it. Let your partner identify it.

LANGUAGE DEVELOPMENT

64. Fill in the words listed below.

a) hold	*d) electric*	*g) passes*
b) primary	*e) ignited*	*h) maintained*
c) water	*f) rises*	*i) continuously*

How does a gas water heater work?

Gas 1)_____ heaters can either be tankless or of the traditional storage type. A conventional or "storage" water heater uses a tank to 2)_____ water. Gas water heaters use gas (either natural gas or propane) as their 3)_____ fuel. A small flame called a "pilot light" burns continuously so that it is ready to "cook" your water at a moment's notice. Standard pilot lights must be 4)_____ with a match, but some more modern versions use an 5)_____ igniter to get the pilot light burning.

The cold water at the bottom is heated by the fuel, and then it 6)_____ to the top. A thermostat regulates the temperature, so that even if no one is using the water, the water temperature inside the tank is 7)_____ and ready to be piped into various faucets or appliances. In a gas-fueled tankless system, a small flame 8)_____ burns underneath the pipes. Cold water is heated as it 9)_____ by on its way to the tap.

FOLLOW UP

65. Read the texts of Unit I again and make notes under the following headings. Then use your notes to talk about *Heating*.

1) History of artificial heating.
2) Local heating systems.
3) Central heating systems. Basic types and components.
4) Water heaters, their advantages and disadvantages.
5) Three basic arrangements for the pipework and the main principles of their work.

UNIT II

VENTILATION

START HERE

1. Match the terms with their definitions.

a) contaminant	*e) diffuser*	*i) outdoor air supply*
b) plenum	*f) hood*	*j) air changes per hour*
c) pressure drop	*g) fan*	*k) unit ventilator*
d) drain trap	*h) mist*	*l) diffusers and grillers*

1) a harmful, irritating material;
2) an air outlet; sometimes associated with an inlet air register; constructed of perforated metal plates to discharge and mix supply air with ambient room air;
3) an aerosol consisting of liquid particles generated by condensation of a substance from the gaseous to the liquid state;
4) air compartment connected to a duct or ducts;
5) a fan-coil unit package device for applications in which the use of outdoor- and return-air mixing is intended to satisfy tempering requirements and ventilation needs;
6) the rate at which outside air replaces indoor air in a space;
7) the reduction in air pressure between any two points in the ventilation duct network; it occurs as the compressed air travels through filters and ducts;
8) components of the ventilation system that distribute and return air to promote air circulation in the occupied space;
9) a mechanical device which causes air movement;
10) a device designed to contain and/or capture aerosols and direct them to the exhaust duct network;
11) air supplied to a space to replace exhausted air;
12) a dip in the drain pipe of sinks, toilets, etc., which is designed to stay filled with water, thereby preventing sewer gases from escaping into the room.

2. Match a device and its name.

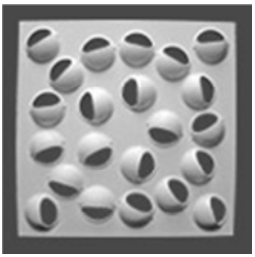
a) axial fan
b) door grill
c) swirl diffuser
d) chimney fan
e) ventilation grill
f) fan for industrial ventilation
g) chimney fan
h) flexible duct for ventilation and heating

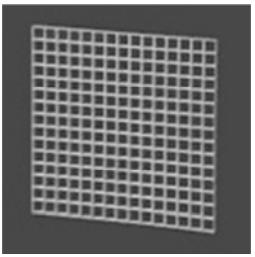
1 

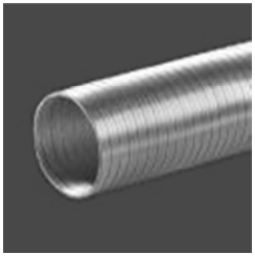
2 

3 

4 

5 

6 

7 

8 

ACTIVE VOCABULARY

3. Give Russian equivalents of the following words and phrases. Try to memorize them.

Nouns and noun phrases

dryer fan	garbage	mildew
laundry soap	mold	closet
condensation	trash	formaldehyde
operating costs	feature	saving
air intake	exhaust fan	ductwork
spot ventilation	exhaust-only	back drafting
general ventilation	supply-and-exhaust	fabric fiber

Verbs and verbal phrases

to dilute	to air out	to deliver
to depressurize	to respond	to identify
to fix	to ensure	to benefit

Adjectives

stale	musty	reasonable
outgoing	sealed	leaky
energy-recovery	overflowing	digestive
neutral	high-efficiency	incoming

4. Combine the words from the column on the left with the suitable nouns from the column on the right. Translate them into Russian.

1) proper	a) gases
2) body	b) ventilation
3) digestive	c) air
4) exhaust	d) fan
5) air	e) odors
6) heating and cooling	f) side
7) energy-recovery	g) ducts
8) pressure	h) intake
9) upwind	i) pressure

10) neutral	j) differences
11) enclosed	k) place

5. Choose the odd word.

1) to remove / to pull / to exhaust / to withdraw / to supply
2) to run / to operate / to exist / to perform / to function / to act
3) to spread / to extend / to distribute / to disperse / to dissolve
4) to lower / to raise / to lessen / to decrease / to cut / to diminish
5) to benefit / to advantage / to support / to improve / to promote
6) crisp /stale / close / stuffy / stifling
7) choice / selection / option / variant / alternative / range

6. Match the words with their synonyms.

1) to exhaust	5) to fix	*a) complex*	*e) suitable*
2) to dilute	6) to leak	*b) to release*	*f) to allocate*
3) to distribute	7) complicated	*c) to soak*	*g) to guarantee*
4) to ensure	8) appropriate	*d) to install*	*h) to attenuate*

7. Match the words with their opposites.

1) positive	6) sour	*a) excessive*	*f) sweet*
2) incoming	7) complicated	*b) to seal*	*g) similarity*
3) to leak	8) to improve	*c) negative*	*h) outgoing*
4) difference	9) to exhaust	*d) fresh*	*i) to deteriorate*
5) reasonable	10) stale	*e) to draw*	*j) simple*

8. Choose the contextual meanings of the words written in bold in Text 1.

1) way

a) особенность	c) способ
b) путь	d) состояние

2) sign

a) символ	c) сигнал
b) признак	d) обозначать

3) can

a) мочь
b) чехол
c) урна
d) банка

4) source

a) источник
b) ресурс
c) получать
d) исток

5) lower

a) недавний
b) сердитый
c) снижать
d) более низкий

9. Fill in the correct prepositions, translate the phrases, then choose any five items and make up the sentences of your own.

1) to air ___ home; 2) to move ___ place ___ place; 3) to spread ___ home; 4) to be appropriate ___ workshops; 5) to mix outdoor air ___ indoor air; 6) to force air out ___ cracks and openings; 7) to cool incoming air ___ outgoing exhaust air; 8) to be ___ pressure; 9) to cost ___ the range of; 10) air leaking ___ homes.

READING TASK: Text 1

10. What are the main approaches to ventilating a house? Read the text below to check your answer.

Ventilation

Ventilation is the process and practice of keeping an enclosed place supplied with proper air for breathing. People spend about 90% of their time inside, that's why good ventilation is important because it helps protect your health and your home. Ventilation supplies fresh air to your home and dilutes or removes stale air. There are many **ways** this can happen: opening windows to air out your home, turning on the fan over the kitchen range or in the bathroom, using chimneys and clothes dryer fans. Conditions such as the sour smell of garbage from a trash; a musty, gym-like smell coming from the bedroom walls; or mold or mildew in

closets, or on ceilings or exterior walls; the condensation on the inside of your windows, irritation of your eyes, when you are at home may be **signs** of poor ventilation. It may be as simple as an overflowing garbage **can** or as complicated as mold growing inside walls. Whatever the case, you must identify the source before you can solve the problem. One of the easiest ways to improve indoor air quality is to remove or avoid using common sources of moisture, odors, and gases.

There are two basic approaches to ventilating your home: 1) spot ventilation for localized pollution sources; and 2) general ventilation to dilute pollutants from sources that exist in many locations or move from place to place.

Spot ventilation uses exhaust fans to collect and remove pollutants before they spread throughout your home. The exhaust fan is generally turned on only when the **source** is producing pollutants. Bathrooms, kitchens, and laundry rooms all contain obvious sources of moisture and odors. Spot ventilation may also be appropriate for home offices, hobby rooms, or workshops.

General ventilation fans run all the time to control pollutants from sources that can't be spot-ventilated. General ventilation mixes fresh outdoor air with stale indoor air to lower the concentration of pollutants (dilution). Fresh air is provided by fans blowing outdoor air into the house, which forces air out through cracks and openings (pressurizing), or by exhausting air from the house, which then draws fresh air inside (depressurizing). General ventilation can be provided in two ways: exhaust-only, and supply-and-exhaust.

With exhaust-only ventilation, exhaust fans pull stale air out of your home while drawing fresh air in through cracks, windows, or fresh air intakes. If you use this strategy, your home will be depressurized. Exhaust-only ventilation is a good choice for homes that do not have existing ductwork to distribute heated or cooled air. However, if there is radon in the soil around the house, this method can increase indoor radon levels.

With supply-and-exhaust ventilation, exhaust fans pull stale air out of the house while intake fans blow in fresh air. This system is more complex than exhaust-only, but may ensure a better flow of fresh air into your home. Outdoor air is drawn in by fans and delivered to rooms through heating and cooling ducts. Supply-and-exhaust ventilation is a good choice for homes with heating or cooling ducts because it's an

inexpensive way of providing fresh air. Some homes may benefit from energy-recovery ventilation, which warms (or cools) incoming air with outgoing exhaust air.

Air pressure differences are caused by such things as wind, temperature differences, and fans. For example, air moves into a home on the upwind side and out of a home on the downwind side because of pressure differences; heated air from a boiler or fireplace goes up a chimney because of temperature differences; exhaust fans remove cooking odors by making the pressure in the kitchen lower than the air pressure outside. Air always moves from higher to **lower** pressure areas.

Understanding how air moves inside your home can help you avoid or fix such ventilation-related problems as excess moisture, back drafting, and radon. If the pressure inside is higher than outside, your home is under positive pressure, and air moves out of the house. Air moves into, out of, and around the inside of your home because of differences in air pressure. When the pressure inside your home is lower than it is outside, the house is under negative pressure. In this case, outdoor air, including that in the soil, moves into the house. When there is no difference between the indoor and outdoor pressure, the house is under neutral pressure. Air differences also control the way air moves, from room to room inside your home.

COMPREHENSION CHECK

11. Decide whether the following statements are true or false according to Text 1.

1) Stale air is diluted or removed by ventilation which supplies fresh air to your home.
2) Using common sources of moisture, odors, and gases means improving indoor air quality.
3) General ventilation is used for localized pollution sources.
4) In spot ventilation the exhaust fan is usually turned off when the source is producing pollutants.
5) General ventilation fans operate constantly to control pollutants.
6) Exhaust fans draw fresh air in through cracks, windows, or fresh air intakes while pulling stale air out of your house.

7) Exhaust-only ventilation is more simple than supply-and-exhaust.
8) Exhaust-only ventilation means energy-recovery ventilation.
9) Air always moves from lower to higher pressure areas.

12. Complete the following sentences according to the text.

1) Good ventilation is important because …
2) … are signs of poor ventilation.
3) Spot ventilation uses exhaust fans in order to …
4) General ventilation is used constantly because ...
5) General ventilation can be provided in two ways: …
6) Exhaust-only ventilation is a good choice for homes that …
7) With supply-and-exhaust ventilation, exhaust fans pull stale air out of the house while …
8) Supply-and-exhaust ventilation is a good choice for homes with …
9) Understanding how air moves inside your home can help you …

13. Answer the following questions and give examples.

1) What is ventilation?
2) What is fresh air provided by in general ventilation?
3) What do the fans in general ventilation do?
4) What is pressurizing and depressurizing?
5) What are the advantages of supply-and-exhaust ventilation?
6) What are air pressure differences caused by? Give examples.
7) When is your home under positive pressure / negative pressure / neutral pressure?

14. Fill in the table using the information from Text 1.

	Types	**Peculiarities**	**Usage**
spot ventilation	----------		
general ventilation	exhaust-only		
	supply-and-exhaust		

15. Write a summary of Text 1.

OVER TO YOU

16. Discuss with your groupmates or in pairs: Prove that ventilation is important. How are houses ventilated? What can you do to improve ventilation?

ACTIVE VOCABULARY

17. Give Russian equivalents of the following words and phrases. Try to memorize them.

Nouns and noun phrases

partition wall	air-conditioning plants	transom window
awareness	buoyancy	louver
scoop	challenge	grill
leeward side	attic fan	outlet and inlet
net area	rated fan volume	glass pane
soffit	gable	roof overhang
incidence	casement window	hinge

Verbs and verbal phrases

to complete	to alleviate	to suck
to accomplish	to mount	to justify
to prevail	to induce	to orient

Adjectives

acceptable	perceived

Adverbs

parallel	perpendicular

18. Combine the words from the column on the left with the suitable nouns from the column on the right. Translate them into Russian.

1) partition	a) side
2) increased	b) awareness

3) favorable	c) effect
4) air-conditioning	d) air
5) buoyancy	e) plants
6) leeward	f) walls
7) humid	g) feature
8) attic	h) ventilator
9) wind-assisted	i) methods
10) motorized	j) climates
11) architectural	k) inlets
12) casement	l) window
13) windward	m) inlet louver

19. Match the words with their synonyms.

1) approach	6) to accomplish	*a) quantity*	*f) to lessen*
2) amount	7) to alleviate	*b) to direct*	*g) to perform*
3) acceptable	8) to mount	*c) way*	*h) to produce*
4) challenge	9) to induce	*d) to install*	*i) suitable*
5) velocity	10) to orient	*e) problem*	*j) speed*

20. Unjumble the words. (*Model: yesmst → system)*

1) ncyyauob → …	4) rllig → …	7) uettlo → …
2) loveciyt → …	5) nepa → …	8) spnlat → …
3) ietnl → …	6) ginhe → …	9) itsoff → …

21. Give the definitions of the following terms.

1) gable	4) transom window
2) louver	5) attic fan
3) buoyancy	6)casement window

22. Choose the contextual meanings of the words written in bold in Text 2.

1) plant

a) растение	c) оборудование
b) размещать	d) завод

2) critically

a) критически
b) опасно
c) значительно
d) серьезно

3) transfer

a) перемещение
b) перемещать
c) перевозить
d) переход

4) close

a) закрытый
b) закрывать
c) близкий
d) душный, спертый

5) level

a) коэффициент
b) ровный
c) выравнивать
d) уровень

23. Fill in the correct prepositions, translate the phrases, then choose any five items and make up the sentences of your own.

1) an approach ___ using mechanical ventilation; 2) to use ___ an alternative ___ smth.; 3) to rely ___ pressure differences; 4) to be ineffective ___ reducing; 5) to place a limit ___ the application; 6) to suck air ___ openings ___ the leeward side; 7) to enter ___ lower openings; 8) to accomplish ___ two ways; 9) to pull ___ open windows; 10) $1/800^{th}$ ___ the rated fan volume ___ cfm; 11) to be ___ the soffit; 12) ___ conjunction ___; 13) to be ___ operation; 14) to be ___ a 90° angle; 15) to have hinges ___ the left-hand side; 16) to be perpendicular ___ the airflow.

READING TASK: Text 2

24. What are the two main ventilation methods? Read the text below to check your answer.

Ventilation Methods

Almost all historic buildings were ventilated naturally, although many of these have been compromised by the addition of partition walls and mechanical systems. With an increased awareness of the cost and

environmental impacts of energy use, natural ventilation has become an increasingly attractive method for reducing energy use and cost and for providing acceptable indoor environmental quality and maintaining a healthy, comfortable, and productive indoor climate rather than the more prevailing approach of using mechanical ventilation. In favorable climates and buildings types, natural ventilation can be used as an alternative to air-conditioning **plants**, saving 10%-30% of total energy consumption.

Natural ventilation systems rely on pressure differences to move fresh air through buildings. Pressure differences can be caused by wind or the buoyancy effect created by temperature differences or differences in humidity. In either case, the amount of ventilation will depend **critically** on the size and placement of openings in the building. It is useful to think of a natural ventilation system as a circuit, with equal consideration given to supply and exhaust. Openings between rooms such as transom windows, louvers, grills, or open plans are techniques to complete the airflow circuit through a building. Code requirements regarding smoke and fire **transfer** present challenges to the designer of a natural ventilation system. For example, historic buildings used the stairway as the exhaust stack, a technique now prevented by code requirements in many cases.

Natural ventilation, unlike fan-forced ventilation, uses the natural forces of wind and buoyancy to deliver fresh air into buildings. Fresh air is required in buildings to alleviate odors, to provide oxygen for respiration, and to increase thermal comfort. At interior air velocities of 160 feet per minute (fpm), the perceived interior temperature can be reduced by as much as 5°F. However, unlike true air-conditioning, natural ventilation is ineffective at reducing the humidity of incoming air. This places a limit on the application of natural ventilation in humid climates.

Types of Natural Ventilation Effects

Wind can blow air through openings in the wall on the windward side of the building, and suck air out of openings on the leeward side and the roof. Temperature differences between warm air inside and cool air outside can cause the air in the room to rise and exit at the ceiling or ridge, and enter via lower openings in the wall. Similarly, buoyancy caused by differences in humidity can allow a pressurized column of dense, evaporatively cooled air to supply a space, and lighter, warmer, humid air to exhaust near the top.

Power Ventilation. Power ventilation can be accomplished in two ways. In homes not mechanically cooled (air conditioned) the tempera-

ture can be controlled to some extent by the use of attic fans. These fans are usually ceiling mounted in a central hallway so that outside air is pulled through open windows and exhausted through the attic. Sufficient outlets must be installed in the attic to exhaust the air without creating high pressures against which the fan must operate. The net area of attic outlets should be 1/800th of the rated fan volume in cfm and 1/8 inch static pressure. The outlets should be distributed uniformly.

Air conditioned homes can use power attic ventilators by installing an exhaust fan through the roof or in the gable. Inlets for the ventilating air should be at the soffit, or the opposite gable, when no roof overhang exists.

Power ventilators have the advantage of providing good ventilation even when there is no wind. They also provide limited attic temperature control when installed in conjunction with a thermostat. For well-insulated ceilings (i.e. insulation **levels** of R-19 or above) it is doubtful that power ventilation can be justified economically.

However, there are some attics which cannot be ventilated by gravity or wind-assisted methods, and in these the power vent is necessary for moisture and temperature control.

For areas of Texas where blowing dust and sand are a problem, consideration should be given to the use of a power ventilator with automatic or motorized inlet louvers which **close** when the fan is not in operation. Ventilation can be shut off during a dust storm to prevent the buildup of dust and sand in the attic.

The coefficient of effectiveness depends on the angle of the wind and the relative size of entry and exit openings. It ranges from about 0.4 for wind hitting an opening at a 45° angle of incidence to 0.8 for wind hitting directly at a 90° angle.

Sometimes wind flow prevails parallel to a building wall rather than perpendicular to it. In this case it is still possible to induce wind ventilation by architectural features or by the way a casement window opens. For example, if the wind blows from east to west along a north-facing wall, the first window (which opens out) would have hinges on the left-hand side to act as a scoop and direct wind into the room. The second window would hinge on the right-hand side so the opening is down-wind from the open glass pane and the negative pressure draws air out of the room.

It is important to avoid obstructions between the windward inlets and leeward exhaust openings. Avoid partitions in a room oriented perpendicular to the airflow. On the other hand, accepted design avoids inlet

and outlet windows directly across from each other (you shouldn't be able to see through the building, in one window and out the other), in order to promote more mixing and improve the effectiveness of the ventilation.

COMPREHENSION CHECK

25. Decide whether the following statements are true or false according to the text.

1) A small number of historic buildings were ventilated naturally.
2) Air-conditioning plants are the alternative to natural ventilation.
3) The size and placement of openings in the building influence the amount of ventilation.
4) The natural forces of wind and buoyancy are used to deliver fresh air into buildings in natural ventilation.
5) Natural ventilation also decreases the humidity of incoming air.
6) Attic fans are usually installed through the roof or in the gable.
7) The power vent is necessary for moisture and temperature control if an attic cannot be ventilated by gravity or wind-assisted methods.
8) Architectural features or by the way a casement window opens always induce wind ventilation.
9) There shouldn't be obstructions between the windward inlets and leeward exhaust openings.
10) Partitions in a room should be oriented parallel to the airflow.

26. Complete the following sentences according to the text.

1) Natural ventilation saves about …
2) … cause pressure differences.
3) It is useful to think of a natural ventilation system as …
4) Fresh air is required in buildings to …
5) Wind can blow air through … and suck air out of …
6) Buoyancy is caused by …
7) The use of attic fans controls …
8) Sufficient outlets must be installed in the attic to exhaust the air without …
9) Air conditioned homes can use power attic ventilators by …
10) The coefficient of effectiveness depends on … and ranges from …

27. Answer the following questions.

1) What is natural ventilation aimed at?
2) What do natural ventilation systems rely on?
3) What is used to complete the airflow circuit through a building?
4) What presents challenges to the designer of a natural ventilation system?
5) What can temperature differences between warm air inside and cool air outside cause?
6) What ways can power ventilation be accomplished?
7) What should the net area of attic outlets be?
8) What are the requirements for fans and inlets in air conditioned homes?
9) What is the main advantage of power ventilators?
10) When should consideration be given to the use of a power ventilator with automatic or motorized inlet louvers?
11) Why does accepted design avoid inlet and outlet windows directly across from each other?

28. Find key words and phrases which best express the general meaning of each part. Make the plan of Text 2. Write a summary.

OVER TO YOU

29. Discuss with your groupmates or in pairs: What does the cost of ventilation depend on?

ACTIVE VOCABULARY

30. Give Russian equivalents of the following words and phrases. Try to memorize them.

Nouns and noun phrases

depressurization	crawlspace	pollen
cavity	fume	

Verbs and verbal phrases

to infiltrate	to discourage
to temper	to promote

Adjectives

intentional	random	applicable
adjustable	appropriate	

Adverbs

vice-versa

31. Combine the words from the column on the left with the suitable nouns from the column on the right. Translate them into Russian.

1) building	a) damage
2) pressure	b) ventilation
3) exhaust	c) air
4) moisture	d) openings
5) outdoor	e) shell
6) combustion	f) systems
7) supply	g) leak
8) random	h) difference
9) balanced	i) gases
10) air	j) fan

32. Match the English and Russian equivalents.

1) exhausted ventilation system	*a) вентиляция с рекуперацией тепла*
2) supply ventilation system	*b) избегать обратной тяги*
3) balanced ventilation system	*c) предотвращать ухудшение*
4) heat-recovery ventilation system	*d) вытяжная система вентиляции*
5) to avoid back drafting	*e) ограждающая конструкция здания*
6) a single-point exhaust	*f) теплопередающая поверхность*
7) building envelope	*g) приточная система вентиляции*
8) to prevent deterioration	*h) изолированные помещения*
9) heat exchange surface	*i) одноточечное вытягивание*
10) discrete locations	*j) комбинированная система вентиляции*

33. Match the words with their synonyms.

1) properly	6) preferable	*a) desirable*	*f) accumulation*
2) inexpensive	7) humid	*b) correctly*	*g) to interfere*
3) to reduce	8) to condense	*c) to further*	*h) to intensify*
4) to discourage	9) to contribute	*d) to diminish*	*i) low-priced*
5) buildup	10) to remove	*e) to withdraw*	*j) moist*

34. Translate these phrases into English.

Доброкачественный воздух, механическая система, разгерметизировать здание, давление внутри помещения, очищенный воздух, утечка, возможность планировки, разность давлений, непрерывно, быть причиной повреждения, топочные газы, регулируемый, жилое помещение, смешанный климат, наружные стены, устранять влагу, равное количество, уменьшать тягу, теплообменник, энергосбережение, техническое обслуживание, рост плесени и бактерий, скопление льда.

READING TASK: Text 3

35. How can Ventilation Systems be classified? Read the text below to check your answer.

Whole-House Ventilation System Designs

The decision to use whole-house ventilation is typically motivated by concern that natural ventilation is not providing adequate air quality, even with source control by spot ventilation. Whole-house ventilation systems are usually classified as:

- exhaust ventilation if the mechanical system forces inside air out of the home,
- supply ventilation if the mechanical system forces outside air into the home,
- balanced ventilation if the mechanical system forces equal quantities of air into and out of the home.

Exhaust ventilation systems work by depressurizing the building. By reducing the inside air pressure below the outdoor air pressure, they

extract indoor air from a house while make-up air infiltrates through leaks in the building shell and through intentional, passive vents.

Exhaust ventilation systems are relatively simple and inexpensive to install. Typically, an exhaust ventilation system is composed of a single fan connected to a centrally located, single exhaust point in the house. A preferable design option is to connect the fan to ducts from several rooms (preferably rooms where pollutants tend to be generated, such as bathrooms). Adjustable, passive vents through windows or walls can be installed in other rooms to introduce fresh air rather than rely on leaks in the building envelope. However, their use may be ineffective because larger pressure differences than those induced by the ventilation fan may be needed for them to work properly. Spot ventilation exhaust fans installed in the bathroom but operated continuously can represent an exhaust ventilation system in its simplest form.

Exhaust ventilation systems are most applicable in cold climates. In climates with warm humid summers, depressurization can draw moist air into building wall cavities, where it may condense and cause moisture damage.

One concern with exhaust ventilation systems is that they may draw pollutants, along with fresh air, into the house. For example, in addition to drawing in fresh outdoor air, they may draw in radon and molds from a crawlspace, dust from an attic, fumes from an attached garage, or flue gases from a fireplace or fossil-fuel-fired water heater and furnace. This can especially be of concern when bath fans, range fans, and clothes dryers (which also depressurize the home while they operate) are run when an exhaust ventilation system is also operating. Also, exhaust ventilation systems can contribute to higher heating and cooling costs compared with heat-recovery systems because exhaust systems do not temper or remove moisture from the make-up air before it enters the house.

Supply ventilation systems work by pressurizing the building. They use a fan to force outside air into the building while air leaks out of the building through holes in the shell, bath and range fan ducts, and intentional vents (if any exist).

As with exhaust ventilation systems, supply ventilation systems are relatively simple and inexpensive to install. A typical supply ventilation system has a fan and duct system that introduces fresh air into usually one, but preferably several rooms of the home that residents occupy most often (e.g., bedrooms, living room), perhaps with adjustable window or

wall vents in other rooms. Supply ventilation systems allow better control of the air that enters the house than do exhaust ventilation systems. By pressurizing the house, supply ventilation systems discourage the entry of pollutants from outside the living space and avoid backdrafting of combustion gases from fireplaces and appliances. Supply ventilation also allows outdoor air introduced into the house to be filtered to remove pollen and dust or dehumidified to provide humidity control.

Supply ventilation systems are most applicable in hot or mixed climates. Because they pressurize the house, supply ventilation systems have the potential to cause moisture problems in cold climates. In winter, the supply ventilation system causes warm interior air to leak through random openings in the exterior wall and ceiling. If the interior air is humid enough, some moisture may condense in the attic or cold outer parts of the exterior wall where it can promote mold, mildew, and decay.

Like exhaust ventilation systems, supply ventilation systems do not temper or remove moisture from the make-up air before it enters the house. Thus, they may contribute to higher heating and cooling costs compared with heat-recovery systems. Because air is introduced in the house at discrete locations, outdoor air may need to be mixed with indoor air before delivery to avoid cold air drafts in the winter. An in-line duct heater is another option, but it will increase operating costs.

Balanced ventilation systems neither pressurize nor depressurize a house if properly designed and installed. Rather, they introduce and exhaust approximately equal quantities of fresh outside air and polluted inside air, respectively. Balanced ventilation systems are appropriate for all climates.

A balanced ventilation system usually has two fans and two duct systems and facilitates good distribution of fresh air by placing supply and exhaust vents in appropriate places. Fresh air supply and exhaust vents can be installed in every room, but a typical balanced ventilation system is designed to supply fresh air to bedrooms and living rooms where people spend the most time, and exhaust air from rooms where moisture and pollutants are most often generated (kitchen, bathrooms, and perhaps the laundry room). Some designs may use a single-point exhaust. Because they directly supply outside air, balanced systems allow the use of filters to remove dust and pollen from outside air before introducing it into the house.

Balanced systems are usually more expensive to install and operate than supply or exhaust systems because they require two duct and fan systems. Like these other systems, balanced ventilation systems do not temper or remove moisture from the make-up air before it enters the house and thus may contribute to higher heating and cooling costs compared with heat-recovery systems. Like supply ventilation systems, outdoor air may need to be mixed with indoor air before delivery to avoid cold air drafts in the winter.

Balanced, Heat-recovery Ventilation Systems A special type of balanced ventilation system adds a heat-recovery unit to the basic design. A heat-recovery unit reduces the heating and cooling costs of ventilation by transferring heat from the warm inside air being exhausted to the fresh but cold outside air in the winter, and vice-versa in the summer. Comfort is also improved because the supply air is tempered before delivery, reducing drafts. Some heat-recovery systems also transfer moisture — an advantage in warm, humid climates in the summer and cold climates in the winter.

Balanced ventilation systems with heat recovery are more costly to install than balanced systems without heat recovery because heat-recovery systems require more powerful fans that use more energy to overcome the air resistance of the heat exchanger.

Balanced, heat-recovery units are most cost effective in climates with extreme winters or summers, and where fuel costs are high. In mild climates, the cost of the additional electricity consumed by the fans may exceed the energy savings from not having to heat and cool the air introduced by the ventilation system.

Heat-recovery systems require more maintenance than other whole-house ventilation systems. They need to be cleaned regularly to prevent deterioration of ventilation rates and heat recovery, and to prevent growth of mold and bacteria on heat exchange surfaces. When warm, moist air is cooled, condensate forms on cool surfaces and must be drained from the heat-recovery system. In cold climates, very cold air brought into a heat-recovery system can cause frost formation in the heat exchanger. Because frost buildup reduces ventilation effectiveness and can damage the heat exchanger, heat-recovery systems must have devices to deal with frost.

COMPREHENSION CHECK

36. Decide whether the following statements are true or false according to the text.

1) Whole-house ventilation systems are usually classified as supply, exhaust and heat-recovery.
2) There are four main types of ventilation systems.
3) Exhaust ventilation systems are relatively low-priced to install.
4) Spot ventilation exhaust fan is the simplest form of an exhaust ventilation system.
5) Exhaust ventilation systems can contribute to higher heating and cooling costs compared with supply ventilation systems.
6) Supply ventilation systems work by depressurizing the building.
7) Supply ventilation systems allow better control of the air than do balanced systems.
8) Supply ventilation systems are most applicable in cold climates.
9) A balanced ventilation system usually has two fans and two duct systems.
10) A heat-recovery unit reduces the heating and cooling costs of ventilation.

37. Answer the following questions.

1) What is the classification of whole-house ventilation systems?
2) Are the mechanical or natural or combined?
3) What is the principle of exhaust ventilation systems working?
4) Why its use may be ineffective?
5) What is the principle of supply ventilation systems working?
6) What do exhaust ventilation systems and supply ventilation systems have in common?
7) What type of ventilation systems is the most expensive to install?
8) What type of ventilation systems can be added to the basic design?
9) A heat-recovery unit reduces maintenance, doesn't it?
10) Are balanced, heat-recovery ventilation systems energy efficient?

38. Fill in the table using the information from Text 3.

Type	***Equipment***	***Climate***	***Disadvantages***
Exhaust ventilation systems			
Supply ventilation systems			
Balanced ventilation systems			
Balanced, Heat-recovery Ventilation Systems			

39. Make an oral report on the text.

OVER TO YOU

40. Discuss with your groupmates or in pairs: What are the steps for designing a whole-house ventilation system? What type of ventilation system is the most common in Belarus?

LANGUAGE DEVELOPMENT

41. Make up the text using the sentences below. Note how certain words refer forward and back to other words in the text. Use such link words as *although, despite/in spite of, however, furthermore, moreover, in addition, also*, etc. You may use your own link words.

1) Good ventilation is as critical to your comfort and safety as a reliable heating system, a smoke alarm, or a dry basement.
2) _____
3) _____
4) _____
5) _____
6) _____
7) _____

- Well-planned ventilation prevents the growth of mold and mildew, which can cause or aggravate allergic reactions and lung problems such as asthma.
- It protects you, your family, and your guests from unpleasant odors, irritating pollutants, and potentially dangerous gases like carbon monoxide and radon.
- Too much moisture rots window sills and attic eaves, peels paint, and invites insect infestation.
- Good ventilation protects your home from damage by eliminating excess moisture from the air.
- Carpeting, wallpaper, electronic equipment, and furniture all can be damaged by excess moisture.
- Damp insulation in walls and ceilings means lost heat, higher fuel bills, and destructive mold growth.

FOLLOW UP

42. Read the texts of Unit II again and make notes under the following headings. Then use your notes to talk about Ventilation.

1) Broad definition of ventilation and basic approaches to it (spot and general).
2) Ventilation methods (natural and power).
3) Whole-house ventilation systems' classification (exhaust, supply and balanced): equipment needed, appropriate climates, disadvantages.

UNIT III

HUMIDIFICATION

START HERE

1. Choose the right word.

(Humidity / Humidification) is the amount of moisture that exists in the *(air / soil)*. It can *(occur / change)* depending upon the time of year and whether there is active *(rain / precipitation)*. Relative humidity is the percentage of *(moisture / water)* that actually exists relative *(with / to)* the amount that could. Dew points reflect the temperatures where *(80 / 100)* percent humidity will occur.

There are *(certain / several)* regions that tend to have higher levels of humidity than others. In general, cities that are located *(farther / closer)* to the equator have *(lower / higher)* dew points and feel more *(humid / humidity)*.

2. Fill in the words listed below.

a) remove	*c) increase*	*e) key*	*g) precipitation*
b) dew	*d) Moisture*	*f) cool*	*h) thunderstorms*

Air moisture is a 1)_____ component of humidity. When more moisture exists, there is a greater chance of 2)_____. Storm activity tends to 3)_____ with high amounts of air moisture. For example, locations such as Florida in the USA tend to experience regular afternoon 4)_____ year round.

5)_____ levels tend to be higher when the air is 6)_____. In many locations, morning temperatures often result in visible 7)_____ on plants and grass. This is because colder temperatures are not able to 8)_____ as much moisture from the air.

3. Make up the texts using the sentences below. Note how certain words refer forward and back to other words in the texts.

1b , 2__, 3__, 4__, 5__, 6__, 7__, 8__.

a) In humid locations, warm temperatures will feel warmer than the same temperatures in an arid climate.
b) Higher levels of air moisture can strengthen the feeling of warm or cool temperatures.
c) The breeze helps to circulate the air and remove some of its heaviness, while cooling temperatures.
d) An example of this phenomenon can be seen in a location such as Florida.
e) Likewise, cool temperatures in humid locations will feel much colder than the same temperatures in a dry area.
f) The same temperature in a drier climate, such as the state of Colorado, might prompt those residents to turn off their heaters.
g) Residents of this state often put on sweaters and turn on their heat with temperatures as high as 10° Celsius.
h) Coastal breezes can diminish the feeling of humidity.

ACTIVE VOCABULARY

4. Give Russian equivalents of the following words and phrases. Try to memorize them.

Nouns and noun phrases

respiration	atomizer	condensation
warping	ratio	humidity
absolute humidification	equilibrium	humidifier
relative humidification		

Verbs and verbal phrases

to assemble	to couple with	to integrate with
to express	to contribute to	to relax

Adjectives

artificial	delicate	wrinkled
ambient	tuned	

Adverbs

precisely	intimately

5. Combine the words from the column on the left with the suitable nouns from the column on the right. Translate them into Russian.

1) artificial	a) application
2) health care	b) discharge
3) ambient	c) respiration
4) fire	d) system
5) static	e) sensor
6) precisely tuned	f) atomizer
7) liquid	g) risk
8) humidity control	h) dust
9) unwanted	i) humidity level
10) accurate	j) humidity

6. Match the words with their synonyms.

1) artificial	6) to tie	*a) to diminish*	*f) to reflect*
2) ambient	7) to distribute	*b) to gather*	*g) imitation*
3) to reduce	8) accurate	*c) to fasten*	*h) encompassing*
4) to assemble	9) to express	*d) exactly*	*i) to take place*
5) precisely	10) to occur	*e) exact*	*j) to spread*

7. Choose the contextual meanings of the words written in bold in Text 1.

1) delicate

a) искусный	c) непростой
b) чувствительный	d) хрупкий

2) accurate

a) аккуратный	c) верный
b) точный, безошибочный	d) четкий

3) discharge

a) разряжать	c) выплата
b) выпускать	d) разряд

8. Fill in the correct prepositions, translate the phrases, then choose any five items and make up the sentences of your own.

1) to couple ___ smth.; 2) to express ___ grams ___ moisture ___ cubic volume ___ air; 3) a ratio ___ the amount of moisture currently in the air and the maximum moisture; 4) to contribute ___ allergies; 5) to be hung ___ the ceiling ___ duct work; 6) to be tied ___ heating and cooling systems; 7) to be integrated ___ cooling system; 8) to be linked ___ ventilation system; 9) to reach equilibrium ___ the humidity outside; 10) to become wrinkled ___ age.

READING TASK: Text 1

9. Try to define "humidification", "humidifying", "humidifier", "humidity" in your own words. Do any of them have the same meaning? Read the text below to check your answer.

What is Humidification?

Humidification is the artificial regulation of humidity in home environments, industrial environments, and health care applications such as artificial respiration. To be comfortable, people require a certain amount of ambient humidity – not too high, and not too low. Adequate humidification in a manufacturing environment stabilizes moisture in wood, paper, and textiles, while preventing warping in glue joints. In all environments, humidification reduces fire risk and static electricity while making the area feel comfortable.

Areas in which **delicate** components such as electronics are assembled require precisely tuned humidity levels. Humidification is achieved using liquid atomizers which distribute moisture to the area, coupled with **accurate** sensors which measure ambient humidity.

In humidification, two quantities are commonly used. Absolute humidification is expressed in grams of moisture per cubic volume of air, while the more commonly used relative humidification is expressed as a ratio between the amount of moisture currently in the air and the maximum moisture the air could hold before condensation occurs. A typical comfortable level of relative humidification is between 35 % and 50 %. Excess humidity can cause the growth of mold or fungus. Too little

humidity can cause static **discharge** or the accumulation of unwanted dust, contributing to allergies.

Many humidifiers are cheap and require little maintenance. In industrial settings, they are often hung from the ceiling among duct work. Humidification is intimately tied to heating and cooling systems. The level of humidity in the air is also a function of the temperature. Therefore, humidity control systems are often integrated with cooling systems.

Humidification systems are designed by mechanical engineers and are also linked to ventilation systems. Given adequate ventilation from the outside, the humidity of an indoor environment will tend to reach equilibrium with the humidity outside. Humidification is also used to "relax" old documents that have become wrinkled with age.

COMPREHENSION CHECK

10. Complete the following sentences according to Text 1.

1) Humidification is …
2) Humidification makes the area feel …
3) Humidification is achieved …
4) Absolute humidification is expressed in …
5) Relative humidification is expressed as …
6) Too little humidity can cause …
7) In industrial settings, humidifiers are often hung from …
8) Humidification systems are designed by …

11. Decide whether the following statements are true or false according to Text 1.

1) People require a high or low amount of ambient humidity.
2) In all environments, humidification lowers static electricity and fire risk.
3) Liquid atomizers spread moisture to the area.
4) Absolute humidification is more often used than relative humidification.
5) The growth of mold or fungus is always caused by excess humidity.
6) Many humidifiers are inexpensive and need little maintenance.
7) Humidification is closely connected with heating and cooling systems.
8) Humidification systems aren't connected with ventilation systems.

12. Answer the following questions.

1) What is humidification?
2) What does adequate humidification in a manufacturing environment stabilize?
3) Where are precisely tuned humidity levels required?
4) What do accurate sensors measure?
5) What is a usual comfortable level of relative humidification?
6) Why are humidity control systems often integrated with cooling systems?
7) Adequate ventilation from the outside helps the humidity of an indoor environment to reach equilibrium with the humidity outside, doesn't it?

13. Write an abstract for Text 1.

OVER TO YOU

14. Discuss with your groupmates or in pairs: How do different levels of relative humidification influence people? What levels of humidification are common for Belarus?

ACTIVE VOCABULARY

15. Give Russian equivalents of the following words and phrases. Try to memorize them.

Nouns and noun phrases

dry bulb temperature	desert cooler	blower
spray	running cost	dew point
content	enthalpy	

Verbs and verbal phrases

to evaporate	to release	to maintain

Adjectives

pure	evaporative	unitary
sensible	latent	

Adverbs

simultaneously

16. Unjumble the words. *(Model: yesmst → system)*

1) ruep → …	4) eontntc → …	7) abbrso → …
2) enblssie → …	5) ypsar → …	8) nttela → …
3) erlobw → …	6) ubbl → …	9) diceev → …

17. Combine the words from the column on the left with the suitable nouns from the column on the right. Translate them into Russian.

1) dry bulb	a) cost
2) actual	b) water
3) air conditioning	c) application
4) evaporated	d) temperature
5) moisture	e) temperature
6) evaporated	f) content
7) running	g) climates
8) high humidity	h) practice
9) dew point	i) air conditioners
10) unitary	j) cooler

18. Form the verbs from the following nouns.

application → …	release → …	maintenance → …
additive → …	circulation → …	comparison → …
absorption → …	spray → …	accompaniment → …

19. Try to explain the following terms.

a) dry bulb temperature
b) dew point
c) desert cooler
d) running cost
e) pure humidification process

20. Choose the contextual meanings of the words written in bold in Text 2.

1) current

a) струя
b) поток
c) ток
d) текущий

2) effective

a) результативный
b) действующий
c) эффектный
d) полезный

3) running

a) непрерывный
b) текущий
c) плавный
d) работающий

4) certain

a) некоторый
b) уверенный
c) определенный
d) известный

5) sensible

a) ощущаемый
b) чувствительный
c) практичный
d) восприимчивый

21. Fill in the correct prepositions, translate the phrases, then choose any five items and make up the sentences of your own.

1) ___ actual practice; 2) to add ___ the air; 3) water present ___ the steam; 4) to pass ___ the steam of water; 5) to give ___ the heat ___ the stream; 6) ___ the same time; 7) reduction ___ the overall temperature; 8) to be called ___ the desert cooler; 9) to compare ___ the unitary air conditioners; 10) ___ such cases; 11) to blow the air ___ the spray of water; 12) to result ___ the overall increase ___ the enthalpy of the air; 13) to get absorbed ___ the air; 14) dew point temperature increases along ___ its relative humidity.

READING TASK: Text 2

22. What are the two types of humidification process? Read the text below to check your answer.

What is Humidification Process?

The process in which the moisture or water vapor or humidity is added to the air without changing its dry bulb (DB) temperature is called as humidification process. In actual practice the pure humidification process is not possible, since the humidification is always accompanied by cooling

or heating of the air. Humidification process along with cooling or heating is used in number of air conditioning applications.

Cooling and humidification process is one of the most commonly used air conditioning application for the cooling purposes. In this process the moisture is added to the air by passing it over the stream or spray of water which is at temperature lower than the dry bulb temperature of the air. When the ordinary air passes over the stream of water, the particles of water present within the stream tend to get evaporated by giving up the heat to the stream. The evaporated water is absorbed by the air so its moisture content, thus the humidity increases. At the same time, since the temperature of the absorbed moisture is less than the DB bulb temperature of the air, there is reduction in the overall temperature of the air. Since the heat is released in the stream or spray of water, its temperature increases.

One of the most popular applications of cooling and humidification is the evaporative cooler, also called as the desert cooler. The evaporative cooler is the sort of big box inside which is a small water tank, small water pump and the fan. The water from the tank is circulated by the pump and is also sprayed inside the box. The fan blows strong **currents** of air over the water sprays, thus cooling the air and humidifying it simultaneously. The evaporative cooler is highly **effective** cooling device having very low initial and **running** cost compared to the unitary air conditioners. For cooling purposes, the cooling and humidification process can be used only in dry and hot climates like desert areas, countries like India, China, Africa etc. This cooling process cannot be used in hot and high humidity climates.

The cooling and humidification process is also used in various industries like textile, where **certain** level of temperature and moisture content has to be maintained.

During the cooling and humidification process the dry bulb of the air reduces, its wet bulb and the dew point temperature increases, while its moisture content and thus the relative humidity also increases. Also, the **sensible** heat of the air reduces, while the latent heat of the air increases resulting in the overall increase in the enthalpy of the air.

In heating and humidification process of the air, the dry bulb temperature as well as the humidity of the air increases. The heating and humidification process is carried out by passing the air over spray of water, which is maintained at temperature higher than the dry bulb temperature of air or by mixing air and the steam.

When the ordinary air is passed over the spray of water maintained at temperature higher than the dry bulb temperature of the air, the moisture particles from the spray tend to get evaporated and get absorbed in the air due to which the moisture content of the air increase. At the same time, since the temperature of the moisture is greater than the dry bulb temperature of the air, there is overall increase in its temperature.

During heating and humidification process the dry bulb, wet bulb, and dew point temperature of the air increases along with its relative humidity.

COMPREHENSION CHECK

23. Complete the following sentences according to Text 2.

1) The pure humidification process is not possible, since …
2) In cooling and humidification process the moisture is added to the air by …
3) One of the most popular applications of cooling and humidification is …
4) For cooling purposes, the cooling and humidification process can be used in …
5) In heating and humidification process of the air, the dry bulb temperature and the humidity of the air …
6) When the ordinary air is passed over the spray of water maintained at temperature higher than the dry bulb temperature of the air, the moisture particles from the spray …

24. Decide whether the following statements are true or false according to Text 2.

1) The humidification is usually carried out together with cooling or heating of the air.
2) When the ordinary air passes over the stream of water, the particles of water present within the stream are evaporated by giving up the heat to the stream.
3) In cooling and humidification process since the heat is released in the stream of water, its temperature reduces.

4) The fan of the evaporative cooler blows strong currents of air over the water sprays, thus cooling the air and only then humidifying it.
5) During the cooling and humidification process the dry bulb of the air decreases, its wet bulb and the dew point temperature raises, while its moisture content and thus the relative humidity also increases.
6) In heating and humidification process there is overall increase in temperature because the temperature of the moisture is greater than the dry bulb temperature of the air.

25. Answer the following questions.

1) What is humidification process?
2) How does the humidity increase?
3) Why does the overall temperature of the air reduce?
4) What is the evaporative cooler? How does it work?
5) What are the advantages of the desert cooler?
6) Why is the cooling and humidification process used in various industries like textile?
7) How is the heating and humidification process carried out?
8) Why does the moisture content of the air increase in heating and humidification process?
9) What increases along with the relative humidity during heating and humidification process?

26. Fill in the table using the information from Text 2.

Type of Humidification Process	Function	Principle of Operation	Usage	Advantages and/or Disadvantages

27. Complete the following abstract for Text 2 or you may write your own.

Two types of …such as …and … as well as their principles of … and usage are described in the text. Also … are paid attention to.

OVER TO YOU

28. Discuss with your groupmates or in pairs: What are the peculiarities of two types of humidification processes?

ACTIVE VOCABULARY

29. Give Russian equivalents of the following words and phrases. Try to memorize them.

Nouns and noun phrases

hygrometer	coverage area	hissing
dual unit	square footage	
bypass unit	humidistat	

Verbs and verbal phrases

to monitor	to expel

Adjectives

ultrasonic	crucial

30. Fill in the table with appropriate derivatives.

Humidity, purify, ultrasonic, adequate, therefore, inexpensive, mildew, hazard, adjust, actually, determine, optimum, though, condensation, indicate, generally.

Noun	Verb	Adjective	Adverb

31. Choose the contextual meanings of the words written in bold in Text 3.

1. **mist**
   a) туман
   b) пар
   c) мгла
   d) пелена

2. **adequate**
   a) адекватный
   b) достаточный
   c) соразмерный
   d) пригодный

3. environment

a) оборудование
b) обстановка
c) окружение
d) среда

4. capacity

a) объем
b) вместимость
c) способность
d) мощность

5. maintain

a) обслуживать
b) поддерживать
c) защищать
d) содержать

6. crucial

a) ключевой
b) критический
c) решающий
d) ответственный

32. Match the opposites.

1) inexpensive	6) purchase	*a) unsuitable*	*f) sell*
2) purify	7) compact	*b) extended*	*g) unproductive*
3) hazard	8) safe	*c) costly*	*h) safety*
4) correct	9) efficient	*d) particularly*	*i) add*
5) remove	10) generally	*e) pollute*	*j) dangerous*

33. Translate these phrases into English.

Измерять уровень влажности, оптимальный уровень, водяной туман, ультразвуковой, переносной, напольная модель, зона охвата, гигрометр, уровень шума, шипение.

READING TASK: Text 3

34. What are the main points to consider before purchasing a humidifier? Read the text below to check your answer.

Before You Buy a Room Humidifier

By Mariette Mifflin

If you are not sure that you really need a humidifier, you may want to measure the humidity level in your home with a hygrometer. They are

inexpensive and can help you monitor the air you breathe so you can take action to maintain it at the optimum level.

Determine The Type of Humidifier You Need – Cool vs Warm Mist

First, you need to decide what type of humidifier you are looking for – warm or cool **mist**, or whether a dual unit would be more convenient. If you're not sure, learn the difference between a warm and cool mist humidifier to help you determine what is best for you. Read why some feel a cool mist is safer when young children are present. There are also models that humidify and purify (or wash) the air – these are usually a more expensive, but may be worth considering.

Type of Humidification Processes

There are basically two types of processes that a humidifier might use to generate moisture or steam – evaporative which is more common and generally the cheapest, and ultrasonic which produces a finer water mist. Either type can be used for warm or cool mist models, but ultrasonic is considered safer since it does not produce a mist by boiling water. Therefore the humidifier does not contain hot water that could create a hazard if the unit was knocked over.

Humidifier Styles – Personal, Portable, Console or Flow-Through ByPass

1) a personal humidifier is a very compact, no more than 1-liter that can be taken on trips to provide moisture where you need it. Though efficient for personal use, the coverage area is limited.
2) portable, a room humidifier can vary in capacity from compact to large room size and is most commonly used in bedrooms or living areas.
3) a console model is a large, free-standing unit on wheels. Because of the larger capacity and efficiency, console models are considered whole-house units.
4) a flow-through bypass unit, another type of whole-house humidifier, that must be installed on the home's duct system.

Determine Capacity

Sizing the humidifier to the room size is most important. Humidifiers are rated for a coverage area in square footage. Take measurements to determine the correct room size you are looking for. Models for 700 sq. ft. are **adequate** for a bedroom or small room. If the humidifier is too large for the room, condensation will appear on the inside of the windows, and bacteria and mildew could grow in this **environment**. **Capacity** is usually denoted on the packaging, but it should not be confused with moisture

output which will be more than the water tank capacity. Water tank size is often a convenience decision.

Controlling Moisture Output

While some humidifiers are basic in moisture control with two or three variable fan speeds, others may have a built-in hygrometer to indicate the moisture level in the room and a humidistat that you can set for the unit to cycle on/off to **maintain** the proper level. Unless you want to monitor the room's moisture level and adjust settings to maintain it, these measurement features are very handy and worth the extra cost.

Ease of Handling & Maintenance

Some water tanks are a little harder to remove and refill, some lift off easily. Could the weight of a full tank be a problem for you? Take time to inspect the unit to see how easy the water tank removes from the base. Also note if the model will require filter changes, check on availability, as well as how easy they are to change. Consider purchasing a couple of filters along with your new humidifier as maintenance is **crucial** to reduce the risk of bacteria and unhealthy air.

Operation Noise Level & Settings

Expect some operating noise from a humidifier, but if the unit is for a bedroom, you may want to look for one with a low, night or silent setting. You should have at least two settings on the unit, high and low options. Ultrasonic humidifiers are considered the quietest to operate since there is no boiling of water (hissing) and moisture is expelled in a very fine mist.

COMPREHENSION CHECK

35. Decide whether the following statements are true or false according to the text.

1) A hygrometer is costly but it can help you monitor the air you breathe.
2) Models that humidify and purify the air are worth considering deciding what type of humidifier you need.
3) Ultrasonic and evaporative are two types of processes that a humidifier might use to generate moisture or steam.
4) Ultrasonic is considered safer because the humidifier does not contain hot water that could create a hazard.

5) A personal humidifier is efficient for industrial use.
6) A flow-through bypass unit is a large, free-standing unit.
7) Models to 700 sq. ft. are adequate for a bedroom or small room.
8) A built-in hygrometer to indicate the moisture level in the room and a humidistat worth the extra cost.

36. Answer the following questions.

1) What is a device to measure the humidity level in your home?
2) What type of humidifier is safer for young children?
3) Which type of humidification processes is cheaper: evaporative or ultrasonic?
4) List humidifier styles you know.
5) What is the most important point before buying a humidifier?
6) What are the results of condensation?
7) What is the function of hydrometer?
8) What should be considered before buying the unit for a bedroom?
9) What humidifiers are the quietest to operate?

37. Make a written report on Text 3.

OVER TO YOU

38. Discuss with your groupmates or in pairs: What should be determined before buying a humidifier? What type of a humidifier would you choose? Why?

LANGUAGE DEVELOPMENT

39. Read the following text and fill in the words from the list below, answer the following questions and title the text.

a) readings	*e) calculated*	*i) resistance*
b) fan	*f) measures*	*j) sophisticated*
c) include	*g) displays*	*k) hair*
d) accurate	*h) methods*	*l) dehumidifiers*

There are various 1)_____ of humidity measurement, most of them using a device called a hygrometer. The hygrometer can work in a variety of ways, depending on the type, and is the most 2)_____ method for determining the humidity in the air. Some are connected to other devices called humistats, which are connected to humidifiers and 3)_____, and help control the level of humidity in the air.

One type of hygrometer uses 4)_____, usually human, that is attached to levers inside the unit. When the humidity in the air increases, the hair stretches, and then contracts when it decreases. The levers are generally connected to a dial which 5)_____ the humidity reading.

Other methods of humidity measurement using a hygrometer 6)_____ the psychrometer as well as electric hygrometers. Both methods are fairly accurate, although the electric version is more 7)_____ in design. There are also chemical hygrometers that are similar in effectiveness.

The psychrometer, also known as the two-bulb hygrometer, works by using two thermometer bulbs. One bulb is dry and 8)_____ the temperature in the air. The other bulb is covered in a substance, usually wick or muslin, and then wetted down. After being wetted, the bulb is exposed to moving air, either through a 9)_____ or by slinging the psychrometer through the air. As the water evaporates in the moving air, the temperature on the thermometer will drop. The amount the temperature drops helps to tell the amount of humidity in the air.

This method of humidity measurement is similar to when one goes swimming on a warm breezy day. Before entering the water, the temperature feels warm even with a breeze. If one jumps into the water and becomes wet and then gets back out, the breeze suddenly feels very cool. This is called evaporative cooling. Generally, the lower the humidity in the air, the bigger the drop in temperature.

Electric hygrometers work by measuring the electrical 10)_____ of a particular substance. Most substances, such as lithium chloride, have varying resistances to an electrical current based on the humidity in the air. These differences are then 11)_____ to display the humidity.

Chemical hygrometers work by using a chemical substance and exposing it to air. The chemical will be measured before being exposed and then again after. Any changes in weight indicate how much humidity is in the air.

Although hygrometers are fairly accurate methods of humidity measurement, the most accurate way of testing humidity on a global scale is through the use of satellites. Specialized satellites can detect the exact humidity in the troposphere, thereby giving accurate 12)_____ about weather conditions around the world. They are capable of tracking sudden changes in humidity and weather patterns to predict thunder storms, wind, and climate changes.

- *What are the methods of humidity measurement?*
- *What device is the most accurate method for determining the humidity in the air?*
- *What is the function of a humistat?*
- *One type of hygrometer uses hair. How does it work?*
- *How does the psychrometer work?*
- *How do electric hygrometers work?*
- *How do chemical hygrometers work?*
- *What is the most accurate way of testing humidity on a global scale?*
- *What are satellites capable of?*

FOLLOW UP

40. Read the texts of Unit III again and make notes under the following headings. Then use your notes to talk about Humidification.

1) What is Humidification?
2) Humidification Process.
3) Types of Humidifiers.
4) Methods of humidity measurement.

UNIT IV

CONDITIONING

START HERE

1. Fill in the words listed below and answer the following questions.

a) invention	*c) equipment*	*e) applied*	*g) sole purpose*
b) high	*d) public places*	*f) benefits*	*h) simultaneous*

1) Air-conditioning is defined as the [1)]_____ mechanical control of temperature, humidity and air motion.
2) Air conditioning is usually [2)]_____ to the cooling effect of a system.
3) Air conditioning was not used until about 1920, and then it was used mostly in [3)]_____ such as theatres, trains, and some department stores. This is when the general public became aware of the [4)]_____ of air conditioning.
4) Willis Haviland Carrier had called his [5)]_____ "Apparatus for Treating Air".
5) The first use of air-conditioning for the [6)]_____ of human comfort came in 1914, when Carrier designed special [7)]_____ for the Charles Gates mansion (особняк) in Minneapolis, Minnesota. That first home conditioner was 20 feet long, 6 feet wide and 7 feet [8)]_____!

- *What is air-conditioning?*
- *What is air-conditioning applied to?*
- *Where was air-conditioning mostly used after 1920?*
- *Who invented air-conditioning?*
- *When and where was the first use of air-conditioning for the sole purpose of human comfort?*
- *What was the size of the first home conditioner?*

2. Make up the texts using the sentences below. Note how certain words refer forward and back to other words in the texts.

I. 1_d_, 2__, 3__, 4__, 5__, 6__, 7__.

a) The result was blurry (размытое) images.
b) While trying to figure out a way to solve a printing company's humidity problem, this young engineer invented mechanical air-conditioning.
c) The Sackett-Wilhelms Lithographing and Publishing Company of Brooklyn were having difficulty with its printing jobs during the summer.
d) In 1902, Willis Haviland Carrier did for indoor climate control what Alexander Graham Bell did for communication and Henry Ford did for transportation.
e) He designed a machine that blew air over artificially cooled pipes... and the process controlled both humidity and temperature.
f) The paper it used absorbed moisture from the air and expanded, so colors printed on humid days didn't line up with those printed on drier days.
g) Carrier theorized he could control the troublesome moisture in the printing plant by chilling the air.

II. 1_b_, 2__, 3__, 4__, 5__, 6__, 7__, 8__, 9__.
a) Some of these functions are required during all modes of operation.
b) Air conditioning is not simply just the process of cooling the air.
c) It covers six different functions, defined below.
d) When the system is in the heating mode, the processes are heating, circulation, cleaning and humidifying the air.
e) The person who is to estimate an air conditioning job must have at least a working knowledge of the functions and how they affect the overall total operation of the system.
f) When the system is operating in the cooling mode, the processes involved are air circulation, air cleaning, cooling and dehumidifying the air.
g) Unless all of these functions are accomplished the system is not an air conditioning system.
h) These six functions are cooling, heating, air circulation, air cleaning, humidification and dehumidification.
i) It should be obvious that air circulation is a very important aspect of the total system operation.

ACTIVE VOCABULARY

3. Give Russian equivalents of the following words and phrases. Try to memorize them.

Nouns and noun phrases

unitary system	evaporation cooler
packaged air conditioner	terminal unit
split air conditioner	refrigerant tubing
ductless air conditioner	evaporator coil
window air conditioner	PTAC
portable air conditioning unit	plenum
central air conditioning	expansion valve

Verbs and verbal phrases

to complicate	to size

Adjectives

multiple	sophisticated	premium
decent	emergency	boxy

4. Combine the words from the column on the left with the suitable nouns from the column on the right. Translate them into Russian.

1) refrigerant	a) effect
2) packaged terminal	b) fan
3) home	c) unit
4) condenser	d) application
5) evaporative	e) tubing
6) expansion	f) air conditioner
7) evaporator	g) cooling solution
8) cooling	h) valve
9) premium	i) coil

5. Match the words with their synonyms.

1) to mount	5) appropriately	*a) constantly*	*e) thoroughly*
2) portable	6) to perform	*b) crisis*	*f) to entangle*
3) emergency	7) permanently	*c) to install*	*g) mobile*
4) supplemental	8) to complicate	*d) additional*	*h) to work*

6. Say in other words.

1) Packaged air conditioners *contain* all their parts in one package.
2) *As a rule* this package *is mounted* on the roof of the building.
3) The split system *breaks* the air conditioning system into two terminal units.
4) They are not as *sophisticated* as the other types of air conditioners and they can't *lower* the temperature *substantially*.
5) Window air conditioning units are *relatively cheap* and this is another *benefit* of theirs.
6) If the central air conditioning system *is sized* too large it will not perform well and will not *adequately dehumidify* and may also *short* cycle.
7) The condensing unit is the large boxy unit that *sits* outside and *consists of* the compressor, condensing coils and condensing fan.
8) The central air conditioning system *is made up of* two packaged units, the condensing unit and the evaporative unit. Both *are connected* by refrigerant tubing.

7. Fill in the correct prepositions, translate the phrases, then choose any five items and make up the sentences of your own.

1) to be mounted ___ the roof; 2) a variety ___ the packaged air conditioner type; 3) to pass ___ the wall; 4) to be great ___ dry locations; 5) to run ___ water; 6) to do a good job ___ residential air conditioners; 7) a benefit ___smth.; 8) to be great ___ supplemental air conditioner; 9) to sit ___ the plenum ___ the furnace.

READING TASK: Text 1

8. What are the main types of industrial ant residential air conditioning systems? Read the text below to check your answers.

Types of Air Conditioning Units

Industrial and Residential Air Conditioning Systems

There are several types of air conditioning units: unitary, PTAC, window, portable, central, split, ductless systems and so on.

Packaged Air Conditioners contain all their parts in one package. As a rule this package is mounted on the roof of the building but it could also be mounted on a wall.

Packaged air conditioners come in several flavors. For instance, a single-packaged central air conditioner is a variety of the packaged air conditioner type and it is one of the most common types of industrial air conditioning system because it is designed to cool huge areas.

Split or Ductless Air Conditioner. The split system or ductless system is technically called a "packaged terminal air conditioner" or PTAC. You see these occasionally in home applications but more commonly in hotels, motels and apartments. The split system breaks the air conditioning system into two packages or terminal units and refrigerant tubing passes through the wall connecting both package units.

One terminal package is the condensing unit located on the exterior and includes the compressor, condenser and condenser fan. The other terminal package is the evaporative unit located on the interior and handles air cooling and distribution. The internal evaporative unit includes the fan, expansion valve and evaporator coil.

Evaporation Coolers are great for hot dry locations because they add humidity to the air. They are not as sophisticated as the other types of air conditioners and they can't lower the temperature substantially.

Still, for residential air conditioners they do a decent job. Evaporation coolers run on water, which evaporates and this creates the cooling effect.

Window Air Conditioners are used to condition a single room and are generally mounted in the window (or in the wall).

Window air conditioning units aren't very efficient but they do a good job as residential air conditioners. They are relatively cheap and this is another benefit of theirs.

Portable Air Conditioning Units also known as mobile air conditioning units don't have to be mounted and they are easy to transport. Their main disadvantages are that they are noisier and less efficient than the other types of air conditioning units. Portable air conditioning units are great as emergency air conditioners or as supplemental air conditioners.

Central Air Conditioning. The central air conditioning system is the premium cooling solution for your home. It is the quietest, best performing and most comfortable. The only real risk is that the system

be sized appropriately for your home. If it is sized too large it will not perform well.

The central air conditioning system is made up of two packaged units, the condensing unit and the evaporative unit. Both are connected by refrigerant tubing. The condensing unit is the large boxy unit that sits outside and consists of the compressor, condensing coils and condensing fan. The evaporative unit typically sits in the plenum of your furnace so the air conditioning can use the same ductwork as your heating system. In the plenum, the evaporative unit consists of the evaporator coil and expansion valve.

COMPREHENSION CHECK

9. Complete the following sentences according to the text.

1) The several types of air conditioning units are …
2) The split system breaks the air conditioning system into …
3) In ductless air conditioner the internal evaporative unit includes …
4) Evaporation coolers run on …
5) Window air conditioning units are used to condition …
6) Portable air conditioning units are great as … or as ...
7) The central air conditioning system is the premium cooling solution for …
8) The central air conditioning system is made up of …
9) In the central air conditioning system the condensing unit is …

10. Decide whether the following statements are true or false according to the text.

1) Package air conditioner is always mounted on the roof of the building.
2) A single-packaged central air conditioner is designed to cool huge areas.
3) The split system or ductless system is often used in home applications.
4) Evaporation coolers except for swamp coolers are great for hot dry locations.
5) Window air conditioning units are not efficient for industrial premises.

6) Portable air conditioning units are also called mobile air conditioning units.
7) The disadvantage of the central air conditioning system is its large size.
8) In the plenum, the evaporative unit includes the evaporator coil and expansion valve.

11. Answer the following questions.

1) What does packaged air conditioner contain?
2) Where are terminal packages located on in a split air conditioner?
3) What do these terminal packages include?
4) Why are evaporation coolers used for hot dry locations?
5) What is the cheapest type of air conditioners?
6) What are the main pros and cons of portable air conditioning units?
7) How is the central air conditioning system characterized?
8) When may the central air conditioning system dehumidify inadequately?
9) What is connected by refrigerant tubing in the central air conditioning system?
10) What does the condensing unit consist of?
11) Where and why does the evaporative unit usually sit?

12. Fill in the table using the information of Text 1 and make an oral report using the table below.

Type of Conditioner	Main Elements	Peculiari-ties	Location	Usage
package air conditioner				
…				
…				
…				
…				
…				

OVER TO YOU

13. Discuss with your groupmates or in pairs: What types of air conditioners are used in Belarus? Where?

ACTIVE VOCABULARY

14. Give Russian equivalents of the following words and phrases. Try to memorize them.

Verbs and verbal phrases

to squeeze	to flip around
to suck	to melt

15. Fill in the table with appropriate derivatives.

Chemical, dissipate, entire, rather, fluid, pressure, low, efficient, extremely, suck, separate, periodically, narrow, fin, convert, surrounding, evaporator, evaporate.

Noun	Verb	Adjective	Adverb
…	…	…	…

16. Match the terms with their definitions.

a) chemical	*d) pressure*	*g) refrigerator*
b) liquid	*e) compressor*	*h) thermostat*
c) gas	*f) converter*	*i) heat pump*

1) a substance in a physical state in which it does not resist change of shape and will expand indefinitely to fill any container. If very high pressure is applied it may become liquid or solid;
2) a device for converting alternating current to direct current or vice versa;
3) a device, as used in a refrigerator, for extracting heat from a source and delivering it elsewhere at a much higher temperature;

4) any substance used in or resulting from a reaction involving changes to atoms or molecules, especially one derived artificially for practical use;
5) a chamber in which food, drink, etc., are kept cool;
6) a device that maintains a system at a constant temperature. It often consists of a bimetallic strip that bends as it expands and contracts with temperature, thus breaking and making contact with an electrical power supply;
7) the state of pressing or being pressed;
8) any reciprocating or rotating device that compresses a gas;
9) a substance in a physical state in which it does not resist change of shape but does resist change of size.

17. Translate the following words and phrases into English using the vocabulary of the text.

Охлаждение, изолированное место, внешняя часть, рабочая жидкость, газ под высоким давлением, металлические пластины, рассеиваться, испаряться, извлекать, тепловая энергия, на уровне пола, достигнуть температуры, переворачивать, тепловой насос, режим отопления.

READING TASK: Text 2

18. What are the main parts of air conditioner? Read the text below to check your answer.

How Does an Air Conditioner Work?

Air conditioners and refrigerators work the same way. Instead of cooling just the small, insulated space inside of a refrigerator, an air conditioner cools a room, a whole house, or an entire business.

Air conditioners use chemicals that easily convert from a gas to a liquid and back again. This chemical is used to transfer heat from the air inside of a home to the outside air.

The machine has three main parts: a compressor, a condenser and an evaporator. The compressor and condenser are usually located on the outside air portion of the air conditioner. The evaporator is located on the inside the house, sometimes as part of a furnace. That's the part that heats your house.

The working fluid arrives at the compressor as a cool, low-pressure gas. The compressor squeezes the fluid. This packs the molecule of the fluid closer together. The closer the molecules are together, the higher its energy and its temperature.

The working fluid leaves the compressor as a hot, high pressure gas and flows into the condenser. If you looked at the air conditioner part outside a house, look for the part that has metal fins all around. The fins act just like a radiator in a car and help the heat go away, or dissipate, more quickly.

When the working fluid leaves the condenser, its temperature is much cooler and it has changed from a gas to a liquid under high pressure. The liquid goes into the evaporator through a very tiny, narrow hole. On the other side, the liquid's pressure drops. When it does it begins to evaporate into a gas.

As the liquid changes to gas and evaporates, it extracts heat from the air around it. The heat in the air is needed to separate the molecules of the fluid from a liquid to a gas.

The evaporator also has metal fins to help in exchange the thermal energy with the surrounding air.

By the time the working fluid leaves the evaporator, it is a cool, low pressure gas. It then returns to the compressor to begin its trip all over again.

Connected to the evaporator is a fan that circulates the air inside the house to blow across the evaporator fins. Hot air is lighter than cold air, so the hot air in the room rises to the top of a room.

There is a vent there where air is sucked into the air conditioner and goes down ducts. The hot air is used to cool the gas in the evaporator. As the heat is removed from the air, the air is cooled. It is then blown into the house through other ducts usually at the floor level.

This continues over and over and over until the room reaches the temperature you want the room cooled to. The thermostat senses that the temperature has reached the right setting and turns off the air conditioner. As the room warms up, the thermostat turns the air conditioner back on until the room reaches the temperature.

Heat Pump

Imagine that you took an air conditioner and flipped it around so that the hot coils were on the inside and the cold coils were on the outside. Then you would have a heater. It turns out that this heater works extremely well. Rather than burning a fuel, what it is doing is "moving heat."

A heat pump is an air conditioner that contains a valve that lets it switch between "air conditioner" and "heater." When the valve is switched one way, the heat pump acts like an air conditioner, and when it is switched the other way it reverses the flow of the liquid inside the heat pump and acts like a heater.

Heat pumps can be extremely efficient in their use of energy. But one problem with most heat pumps is that the coils in the outside air collect ice. The heat pump has to melt this ice periodically, so it switches itself back to air conditioner mode to heat up the coils. To avoid pumping cold air into the house in air conditioner mode, the heat pump also lights up burners or electric strip heaters to heat the cold air that the air conditioner is pumping out. Once the ice is melted, the heat pump switches back to heating mode and turns off the burners.

COMPREHENSION CHECK

19. Decide whether the following statements are true or false according to the text.

1) Basic principles of conditioners and refrigerators work are the same.
2) The chemical in air conditioner transfers cold air to the outside.
3) Three main parts of the machine are located on the outside portion.
4) The evaporator can be a part of a furnace.
5) The main function of the compressor is to squeeze the fluid.
6) The second step in working cycle of air conditioner is the condenser.
7) The working fluid leaves the condenser in the form of gas.
8) The cooled air is usually blown into the house at the floor level.
9) The thermostat controls the temperature in the room.
10) The main problem with heat pumps is their low energy efficiency.

20. Choose the underlined words and phrases which have mistakes.

1) Air-conditioning units [a)]utilize chemicals to transfer [b)]cold air from inside of a home to [c)]the outside air.
2) The evaporator is one of [a)]three main parts of the air-conditioner and is located on the [b)]outside portion of [c)]the machine.

3) The [a)]molecule of [b)]the fluid are packed closer in [c)]the condenser.
4) When leaving [a)]the condenser, the temperature of the working fluid is much [b)]cooler and it has changed from a gas to a liquid under [c)]low pressure.
5) The working fluid [a)]enters the evaporator and begins its [b)]cycle all over again in the form of [c)]low pressure gas.
6) As the air is cooled in [a)]the air conditioner, it is then blown into the house through [b)]pipes at the [c)]ceiling level.
7) [a)]The heat pump senses that the temperature has reached the [b)]necessary setting and [c)]turns off the air conditioner.
8) When the valve is switched one way, the heat pump [a)]performs like an air conditioner, and when it is switched the other way it reverses the flow of the liquid [b)]outside the heat pump and acts like [c)]a heater.

21. Answer the following questions.

1) What is different in work of conditioners and refrigerators?
2) What transfers heat from the inside air to the outside air?
3) What are three main parts of the air conditioner?
4) What is the function of the compressor? How does it work?
5) What is the condenser applied for?
6) Describe the process of the evaporator work.
7) What is the thermostat for in air conditioner? How does it work?
8) Define a heat pump and describe its working cycle.
9) What is the main problem with heat pump?
10) How does the heat pump overcome the problem of pumping cold air into the house?

22. Fill in the table using the information of Text 2.

	Function	**Location**
1) compressor		
2) condenser		
3) evaporator		
4) thermostat		

23. Make an abstract on Text 2.

OVER TO YOU

24. Discuss with your groupmates or in pairs: What are the peculiarities of the work of air conditioners? Why are they usually installed at the top of walls?

LANGUAGE DEVELOPMENT

25. Read the following texts and fill in the missing words from the list below.

TEXT A

a) result	*g) investigation*	*m) servicing*
b) located	*h) reference*	*n) evaporator*
c) function	*i) current*	*o) basement*
d) size	*j) determined*	*p) standards*
e) weather	*k) BTUs*	*q) inlet*
f) addition	*l) calculate*	*r) measured*

Undersized Air Conditioners

Undersized air conditioners may 1)_____ from poor installation practices that do not include a heat gain calculation or do not adequately recognize the characteristics of the home. Undersized units may also be a result of house changes or additions. For example, the 2)_____ of skylights or the removal of mature trees can increase the heat gain dramatically.

During moderate weather, the air conditioner may 3)_____ adequately, but during hot 4)_____, the air conditioner may not be able to achieve a 15°F to 20°F temperature differential between indoors and outdoors.

The first step is to determine the 5)_____ of the air conditioning system. This can often be done by reading the model number on the data plate. This is typically 6)_____ on the outdoor (condenser) unit. The

size may be recorded in thousands of 7)_____ per hour or in number of tons.

Sometimes it is difficult to translate a model number into a system capacity. The Carrier Blue Book available through ASHI® or Carrier Corporation in Indianapolis is an excellent 8)_____ guide, with the model, serial numbers, and SEER (Seasonal Energy-Efficiency Ratings) of many residential air conditioning systems used in the United States.

If the size cannot be 9)_____ from the model number on the data plate, the size can be approximated from the Rated Load Amperage (RLA) on the data plate. A typical reciprocating compressor will be rated at 6 to 8 amps per ton of cooling. The newer high-efficiency units and scroll compressors will draw less 10)_____, more like 5 amps per ton. Be sure to make it clear that this is an approximation only.

The next step is to roughly 11)_____ the above-grade square footage of the home. Divide the square footage into the number of tons and determine the number of square feet per ton.

If the number of square feet per ton exceeds the ranges we discussed, it is probably best to describe this as marginal or suspect capacity and to recommend further 12)_____. There may be a number of factors in the home that cause the guidelines not to apply.

It's also possible to find a system that seems to be just fine with respect to capacity using your guideline and yet it isn't really big enough. When considering the square footage of the house, the 13)_____ is not usually considered. However, if the basement has a walk-out with a large glass surface facing south, east, or west, the air conditioning load may be far greater than contemplated.

If the system is adequately sized and is working properly, the air temperature entering the 14)_____ coil will be whatever the room temperature is. Let's say it's 75°F. The air coming off the coil should be 14°F to 22°F cooler (some say 15°F to 20°F). If the 15)_____ temperature is 75°F, the air coming off should be 55°F to 60°F. This can be measured with a thermometer with a sharp probe that is pushed into a joint or hole in the supply plenum immediately downstream of (or after) the evaporator coil.

If the temperature drop is different, the problem may be size related or may indicate a need for 16)_____. This test should be compared with your approximation of the size of the air conditioner, based on the number of square feet per ton. Make sure the temperature drop is

17)_____ after the system has established equilibrium. The unit should run for at least 15 minutes before checking the temperature split.

Note: Measuring this temperature split is beyond the 18)_____ but is mentioned because many inspectors do it.

TEXT B

a) dehumidification	*e) startup*	*i) question*
b) installation	*f) much*	*j) demand*
c) expectancy	*g) movement*	*k) oversized*
d) variations	*h) results*	*l) identify*

Oversized Air Conditioners

An oversized air conditioner is susceptible to short cycling, inadequate dehumidification, and large temperature 1)_____ in the house.

Oversized air conditioners are usually the result of a design or 2)_____ problem.

Oversized units will have a shortened life 3)_____ and will provide a less comfortable environment. The largest comfort issue is the lack of 4)_____. Because the temperature drops rapidly with an oversized unit, there is not an adequate volume of air 5)_____ across the coil to extract the water from the house air. This 6)_____ in a house that is cold, but with a humid, swamp-like environment. Since compressors experience most damage on 7)_____, short cycles also mean more startups and a shorter life.

Other than the rough guideline test, it is difficult to know whether and how much the unit is oversized. Some public utilities indicate that a unit may be as 8)_____ as 25 percent oversized without adverse effect. The temptation to oversize may become apparent when we talk about heat pumps. Since heat pumps have to deal with a much larger temperature differential from outside to inside, the tendency is to make the heat pump large enough to meet the heating 9)_____. This makes it too large for the cooling load. There are some strategies to address this problem, but within this context, we are watching for oversized cooling units.

One way inspectors 10)_____ an oversized air conditioner is by sensing the cold damp environment when walking into a house. Also, an

air conditioner that short cycles (turns on and off every 5 minutes) is a suggestion that the unit may be 11)_____.

Two surveys have shown that one third to one half of all residential air conditioning systems are oversized.

While the standards don't require it, most inspectors will red-flag systems that seem too big or too small. They will usually phrase it as a 12)_____ rather than as a conclusion.

FOLLOW UP

26. Read the texts of Unit 4 again and make notes under the following headings. Then use your notes to talk about Conditioning.

1) Air conditioner, its invention, its functions.
2) Types of air conditioning units for residential and industrial premises.
3) Basic principles of conditioners and refrigerators work.
4) What a heat pump is.

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Учебное издание

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КОБЯК Ольга Николаевна

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