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CONTENTS

Unit 1

COMBUSTION

COMBUSTION is a chemical process that liberates heat. The word carries the connotation of fire or flame. Combustion can be described as the combination of an oxidizer with a fuel, for example, oxygen with petroleum, to produce compounds such as carbon dioxide and water, Processes of this type are important in home and industrial furnaces, various engines, and also in harmful fires. Combustion processes involving different oxidizers or fuels, for example, rusting of metals, have long been recognized and are important in chemical industries. Some "fuels," such as nitrocellulose, are capable of experiencing combustion in the absence of an oxidizer because they contain atoms of fuel and atoms of oxidizer within the same molecule. These substances form common ingredients of explosives and of propellants for rocket motors. Thus, combustion encompasses a wide class of chemical phenomena in nature and has various uses.

PRINCIPLES OF COMBUSTION

Materials for Combustion. Most substances can participate in combustion, either as fuels or as oxidizers. Those that cannot are the noble gases (for example, helium), molecular nitrogen, and a large class of compounds—including many oxides, sulfides, fluorides, and chlorides—that exist in their most stable chemical configurations and that can be formed as products of combustion.

The list of known oxidizers is much shorter than the list of known fuels. The most common oxidizer is oxygen, Others include sulfur, all of the halogens, compounds made solely from halogens, ozone, nitrogen and oxides of nitrogen, hydrogen peroxide, nitric acid, and potassium nitrate. Oxidizers also include, among a number of oxygen-rich salts, ammonium perchlorate, which is the most common oxidizer in solid-propellant rocket motors.

Fuels encompass hydrogen, boron, carbon, silicon, phosphorus, sulfur, all metals, all hydrocarbons, and essentially all organic molecules. Among other fuel substances are ammonia, hydrazine, and metal hydrides. In the past, many of these materials have not been classified as fuels; for example, metallic aluminum is often used in construction and is commonly considered noncombustible, but it will bum with oxygen and release more heat than conventional fuels if it is brought to sufficiently high temperatures (approximately 2300°K). - Degrees **Kelvin** (^{D}K) are units of measurement on the Kelvin scale of absolute temperature. Temperature given on the Kelvin scale may be converted to centigrade by subtracting 273 or to Fahrenheit by multiplying by 1.8 and then subtracting 460.

Most of the energy that man consumes today is produced by the combustion in air of organically derived fuels. The three primary types of natural fuels are coal, petroleum, and natural gas. Fuels manufactured from them include such gases as coal gas, carbon monoxide, hydrogen, acetylene, and propane; the liquids benzene, kerosine, gasoline, and alcohol; and the solid coke. Other natural fuels are wood, peat, and lignite, a solid whose properties are intermediate between those of peat and coal.

Heat of Combustion and Flame Temperature. A basic thermodynamic property of a fuel, relevant to its usefulness in combustion, is its heat of combustion, which is the energy released when a given amount of fuel reacts with an oxidizer to form specified combustion products at constant pressure and temperature. The heat of combustion with oxygen ranges from very low values for poor fuels to 34,000 calories per gram of fuel for hydrogen. For natural fuels, the values are 4,000 to 4,500 cal/gm for wood, 6,500 to 8,500 cal/gm for coal, 10,000 to 11,000 cal/gm for petroleum, and 11,000 to 14,000 cal/gm for natural gas.

An important thermodynamic property of a combustible system is its adiabatic flame temperature, the maximum temperature achieved if all of the heat of combustion is used to increase the temperature of the combustion products. Adiabatic flame temperatures range up to about 2100°K for natural fuels burning in air and to 3000°K for natural fuels burning in pure oxygen.

For Individual Reading

Ignition. The *ignition temperature* is the temperature to which a fuel must be raised before it begins to burn. Ignition temperatures depend on rates at which chemical reactions take place, on the rate at which the system can lose heat and materials to its surroundings, on the shape of the fuel and its container, and on the method of ignition that is ed. Approximate values of ignition temperatures for common fuels in air are 650°-750°K for coal, 500^{D}-650°K for newspaper, dry wood, and gasoline, and 850°K for hydrogen.

Ignition criteria have been expressed in terms of many quantities besides ignition temperature. Examples include the minimum rate of addition of energy and the minimum amount of energy needed for ignition. After the energy or temperature necessary for combustion to occur is imparted to a combustible system, a certain amount of time elapses before observable combustion begins; this is the *ignition delay time,* ranging from small fractions of a second to many days.

Spontaneous Combustion. In this process, piles of certain materials, such as oily rags, react slowly with trapped oxygen. The heat produced by the reaction is lost slowly enough for the temperature of the materials to increase to a point at which flaming combustion begins.

Flammability. Some fuel-oxidizer mixtures cannot be made to burn, either because the pressure is too low or because too little fuel or oxidizer is present; these mixtures lie outside the *limits of flammability* of the system. At atmospheric pressure, the upper and lower values of the percentage (by volume) of fuel in air between which the concentration must lie for combustion to be possible are 6 and 1 for gasoline vapor, and about 75 and 4 for hydrogen.

Arrangements of Fuel and Oxidizer. Central to the science of combustion is the fact that there are two basic arrangements of fuel and oxidizer. They are premixed systems, wherein the fuel and oxidizer are intimately mixed before combustion begins, and non-premixed systems, wherein fuel and oxidizer are separated initially and mix as they burn. An example of premixed combustion is the inner flame cone of a Bunsen burner, in which gaseous fuel is thoroughly mixed with air at the base of a tube that holds a flame at its upper exit. An example of non-premixed burning is a wood fire. Fuels such as explosives that bum "without" an oxidizer are intrinsically premixed. Liquid and solid fuels that require an oxidizer are usually non-premixed, although fine spray or dust (for example, pulverized coal) suspensions in air sometimes burn as premixed systems. In such cases, the premixed flame may have a non-premixed substructure.

Explosions. Premixed systems experiencing homogeneous combustion are often observed to react slowly under certain conditions of pressure, temperature, composition, and chamber dimensions, and to explode under other conditions. Two qualitatively different mechanisms can produce explosions in homogeneous combustion systems. One mechanism is that of a thermal explosion, in which heat released by the reactions raises the temperature, which in turn accelerates the rate of heat release. The other mechanism is that of a branched-chain explosion, in which large numbers of highly reactive intermediate chemical species (free radicals) are produced in the combustion reactions and further accelerate the rates of these reactions. The destructive phenomenon of "knock" in internal combustion engines is believed by many experts to be caused by high pressures resulting from a branched-chain explosion.

Combustion Waves. For any temperature, pressure, and composition (within the limits of flammability), two distinct types of combustion waves occur in premixed systems: deflagrations and detonations.

Deflagrations. Deflagration waves propagate slowly, typically at *flame speeds* of 50 cm per second. At atmospheric pressure their thicknesses are of the order of a millimeter. Combustion is completed within the wave, causing the temperature behind the wave to be much greater than the temperature ahead of it. The wave propagates by conducting enough heat to the combustible gases ahead of it to raise their temperature to a point at which they begin to burn rapidly. Deflagrations provide a useful means for

achieving hot flames and high rates of heat release per unit volume without producing damaging pressure waves. Bunsen burner flames and oxyacetylene torches are deflagrations, as are the combustion processes in jet engines and in solid propellant rockets.

Detonations. Detonation waves propagate rapidly, at velocities of approximately 5,000 meters per second. They consist of a very thin shock wave, across which the pressure and temperature both increase by a factor of ten or more, followed by a combustion zone, in which chemical reactions proceed rapidly to completion. The strong shock wave serves to ignite the combustible gases in a detonation. The pressure pulses associated with detonations are highly destructive, and therefore detonations usually must be avoided in engines and furnaces. High explosives are purposely constructed to support detonations. Concepts of detonative combustion form the basis of some novel theoretical designs for jet and rocket engines.

Word list

arrangement- класифікація
Adiabetic – адіабатичний, адіабатний
Approximate – що знаходиться близько; близький; приблизний
Approximate value – наближене значення
addition of energy – додаткова енергія, надлишок енергії
aluminum алюминий
achieve- досягати
Blaze – полум´я, блиск, горіти, палати,
branched-chain розгалужений ланцюг
Gas engine – газовий двигун
Carbon – вуглевод, вугілля
Carbon black – сажа
Carbon dioxide – вуглекислий газ
Carbon steel – вуглецева сталь
Carbon monoxide – чадний газ
composition - склад
completion- завершення
chamber dimensions – вимірювальна камера
Conflagration – велика пожежа, спалення
Criterion – критерій
Connotation – додаткове, супутне значення; те, що мається на увазі
Detonation – детонація, вибух
Deflagration – згоряння вибухових речовин без вибуху
Detonator – детонатор, капсуль, петарда
depend on – залежати від
delay – відкладати
diffuse out / into розповсюджувати зовні /всередину
experiencing - відчувати на собі вплив
encompass –містити, здійснювати
employ - употреблять, применять, использовать (in, on, for)
elapse- виходити, закінчуватися (про час)
Explosion – вибух,
Explosive – вибуховий
Flame – полум´я, яскраве світло, полум´яніти, палати, спалахнути
Flaming – палаючий, горючий, яскравий
further - далі
Furnace – піч, топка
Fire-damp – метан, болотяний газ, рудниковий газ
Gas – газ, газоподібне тіло, бензин, газолін, пальне
gasoline vapor – випаровування бензину
heat – тепло, жар теплове випромінювання
hydrogen peroxide перекись,
Homogenious – однорідний, хім. Гомогенний
impart – передавати
intimately- глибоко, детально
intrinsically – у дійсності
in turn – у свою чергу
Ignition – запалення, спалах,
Internal combustion engine - двигун внутрішнього згоряння
Lignite – буре вугілля
nitric хим. Азотный
Noble gas – інертний газ
Naturul gas – природний газ
Occur – трапляться, відбуватися
Oxygen – кисень,
Oxidize – окисляти,
Oxidizer – окислювач
potassium nitrate нитрат, соль калия
peat- торф
Pile – купа, груда
Pertinent- безпосередній, той що стосується справи
proceed – продовжувати дію, рух, процес

Propellant – метальна вибухова речовина
Petroleum – нафта, газ, нафтовий
Propagation – поширення
Propagate – фіз. Передавати на відстань через середовище
release – виділяти, віддавати,
trapped- той , що утримується, знаходиться у замкненому просторі
thoroughly- ретельно
transient – тимчасовий, перехідний
Sportaneous combustion – самозаймання,

Exercise 1.
Answer the questions.
Part 1.

1. What is combustion?
2. What „fuels“ are capable of experiencing combustion in the absence of an oxidizer. Why?
3. What substances form common ingredients of explosives and of propellants for rocket motors?
4. What substances can participate in combustion? Name some of them.
5. What conventional and unconventional fuels are mentioned in the text?
6. How can temperature given on the Kelvin scale be converted to centigrade or to Farhenheit?
7. What is the most powerful fuel discovered?
8. Where is most of the energy man consumes today produced?
9. What are a basic thermodynamic property of a fuel?
10. What other substances can be considered natural fuels?
11. Whose properties are intermediate between those of peat and coal?
12. What important thermodynamic property of a combustible system do you know?

Part 2

1. What is the ignition temperature?
2. What do the ignition temperatures depend on?
3. Supply approximate values of ignition temperatures for common fuels. Don‘t you know them?
4. What is flaming combustion?
5. What is central to the science of combustion?
6. What is called a diffusion flame? Why?
7. What is considered a transient process?
8. What are the two mechanisms that can produce explosions in combustion systems?
9. How many types of combustion waves occur? What are they?
10. In what way do deflagration waves propagate? What do they provide? Supply an example?
11. In what way do detonation waves propagate?

Тестові завдання до теми 1.

Variant 1

1. Match the following English words and expressions with their Ukrainian equivalents.

1	furnace	5	conflagration
2	propellant	6	ignition
3	explosion	7	flame
4	combustion	8	property

9	carbon dioxide	4	запалення, спалах
10	fuel	5	полум'я, горіти
		6	паливо, пальне
		7	піч, топка
		8	велика пожежа, спалення
		9	чуття здібність
1	вуглекислий газ	10	вибух, спалах
2	властивість, якість	11	фіксація
3	окислення, горіння	12	метальна вибухова речовина

2. Fill in the gaps in the following sentences. Use the appropriate grammar form.

1) combustion processes … (involved, involving, have involved, have been involved) different oxidizers or fuels, for example, rusting of metals, …(has recognized, have recognized, recognized) long and (is, was, were, are) important in chemical industries.

2) the wave … (propagated, will propagate, propagates, has propagated) by conducting enough heat to the combustible gases ahead of it … (raised, raises, has raised, to raise) their temperature to a point at which they … (begin, began, have begun, had begun) to burn rapidly.

3. Odd man out in the line below choose one word that doesn't belong to the group and explain why you thick so:

Coal gas, acetylene, carbon monoxide, oxygen, propane, gas engine, methane.

4. Give synonyms:

oxygen - ; detonation - ; benzene - .

Variant 2

Match the following English words and expressions with their Ukrainian equivalents.

1	carbon monoxide	10	proportionate
2	detonation		
3	blaze		
4	gas		
5	oxygen	1	пропорційний
6	value	2	кисень, кисневий
7	approximate	3	величина, значення
8	pile	4	детонація, вибух
9	deflagration	5	чадний газ

6 приблизний
7 купа, груда
8 оцінювач
9 вагомий, обгрунтований
10 газоподібне тіло
11 полум'я, палати
12 згоряння вибухових речовин без вибуху, спалах

2. Fill the gaps in the following sentences. Use the appropriate grammar form.

1. The early history of the study of combustion … (is, was, were, are) closely related to the history of chemistry and of the molecular theory of matter.
2. During the Middle Ages the idea … (persists, persisted, has persisted, had persisted) that fire … (is, was, were, are) one of the four basic elements of matter.
3. At atmospheric pressure deflagration waves thicknesses … (have been, had been, were, are) of the order of a millimeter.
4. An important thermodynamic property of a combustible system (are, were, is) it's adiabatic fame temperature, the maximum temperature achieved if all of the heat of combustion (are, is, was, were) used to increase the temperature of the combustion products.

3. Odd man out. In the line below choose one word that doesn't belong to the group and explain why you thick so:
Benzene, kerosene, gasoline, alcohol, water, lignite petroleum.

4. Give antonyms:
detonative combustion - ,
detonation - .

Variant 3

1 Match the following English words an expressions with their Ukrainian equivalents.

1 Internal
2 gas-alarm
3 detonation
4 propagate
5 nozzle gas
6 flame
7 deflagration
8 spontaneous combustion
9 ignition
10 propellant
1 самозаймання
2 вибух
3 інертний газ
4 горіти, палати
5 метальна вибухова речовина
6 якість
7 внутрішній
8 хімічна тривога
9 згоряння речовин без вибуху
10 запалення, спалах
11 виконання
12 передавати на відстань через середовище

2. Fill the gaps in the following sentences. Use the appropriate grammar form.

1. In nor premixed systems combustion … (is, was, are, were) nonexplosive, and chemical heat release … (has occurred, have occurred, occurs, occurred) in a flame into which fuel and oxidizer … (is, are, was, were) transported from opposite sides.

2. Such flames (have been, had been, were, are) called diffusion flames, because fuel and oxidizer … (diffuses, diffused, diffuse, are diffused) into the flame zone while combustion products and heat … (diffuses, diffused, diffuse, are diffused) out.

3. Odd man out. In the line below choose one word that doesn't belong to the group and explain why you think so:
hydrogen, natural gas, gas engine, fire – damp, helium, molecular nitrogen, carbon dioxide.

4. Give synonyms:
flame-engine -,
fire-damp - ,
gasoline - .

Variant 4

1. Match the following English words and expressions with their Ukrainian equivalents:

1	furnace	8	велика пожежа
2	propellant	9	чуття, здібність
3	explosion	10	вибух, спалах
4	combustion	11	інертний газ
5	conflagration	12	метальна вибухова речовина
6	ignition		
7	lignite		
8	property		
9	carbon dioxide		
10	deflagration		

1	вуглекислий газ
2	властивість, якість
3	окислення, горіння
4	запалення, спалах
5	буре вугілля
6	згоряння вибухових речовин без вибуху
7	піч, топка

2.
1) The wave … (propagated, will propagate, propagates, has propagated) by conducting enough heat to the combustible gases ahead of it … (raised, raises, has raised, to raise) their temperature to a point at which they … (begin, began, have begun, had begun) to burn rapidly.
2) In no premixed systems combustion … (is, was, are, were) nonexplosive, and chemical heat release … (has occurred, have occurred, occurs, occurred) in a flame into which fuel and oxidizer … (is, are, was, were) transported from opposite sides.

3. Odd man out. In the line below choose one word that doesn't belong to the group and explain why you think so:
coke, wood, peat, lignite, carbon, carbon dioxide, carbonate, carbon steel, iron, pig-iron.
4.Give synonyms:
fire – damp -,
air -
Give antonyms:
deflagrative combustion - ,
explosion - .

INFINITIVE

1. Translate the sentences:
They are better able to locate and extinguish the fire. From the inside, thermal imagers can be used to monitor fire conditions.
25 firefighters used thermal imagers to evaluate failing structures.
It can be quick and simple to identify the progress and spread of fire conditions.
It's preferable to identify the seat of the fire and the extent of the fire conditions from the exterior of the structure
Firefighters arrived on scene to find the two-story building surrounded by smoke with no visible fire.

2. Fill the gaps in the following sentences. Use the appropriate grammar form of infinitive:

1) There are several means by which they can (to use, use) thermal imaging to better understand the building and the fire conditions that they're working in.
2) The thermal imager helped firefighters quickly (to determine, determine) the fire had originated in the basement, allowing them to avoid putting themselves in danger.

3) The wave propagates by conducting enough heat to the combustible gases ahead of it to raise their temperature to a point at which they begin (to burn, burn) rapidly.
4) Combustion is the combination of an oxidizer with a fuel, for example, oxygen with petroleum, (to produce, produce) compounds such as carbon dioxide and water.
5) These features may be actual hazards, or they may serve (to hide, hide) or (to spread, spread) a fire condition.
6) Some fuel-oxidizer mixtures cannot be made (to burn, burn).
7) The strength of concrete is its ability (to resist, resist) the stresses caused by force.

Unit 2

FIREPROOF MATERIALS

FIREPROOF MATERIALS are substances that do not ignite and burn when subjected to fire. The term "fireproof" is somewhat misleading because no material is totally immune to the effects of fire, and the more appropriate term "fire-resistant" is often used. For practical purposes, however, it can be said that materials such as concrete, structural steel, and glass are noncombustible, whereas materials such as cotton, wood, paper, and most synthetic fibers are combustible. In general, any material consisting primarily of carbon and hydrogen is combustible. Because fire is a common danger, fire-resistant building materials and flame-resistant textiles and fabrics are especially important in reducing loss of life and injury from fire.

1) Steel, brick, concrete, asbestos, glass, and most plasters are excellent non-combustible building materials. There are also many acceptable building materials that have varying degrees of combustibility—for example, lumber, paper-covered wallboards, translucent sheets and panels, and most interior wall coverings.

A standard test of the combustibility of building materials is the tunnel test *devised* by Underwriters' Laboratories, Inc. One property *measured* by this test, which is conducted in a tunnel-shaped structure, is the surface burning characteristics of the material. When *exposed* to fire, a material gives off combustible vapors that cause flames to spread over the surface. The rate at which the fire spreads is rated on a scale, using 0 for cement-asbestos board and 100 for *untreated* red oak. Another property *measured* by this test is the fuel *contributed* by the material itself. A good fire-resistant material such as cement-asbestos board will not contribute any fuel to a fire, whereas plywood, most paints, and all plastics will make substantial contributions to the fuel supply. A third property measured by the test is the amount of smoke *produced*, which may not be directly related to the flame spread. The table, based on the tunnel test, shows the relative merits of some materials.

RELATIVE MERITS OF SOME BUILDING MATERIALS

Material	Flame spread	Fuel contributed	Smoke developed
Cement-asbestos board	0	0	0

Red oak	100	100	100
Red oak, treated	30-50	20-25	25
Plywood, treated	15-60	10-35	0-85
Glass fiber-reinforced panels	40-100	0-30	over 200
Wallboard 1/2 to 5/8 inch thick	10-15	5-15	0-45
Wood particle boards	15-190	20-110	0-over 200

All materials can be damaged by *prolonged* exposure to fire—for example, masonry walls can distort and collapse under excessive heat, and concrete can completely disintegrate under prolonged exposure at very high temperatures. In tests of materials, both the temperature and the duration of the exposure to heat are important factors in determining the extent of damage to a material. Standard tests with fires of *controlled* intensity have been developed to measure the amount of time a material can resist the effects of a fire; for example, a l/2-inch-thick (1.3-cm) fiberboard over wood framing, *exposed* to fire on the finish side, has a fire-resistance rating of 5 minutes.

2). No fire-retardant treatment can make a material completely resistant to fire because the material will still be subject to smoldering and charring. However, the treatment retards flame spread and reduces the rate of consumption in a fire. Wood is made fire-retardant by pressure impregnation or by coating. Pressure impregnation deposits chemicals such as phosphates, borax, and boric acid into the fibrous passages of the wood. Intumescent paints, mastics, and glazes can be applied as a coating on wood, but they are a less permanent form of protection. Paper products, such as crepe paper, *corrugated* cardboard, and window shades, can be treated to stop them from flaming and glowing after the source of the fire has been removed.

Plastics can be made fire-retardant when *treated* by chemical change to reduce flame spread and smoke generation. It is not possible to identify by sight the flame-resistant properties of plastics, so care should be exercised in their, use.

3). Noncombustible textiles and fabrics can be made from glass or asbestos fibers. Glass fabric draperies woven from glass yarn, for example, will not propagate flame unless combustible coloring or coating materials are added. Fabrics made of admixtures of fibers have varying degrees of combustibility, depending on the particular fibers *used*.

Small-scale tests of the flame resistance of textiles and fabrics can be misleading. For instance, a material may seem to be flameproof *when tested* with a match, but it may burst into flames or generate large quantities of smoke *when subjected* to a more intense flame.

The fireproofing of textiles and fabrics is a complex art. Cellulose acetate fibers, such as acetate rayon, can be partially protected by treatment. However, nylon and other thermoplastic fibers do not lend themselves to fireproofing because they melt before they bum, and the molten material can cause other problems. Many different chemicals have been used for fireproofing fabrics. Most commonly the chemicals are solutions of borax, boric acid, and combinations of phosphates, chlorides, and sulfates. Wearing apparel is particularly difficult to flameproof because

frequent washing and dry cleaning remove the effectiveness of the treatment. Weather-resistant flameproofed fabrics for tents and awnings must be retreated at frequent intervals or be impregnated with waterproofing and flameproofing chemicals that prevent washing out of the treatment.

Word list

fireproof - вогнестійкий
immune – той, що не сприймає дію чогось, захисний, стійкий до впливу
appropriate - відповідний
resistant - стійкий
concrete - бетон
synthetic fibers – синтетичні скловолнно
fabrics - тканини
loss - витрати, збитки
acceptable – той, що можна прийняти
lumber – піломатеріали, амер. – буд. ліс
translucent [tranz 'lusnt] - напівпрозорий
coverings. - покриття
Conduct - проводити
tunnel-shaped – у формі трубки
expose – піддавати впливу
untreated - необроблений
red oak – червоний дуб
contribute – вкладати, робити внесок
plywood - фанера
supply – постачати, забезпечувати, ресурси,
relative merits – порівняні, відносні якості
prolonged - продовжувати
exposure - випромінювання, вплив на обєкт теплом, температурою, радіацією
excessive – надзвичайний, надмірний
duration – тривалість, довжина
extent of damage - обсяг шкоди, ушкоджень
fire-retardant treatment - протипожежна обробка, покриття
smoldering - тління, горіння без полумя
consumption - споживання
impregnation - напоювання
permanent - постійний
crepe paper – гофрований папір
corrugated cardboard – гофрований картон
generation – утворення, накопичення
draperies - занавіски, штори
woven - ткацтво, ткальна
admixtures – доміс, суміш, що додається
misleading – той, що вводить в оману, помилковий
generate - породжувати, виробляти, накопичувати
melt - таяти, плавитися
solutions - розчин
apparel – одяг, снарядження
Intumescent – той, що розбухає, той що закипає

Exercise 1.

Read the following text about **Fireproof Materials** and match the headlines given in the box to the appropriate paragraph.

Treatment of Wood, Paper, and Plastics. Textiles and Fabrics. Fireproof Materials. Building Materials.

Exercise 2.

Check your knowledge of the active vocabulary. Match the following English words and expressions to their Ukrainian equivalents.

1	Plywood	1	споживати
2	Expose	2	бура
3	Retard	3	просочення
4	Consume	4	фанера
5	Impregnation	5	гальмувати, справляти опір
6	plaster of Paris (Paris Plaster)	6	впливати, випрмінювати
7	rayon	7	гофрований, рифлений
8	borax	8	горючість
9	corrugated	9	штучний шовк, віскоза
10	combustibility	10	гіпс, алебастр

Exercise 3.
In the following line choose one word that doesn't belong to group and explain why you think so:
Fire-resistant – noncombustible – fireproof – flame – retardant - fire retardant – fire raising – flame proof

Exercise 4.
Answer the following questions:
1. Are fireproof materials really immune to the effects of fire?
2. What does it mean to be combustible or noncombustible? Supply some examples.
3. What is especially important in reducing loss of life and injury from fire?
4. What do you know about the tunnel test? What is it decided for?
5. What properties are measured by this test?
6. What are important facts in determining the extent of damage to a material?
7. What is the purpose of fire-retardant treatment?
8. What chemicals are used in pressure impregnation?
9. What materials can be made flame-retardant?
10. Under what condition will noncombustible textiles and fabrics propagate flame?
11. Can we depend on small – scale tests of the flame resistance of textiles and fabrics?
12. Why can't some textiles and fabrics under go the process of flame-proofing?
13. What was used for fire protection of wood as early as about 400 B.C.?
14. Who made the first systematic investigation of fire-proofing?

Exercise 5.
Correct the following statements. Begin with: **I'm afraid that's wrong; you are not quite right; that's not quite so; as far as I now; I think you are mistaken; on the contrary; I don't think so; according to the text.**

1. Fireproof materials are absolutely immune to the effects of fire.
2. Most synthetic fibrous is noncombustible.

3. You can hardly find any noncombustible building materials.
4. When exposed to fire, a material gives off vapors that prevent flames to spread over the surface.
5. Intumescent paints can't be applied as a coating on wood to make it fireproof.
6. It's usually possible to identify by sight the flame-resistant properties of plastics.
7. Fabrics made of admixtures of fibers are flame-retardant.
8. Wearing apparel is particularly easy to flame – proof as it can be impregnated with waterproofing and flame-proofing chemicals.

Exercise 6.
Match the words in the left column with their explanations in the right column.

1) Asbestos	1) something that catches fire and burns easily
2) Fabric	2) the gaseous products of burning carbonaceous materials made visible by the presence of small particles of carbon
3) Translucent	3) to be on fire or destroy something by fire
4) Flame-proof	4) something that cannot be damaged by fire, or something you make it so
5) Flame-retardant	5) a building material which is made by mixing together cement, sand, small stones, and water, and which hardens it dries.
6) Smoke	6) cloth or other material produced by weaving cotton, nylon, wool, silk or other threads together
7) Burn	7) something that seems to glow when light passes through it.
8) Concrete	8) resistant to damage or burning on contact with flame made or treated so as to resist burning
9) Combustible	9) in a gray material which does not burn and which is used as a protection against fire or heat. Clothing and mats are made from it.

ABBREVATIONS

1. What do all those firefiqthers' acronyms mean anyway? Read and translate the advertisment below.

C.P.R - Cardio pulmonary resuscitation
EMT – Emergency Medical Technician
ICS – incident command system. The incident command system is designed to be used on incidents of all sizes and types from small single unit incidents to large

scale incidents involving several agencies and lasting for days or even weeks. Also known as Incident Management System.
EMS – Emergency Medical Services

Probie is a term used by firefighters to identify a **probationary** firefighter, or rookie.
Hazmat – hazardous material
Firedep(t) – Fire department

Hot Jobs:
Paramedic: Greenville, SC. Greenville Co. EMS. Requirements: 18 yrs of age or older, EMT cert., CPR card. Apply to: Greenville Co. EMS., 301 University Ridge Suite 1100, Greenville, SC 29601 Deadline: Open until filled

2. Read the text and write down the abbreviations, practice their pronunciation, give their meaning:

When you are born, your family gives you a **first name**, e.g. Kate, Ivan, Sasha. You **family name** (i.e. **surname**) the name that all your family have: Brown, Pavlov, Smirnitski etc. Some parents give their children a **middle name**, but you do not usually say this name. In some countries people add to first name the name of their fathers – it is **patronimic name**. Your **full name** is all the names you have , e.g Maria Luiza Lopez or Oleg Ivanovich Svetlov.

Unit 3

CONCRETE

CONCRETE, is a composite material whose key ingredient is a binding medium in which small pieces of rock or other materials are embedded. The small pieces are called aggregate; the binder is a cementing material. In port-land-cement concrete, the binder is a mixture of Portland cement and water. Asphalt and other cements are used to make some types of concrete,

Concrete is the most versatile and widely used building material. It is used in dams, canals, and aqueducts; in highways, pavements, and sidewalks; and in buildings, bridges, and other structures, both as a structural and as a decorative material.

Where concrete is not used as the primary structural material, it may be used for fireproofing, waterproofing, or soundproofing. Concrete also acts as a shield against damaging nuclear radiation.

Concrete is of such importance that almost every civil engineering structure uses it. On a worldwide basis the yearly production of concrete amounts to approximately one ton per capita

MATERIALS. Portland Cement. Portland cement is composed essentially of two of the most abundant elements of the earth's crust, silica and calcium. To make it, a lime-containing material (such as limestone, shell, or chalk) and a claylike material (such as shale, slate, or clay itself) are finely ground, carefully proportioned either dry or in a wet slurry, and fed into a rotary kiln. When the temperature in the kiln reaches about 2700°F (1682°C), the clay-bearing components become molten, In the meantime, the limestone, $CaCO_a$, has been reduced to calcium oxide (CaO) and carbon dioxide - The calcium oxide reacts chemically with the molten clay material, forming silicates of calcium. Portland-cement clinker, which is the fused product formed in the kiln, is cooled and ground to a fine gray powder.

Aggregates. Aggregates are usually inert materials that, when bound together into a conglomerated mass by portland-ccment paste (the mixed portland cement and water), form concrete, mortar, or plaster. Aggregates, make up about 75% of the total mass of concrete. Aggregates are classed as coarse or fine, depending on size.

Suitable concrete aggregates can be formed from nearly all of the minerals found in the earth's crust. The aggregates should be free from harmful materials such as clay, soluble salts, and organic materials.

Sand, or fine aggregate, is generally the product of natural disintegration of silica-bearing or calcium-bearing rock. Fine aggregate is sometimes manufactured from larger pieces of aggregate by crushing, grinding, and rolling.

Water. For concrete mixtures, water should not contain substances that harm the concrete. In general, water that is acceptable for drinking purposes is also satisfactory for use as mixing water in concrete. Excessive amounts of silt, oil acids, alkalis, salts of alkali, organic matter, or sewage in water have an injurious effect upon concrete.

Admixtures. An admixture is a material other than water, aggregate, or port-land cement that is used as an ingredient in concrete and is added to the batch immediately before or during its mixing. Admixtures are used in cements, mortars, and concretes to improve workability or consistency, improve durability, increase strength, accelerate strength development, retard or accelerate the initial setting, retard or reduce the evolution of heat, control alkali-aggregate expansion, and increase density and reduce permeability.

PROPERTIES. Workability. Concrete is said to be workable when it is (1) properly proportioned for transport and placed without segregation (non-uniform distribution of the particles of aggregate), (2) easily molded into desired shapes that completely fill the space it is to occupy, and (3) easily finished. Other terms used in describing workability are consistency,

plasticity, and mobility. Consistency is the degree of wetness or slump of a concrete mix**;** it varies directly with the amount of water in the mix.

Strength. Concrete in structures is subjected to compressive, tensile, flexural, and shearing forces. The strength of concrete is its ability to resist the stresses caused by these forces. This important property determines the load-carrying capacity of concrete structures.

Durability. The durability of concrete is its ability to resist the forces of deterioration. The forces that cause concrete to deteriorate include freezing and thawing of water-saturated concrete, expansion caused by the reaction between reactive aggregates and alkalis in cement, reactions between soil and water sulfates and the hydrated portland cement, and expansion and shrinkage caused by wetting and drying, respectively.

Freezing and Thawing. The freezing of water in the pore structure of concrete causes it to expand about 50% in volume. If the concrete is saturated and the pore structure cavities are filled, freezing water is forced into the surrounding hydrated portland-cement gel structure. The pressures caused by expansion of freezing water may be sufficient to damage the gel structure and cause deterioration of the concrete.

Reactions Between Aggregates and Cement Alkalis. Chemical reaction between reactive aggregates and a portland cement with a high alkali (K_2O and Na-O) content causes expansion, which can lead to cracking and deterioration of the concrete.

Reactions Between Sulfates and Cement. Unprotected concrete is actively attacked by sodium and magnesium sulfates that are present in alkali soils and some corrosive waters. These sulfates react with the hydrated portland cement. As a result, the concrete corrodes and disintegrates. Sulfate-resistant cements have been developed for use in such conditions. Low water-cement ratios and an increase in watertightness provide added protection from sulfate attack.

Shrinkage and Expansion. Concrete tends to swell upon wetting and to shrink upon drying. Swelling takes place when moisture enters the gel structure of the hydrated portland cement, The tiny crystals of the hydrated portland cement are long and thin and resemble a pile of matches in which the matches of each layer are at right angles to the matches of the layer below. As moisture enters, these crystal layers tend to be forced apart, causing swelling of the cement gel. As concrete dries out, this layered structure becomes more compact, causing shrinkage of the concrete.

Shrinkage also occurs because the volume of the Portland cement and water gradually decreases as chemical combination proceeds during hydration.

An increase in temperature will cause thermal expansion of concrete due to the increased energy in the atomic structure. This increased activity decreases as the concrete cools. A large difference between the temperature of the

outside surface of the concrete and the temperature of the interior mass will cause fine cracks in the concrete.

Water Tightness. However, the ingress of water into a porous or permeable concrete can cause it to reach the critical saturation point for freezing and thawing actions that deteriorate it. If the concrete is porous or permeable, harmful salts and acids also may permeate the inner structure of the concrete matrix. There is also a slow weakening of concrete structures when pure water from rain or snow slowly dissolves the soluble components of hydrated portland cement.

Chemical Resistance. Because hydrated port-land cement is chemically a base, it will react with most acids; this reaction causes concrete to disintegrate.

Magnesium fluorosilicate or zinc fluorosili-cate hardens the surface of concrete by chemical action and makes it more impervious to chemical attack. Sodium silicate (water glass), linseed oil, synthetic resins, paints, and varnishes have also been used as protective coatings for concrete.

Fire Resistance. Concrete is used extensively to fireproof steel beams because it has a low thermal conductivity. The gel structure of hydrated portland cement does not break down(1093°C) is reached; and the point of fusion of most aggregates is reached only at very high temperatures.

The kind of aggregate that is used affects the fire resistance of concrete. Limestone or other calcium-bearing aggregates are the least effective in their resistance to fire. The basalts and related igneous rocks are more resistant than limestone but are less resistant than granites and sandstones. Aggregates made of quartz and quartzites have the highest resistance to fire.

WILLIAM A. CORDON *Utah State University*

Word list

binding medium –вязка середа
embed – вставляти, вкраплювати
aggregate – наповнювач бетону
binder – речовина, що звязує
versatile[‘vэ:sэtail]– універсальний, багатофункційний
structural material – будівельні матеріали
shield – захист
abundant[э’b^ndэnt]– поширений, у достатній кількості
crust – кора
silica-кварц
lime – вапно
shale, slate, clay – сланцева глина, сланец, глина
slurry – рідинний цементний будівельний розчин
kiln – піч для обжигу, обжигати
mortar – будівельний розчин
soluble – розчинний
salts, and organic materials.
Fine – тонкий, невеликий
disintegration - розпад, розподіл на складові
satisfactory – той, щзадовільняє
silt – осадок
sewage – викиди, стічні води
injurious – шкідливий
consistency – стійкість, щільність
density – плотность
reduce – знижати
permeability [pэ:mjэ’biliti] – проникливість, негерметичність.

Term – термін
Wetness – вогкість
Capacity – якість
tensile растяжимый
flexural сгибание; изгибание; прогибание
shearing срезывающая сила
deterioration–старіння, амортизація, знашування
thawing – розморожуваний
soil – почва
respectively- відповідно.
Saturated – вогкий, напоєний водою
Sufficient – достатьній
Crack – тріщина
Shrinkage – деформація, зменшення в обсязі
Swelling – розбухання
Resemble – нагадувати, бути схожим
Angle – кут
ingress вхід
impervious[impeves] непроникливий,стійкий
beam – балка,брус
conductivity- проводимость
fusion – плавлення
igneous [‘ignjes] – вулканічного походження

Exercise 1. Check your knowledge of the active vocabulary.

Test 1

1) Match the following English words and expressions with their Ukrainian equivalents:

1)tuff	1) що складається з окремих мінералів/
2)mortar	2) осідання (грунту).
3) alumina	3) ступінь щільності ,густини.
4) aggregate	4) глина, глинозем.
5) clay	5) кремпозем, кварц.
6) consistency	6) усадка (бетону); оповзання грунту.
7) slump	7) туф
8) quarry	8) кар'єр каменоломня.
9) silica	9) окис алюмінію; глинозем.
10) subsidence	10) вапняковий розчин; будівельний розчин.

Test 2

1) Match the following English words and expressions with their Ukrainian equivalents:

1	Watertight	1	шліфування
2	Batch	2	водонепроникний
3	Durability	3	завантаження
4	Flexure	4	заміс бетону
5	Agitate	5	стиснення
6	Charge	6	згинання, прогиб
7	Compressions	7	перемішувати
8	mold (mould)	8	тривалість

Test 3

1) Match the following English words and expressions with their Ukrainian equivalents:

1	Agitation	1	відливати в форму
2	Slate	2	одержувати
3	mold (mould)	3	балка, брус
4	pore	4	клин, домкрат
5	prefabricate	5	сланець, шифер
6	obtain	6	коливання
7	beam	7	пора, свердловина
8	wedge	8	розтяжний
9	jack	9	клин, форма клина
10	tensile	10	виготовляти заздалегідь

Exercise 2.

Match the words in the left column with their explanations in the right column.

1) Concrete	1) a material other than water, aggregate, or port-land cement that is used as an ingredient in concrete and is added to the batch immediately before or during its mixing.
2) Aggregates	2) its ability to resist the stresses caused by these forces.
3) Durability of concrete	3) its ability to resist the forces of deterioration.
4) Sand, or fine aggregate	4) takes place when moisture enters the gel structure of the hydrated portland cement causing shrinkage of the concrete.
5) Admixture	5)ability of concrete to fireproof steel beams because it has a low thermal conductivity.
6) Fire resistance	6) composite material whose key ingredient is a binding medium in which small pieces of rock or other materials are embedded
7) The strength of concrete	7) usually inert materials that form concrete, mortar, or plaster.
8) Swelling	

8) generally the product of natural disintegration of silica-bearing or calcium-bearing rock

Exercise 3. Choose the correct form of the verb:

1. The strength of concrete(1.resist,2.resisted,3.to resist,4.will resist) the stresses caused by compressive, tensile, flexural, and shearing forces.
2. Because a high-quality Portland-cement paste (is, was, were, has been) the binder in concrete, had had, to have, has) the most important influence on the strength of concrete.
3. The freezing of water in the pore structure of concrete (has caused, had caused, caused, causes) it (to expand, expanding, had expanded) .
4. Concrete (was, is, will be, shall be) used extensively (fireproofed, fireproofs, fireproofing, to fireproof) steel beams.

Exercise 4. Decide whether the following statements are true or false. If necessary - correct them. Begin with: **I'm afraid that's wrong; you are not quite right; that's not quite so; as far as I now; I think you are mistaken; on the contrary; I don't think so; according to the text.**

1. Asphalt and other cements are used to make some types of concrete,
2. Concrete is not used in highways.
3. Portland cement is composed essentially of the rarest elements of the earth's crust, iron and carbon.
4. Fine aggregate is manufactured from larger pieces of aggregate by washing.
5. For concrete mixtures, water should not contain substances that harm the concrete.
6. The forces that cause concrete to deteriorate include wind, sun, water.
7. The pressures caused by expansion of freezing water may be sufficient cause deterioration of the concrete.
8. Concrete is used to fireproof steel beams because it has a high ignition temperature.

RESUME

1. Read the example of resume. Get ready to discuss it and make up your own one.

Jennifer L. D'Alessio

Desired Industry: Firefighter/Paramedic/Emergency
SpiderID: 1456
Desired Job Location: Los Angeles, California
Date Posted: 11/16/2004
Type of Position: Full-Time Permanent
Availability Date: 1/1/05
Desired Wage: open
U.S. Work Authorization: Yes
Job Level: New Grad/Entry Level

Willing to Travel: Yes, More Than 75%
Highest Degree Attained: Other
Willing to Relocate: Yes

Objective:

To preserve life ,the enviorment, and property. To begin my career and continue to educate myself to a paramedic firefighter.I want to be a company's engineer one day.

Experience:

I'v done ride alongs with Santa Clara city fire as well as time in the ER as a volunteer. I recently obtained my EMT certification.

Education:

I have an AS degree in Fire Protection Technology with a 4.0 GPA. I am Hazmat certified , certified in rough terrain rescue, and ICS-195. Wildland certification and EMT.

Candidate Contact Information:

Click "Contact Candidate" to send this candidate a response.

2. Read the Internet articles, discuss them.

Words You Need in Your Resume

Every word on your resume counts in today's competitive job market. But some words count more than others -- especially those that refer to soft skills. Soft skills are increasingly important in the workplace. In fact, 86 percent of employers considered soft skills to be among their most important hiring criteria in a recent survey by two University of Massachusetts economists.

'Teamwork'

Teamwork is more important than ever in the workplace. The ability to work well with others to accomplish a common goal is vital for a harmonious workplace. Employees are often organized into teams to manage projects. And many employers believe collaboration increases the quality of work and improves productivity. A team player is an attentive listener, a co-operative colleague and is willing to help others.

'Flexibility'

Employers value workers who are flexible and able to juggle multiple tasks simultaneously. In other words, it's sometimes just as important to be a jack-of-all-trades as a master of one. You can show that you're flexible by demonstrating a willingness to take on new and varied projects and an ability to handle changing priorities and deadlines. Ultimately, being flexible doesn't only increase the odds that you'll get a job -- it also improves your chances of keeping it should layoffs occur.

'Detail-Oriented'

Employers want to know that they can trust workers to handle a project down to the last detail. Being "detail-oriented" means being organized and meticulous about your work. It also implies that you can work without constant supervision and act independently.

'Self-Motivated'

Employers value employees who are self-starters. These workers can generate their own ideas and follow them through to fruition. A self-motivated worker goes the extra mile. She regularly takes on tasks that may not be part of her job description. She's inspired to work hard not just to reap rewards but also for personal satisfaction.

Words to Avoid in Your Resume

Most resume-writing guides focus on "power words" -- words that promise to grab the attention of recruiters as they scan hundreds of resumes -- but few tell you what words to avoid in your resume.

Below is a list of words and word types that your resume would be better without.

Abbreviations and Acronyms

AFPCA, CHIGFET, FIPL, MRSRM, ZWE: Looks like a fresh game of Scrabble, doesn't it? Too many abbreviations and acronyms in a resume make it unreadable.As a rule, avoid using abbreviations and acronyms unless they are commonly recognized. If you work in an acronym-heavy industry, such as technology, use acronyms sparingly.

Personal Pronouns

It seems odd to avoid personal pronouns (I, me, my) in your resume -- a document that is all about you. But, it actually does make sense.

Since your resume is all about you, the addition of "I" or "me" is redundant. Since a resume should contain no unnecessary words, there is no place for the personal pronoun. Your resume, after all, is not a memoir but a concise summary of your skills and experience.

Negative Words

These words spell death for a resume. Words like "arrested," "boring," "fired," "hate" and "sexist" catch a recruiter's eye like to a two-ton magnet catches a paper clip. If there are difficult issues you want to raise, save them for the interview.

Keep These Words to a Minimum

There are other words that are sometimes necessary in a resume, but that should nevertheless be kept to a minimum.

Among these:

- Abused words: a, also, an, because, the, very

- Any word you can't define: You may think using these words make you sound smart, but if you use them incorrectly they could kill your chances of landing the job.

- Words that can be embarrassing if spelled wrong: assess, skills

Unit 4

Fighting a Forest Fire

Fighting a Forest Fire requires teamwork and modern equipment. Observers in helicopters fly over the fire and note it; size and behavior. They can make accurate plans to combat the fire. Helicopters can **also** transport men and supplies to a fire quickly. Fire fighters called "smoke jumpers" parachute into remote areas to combat fires ihaf cannoi be reached easily from The ground. They can control a fire before it spreads. Fire-fighting equipment and supplies are dropped to smoke jumpers by parachute, reduced the annual forest-fire loss from a high of 50,000,000 acres in 1931.

FORESTRY TERMS

Insects that destroy trees include the Douglas fir beetle, pine bark beetle, balsam woolly aphid, western pine beetle, and spruce budworm. Bark

beetles burrow under the bark next to the wood. Some insects eat rings around the trunks until the sap stops flowing and the trees die. Others eat buds, young shoots, or leaves.

The first organized attack on forest-destroying insects and diseases came in 1947 when Congress passed the Forest Pest Control Bill. This act provided a way for federal and state governments and private forest owners to pool their money and efforts. Today, foresters use helicopters and airplanes to spray trees with insecticides that kill leaf-eating insects. Insect-infested trees are removed from forests as quickly as possible. This gels rid of the insects before they attack other trees. Unharmed parts of the wood are used to make wood products.

Diseases cause high losses in timber. Disease damage is especially common in the West, where the trees are older. These older trees cannot fight disease so well as younger ones do. The losses from disease will probably continue until vigorous young forests replace the older virgin woodlands.

Fungi, including molds, mildews, and mushrooms, cause most tree diseases. White pine blister rust and chestnut blight are among the most destructive fungi. The chestnut blight has destroyed most of the chestnut trees in the United States. Dutch elm disease and needle rust also kill many trees.

Forest Fires destroy much more than trees and other plants. The raging flames kill many birds and other animals. Wild creatures may die later of starvation and thirst before they can find fresh food and water. Ashes floating on streams can kill fish, and so can the increased temperature of the water.

A serious fire may even destroy the soil in a forest. Flames may burn the humus (decayed organic matter in

Fire Lookout Towers stand as sentinels throughout the forests of the United Stales. Rangers in the towers watch for the firs! signs of a fire and give directions to fire-fighting crews.

Slowdowns are trees that have been blown down by high winds.

Fire Boss directs a crew of forest-fire fighters.

Fire-Lookout Tower stands above the treetops. Men in these high towers watch for and report fires.

Forester plans and guides the management of a forest. He has professional training in growing and harvesting trees as a crop.

Lumber includes boards and large pieces of wood that have been sawed from logs,

Lumberjack, or Logger, cuts clown trees and helps deliver the logs to a sawmill.

Pulp is a matted mixture of wood fibers and water. Paper and other products come from wood pulp.

Pulpwood is wood that has been cut to be made into pulp. Most pulpwood logs measure from 4 to 8 feet in length and 4 to 14 inches across.

Ranger is an administrative officer in charge of a unit of government forest land.

Saw Logs are logs large enough to saw into lumber. In the eastern United States, they must measure at least 9 inches across. In the West, they must be at least 11 inches.

Sawmill is a manufacturing plant that saws logs into lumber.

Seedling is a young tree less than 3 feet tall.

Stand is a group of trees growing together.

Timber is trees or logs that contain wood suitable for use.

Tree-Planting Machine plants seedling trees.

Watershed is an area of sloping land down which water drains from rain and melted snow. The water flows into streams, lakes, or underground pools. Forests help regulate the flow of water down a watershed, to prevent floods and soil erosion.

Wood Lot is a small forest, usually on a farm.

Hardwood Forests thrive mainly in warm, regions that have long growing- seasons. But hardwood forests of birch, maple, and aspen live in colder place Most hardwoods are deciduous trees. They lost their leaves each year and grow new ones. They generally have broad leaves. Most of hardwood trees have strong, hard wood. But sometimes hardwood that is even softer than pine. Leading hardwood include oak, beech, birch, maple, poplar, gum, art hickory. Squirrels, raccoons, rabbits, wild turkeys, nilfe grouse, and other animals find food and shelter in tl: bushy undergrowth of many hardwood forests.

Tropical Rain Forests grow near the equator ink wet regions that never have a dry season. The dost, growing trees and vines need about 80 inches of raio, year. Many different, species (kinds) of trees grow in tar forests. Most of them have broad leaves and are no-bare. They lose only a few leaves at a time, and grow the new to replace those that. fall. Tropical rain forests grow in Central America a; northern South America, and on the central coast Brazil.

Jungles differ from tropical rain forests. Jungles have dense, low vegetation, and may grow in wet ore:. climates. Some jungles have few trees, and thickets of low shrubs.

EXERCISE 1. Put the verbs in brackets into the correct form**.**

Forest Fires

Forest fires (to be) a great danger, especially in the summer when (there be) long periods without rain. A cigarette carelessly (to toss) into a pile of leaves may (to burn) slowly for a while without anyone's noticing it. Then a wind (to come) along. If forest rangers do not act quickly, the fire (to get out) of control.

In 1825 a fire in Maine and New Brunswick, Canada, (to burn) over 3,000,000 acres of forest land. One of the worst forest fires in history (to destroy) the town of Peshtigo, Wisconsin, in 1871. The fire (to start) in the woods after a long period of drought. When a strong wind (to start), it quickly (to carry) the fire through the dry forest. Within four hours the fire (to have) completely (to cover) an area 40 miles long and 10 miles wide. This included all of Peshtigo and several smaller villages. Almost 1,500 people (to be kill).

Today, forest fires usually (to be bring) under control much more quickly. In isolated forest areas, (there be) forest rangers on the (to lookout) for fires. Often airplane patrols look for smoke. If a fire (to be spot) before it (to start) (to spread), it usually (to be put out) quickly. But if the fire is too big, fire (to be) fighters either (to be fly) in by helicopter or parachuted to the site of the fire, Airplanes (to spray) the fire with chemicals. Bulldozers and plows (to clear) a strip of land around the fire. This (to be call) a fire line. Often small fires, called backfires, are deliberately set near the fire line. The fire (to move) by jumping from tree to tree. When it (to reach) the fire line it (to have) no place to go and (to stop). Then for days and sometimes weeks afterward, fire fighters (to go) over the area until (there be) no more burning embers. In spite of all the improvements in fighting forest fires, millions of dollars of damage (to do) every year.

ANNOTATION

1. Read the examples of the annotation and answer the questions.

Division Officer's Guide has been written for the benefit of division officers, who constitute the foundation upon which a ship's organization is built. The division officer is close to his men; he organizes, trains, and directs them according to the fundamental precepts of the Naval Service and with due regard for their individual development and personal needs.

This book is not a detailed study of each task to be performed by a division officer, but more a summary of what must be accomplished on board ship in the management of a strong, effective unit of men. Junior officers will find here many of the lessons usually learned only through long years of experience.

1. What is the title of a book?
2. What field of sciences or humanities is covered by this book?
3. What type of book is it?
4. What is the subject of the book?
5. What category of readers is it written for?

2. Read the examples of the annotations and determine the basic elements of annotation structure. Check the plan and say what elements are necessary or additional or false.

The title of this book, CHEMISTRY & CHEMICAL REACTIVITY, was chosen to convey its principal themes: a broad overview of the principles of chemistry and the reactivity of chemical elements and compounds. While attempting to provide a firm foundation in these areas, it is our hope also to convey a sense of chemistry as a field that not only has a lively history but also one that is currently dynamic, with important new developments on the horizon.

CHEMISTRY & CHEMICAL REACTIVITY is a textbook for introductory courses in chemistry for students interested in further study in science, whether that science is biology, chemistry, engineering, geology, physics, or related subjects. Our assumption is that students beginning this course will have had a basic foundation in algebra and some in general science. Although undeniably helpful, a previous exposure to chemistry is neither assumed nor required.

Professor Mehta has presented the subject of concrete in a remarkably clear and logical manner. Actually, he has adopted a rather revolutionary approach, rejecting the dry and pedantic presentations of past texts, in order to address concrete as a living material, both in itself and in its application to structures and facilities built to serve society. While this book accurately reflects the latest scientific advances in concrete structure and technology, it recognizes that working with concrete is an "art." Thus he has structured the book's arrangement and presentation from the point of view of the professional engineer charged with designing and building facilities of concrete. He introduces not only the latest understanding of this complex material but the new and exciting techniques that enable dramatic improvements in the properties and performance of concrete. The book is written primarily as an introductory text for Civil Engineering undergraduate students, but graduate students and professionals alike will find it useful for its explanations and comprehensive treatment of the many interactive aspects.

Forecast and Solution is a trilogy. Book I introduces a novel easy-to-use formula. The formula uses elementary algebra to show how long nuclear peace would tend to continue at different levels of proliferation and at different levels of peacefulness. The method is sufficiently clear that it can be used by, and is designed for, the general literate public, including those who have a non-mathematical orientation. Fifty-one graphs and a conversational style of writing make the material easily accessible. Book II introduces UNIFIED THEORIES. Here nuclear peacefulness is subdivided into components: Accident, Deterrence, and Civility. Book III, almost exclusively in prose, analyzes WWI and its aftermath, especially some of the long-forgotten proposals of the League of Nations, which may well have come within a hairsbreadth of averting WWII.

Plan of Annotation

1. The title of a book.
2. The name of an author of the book.
3. The name of publishers, the date and place of issues.
4. The field of science, scope and subject of the book .
5. The price of the book.
6. The structure, design of the book.
7. The type of the book (textbook, reference, guide, manuals, summary).
8. The category of readers which the book is devoted for.

Find in the annotations determined basic elements and mark the beginnings of each ones in the text.

3. Write the plan of the annotation and put the sentences in right order according to your plan. Add your own sentences when needed.

1) It provides a comprehensive treatment of selected topics in both finite mathematics and calculus.
2) It is appropriate for use in both two-year schools and four-year schools, as well as at the "foundation" level for graduate programs which require some mathematics background.
3) This book is an applied mathematics book for students in business, economics, and the social sciences.
4) Designed primarily for a two-term course, the book can be adapted easily for a one-term course
5) Although intended principally for students in business and economics, the book is appropriate for students in the social sciences.

Unit 6

SEWEAGE

Some of the liquid and solid wastes from homes, factories, and other buildings is flushed by water into sewers. This mixture is called sewage. Sewage contains many germs or bacteria. A large number of these are harmless, but it is possible for many kinds of disease-producing bacteria to be present. Diseases., such as typhoid fever, dysentery, and cholera, may be spread by sewage that is not properly treated.

At one time human waste matter was dumped carelessly on the ground, or allowed to seep into the soil close to houses. This unsanitary practice caused many deaths, especially where the wastes were able to enter and pollute a water supply.

The system of pipes, manholes, street inlets, and other structures used to collect sewage and rain water is called the sewerage system. There are two kinds of sewerage systems. In one, both the rain water and sewage are collected and carried in the same pipe line. This method of collection is called a combined system, because the storm water and sewage are

mixed. In the second kind of system, two separate pipe lines are built. One pipe line is used to collect rain water, and the other pipe line is used to collect sewage.

With a combined system, in order to treat the sewage which is mixed with a great amount of rain water, a large treatment plant has to be built. Also, there is danger that the mixture of rain water and sewage will flood the street, or back up into homes during times of heavy rain. By using the separate system, the storm water may be discharged to a stream, lake, or ocean without treatment. The much smaller amount of sewage flows in the pipes to a treatment plant. Since only the sewage is treated, the size and cost of the treatment plant can be greatly reduced.

Sewage as collected in modern sewerage systems is more than 99 per cent water. Although the solids are not present in great quantity, they are mostly organic matter, which means the solids are living, or derived from living, material. It is organic matter which contains bacteria that may be harmful. Certain bacteria feed on organic matter and are able to change it to simple chemical compounds which are quite harmless. Sewage treatment plant designed to make use of this ability of bacteria.

In rural areas and in the outlying d near cities, a public sewerage system may be available. There private sewage disposal plants should be built, so that waste water flows from the buildings through a sewer pipe to a septic tank. This tank should be us tight and located a safe distance from source of water supply. The septic tank should be built downhill from the well, at lea feet away.

In a septic tank the solids settle to the torn and grease floats to the top. The set! solids are decomposed by the action of millions of bacteria which are normally present in the sewage. The bacteria multiply the solids and also in the scum on top of tank. These bacteria live without oxygen break up the solids into liquid and gases, liquid, called *effluent,* flows from the tank In a series of drain pipes located two to three feet below the ground surface. The drain pipes are laid with open joints so that the will seep into the ground. In this way any solids that are present receive additional treatment by the action of the bacteria and other life in the upper layer of the soil.

To treat large quantities of sewage cities, towns, and industries, special scientific methods are used.

The sewage, as it flows through the underground pipe system to the treatment plant contains solid particles of all sizes. Some solids are in solution and some are objects such as rags, sticks, and pieces of garbage. At the treatment plant the sewage passes through coarse screens which catch large objects. These are removed from screens by mechanically operated rakes, are burned or ground up into fine pieces dropped back into the flowing liquid. The sewage then flows through tanks. In these tanks the speed is so slow that about half of the solids settle to the bottom

of the These solids are removed by automatic scraping machines and are pumped to another tank called the digestion tank. The liquid from the settling tank is sprayed onto a trickling filter for further treatment.

The trickling filter is a large bed of coarse rock or broken stone, about five or six feet deep. The stones soon become covered with a film or slime. This slime develops from the bacteria and other forms of life that are present in the sewage. As the liquid trickles past the stones, solid material sticks to the slime and is used by the organisms as food. The bacteria are able to change solids that are not dissolved into soluble material which they can use. The bacteria that make up the slime need oxygen. This they obtain from the air in the spaces between the rocks in the filter.

After passing through the filter, the liquid, which now has had most of the organic matter removed, passes through another settling tank. In this final settling- tank, solid material which occasionally is washed off the filter settles to the bottom. The clear liquid, called the final effluent, is then discharged to the stream, lake, or ocean. In this process most of the solids are removed.

Sometimes, instead of using a trickling filter, another method called the activated sludge process is used. In this process the liquid flows into another tank after screening and settling. Air is blown through the liquid in this tank. Fluffy, woollike clumps of bacteria develop in the aeration tank, These bacteria use the solid material in rnuch the same way as those that live in the slime on the trickling filter. Again a final settling tank is used and the bacteria settle to the bottom of the tank. Some of these are pumped back to the aeration tank to speed up the oxidation of the organic matter.

The liquid from the final settling tanks of either the trickling filter or activated sludge method is clear and looks like water, but still contains many bacteria. To destroy the bacteria the liquid is often disinfected.

The solids, or sludge, from the settling tanks must also be treated. They are pumped to covered digestion tanks where they remain for about 30 days. There, in the absence of air, bacteria, such as those in the septic tank, change the solids to liquids and gases. The gases can be burned, and in many plants are i fuel to run gas engines. The liquids turned to the plant to be retreated.

Exercise1.All the paragraphs in this text about SEWAGE DISPOSAL are jumbled up.Rearrange them into the correct order and read the text, filling in the blanks with a suitable word from the box:

wastes, sewage, germs, disease-producing, typhoid fever, properly, seep, pollute, inlets, sewerage, pipe line, flood, discharged, treatment, amount, reduced.}

SEWERAGE.

The system of pipes, manholes, street … , and other structures used to collect sewage and rain water is called the … system. There are two kinds of sewerage systems. In one, both the rain water and sewage are collected and carried in the same … . This method of collection is called a combined system, because the storm water and sewage are mixed. In the second kind of system, two separate pipe lines are built. One pipe line is used to collect rain water, and the other pipe line is used to collect sewage.

With a combined system, in order to treat the sewage which is mixed with a great amount of rain water, a large treatment plant has to be built. Also, there is danger that the mixture of rain water and sewage will … the street, or back up into homes during times of heavy rain. By using the separate system, the storm water may be … to a stream, lake, or ocean without … . The much smaller … of sewage flows in the pipes to a treatment plant. Since only the sewage is treated, the size and cost of the treatment plant can be greatly … .

Some of the liquid and solid … from homes, factories, and other buildings is flushed by water into sewers. This mixture is called … . Sewage contains many … or bacteria. A large number of these are harmless, but it is possible for many kinds of … bacteria to be present. Diseases., such as … , dysentery, and cholera, may be spread by sewage that is not … treated.

At one time human waste matter was dumped carelessly on the ground, or allowed to … into the soil close to houses. This unsanitary practice caused many deaths, especially where the wastes were able to enter and … a water supply.

Exercise2. Match the two halves of the sentences and read about sewage disposal

Sewage as collected in modern	a public sewerage system may be available.
sewerage systems	and are able to change it to simple chemical great quantity
Although the solids are not present in	compounds which are quite harmless
It is organic matter	designed to make use of this ability of bacteria.
Certain bacteria feed on organic matter	they are mostly organic matter, which means the solids are living or derivea from living material.
Sewage treatment plant	which contains bacteria that may be harmful
In rural areas and in the outlying districts	is more than 99 per cent water near cities,
There private sewage dispoal plants	flows from the tank the scries of drain pipes located two to three feet below the ground surface
This tank should be	should be built, so that waste water flows from the buildings through a sewer pipe to a septic tank.
The septic tank	multiply the solids and also in the scum on top

	of the tank
In a septic tank	without oxygen and break up the solids into liquid and gases
The settled solids	are decomposed by the action of millions of bacteria which are normally present in the sewage.
The bacteria	should be built downhill from the well, at lea feet away.
These bacteria live	the solids settle to the torn and grease floats to the top.
The drain pipes are laid	the liquid, called *effluent*.
	water tight and located at a safe distance from source of water supply
	receive additional treatment by the action of the bacteria and other life in the upper layer of the soil.
In this way any solids that are present	with open joints so that the effluent will seep into the ground.

Exercise 3 .Several sentences have been removed from the text and placed in a box. Put them into the right places and read about sewage disposal.

To treat large quantities of sewage from cities, towns, and industries, special scientific! methods are used.

The sewage, as it flows through the under- ground pipe system to the treatment plant contains solid particles of all sizes. ……At the treatment plant the sewage passes through coarse screens which catch large objects. These are removed from screens by mechanically operated rakes, are burned or ground up into fine pieces dropped back into the flowing liquid. The sewage then flows through tanks. ……These solids are removed by automatic scrapling machines and are pumped to another tank, called the digestion tank. The liquid from the settling tank is sprayed onto a trickling filter for further treatment.

……The stones soon become covered with a film or slime. This slime develops from the bacteria and other forms of life that arc present in the sewage. As the liquid trickles past the stones, solid material sticks to the slime and is used by the organisms as food. The bacteria are able to change solids that are not dissolved into soluble material which they can use. ……This they obtain from the air in the spaces between the rocks in the filter.

After passing through the filter, the liquid, which now has had most of the organic matter removed, passes through another settling tank. In this final settling tank, solid material which occasionally is washed off the filter settles to the bottom. The clear liquid, called the final effluent, is then discharged to the stream, lake, or ocean. In this process most of the solids are removed.

Sometimes., instead of using a trickling filter, another method called the activated sludge process is used. ……Air is blown through the liquid in

this tank. Fluffy, woollike clumps of bacteria develop in the aeration tank, These bacteria use the solid material in rnuch the same way as those that live in the slime on the trickling filter. Again a final settling tank is used and the bacteria settle to the bottom of the tank. ……

The liquid from the final settling tanks of either the trickling filter or activated sludge method is clear and looks like water, but still contains many bacteria. To destroy the bacteria the liquid is often disinfected.

The solids, or sludge, from the settling tanks must also be treated. ……There, in the absence of air, bacteria, such as those in the septic tank, change the solids to liquids and gases. The gases can be burned, and in many plants are i fuel to run gas engines. The liquids turned to the plant to be retreated. Tl material, or digested sludge, which rema value as fertilizer.

In this process the liquid flows into another tank after screening and settling.

They are pumped to covered digestion tanks where they remain for about 30 days.

The trickling filter is a large bed of coarse rock or broken stone, about five or six feet deep.

Some of these are pumped back to the aeration tank to speed up the oxidation of the organic matter.

In these tanks the speed is so slow that about half of the solids settle to the bottom of the tank.

Some solids are in solution and some are objects such as rags, sticks, and pieces of; garbage.

The bacteria that make up the slime need oxygen.

Exercise 4. Match the following English words and expressions to their Ukrainian equivalents.Read the text sewage disposal.

1 tertiary	каналізація
2 sewer	засівний, не потрібний
3 waste-pipe	камера
4 trickle	стічні води
5 sewage	зупиняти, затримувати, перехопити.
6 chamber	стік
7 sewerage	третинний
8 intercept	стічна труба
9 waste	витікання, спуск, стік, злив
10 sludge	осадження, відкладення осаду

11 decay текти тонким струмком

12 discharge колектор, каналізаційна труба, стічна труба.

13 sedimentation відстій, густий бруд, мул.

14 effluent гнити, розкладатися

15 alga (pl. algue) морська водорость

Exercise 5. Answer the questions.

1. What is sewage? 2. What does it contain? 3. What diseases may be spread by sewage? Why? 4. What suped into the soil close to houses? 5. Where does most sewage eventually flow into? 6. What do we call effluent? 7. Is untreated sewage harmful? 8. What are methods used to treat sewage? 9. What may serve as food for algae? 10. What is a sanitary sewerage system? 11. How does a public sewerage system work? 12. What is an interceptor? 13. Why do people need a wastewater treatment plant? 14. What is tertiary? 15. What does primary treatment remove? 16. What are the most common methods of secondary treatment? 17. What are tertiary treatment methods? 18. Why do some cities require tertiary treatment?
19. How do rural sewerage systems work?

EXERCISE 6.Confirm or deny the statement. If necessary, begin with:**I‘m afraid that’s wrong; you are not quite right; that’s not quite so; I think you are mistaken; as far as I know; on the contrary; I don’t think so.**

1 Wastewater contains about 1 per cent solid matter.

2 Sewage never flows into lakes, oceans, rivers or streams.

3 Sewage that has been treated can harm the water in no way.

4 If too much oxygen is used up in the decaying process, fish and plants in the water will only flourish.

5 Some cities don’t require even secondary treatment.

6 The harmful bacteria move through the liquid and change the organic matter into dangerous substances.

7 There is only one by very efficient method of tertiary treatment.

8 The humus in a septic tank may be pumped out periodically but not treated.

NOTICES AND WARNINGS

1. Some notices give you information. Match the information with the appropriate notice:

no vacancies

1.For a machine That is not working, Or washing machine.	2 in the window of a B B (cheap hotel). It Means the hotel is full.	3.outside a cinema or concert-there are no Tickets left. All sold.

keep right

1.wait in a line on the other side of this notice
2. stay on the right side, and continue

Mind the step

1. be careful you don't hit your head 2. be careful you don't hit the step and

Beware of pickpockets!

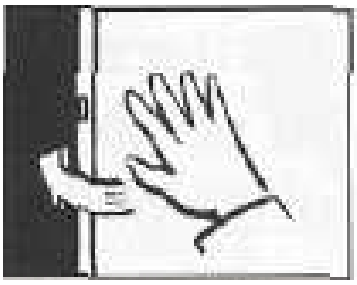
1. be careful, this will break easily
2. be careful, there are people here who will steal things from your bag or pocket without you knowing

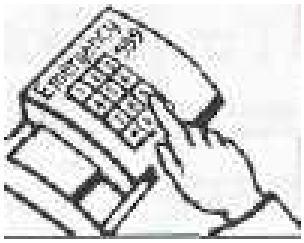
2. Divide into pairs and discuss the design and the text for the next safety notices:

DO NOT stop to collect personal belongings;
DO NOT run;

DO NOT use the lifts;
DO NOT open a door if you suspect there is a fire on the other side;
Your nearest meeting point is_____

Give your ideas about the text for the notices below:





3. Devide the notices into 4 groups according to their meaning:

1) **Informative notices**
2) **Do this!**
3) **Don’t do this!**
4) **Watch out!**

Out of order

KEEP OUT OF CHILDREN

SOLD OUT

Please Queue other side

BEWARE OF PICKPOCKETS

Fragile

NO EXIT

No parking

ENGAGED

Under 18’s will not be served

EEC Passport holders only

FOREIGN EXCHANGE

Flammable!