МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ
ЧЕРНІГІВСЬКИЙ НАЦІОНАЛЬНИЙ
ТЕХНОЛОГІЧНИЙ УНІВЕРСИТЕТ

ПРАКТИКУМ

З АНГЛІЙСЬКОЇ МОВИ

(за професійним спрямуванням)

для студентів ІІ курсу напряму підготовки

194 Гідротехнічне будівництво, водна інженерія та водні технології

(Гідротехніка, водні ресурси) освітньо-кваліфікаційний рівень бакалавра

(частина 1)

Чернігів 2017

УДК 811: 626
ББК 81.2
П69

Обговорено і рекомендовано на засіданні кафедри іноземних мов професійного спрямування протокол № 14 від 29 травня 2017 р.

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Практикум з англійської мови (за професійним спрямуванням) *для студентів II курсу напряму підготовки* 194 Гідротехнічне будівництво, водна інженерія та водні технології (Гідротехніка, водні ресурси) освітньо-кваліфікаційний рівень бакалавра (частина 1) / уклад. О. В. Ніколаєнко, Т. О. Ушата. – Чернігів : ЧНТУ, 2017. – 91 с.

УДК 811: 626
ББК 81.2

ЗМІСТ

Вступ

Метою створення практикуму є формування навичок професійного спілкування студентів напряму підготовки 194 Гідротехнічне будівництво, водна інженерія та водні технології (Гідротехніка, водні ресурси) освітньо-кваліфікаційного рівня бакалавр. Зміст завдань, що поєднують в собі сучасні та традиційні методики, визначено згідно з навчальними потребами фахівців даної галузі. Розділи практикуму побудовано таким чином, щоб студент мав змогу зосередитися на таких видах діяльності як різнопланове читання, включаючи переглядове, вивчаюче, ознайомлююче та пошукове, виконання лексико-граматичних та письмових вправ, а також творчих завдань, що спрямовані на розвиток усного мовлення у професійному контексті. Велика кількість творчих завдань дозволяє розвивати аналітичне, критичне та творче мислення студентів. сприяє формуванню необхідних компетенцій та зміцненню конкурентоспроможності випускників на сучасному ринку праці. Практикум складається з чотирьох модулів, кожен з яких містить професійно орієнтовані тексти, завдання лексико-граматичної спрямованості, на перевірку розуміння текстів за змістом, а також завдання творчого характеру. Практикум також пропонує завдання на розуміння змісту основних навчальних текстів шляхом тлумачення відповідних термінів та вправи на переклад. Завдання мовленнєвого спрямування дозволяють перевірити загальне розуміння прочитаного, закріпити набуті лексичні навички. Завдяки представленим ілюстраціям та рисункам розуміння професійно спрямованого матеріалу стає більш точним та допомагає краще засвоїти лексико-граматичну складову кожного модуля. Практикум визначає порядок виконання завдань по всіх аспектах мовної практики для самостійної роботи і пропонує ілюстрації та рисунки, що спрощують розуміння професійно спрямованого матеріалу й допомагають засвоїти лексико-граматичну складову кожного модуля.

Завдання, що містить практикум, спрямовані здійснювати контроль знань лексико-граматичного матеріалу, передбаченого діючою програмою навчальної дисципліни.

Module 1

Water on the Earth.

Introduction to Water-Supply Engineering

"Water is the driver of Nature."

Leonardo da Vinci (1452-1519)

Vocabulary Work

1. Read the following international words and guess their meaning.

Mind the stressed syllables. Prove that these words are international ones.

Model: substance *['sʌbst(ə)ns]* – **субстанція**; речовина, матеріал

aquatic *[ə'kwætɪk]*

atmosphere *['ætməsfɪə]*

bacterium *[bæk'tɪərɪəm]* (*pl*. bacteria *[bæk'tɪərɪə]*)

base *[beɪs]*

biological *[ˌbaɪə'lɒdʒɪk(ə)l]*

central *['sentr(ə)l]*

chance *[tʃa:ns]*

characteristic *[ˌkærəktə'rɪstɪk]*

chemical *['kemɪk(ə)l]*

civilization *[ˌsɪv(ə)laɪ'zeɪʃ(ə)n]*

class *[kla:s]*

colour *['kʌlə]*

complex *['kɒmpleks]*

component *[kəm'pəunənt]*

condense *[kən'dens]*

corrosive *[kə'rəʊsɪv]*

human *['hju:mən]*

hydrologic *[ˌhaɪdrəˈlɒdʒɪk]*

medium *['mi:djəm]* (*pl*. media *['mi:dɪə])*

metal *['metl]*

microscopic *[ˌmaɪkrə'skɒpɪk]*

molecule *['mɒlɪˌkju:l]*

myriad *['mɪrɪəd]*

normal *['nɔ:m(ə)l]*

ocean *['əuʃ(ə)n]*

organism *['ɔ:g(ə)nɪz(ə)m]*

philosophical *[ˌfɪlə'sɒfɪk(ə)l]*

phytoplankton *[ˌfaɪtəʊˈplæŋktən]*

physical *['fɪzɪk(ə)l]*

planet *['plænɪt]*

polar *['pəʊlə]*

population *[ˌpɒpjʊ'leɪʃ(ə)n]*

cycle *['saɪk(ə)l]*

determine *[dɪ'tɜːmɪn]*

element *['eləmənt]*

experiment *[ɪk'sperɪmənt]*

extreme *[ɪk'striːm]*

fact *[fækt]*

form *[fɔːm]*

formula *['fɔːmjʊlə]* (*pl*. formulae *['fɔːmjuliː]*)

fundamental *[ˌfʌndə'ment(ə)l]*

gas *[gæs]*

glacier *['glæsɪə]*, *['gleɪsɪə]*

ground *[gra͟ʊnd]*

history *['hɪst(ə)rɪ]*

portion *['pɔːʃ(ə)n]*

process *['prəuses]*

recreation *[ˌrɪekrɪ'eɪʃ(ə)n]*

religious *[rɪ'lɪdʒəs]*

saturate *['sætʃəˌreɪt]*

structure *['strʌktʃə]*

temperature *['temp(ə)rətʃə]*

transport 1. *v [træn'spɔːt]*

2. *n ['trænspɔːt]*

transportation *[ˌtrænspɔː'teɪʃ(ə)n]*

typical *['tɪpɪk(ə)l]*

variety *[və'raɪɪtɪ]*

virus *['vaɪrəs]*

zooplankton *[ˌzuːəˈplæŋktən]*

2. Translate the following words and phrases and memorize them.

NOUNS AND NOUN PHRASES

acid

acidity

alga (*pl*. algae)

alkali

alkalinity

boiling point

characteristic

colour

compound

consumption

corrosiveness [corrosivity]

demand

development

gas

glacier

groundwater [ground water]

hardness

hydrogen

liquid

melting point

odour

oxygen

physical state

property

protozoan (*pl*. protozoa

solvent

substance

supply

surface

surface water

taste

temperature

turbidity

vapour

water

water [hydrologic] cycle

water body

drinking water	/ protozoans)	water purification
foamability	salt [saline] water	water recycling
fresh water	solid	water supply
	solution	waterway

VERBS AND VERBAL PHRASES

to assess	to contain	to increase
to be	to cover	to make up
to be composed of	to determine	to nourish
to be saturated with	to develop	to occur
to change	to exist	to protect
to condense	to find	to use

ADJECTIVES

aquatic	chemical	odourless
aqueous	colourless	physical
available	dense	solid
biological	liquid	tasteless

ABBREVIATIONS AND SYMBOLS

o C (degree(s) Celsius)	etc. (etcetera / et cetera)
o F (degree(s) Fahrenheit)	H2O
% (per cent / percent)	pH

3. Match the English and Ukrainian equivalents.

1)

1. aquatic life	a. поводитися або як кислота, або
2. aqueous solution	як луг
3. chemical compound	b. водна флора і фауна, гідробіонти
4. complex property	(організми, що мешкають у воді)

5. to act as an acid or as an alkaline	c. водний розчин
6. to be transported through the atmosphere	d. займати площу
7. to carry out a process	e. використовувати як середовище (речовина, в якій щось існує)
8. to cover the area	f. здійснювати процес
9. to exist in three physical states	g. переміщатися в атмосфері
10.to use as a medium	h. за нормальних умов
11.under normal conditions	i. складна властивість
	j. існувати в трьох фізичних [агрегатних] станах
	k. хімічна сполука

2)

1. ground [subsurface] and surface water	a. бути насиченим водою
2. salt [saline] and fresh water	b. водна поверхня; поверхня води
3. to be saturated with water	c. водойма; водний об’єкт
4. to flourish around major waterways	d. водозабезпеченість, запас води; водопостачання, постачання води; водоподача, подання води; водопровід; *pl*. водні ресурси
5. water [hydrologic] cycle	e. кругообіг води, вологообіг
6. water body	f. оборотне [повторне] водопостачання
7. water purification [treatment]	g. очищення води, водоочистка
8. water recycling	h. грунтові [підгрунтові]води та поверхневі води
9. water supply	i. процвітати навколо головних водних шляхів
10.water surface	j. солена та прісна вода

READING PRACTICE

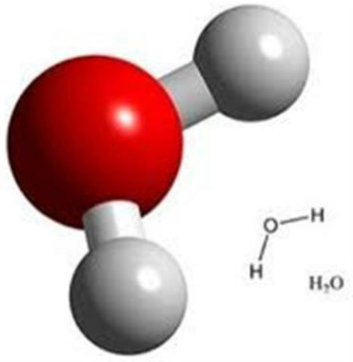
4. Read the text. Using a dictionary, translate it in writing.

Text A. Water. General Information

"Water is H2O, hydrogen two parts, oxygen one,
but there is also a third thing that makes water
and nobody knows what that is."
D.H. LAWRENCE (1885-1930)

Water is a substance composed of the chemical elements hydrogen and oxygen and existing on the Earth in all three physical states: ***solid***, ***liquid***, and ***gas***. Water is a colourless, tasteless, and odourless liquid at room temperature. Its melting point is 0o C (32o F), and its boiling point is 100o C (212o F). Water is undoubtedly the most common, plentiful and essential of all chemical compounds.

Significance of Water for Life. Water is vital to life and essential to all living organisms. Life is believed to have originated in the world's oceans, so water has played a central role in the development of life on Earth. One of water's most important properties is its ability to be a solvent for many other substances, which is essential to living organisms.

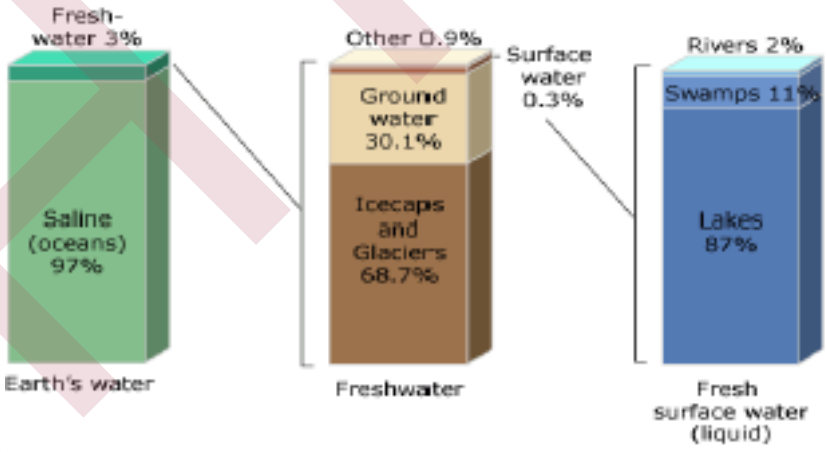


They use aqueous solutions as a medium for carrying out biological processes. In fact, water participates in every process that occurs in plants and animals. **Water Properties.** Although the water molecule formula seems simple in structure (H2O), the physical and chemical properties of the compound are extremely complex. These properties are incompletely understood and are not typical of most substances. For example, water can sometimes act as an acid or as an alkali (a base). Another unusual property is that in its solid form, ice, water is less dense than when it is liquid. Ice therefore floats on water and protects the aquatic life below water surface of water bodies in cold areas of the world. Water occurs as a liquid on the surface of the Earth under normal conditions, which makes it invaluable for transportation, for recreation, and as a habitat for a myriad of plants and animals. The fact that water is readily changed to a vapour (gas) allows it to be transported through the atmosphere from the oceans to

inland areas where it condenses and, as rain, nourishes plant and animal life. The process is called the ***"water cycle"***, or the ***"hydrologic cycle"***.

Water Characteristics. Water quality is determined by assessing three classes of characteristics: physical, chemical, and biological. ***The physical characteristics*** include turbidity, colour, taste, odour, temperature, and foamability. ***The chemical characteristics*** of water are its acidity, alkalinity, pH, hardness, and corrosiveness (corrosivity). ***Thebiological characteristics*** of a water body refer to a variety of living organisms that can be found in water, including microscopic viruses, bacteria and protozoans, as well as phytoplankton (microscopic algae), zooplankton (tiny water animals), insects, worms, large plants and fish.

Earth's Water Supply. About 97% of all water is ***salt (saline) water*** of the oceans, and the remaining 3% is ***fresh water***. The majority of fresh water, about 69%, is locked up in polar ***glaciers*** and ***icecaps***, mainly of Greenland and Antarctica; and the rest is ***ground water***. No matter where on Earth we stand, chances are that, at some depth, the ground below is saturated with water. Of all the fresh water on Earth, only about 0.3% is contained in rivers and lakes, known as ***surface water***. Considering that most of the water we use in everyday life comes from rivers, we make use of a tiny portion of the available water supplies. The Earth is often called the "blue planet" because it appears blue from space. This blue colour is caused by reflection from the oceans which cover about 70% of the area of the Earth. Water is one of the five elements that make up this planet, along with fire, earth, air, and metal. Because of its prominence, water has long played an important religious and philosophical role in human history. The belief that water was a fundamental substance existed for more than 2,000 years until experiments in the second half of the 18th century showed that water is a compound made up of the



elements hydrogen and oxygen. Civilization has historically developed and flourished around rivers and major waterways. As the Earth's population grows and the demand for fresh water increases, water purification and recycling become increasingly important.

COMPREHENSION CHECK

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

1. Water is composed of the chemical compounds hydrogen and oxygen.
2. Solid, liquid, and gas are the three physical states in which water exists on the Earth.
3. Water is a colourful, tasteful and odourless liquid at room temperature.
4. Water has the ability to solve any substance easily.
5. Water takes part in all processes that occur in plants and animals.
6. The formula of a water molecule seems complex in structure, but the physical and chemical properties of the compound are simple.
7. Water in its solid state is denser than water in its liquid state.
8. Water is valueless for transportation, for recreation, and as a habitat for a myriad of plants and animals.
9. The “water cycle” is a synonym for the “hydrologic cycle”.
10. There are three classes of characteristics of water: physical, chemical, and biological.
11. The chemical characteristics of water include its acidity, alkalinity, pH, turbidity, and hardness.
12. Salt water constitutes about 3% of all the Earth’s water supply.
13. Both groundwater and surface water are fresh water.
14. Today water purification and recycling are increasingly important because of the Earth’s population growth.

6. Answer the following questions.

1. What is water?
2. In what physical states does water exist on the Earth?

3. Is water a solvent for all other substances?

4. What do living organisms use aqueous solutions for?

5. What are the examples of unusual and complex properties of water?

6. What are three classes of water characteristics?

7. What do the physical, chemical and biological characteristics of water include?

8. Is 97% of all water on the Earth salt or fresh water?

9. Ground water is fresh water, isn't it?

10. Is fresh surface water contained in rivers, lakes and seas?

11. Why is the Earth often called the "blue planet"?

12. Where has civilization developed historically?

13. Why do water purification and recycling become increasingly important?

7. Choose the right variant according to the text.

1. Water consists of the chemical elements … .

A. carbon and hydrogen

B. oxygen and hydrogen

C. oxygen and nitrogen

D. carbon oxide and carbon dioxide

2. About 97% of all water on the Earth is … .

A. ground water

B. salt water

C. surface water

D. fresh water

3. Fresh surface water is found in … .

A. oceans, seas, rivers, lakes and swamps

B. rivers, lakes and marshes

C. rain, oceans, rivers, lakes, etc.

D. glaciers and icecaps

4. Since rivers are the main source of the water we use in our everyday life, the humanity … .

A. uses the vast majority of the available fresh water

B. makes use of all the Earth's surface water

C. uses only a small part of the available water supplies

D. can't make use of available water supplies at all

5. In the process called the "hydrologic cycle", water is transported through the atmosphere from the oceans to inland areas where it … and, as rain, nourishes plant and animal life.

A. recycles

B. condenses

C. vaporous (vaporizes)

D. saturates

LANGUAGE FOCUS

8. Translate the following pairs of derivatives and memorize them.

Verb – Noun

to boil – boiling

to compose – composition

to condense – condensation

to consume – consumption

to determine – determination

to develop – development

to distribute – distribution

to live – life

to occur – occurrence

to purify – purification

to recycle – recycling

to saturate – saturation

to solve – solvent / solution

to transport – transportation

Noun – Verb

compound – to compound

demand – to demand

supply – to supply

to use – usage

to vary – variety

use – to use

vapour – to vapour

water – to water

Adjective – Verb

pure – to purify

saline – to desalinize / to desalinate

Noun – Adjective

microscope – microscopic

aqua – aqueous / aquatic
biology – biological
chemistry – chemical
colour – colourless
essence – essential
hydrology – hydrologic

Noun – Adjective

complex – complex
gas – gas / gaseous
ground – ground
liquid – liquid
odour – odourless
physics – physical
taste – tasteless
type – typical
salt – salt
solid – solid
surface – surface
water – water / watery

Adjective – Noun

able – ability
available – availability
hard – hardness
turbid – turbidity
corrosive – corrosiveness / corrosivity

Noun – Noun

acid – acidity
alkali – alkalinity
character – characteristics
foam – foamability
historic(al) – historically

Adjective – Adverb

extreme – extremely

Verb – Participle I

to exist – existing
to include – including
to occur – occurring
to remain – remaining

Compound Nouns / Adjectives

atmosphere
everyday
groundwater
hydrogen
hydrology
icecap
microscope
oxygen
waterway
zooplankton / phytoplankton

9. Translate the following pairs of derivatives paying attention to the meaning of prefixes.

ability – **in**ability

(to) **in**crease – (to) **de**crease

common - **un**common

completely – **in**completely

cycling – **re**cycling

essential – **in**essential

ground - **under**ground

important – **un**important

including – **ex**cluding

land – **in**land

surface – **sub**surface

to compose – to **de**compose

to cover – to **un**cover / to **dis**cover

to **in**clude – to **ex**clude

to use – to **re**use

typical – **un**typical

usual – **un**usual

valuable – **in**valuable

10. Transform as in the models.

Model 1 "Verb → Noun": to purify water → purification of water

To use a solution, to carry out a process, to recycle water, to compose a substance, to solve substances, to saturate with water, to use water supplies.

Model 2 "Noun → Noun": purification of water → water purification

A molecule of water, the formula of a water molecule, quality of water, a body of water, the surface of water, water on the surface, water under the ground, supply of water, recycling of water, growth of population, temperature in a room, tiny animals in water, saturation with water, use of water supplies, a solvent for substances and compounds, development of civilization.

11. Insert the appropriate word or word combination.

1)

covers, dependent, drinking, essential, factors, makes up, properties, quality, substance, survive, systems, use, water

1. Water is the most important liquid _____ on Earth. It _____ almost 75 percent of Earth's surface in the form of oceans, rivers, and lakes. All plants and animals need _____ to live. Water's physical and chemical _____ make it _____ to life and civilization.

2. Everyone should drink water every day. Water _____ about 60 percent of an adult's body by weight. Children's bodies have an even higher percentage of water. The human being can _____ only a few days without clean, safe drinking water, and every part of the human body is _____ on water.

3. People have many uses for water besides _____ . They use it for washing and cooking. They use it to irrigate crops and lawns, to clean streets, and to operate air-conditioning units and heating _____ . They also _____ the power of flowing water to produce electricity.

4. Whether the _____ of drinking water is acceptable or not depends on several _____: how it looks, how it tastes, how it smells, and how clean and safe it is.

2)

branch, circulates, evaporation, fluid, hydrologic cycle, management, pH, precipitation, resources, salts, supply, term, treatment

1. A gas and especially a liquid are called a _____ .

2. _____ is a measure of the acidity or alkalinity of a solution, as well as a measure of the hydrogen ion concentration in water.

3. The _____ describes the cycle by which water is transferred over the Earth. It is the cycle of processes by which water _____ between the earth's oceans, atmosphere, and land, involving _____ as rain and snow, drainage in streams and rivers, and return to the atmosphere by _____ and transpiration.

4. Because seawater contains large quantities of dissolved _____, it must be desalinated for most uses including human consumption.

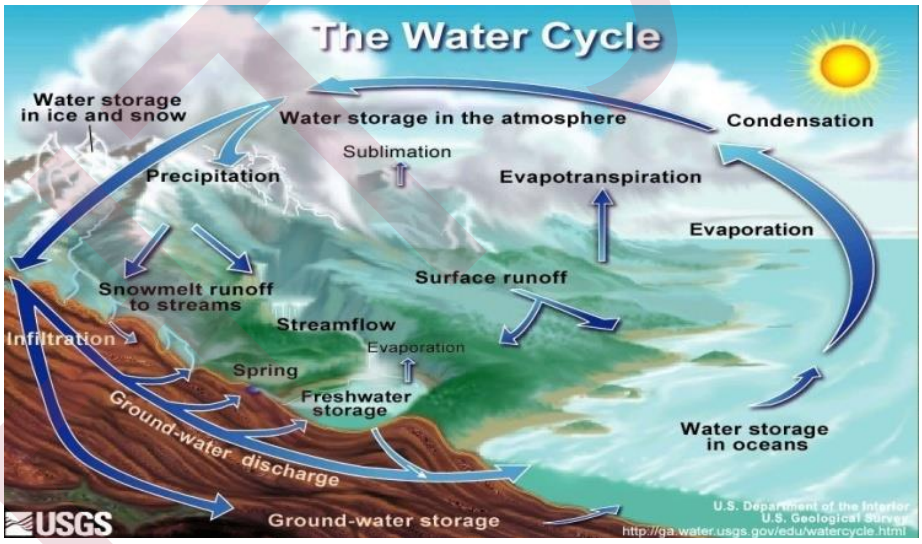
5. Water conservation is the protection, development, and efficient _____ of water _____ for beneficial purposes.

6. Water-supply engineering is a _____ of civil engineering concerned with the development of sources of supply, transmission, distribution, and _____ of water. The _____ is used most frequently for municipal waterworks, but applies also to water _____ systems for industry, irrigation, water reuse, and other purposes.

12. Translate the words and word combinations in brackets.

Rain is the prime (*джерело*) of all water. A part of the rain water sinks into the ground to form (*грунтові води*); part of it evaporates back into the (*атмосфера*), and some runs off to form streams and rivers which flow ultimately into the sea. Some of the water in the soil is taken up by the (*рослини*) and is evaporated in turn by the (*листя*).

This (*процес*) is called the *"**water cycle**"*, or *the "**hydrologic cycle**"*. So the (*кругообіг води / вологообіг*) is the (*циркуляція*) of the earth's water, in which water (*випаровується*) from the sea into the atmosphere, where it condenses and falls as (*дощ*) or (*сніг*), returning to the sea by rivers or returning to the atmosphere by evapotranspiration. *(Евапотранспірація / сумарне випаровування)* is the process by which water is transferred from the land to the atmosphere by (*випаровування*) from the soil and other (*поверхні*) and by transpiration from plants. So, water on Earth moves continually through a cycle of evaporation or transpiration (evapotranspiration), precipitation, and runoff, usually reaching the (*море*).



Water comes a long way to get to the *(водопровідний кран)*! All *(питна вода)* originates in the water cycle when rain and snow sink into the ground or collect in rivers, lakes and streams. Cities usually get their drinking water from lakes, rivers and *(водосховища)*. Water is sent to a treatment plant where it is cleaned and

pumped into our homes, various establishments and *(промислові підприємства)*. In rural areas, many people drink *(вода зі свердловини)* which is pumped from a natural underground storage area called an *(водоносний шар / водоносний горизонт)*.

13. Match the terms and their definitions.

alga (pl. algae), drinking water, fresh water, glacier, groundwater, occur, property, solvent, surface water, water, water supply, waterway

a. a colorless, transparent, odorless, tasteless liquid that forms the seas, lakes, rivers, and rain and is the basis of the fluids of living organisms

b. a liquid capable of dissolving another substance

c. a river, canal, or other navigable channel used as a means of travel or transport

d. a simple nonflowering (нецветковый) plant growing in water

e. a slowly moving mass of ice formed by the accumulation and compaction of snow on mountains or near the poles

f. all water naturally open to the atmosphere (*e.g.* rivers, streams, lakes or reservoirs); water that collects on the surface of the ground

g. an attribute, quality or characteristic of something

h. happen; take place; exist

i. the water available for a community or region; the supply of treated and purified water for a community; water resources

j. the water with the total dissolved substances content of less than 1,000 mg/l

k. water contained underground in the soil or in pores and crevices in rock

l. water intended primarily for human consumption (also known as potable water)

SUMMARIZING

14. Make a summary of the text according to the following plan.

1. The title of the text is "…" .
2. The text is devoted to … .
3. Such problems as … are touched upon in the text.
4. The text consists of … parts.

5. The first part deals with … .

6. The second (third, forth, etc.) part describes … .

7. The main idea of the text is to show … (to underline … / to prove … / to inform the reader about ...).

8. In my opinion, the text is useful / informative / interesting. It is worth reading.

READING PRACTICE

15. Skim over the text and do the tasks that follow.

Text B. Water-Supply Engineering and Sewage Disposal

"Water is fundamental to life and health"

United Nations Committee on Economic, Cultural and Social Rights (2002)

Engineering is a science which deals with design, construction and operation of structures, machines, engines and other devices used in industry and everyday life. Engineering applies scientific and technical knowledge to solve human problems.

The proper Ukrainian equivalents for "engineering" are «инженерия, инжиниринг, инженерное искусство, техника, технология, строительство, разработка, проектирование, конструирование, машиностроение».

Engineering is divided into many branches. The most important of them are civil engineering, industrial engineering, mechanical engineering, chemical engineering, electrical engineering, sanitary engineering, materials engineering, etc. The field of engineering includes a wide variety of activities.

Civil engineering is the oldest of the main branches of engineering. Civil engineers cooperate with architects to design and erect all types of buildings. They plan and supervise large construction projects such as bridges, canals, dams, tunnels and water supply systems. A number of civil engineers focus on the management of water resources, including the construction of flood control and irrigation systems, hydroelectric power plants, water supply and sewerage systems.

Water-supply engineering is a branch of civil engineering. It is a complex of activities concerned with the supply of water to its various consumers – community, industrial enterprises, transport, etc. This discipline based on various branches of

technical sciences has a complex character. The complex character is determined by the necessity of solving a complex of complicated engineering tasks connected with design, construction and operation of water supply systems. These systems include various facilities providing acquisition, treatment and delivery of water in demanded quantities and of adequate quality to water consumers.

So, ***a water supply system*** is a complex of engineering structures carrying out the supply of water including *acquisition* of water from a variety of natural water sources, its *treatment*, *transmission*, *storage*, and *distribution* to the water consumers.

The study of the course in water-supply engineering is based on the knowledge of a number of general technical and specialized disciplines:

1. hydrology, hydrogeology (groundwater hydrology), hydrotechnics (hydraulic engineering) and drilling technology;
2. water chemistry and hydrobiology;
3. hydraulics;
4. building disciplines.

Sewage disposal (also called ***waste disposal***) is a complex of sanitary activities as well as a complex of engineering structures and facilities intended for the collection of wastewater, its disposal outside the city limits or industrial enterprises, its delivery to wastewater treatment plants, as well as its treatment, sanitation and disinfection before recycling or discharge into a body of water.

A. Answer the following questions.

1. What is engineering?
2. What are the proper Ukrainian equivalents for “engineering”?
3. What are the main branches of engineering?
4. Civil engineering is the oldest of the main branches of engineering, isn’t it?
5. Who do civil engineers cooperate with to design and erect all types of buildings?
6. What does the work of civil engineers include?
7. What is water-supply engineering?
8. Does this discipline have a complex character? What is it determined by?

9. What facilities do water supply systems include?

10. What is a water supply system?

11. What does a water supply system include?

12. What general technical and specialized disciplines is the study of the course in water-supply engineering based on?

13. What is sewage disposal?

B. Choose the right variant according to the text.

1. Water-supply engineering is … .

a. a complex of complicated engineering tasks connected with design, construction and operation of water supply systems

b. a complex of activities concerned with the supply of water to its various consumers

c. a complex of sanitary activities intended for the collection and treatment of sewage

d. a complex of engineering structures and facilities intended for the collection and treatment of wastewater

2. Water supply systems include various facilities providing …. .

(several answers possible)

a. acquisition of water from a variety of natural water sources

b. treatment of water

c. design, construction and operation of water supply systems

d. delivery of water to water consumers

3. The study of the course in water-supply engineering is based on the knowledge of the following general technical and specialized disciplines: … . *(several answers possible)*

a**.** hydrology, hydrogeology (groundwater hydrology), hydrotechnics (hydraulic engineering) and drilling technology

b. water treatment technology

c. water chemistry, hydrobiology and hydraulics

d. building disciplines

4. Sewage disposal [waste disposal] is a complex of sanitary activities as well as a complex of engineering structures and facilities intended

for … . *(several answers possible)*

a. water treatment and purification

b. wastewater collection

c. disposal of wastewater outside the city limits or industrial enterprises,

its delivery to wastewater treatment plants and its treatment

d. sewage sanitation and disinfection

16. Read the following text and speak on every type of municipal water consumption.

Text C. Municipal Water Consumption and Its Types

"Water has become a highly precious resource.

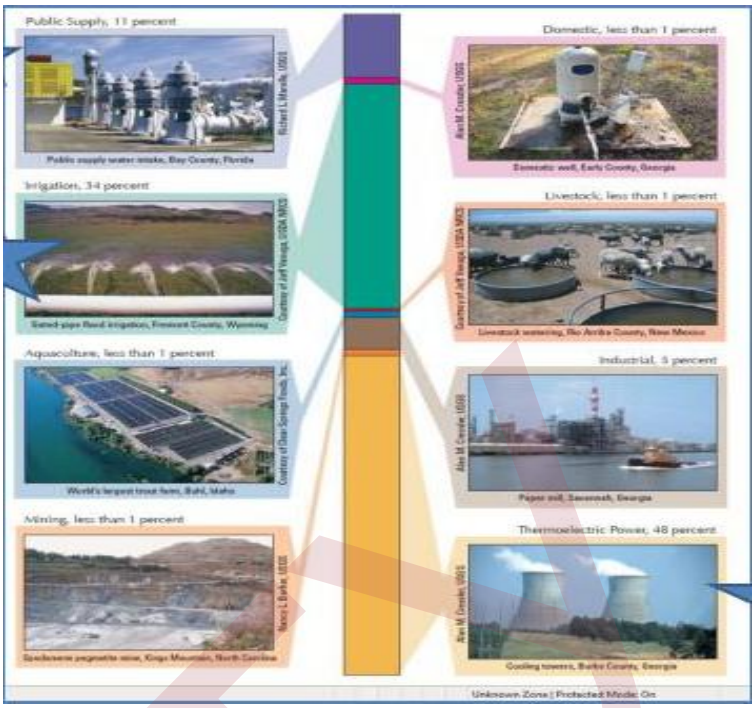
There are some places where a barrel of water costs more than a barrel of oil."

LLOYD AXWORTHY, Foreign Minister of Canada

In designing any water supply system specialists determine the required quantity and quality of water supplied. For solving this problem it is necessary to take into account all the potential water consumers and find out their requirements for the quantity and quality of the water delivered. Water is used by various consumers and is required for a wide variety of purposes.

Water consumption (also called "***water requirement / water demand / water use***") is the use of water delivered to satisfy particular needs of a community. Water consumption is characterized by several ***types (categories) of demands***, including domestic, public, commercial, and industrial uses. ***Domestic water demand*** includes water for drinking, cooking, washing up dishes, cleaning, laundering (washing), bathing, car washing, yard and garden watering, carrying away wastes, and other household functions. ***Public water demand*** includes water for fire protection, street cleaning, and use in schools, hospitals and other public buildings. ***Commercial*** and ***industrial water demands*** include water for shops, warehouses, offices, hotels, laundries, restaurants, and most manufacturing plants, for various technological purposes in industry, power engineering, transport, etc.

There is usually a wide variation in total water demand among different communities. This variation depends on population, geographic location, climate, the extent of local commercial and industrial activity, and the cost of water.



Water use or demand is expressed numerically by average daily consumption per capita (per person). For example, in the United States the average demand is approximately 100 gallons* (380 litres) per capita per day for domestic and public needs. Overall, the average total demand is about 180 gallons per capita per day, when commercial and industrial water uses are included. (These figures do not include withdrawals from freshwater sources for such purposes as crop irrigation or cooling operations at electric power generation facilities.) Water consumption in some developing countries may average as little as 4 gallons per capita per day; the world average is estimated to be approximately 16 gallons per person per day. In any community, water demand varies on a seasonal, daily, andnhourly basis. On a hot summer day, for example, it is not unusual for total water consumption to be as much as 200 percent of the average demand. Water consumption also varies hourly throughout the day. The peak demands in residential areas usually occur in the morning as well as early evening hours (just before and after the normal workday). Water demands in commercial and industrial districts, though, are usually uniform during the working day. Minimum water demands typically occur in the very early morning and predawn hours when very few people use water. Civil and environmental engineers must carefully study each community's water use patterns in order to design efficient pumping and distribution systems.

a **gallon is a unit of volume for liquid and dry measure; US equivalent to 3.79 litres; UK equivalent to 4.55 litres*

17. Read the following text and say what natural sources of water are and what requirements they must satisfy.

Text D. Natural Water Sources and Their Use for Water Supply Purposes

"When the well is dry, we know the worth of water."

BENJAMIN FRANKLIN (1706-1790

The choice of a water source is one of the most responsible tasks in designing a water supply system. The source determines to a considerable degree the type of the water supply system itself, the necessity of certain facilities and, therefore, the cost of its construction and maintenance. A water supply source must satisfy the following requirements:

a. it must provide the acquisition of adequate quantities of water with a glance of a prospective increase in water consumption;

b. it must provide continuity of water supply;

c. it must provide the water of such quality that meets the demands of water consumers by means of reasonably priced treatment;

d. it must enable water transmission at the lowest cost;

e. it must guarantee water acquisition without ecological disturbance*.

Natural sources of water include:

- ***surface sources*** (oceans, seas, lakes, reservoirs, rivers, streams, tanks and ponds);
- ***underground sources*** (ground water, artesian [confined] water, shallow wells, deep wells and springs).

Natural sources such as rivers, lakes, impounding reservoirs, etc. are ***sources of surface water***. Water is withdrawn from them through ***intakes***.

The simplest intakes are pipes extending from the shore into deep water.

Water obtained from subsurface sources, such as sands and gravels and porous or fractured rocks, is called ***ground water***. The flow of ground water takes place in

river valleys and, in some areas, along the seacoast in water-bearing strata known as ***aquifers***. Groundwater is accessed through a bore.

For the community's needs groundwater is more suitable. However, for the supply of water to large inhabited localities groundwater sources are often insufficient, and acquisition of a considerable quantity of water from them is unprofitable.

For the supplying of big cities and industrial enterprises with water, therefore, surface sources of fresh water are mainly used.

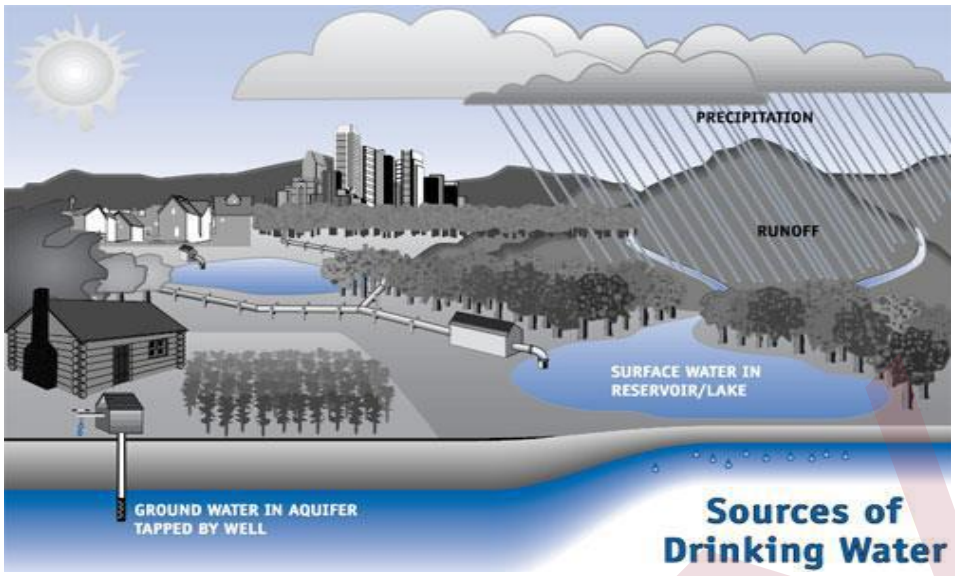
Sources of Drinking Water. Drinking water is water intended primarily for human consumption, either directly, as supplied from the tap, or indirectly, in beverages or food prepared with water. It should contain no harmful concentrations of chemicals or pathogenic microorganisms, and ideally it should be aesthetically pleasing in regard to appearance, taste and odour.

Drinking water comes from ***both surface and groundwater sources***.

Surface water (rainfall and its runoff into streams and rivers) normally contains suspended matter, pathogenic organisms, and organic substances.

Groundwater (water that has collected in aquifers) normally contains dissolved minerals and gases. Both require treatment. Water suppliers access this water, treat it and distribute it to consumers. The amount of water on our planet that is suitable and available for drinking is very small. Across the globe, population growth, urban development and environmental degradation pose an ever-increasing threat to freshwater supplies. Today, 4 out of every 10 people live in areas that are experiencing water scarcity, and nearly 50% of the world's population is likely to face severe water shortages by 2025.

**** ecological disturbance*** – нарушение экологического баланса



FOLLOW-UP ACTIVITIES

18. Read the texts of Module 1 again and make notes under the following headings. Then use your notes to talk about *Water on the Earth* and *Water-Supply Engineering.*

1. Significance of water for life.
2. Water properties and characteristics.
3. The hydrologic cycle.
4. Engineering. Water-supply engineering and sewage disposal.
5. Types (categories) of water consumption.
6. Natural water sources and their use for water supply purposes. Sources of drinking water.

Module 2

Water Supply Systems

"Children of a culture born in a water-rich environment, we have never really learned how important water is to us. We understand it, but we do not respect it."

WILLIAM ASHWORTH, Nor Any Drop to Drink, 1982

Vocabulary Work

1. Read the following international words and guess their meaning. Mind the stressed syllables. Prove that these words are international ones.

Model: engineering *[ˌendʒɪ'nɪərɪŋ]* – **прикладний** (про науку); технічний, інженерний; інженерне мистецтво; машинобудування; інженерія; інжиніринг; будівництво; техніка, апаратура; проектування; конструювання; розробка

activity *[æk'tɪvətɪ]*
adequate *['ædɪkwət]*
adsorption *[æd'sɔ:pʃ(ə)n]*
aeration *[eə'reɪʃ(ə)n]*
coagulation *[kəuˌægjə'leɪʃ(ə)n]*
collection *[kə'lekʃ(ə)n]*
combination *[ˌkɔmbɪ'neɪʃ(ə)n]*
complex *['kɔmpleks]*
component *[kəm'pəunənt]*
conservation *[ˌkɔnsə'veɪʃ(ə)n]*
convert *[kən'vɜ:t]*
definition *[ˌdefɪ'nɪʃ(ə)n]*
disinfection *[ˌdɪsɪn'fekʃ(ə)n]*
distance *['dɪst(ə)ns]*
neutralize *['nju:tr(ə)laɪz]*
operate *['ɔp(ə)reɪt]*
osmosis *[ɔz'məusɪs]*
pressure *['preʃə]*
problem *['prɔbləm]*
process *['prəuses]*
provision *[prə'vɪʒ(ə)n]*
pump *[pʌmp]*
realize *['rɪəlaɪz]*
region *['ri:dʒ(ə)n]*
reservoir *['rezəvwa:]*
resource *[rɪ'sɔ:s]*
reverse *[rɪ'vɜ:s]*
sedimentation *[ˌsedɪmen'teɪʃ(ə)n]*

distillation *[ˌdɪstɪ'leɪʃ(ə)n]*
distribution *[ˌdɪstrɪ'bju:ʃ(ə)n]*
economy *[ɪ'kɔnəmɪ]*
equivalent *[ɪ'kwɪv(ə)lənt]*
factor *['fæktə]*
filtration *[fɪl'treɪʃ(ə)n]*
flocculation *[ˌflɔkjə'leɪʃ(ə)n]*
flotation *[fləu'teɪʃ(ə)n]*
geographic *[ʤɪə'græfɪk]*
hydraulic *[haɪ'drɔ:lɪk]*
hydrologic *[ˌhaɪdrə'lɒʤɪk]*
industrial *[ɪn'dʌstrɪəl]*
method *['meθəd]*
modern *['mɔd(ə)n]*
natural *['nætʃ(ə)r(ə)l]*
serious *['sɪərɪəs]*
standard *['stændəd]*
structure *['strʌktʃə]*
system *['sɪstəm]*
tank *[tæŋk]*
term *[tɜ:m]*
transmission *[trænz'mɪʃ(ə)n]*, *[træns'-]*
transport 1. v *[træn'spɔ:t]*
2. n *['trænspɔ:t]*
transportation *[ˌtrænspɔ:'teɪʃ(ə)n]*
underground 1. adv *[ˌʌndə'graund]*
2. n, adj *['ʌndəgraund]*
variety *[və'raɪətɪ]*

2. Translate the following words and phrases and memorize them.

NOUNS AND NOUN PHRASES

abundance
appurtenance
arrangement
delivery
distribution pipe
maintenance
occurrence
pipeline
plumbing fixtures
pollutant
reservoir
shortage
storage tank
sufficiency [availability] of water
supply
water acquisition [collection]
water conservation
water consumer
water purification plant
water resources
water storage
water storage facility
water supply
water supply system [network]
water transmission [transportation]
water treatment

purpose	water distribution	[purification]
quality	water distribution system	water treatment facility
quantity		water use

VERBS AND VERBAL PHRASES

to accomplish	to carry out	to provide
to be aimed at	to deliver	to refer to
to be intended for	to include	to remove
to be situated	to increase	to require

ADJECTIVES AND PARTICIPLES

additional	elaborate	satisfactory
adequate	engineered	sufficient
available	palatable	suitable
conventional	pure	treated
domestic	purified	wholesome

3. Match the English and Ukrainian equivalents.

1. adequate quantity	a. адсорбція активованим вугіллям
2. adequate supply	b. внутрішні озера та річки
3. carbon adsorption	c. скористатися чимось, використовувати у власних інтересах, з користю для себе
4. complex of activities	
5. complex of engineering structures	d. достатня кількість
	e. достатній запас
6. deferrization and fluoridation	f. інженерна задача
7. engineering task	g. комплекс інженерних споруд
8. firefighting equipment	h. населений пункт
9. industrial enterprise	i. небажана домішка
10. inland lakes or rivers	j. знезалізнення та фторування (води)

11. natural water source	k. зворотній осмос
12. populated locality	l. ґрунтова вологість; вологість ґрунту
13. reverse osmosis	m. природне джерело води
14. soil moisture	n. промислове підприємство
15. to take advantage of	o. протипожежне оснащення
16. undesirable impurity	p. сукупність заходів
17. water softening	q. пом’якшення води

READING PRACTICE

Text A. Water Supply Systems

In the English language, ***“water supply”*** is a broad term which may have the following definitions:

1. water storage or sufficiency [availability] of water for a community or region; the water available for a community

2. the supply [delivery] of treated and purified water for a community

2. the supply [delivery] of treated and purified water for a community

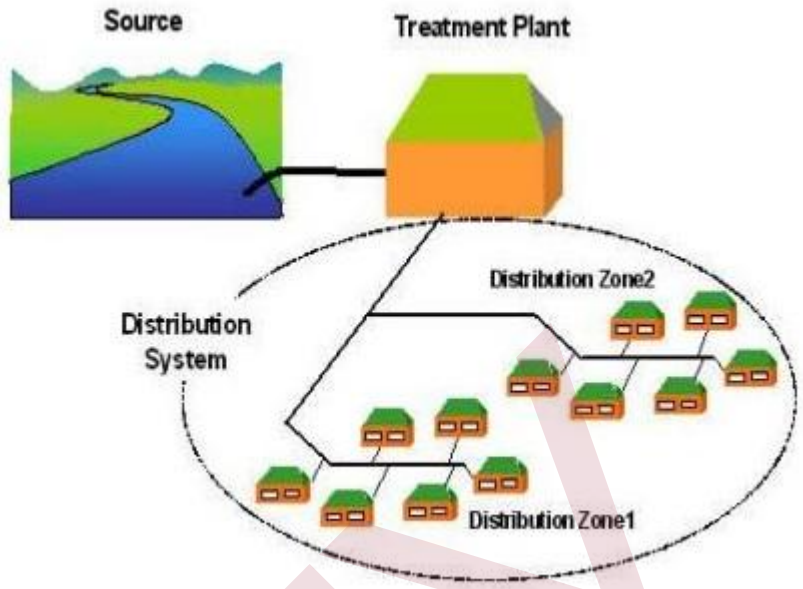
4. water resources (water of rivers, lakes, reservoirs, seas and oceans, as well as groundwater, soil moisture, water (ice) of glaciers, icecap and snow cover which is suitable for use in economy)

The proper Ukrainian equivalents for the term “water supply” are:

- запас води
- водозабезпеченість
- водопостачання, забезпечення водою
- водопостачання, подача води
- водогін
- водні ресурси

An adequate supply of pure, wholesome and palatable water is essential to the maintenance of high standards of health and life and to provide the convenience modern society demands. So, the importance of a sufficient supply of water for domestic and industrial purposes has long been a deciding factor in the location of

settlements, towns and cities. Even early people realized this need and took advantage of natural water sources.



In some regions water is available in unlimited quantities and converting it to use is not a difficult problem. This is especially true of populated localities which are situated on large inland lakes or rivers. However, there are towns and cities whose geographic location requires elaborate ***systems of water supply***, and providing a satisfactory supply of water in these inhabited localities becomes a serious engineering task.

Water supply is a complex of activities intended for the provision of various water consumers (community, industrial enterprises, transport) with water. The term may also refer to the supply of water provided in this way.

A ***water supply system***, or ***water supply network***, is a complex of engineering structures or a system of engineered hydrologic and hydraulic components which are aimed at providing water supply for various water uses. These structures carry out the supply of water including acquisition of water from a variety of natural water sources, its treatment transmission, storage, and distribution to the water consumers. A water supply system is arrangements for transporting water from areas of abundance to an area of shortage.

1. Water acquisition is collection of water from a variety of natural water sources (both surface and underground ones).

2. Water treatment is purification of water to make it suitable for human consumption or for any other purpose. It is any of several processes (or their combination) in which undesirable impurities or pollutants are removed or neutralized. Water treatment is accomplished at various water treatment facilities.

Conventional water treatment processes include coagulation and flocculation, sedimentation and flotation, filtration, disinfection, as well as some additional treatment methods (water softening, aeration, carbon adsorption, distillation, deferrization, desalination, fluoridation, reverse osmosis).

3. Water transmission is transportation of water over long distances, especially in those areas where there is a significant mismatch between water supply and water demand.

4. Water storage is conservation of water in a variety of water storage facilities for future use.

5. A water distribution system is an elaborate network of pumps, pipelines, storage tanks, and other appurtenances. It must deliver adequate quantities of water at pressures sufficient for operating plumbing fixtures and firefighting equipment, yet it must not deliver water at such high pressures as to increase the occurrence of leaks and pipeline breaks.

COMPREHENSION CHECK

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

1. The English term “water supply” has several meanings.
2. The presence of water supply systems has long been a deciding factor in the location of settlements, towns and cities.
3. Providing some regions where water is available in unlimited quantities with a satisfactory supply of water becomes a serious engineering task.
4. Every town and city in the world needs elaborate water supply systems.
5. Water supply is a complex of engineering structures intended for the provision of various consumers with water.
6. A water supply system is a complex of activities aimed at the provision of water to various consumers and for various water uses.
7. Water supply is the same as a water supply system.
8. The terms “a water supply system” and “a water supply network” are synonymous.

9. Water supply systems carry out the supply of water including acquisition of water from a variety of natural water sources, its treatment, transmission, storage, and distribution to the consumers.

10. Water acquisition is storage of water in a variety of natural water sources (both surface and underground ones).

11. Natural water sources include both surface and subsurface ones.

12. The aim of water treatment is to make water suitable for human consumption or for any other purpose.

13. Water purification is accomplished at various sewage treatment facilities.

14. Water treatment is necessarily a combination of several processes in which undesirable impurities or pollutants are removed or neutralized.

15. A significant mismatch between water supply and water demand in an area requires transportation of water over long distances.

16. Water distribution systems must deliver adequate quantities of water at pressures sufficient for operating plumbing fixtures.

6. Answer the following questions.

1. What are the definitions of the term “water supply”?
2. What are the proper Russian equivalents for the term “water supply”?
3. Why has the importance of a sufficient supply of water long been a deciding factor in the location of settlements, towns and cities?
4. Why does providing a satisfactory supply of water in some inhabited localities become a serious engineering task?
5. What is a water supply system, or water supply network?
6. The supply of water includes water acquisition, treatment, transmission, storage, and distribution to the water consumers, doesn’t it?
7. Do natural sources of water include surface or underground ones?
8. What is water treatment? Where is it accomplished?
9. What do conventional water treatment processes include?

10. For what purpose is water storage accomplished?

11. How is an elaborate network of pumps, pipelines and storage tanks called?

7. Choose the right variant according to the text.

1. An adequate supply of pure, wholesome and palatable water …

A. is especially true of towns situated on large inland lakes or rivers

B. is essential for the maintenance of high standards of health

C. may be taken from any source of water

D. should be protected from contamination by filtration

2. There are cities whose geographical location … .

A. makes water pass through an elaborate cycle of treatment

B. requires elaborate systems of water supply

C. makes the problem of water supply very difficult

D. calls for modern systems of water treatment

3. The geographic location of some towns and cities requires … .

A. the removal of undesirable impurities at various water treatment facilities

B. the application of additional water treatment methods

C. elaborate water supply systems

D. transporting water from areas of shortage to an area of abundance

4. Even early people took advantage of natural water sources by … .

A. building water power stations on them

B. establishing their settlements near them

C. providing sufficient water supply for their needs

D. using water without much preliminary treatment

5. A water supply system is a complex of … .

A. engineers

B. engineering structures

C. hydrology and hydraulics

D. water purification plants

6. Too high pressures in a water distribution system increase the occurrence of … .

A. undesirable impurities and pollutants

B. coagulation, sedimentation, filtration and disinfection

C. a significant mismatch between water supply and water demand

D. leaks and pipeline breaks

8. Match 1-9 to a-i to form complete sentences.

1. Water supply …	a. … include coagulation and flocculation, sedimentation and flotation, filtration, disinfection, as well as some additional treatment methods.
2. A water supply system, or water supply network, …	b. … include underground and surface sources, as well as water accumulation and conservation.
3. Water acquisition …	c. … is a complex of activities intended for the provision of various consumers with water.
4. Water treatment …	d. … is a complex of engineering structures aimed at providing water supply for various water uses.
5. Conventional water treatment processes …	e. … is an elaborate network of pumps, pipelines, storage tanks, and other appurtenances aimed at delivering adequate quantities of water.
6. Water transmission …	f. … is collection of water from a variety of natural water sources.
7. Water storage …	g. … is conservation of water in a variety of water storage facilities for future use.
8. A water distribution system …	h. … is purification of water to make it suitable for human consumption or for any other purpose.
9. Water sources …	i. … is transportation of water over long distances.

LANGUAGE FOCUS

9. Translate the following pairs of derivatives and memorize them.

Verb – Noun

to accomplish - accomplishment
to accumulate – accumulation
to acquire – acquisition
to arrange – arrangement
to collect – collector / collection
to conserve – conservation
to consume – consumer / consumption
to define – definition
to deliver – delivery
to distribute – distribution
to equip - equipment
to maintain – maintenance
to neutralize – neutralization
to operate – operator / operation
to plumb – plumber / plumbing
to pollute – pollutant / pollution
to press – pressure
to provide – provision
to pump – pumping
to purify – purification
to remove – removal
to require – requirement
to store – storage
to transmit – transmission
to treat – treatment

Noun – Verb

aim – to aim
break – to break
cover – to cover
demand – to demand
increase – to increase
leak – to leak
mismatch – to mismatch
pump – to pump
supply – to supply
transport – to transport

Noun – Adjective

addition – additional
convention – conventional
desire – desirable / undesirable
hydraulics – hydraulic
hydrology – hydrologic
industry – industrial

Noun – Adjective

engineering – engineering
future – future

Adjective – Noun

abundant – abundance
available – availability
convenient – convenience
moist – moisture
pure – purity / impurity
short – shortage

important – importance

sufficient – sufficiency

Adjective – Verb

pure – to purify

soft – to soften

Verb – Adjective

to avail – available

to suit - suitable

to elaborate – elaborate

to vary – various

Compound Nouns / Adjectives

firefighting

network

hydrologic

pipeline

10. Translate the following pairs of derivatives paying attention to the meaning of prefixes.

adequate – inadequate

available – unavailable

desirable – undesirable

limited – unlimited

match – mismatch

natural – unnatural

pure – impure

purified – unpurified

purity – impurity

satisfactory – unsatisfactory

sorption – adsorption

source – resource

sufficient – insufficient

suitable – unsuitable

to move – to remove

treated – untreated

11. Transform as in the models.

Model 1 "Verb → Noun": to define a term → definition of a term

To deliver water; to supply water; to disinfect water; to treat sewage;to soften hard water; to provide water supply; to pump water; to add fluorine; to fluoridate water; to acquire, treat, transmit, store and distribute water; to remove pollutants; to neutralize undesirable impurities; to provide consumers with water; to accomplish water purification; to construct a plant; to build an industrial enterprise.

Model 2 "Noun → Noun": distribution of water → water distribution

Supply of water; systems of water supply; demand for water; water for drinking; high standards of purity; acquisition, treatment, transmission, storage and distribution of water; collection of water; extreme shortage of water; facilities for water storage; conservation of water; plants for water purification; a facility for water storage; breaks of pipelines; filtration and disinfection of water; transportation of water.

12. Insert the appropriate word.

(1)

contamination, demand, disastrous, engineering, methods, sewage disposal systems, supply of water, treatment, water sources

The importance of a sufficient _____ for domestic and industrial purposes has long been a deciding factor in the location of cities and towns. Early people realized this need and look advantage of natural _____ by establishing their settlements in close proximity to them.

Early people had no need of _____ structures to supply their water. As man`s communities grew on population, the _____ for water increased and the need for protection of the source of water increased and the need for protection of the source of water supply against the possibility of _____ became evident. Progress and civilization have called for elaborate and various systems and _____ of water treatment.

Today water may be taken from any sources of water for human consumption after it has undergone a preliminary _____ to assure its purity.

Man uses water for domestic and sanitary purposes and returns it tothe source through _____ . Industry likewise replaces water diverted to its use. Hence the cycle is completed but it is of prime importance that the supply be protected against pollution, for if it fouls no one can predict how _____ may be the results.

(2)

abundance, conduit, distribution system, fire, industry, reservoir, shortage, street, treatment plant, well

A water supply system is an arrangement for transporting water from areas of _____ to an area of _____ . This includes works for the collection, transmission, treatment, storage, and distribution of water for homes, commercial establishments, _____ and irrigation, as well as for such public needs as _____ fighting and _____ flushing.

A water-supply system consists essentially of the following elements:

- a source of supply which may be a lake, stream, spring, or _____;
- a _____ for storing water for use during periods when demand is greater than the daily flow of water;
- conveying the water from the source of supply to the community is accomplished by means of a pipeline or a _____;
- removing impurities from the water to make it suitable for use requires a _____;
- a _____ of pipes is used for delivering the water throughout the various streets of the community.

13. Match the terms and their definitions.

aqueduct, component, delivery, elaborate, engineered, engineering, maintenance, occur, pipeline, reservoir, treatment

a. a large natural or artificial lake used as a source of water supply

b. a long pipe, typically underground, for conveying oil, gas, etc., over long distances

c. a part or element of a larger whole

d. an artificial channel for conveying water, typically in the form of a bridge supported by tall columns across a valley

e. designed, developed, constructed

f. happen; take place; exist

g. involving many carefully arranged parts or details; detailed and complicated in design and planning

h. the branch of science and technology concerned with the design, building, and use of engines, machines, and structures

i. the process of keeping something in good condition

j. the supply or provision of something

k. the use of a chemical, physical, or biological agent to preserve or give particular properties to something

SUMMARIZING

14. Make a summary of the text according to the following plan.

1. The title of the text is "…" .
2. The text is devoted to … .
3. Such problems as… are touched upon in the text.
4. The text consists of … parts.
5. The first part deals with … .
6. The second (third, forth, etc.) part describes … .
7. The main idea of the text is to show … (to underline … / to prove … / to inform the reader about ...).
8. In my opinion, the text is useful / informative / interesting. It is worth reading.

READING PRACTICE

15. Skim over the text. Answer the following questions.

Text B. The Scheme of Water Supply

In general, **water supply** can be represented as the following **scheme**:

water acquisition [collection] → water storage → water treatment [purification] → water distribution → water consumption → wastewater [sewage] disposal

Water supply systems get water from a variety of sources. ***Water sources*** include:

1. underground sources (groundwater from aquifers, artesian water);

2. surface water (water from rivers, lakes, reservoirs, as well as seas through desalination);

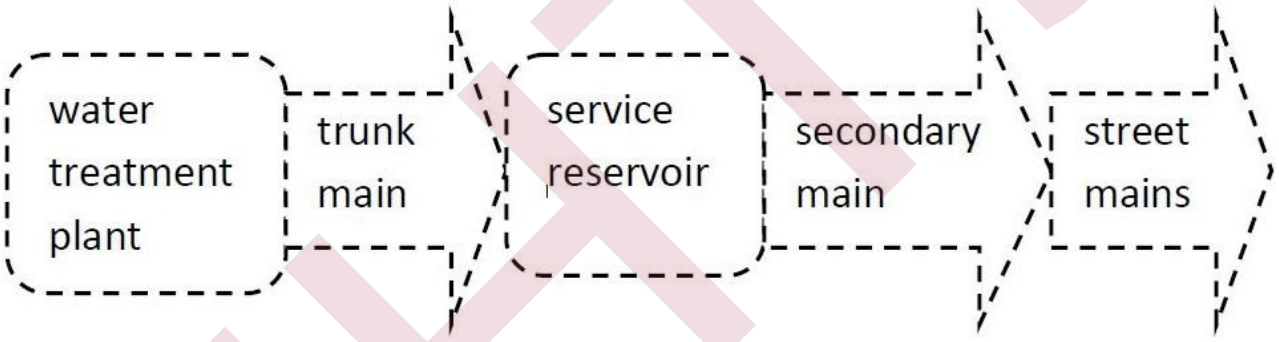
3. water accumulation and conservation.

The water is then, in most cases, purified, disinfected through chlorination

and sometimes fluoridated. Treated water then either flows by gravity or is pumped to reservoirs which can be elevated (*e.g.* water towers) or can be on the ground.

Having been treated, water is to be distributed to all the water consumers served by the area water undertaking. Methods of *water distribution* vary. For towns and cities, water companies treat water collected from wells, lakes, rivers, and ponds and distribute it to individual buildings. In rural areas water is commonly obtained directly from wells.

The construction and maintenance of a *water distribution system* for a large city is a complex operation since there must be at least one water main in each street. A *water main* is a main line in a water supply system. The basic elements of a typical distribution system are shown below:



The layout of water mains is greatly dependent on local conditions and topography.

Water mains can be divided into three classes:

1. *a trunk main* is the main supply line between the treatment plant and service reservoirs or water towers;
2. *a secondary main* is a supply line distributing water from the service reservoirs to the street service mains. In some cases they provide supplies to large industrial consumers;
3. *service mains* are the pipes along each street to which individual consumers are connected.

Once water is used, wastewater is typically discharged into *sewerage* and treated in a *wastewater treatment plant* (also called a *sewage treatment works*) before

being discharged into a river, lake or the sea or reused for landscaping, irrigation or industrial use.

Sewerage (also called a *sewerage system*, a *sewage system*, a *sewer system*, a *collecting system, drainage, sanitary piping)* is intended for the provision of drainage (sewage disposal) by sewers.

A *sewerage network* (also called *a sewer network* or *a drainage system*) is a part of the sewerage system; it is a complex of underground pipes (pipelines) and sewers for the collection and disposal of sewage from populated localities and industrial enterprises to the sewage treatment works.

Plumbing [a plumbing system] is installed in a building and designed for the supply of water and the elimination of wastes. It is the system of pipes, tanks, fittings, and other apparatuses required for the water supply, heating and sanitation in a building.

The general scheme of water supply may vary depending on specific conditions.

1. What is the general scheme of water supply?
2. What sources do water supply systems get water from?
3. In most cases, water is treated and disinfected, isn't it?
4. How is water distributed to the water consumers?
5. Is a water main a main line in a water supply system?
6. What are the basic elements of a typical distribution system?
7. What classes can water mains be divided into?
8. Where is wastewater typically discharged into?
9. Is sewerage intended for the provision of drainage or water storage?
10. A sewerage system is a complex of underground pipes and sewers, isn't it? What do they serve for?
11. What is a plumbing system designed for?
12. What apparatuses does plumbing include?
13. What does the general scheme of water supply depend on?

16. Read the following text and speak on the main components and facilities of water supply systems.

Text C. The Main Components and Facilities of a Water Supply System

A water supply system typically consists of the following *components*:

1. a watershed or *geographic area that collects water*;

2. a source of supply, or *a reservoir of raw (untreated) water* (above or below ground) where the water accumulates (*e.g.* a lake, river, stream, spring, well, groundwater from an underground aquifer);

3. a reservoir for storing the water for use during periods when demand is greater than the daily consumption of water;

4. an underground pipeline or *a ground-level conduit (an aqueduct)* for conveying the water from the source of supply to the community;

5. water treatment facilities (also called "water treatment plants [stations/ works]" or "water purification plants [stations / works]") for removing impurities from the untreated water to make it suitable for various uses;

6. a pipe network (a distribution system of pipes, usually underground) for delivering the treated water to the consumers (which may be residential apartment buildings and private houses, industrial and commercial establishments, educational and medical institutions) and other usage points (such as fire hydrants);

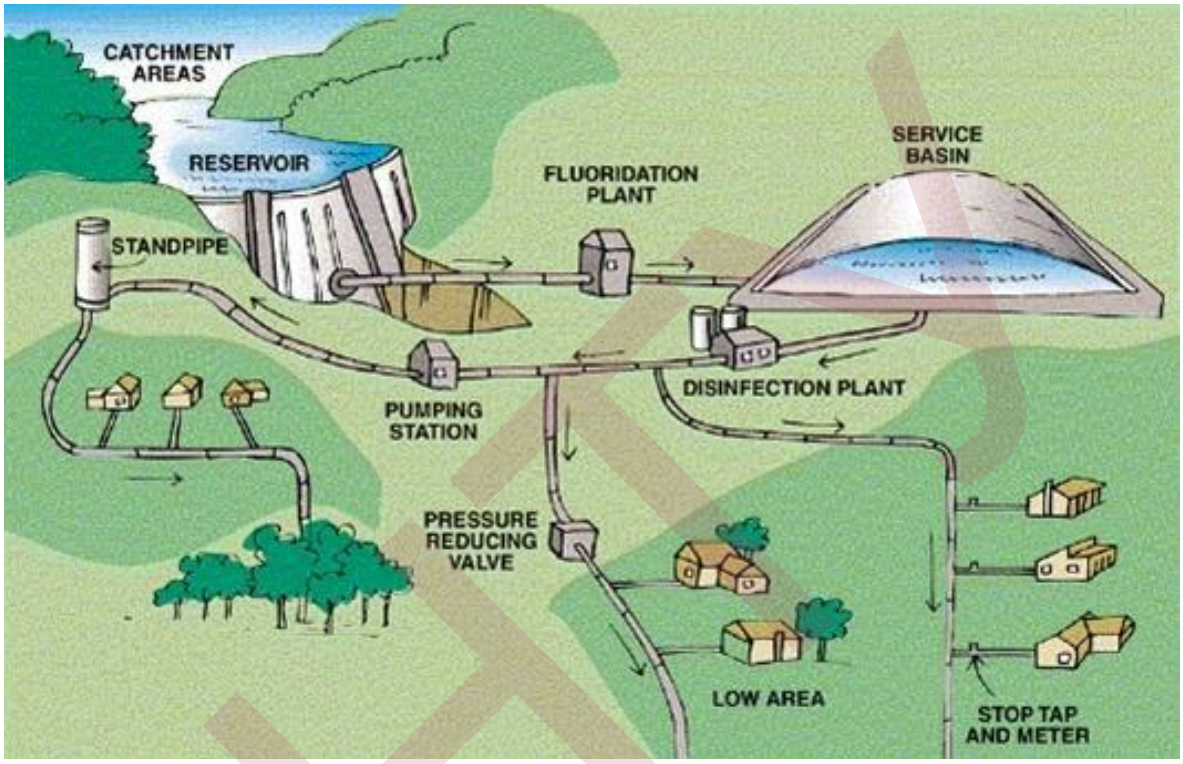
7. wastewater treatment facilities (also called "wastewater treatment plants [stations / works]", or "sewage treatment plants [stations / works]");

8. water storage facilities (reservoirs, water tanks, or water towers for larger water systems; cisterns or pressure vessels for smaller water systems). Tall buildings may also need to store water locally in pressure vessels in order for the water to reach the upper floors.

Some systems are simpler and consist only of a source of supply, a main pipeline, and a small number of distribution piping; others are more complicated and

include, in addition to elements previously listed, distribution reservoirs, additional water pressurizing components (pumping plants / stations), and other accessories.

All these water supply system components are integrated into *water infrastructure* - the stock of basic water facilities and capital equipment needed for the functioning of a country or area.



For the purposes of acquisition of water from a variety of natural water sources, its treatment, transmission, storage, and distribution to the consumers a number of *water supply facilities* are utilized:

- *water intake structures [facilities];*
- *water-pumping facilities [stations / plants]* supplying water to the point of its treatment;
- *water treatment facilities [structures / stations / plants / works]*, also called *water purification facilities [structures / stations / plants / works]*;
- *collection [collecting / accumulator / pipeline] tanks* for purified water;
- *water-pumping facilities [stations / plants]* supplying the purified water to towns, cities or industrial enterprises;
- *water conduits*, *aqueducts*, and *water mains [water-supply networks]* serving for water delivery to the consumers;

- *plumbing [plumbing systems] installed in a building and designed for the supply of water and the elimination of wastes.*

Plumbing is a system of pipes and fixtures installed in a building for the distribution and use of potable (drinkable) water and the removal of waterborne wastes. It is usually distinguished from water and sewage systems that serve a group of buildings or a city.

A complete water supply system is known as a waterworks. Sometimes this term is specifically applied to pumping stations, treatment stations, or storage facilities. Storage facilities are provided to reserve extra water for use when demand is high and, when necessary, to help maintain water pressure. Treatment stations are places in which water may be filtered to remove suspended impurities, aerated to remove dissolved gases, or disinfected with chlorine, ozone, ultraviolet light, or some other agent that kills harmful bacteria and microorganisms. Sometimes hard water is softened through ion exchange. Salts of iodine and fluorine which are considered helpful in preventing goiter and tooth decay are sometimes added to water in which they lack.

Not all water supply systems are used to deliver drinking water. Systems used for purposes such as industry, irrigation and fire fighting operate in much the same way as systems for drinking water, but the water need not meet such high standards of purity. In most municipal systems hydrants are connected to the drinking water system except during periods of extreme water shortage. Because many cities draw water from the same water body into which they discharge sewage, proper sewage treatment has become increasingly essential to the preservation of supplies of useful water.

17. Read the following text and characterize domestic, public and industrial water supply.

Text D. Domestic, Public and Industrial Water Supply

Water supply is available water provided to fulfill a particular need. If the need is domestic, public, commercial, industrial, or agricultural, the water must fulfill both

quality and quantity requirements. Water supply systems are subdivided into several branches according to the purpose of facilities they service:

1. domestic water supply;

2. public water supply;

3. industrial and ***commercial water supply***.

Water use in agriculture (for irrigation) is considered separately.

Domestic and Public Water Supply. Of all municipal services, provision of potable water is perhaps the most vital. All people depend on water for satisfying numerous domestic (household) needs indoors and outdoors.

Domestic water use just covers self-supplied domestic water withdrawals by those people and organizations that use their own wells to supply their water, as opposed to public-supplied (public-service) water.

Water generally gets to our homes in one of two ways. Either it is delivered by a city water supply organization (utility), or people supply their own water, usually from a well. So, water delivered to homes is called "public-supplied / public-service" and water supplied by people themselves is called "self-supplied".

No doubt, the first public-supply water system was when Jack the Caveman* was hired by his neighbours to fetch a bucket of water from the Dinosaur River in exchange for some delicious prehistoric bran muffins. Today organized systems exist all over the world. Their aim is to get water, clean it and deliver it to local residents.

When the population was a lot more rural, people used to have to dig their own wells and create storage tanks for their water supply. But with the majority of urban population the public-supply water systems do that work for us. All we do is turn on the tap and pay the bills!

During times of droughts, floods, earthquakes, or other emergencies, vigorous efforts must be made to maintain public water supplies.

Industrial Water Supply. Water supply systems must also meet requirements for commercial and industrial activities.

The Industrial Revolution was the rapid development of industry that occurred in Britain in the late 18th and 19th centuries and brought about the introduction of

machinery. It was characterized by the use of steam power, the growth of factories, and the mass production of manufactured goods. Water has always played a critical part in implementation of every industrial process. It is estimated that now about 22% of world-wide water use is industrial. The demand for water is sure to increase in future. Though water consumption depends on the region, as a whole, industrial water usage is lower than agricultural use.

The most important purposes of industrial water consumption are cooling, scouring, washing, dampening, steam generation, hydraulic transport, etc. The use of water for cooling exceeds all other kinds of water consumption as it is used in such branches of industry as metallurgy, oil-refining industry, chemical industry, etc. In general, the largest water users are enterprises of metallurgical, chemical, oil-refining, petrochemical, and machine-building industry, as well as thermal power stations.

Industry also uses water to dissipate and transport waste materials. In fact, many streams are now overused for this purpose, especially watercourses in urban centres. The use of watercourses for waste dispersal degrades the quality of the water and may reduce its usefulness for other purposes. This is especially true if the industrial wastes are toxic.

***Jack the Caveman** печерна людина

****bran muffins** оладки з висівками

FOLLOW-UP ACTIVITIES

18. Read the texts of Module 2 again and make notes under the following headings. Then use your notes to talk about *Water Supply Systems* and *The General Scheme and the Main Components and Facilities of Water Supply Systems.*

1. Water supply.
2. Water supply systems.
3. The general scheme of a water supply system.
4. Water distribution systems.

5. The main components and facilities of a water supply system.

6. Domestic, public and industrial water supply.

Module 3

Conventional Water Treatment

"Water has no taste, no color, no odor;
it cannot be defined, art relished while ever mysterious.
Not necessary to life, but rather life itself.
It fills us with a gratification that exceeds the delight of the senses."
ANTOINE DE SAINT-EXUPERY (1900-1944)
"If there is magic on this planet, it is contained in water."
LORAN EISELY

VOCABULARY WORK

1. Read the following international words and guess their meaning. Mind the stressed syllables. Prove that these words are international ones.

Model: atom [*'ætəm*] – атом, найдрібніша частка

analysis [*ə'næləsɪs*] (*pl*. analyses [*ə'næləsi:s*])
analyze [*'æn(ə)laɪz*]
atmospheric [ˌ*ætməs'ferɪk*]
bacteriologically [*bækˌtɪərɪə'lɔʤɪk(ə)lɪ*]
chlorine [*'klɔ:ri:n]*
climatic [*klaɪ'mætɪk*]
colloidal *[kə'lɔɪd(ə)l]*
composition [ˌ*kɔmpə'zɪʃ(ə)n*]
concentration [ˌ*kɔns(ə)n'treɪʃ(ə)n*]
copper [*'kɔpə*]
crystal [*'krɪst(ə)l*]
microbiological [ˌ*maɪkrəuˌbaɪə'lɔʤɪk(ə)l*]
microorganism [ˌ*maɪkrəu'ɔ:g(ə)nɪz(ə)m*]
nature [*'neɪʧə*]
nitrate [*'naɪtreɪt*]
objective [*əb'ʤektɪv*]
organic [*ɔ:'gænɪk*]
original [*ə'rɪʤ(ə)n(ə)l*]
parameter [*pə'ræmɪtə*]
period *['pɪərɪəd]*
pesticide [*'pestɪsaɪd*]
physicochemical

cyanobacteria [ˌ*faɪzɪkəu ˈkemɪk(ə)l*]
[*saɪˌænəubækˈtɪəriə*] product [*ˈprɔdʌkt*]
detergent [*dɪˈtɜːʤ(ə)nt*] progress [*ˈprəugres*]
geology [*ʤɪˈɔləʤɪ*] protection [*prəˈtekʃ(ə)n*]
hepatitis [ˌ*hepəˈtaɪtɪs*] radiological [ˌ*reɪdɪəuˈlɔʤɪk(ə)l*]
identify [*aɪˈdentɪfaɪ*] radium [*ˈreɪdɪəm*]
industry [*ˈɪndəstrɪ*] safe [*seɪf*]
inorganic [ˌ*ɪnɔːˈgænɪk*] special [*ˈspeʃ(ə)l*]
ion [*ˈaɪən*] suspension [*səˈspenʃ(ə)n*]
irrigation [ˌ*ɪrɪˈgeɪʃ(ə)n*] technological [ˌ*teknəˈlɔʤɪk(ə)l*]
landscape [*ˈlæn(d)skeɪp*] tendency [*ˈtendənsɪ*]
manganese [ˌ*mæŋgəˈniːz*] topography [*tɔˈpɔgrəfɪ*]
matter [*ˈmætə*] toxic [*ˈtɔksɪk*]
mechanical [*mɪˈkænɪk(ə)l*] type [*taɪp*]
mercury [*ˈmɜːkjurɪ*] typically [*ˈtɪpɪk(ə)lɪ*]
methyl [*ˈmeθ(ə)l*] universal [ˌ*juːnɪˈvɜːs(ə)l*]
microbial [*maɪˈkrəubɪəl*] uranium [*juəˈreɪnɪəm*]

2. Translate the following words and phrases and memorize them.

NOUNS AND NOUN PHRASES

alga (*pl*. algae)
bacterium (*pl*. bacteria)
compound
detergent
dimension
environment
fertilizer
foreign matter
fungus (*pl*. fungi)
impurity
origin
particle
pesticide
plumbing
polluted [contaminated] water
solution
solvent
suspension
untreated water
water analysis (*pl*. analyses)
water pollutant [contaminant]
water pollution [contamination]
water quality
water sampling
water source
water treatment

microorganism	virus	[purification]
	waste effluents	water user

VERBS AND VERBAL PHRASES

to analyze	to deteriorate	to dissolve
to contain	to determine	to take into account

ADJECTIVES AND PARTICIPLES

clean	fine	organic
coarse	harmful	palatable
colloidal	impure	potable
crystal clear	inorganic	pure
disease-causing	microbial	suspended
dissolved	non-settling	undesirable

3. Match the English and Ukrainian equivalents.

1)

1. aquatic health	a. (науково-)технічний прогрес *(єдиний поступальний розвиток науки й техніки)*
2. composition of natural water resources	b. смачна питна вода
3. health of the community	c. що зустрічається в природ; природний *(про явище)*
4. human activities	d. головна [основна] мета
5. natural landscape features	e. діяльність людини
6. naturally occurring	f. природні особливості місцевості
7. of natural and manmade origin	g. будівля *(напр., підприємства)* з прилеглими будівлями і ділянкою
8. palatable potable water	h. здоров’я населення
9. particular purpose	i. певна мета
10. premises	j. наукові підрахунки
11. primary objective	k. відбір проб води і аналіз її хімічного складу
12. scientific measurements	

13. technological progress	l. природного та штучного походження
14. water sampling and analysis	m. санітарний стан водойми n. склад природних водних ресурсів

2)

1. (undesirable) foreign matter [impurity / material]	a. (небажана) домішка; стороння речовина
2. coarse suspension	b. у розчині
3. colloidal state	c. зважені (тверді) частки, частки в зваженому стані
4. cyanobacteria **(**bluegreen algae)	d. у зваженому стані зважений
5. dissolved organic matter	e. груба [грубодисперсна] суспензія
6. dissolved solids	f. колоїдний стан
7. fine non-settling particles	g. дрібні, що не осідають [що не відстоюються] частки
8. in solution	h. не містити; не мати
9. in suspension	i. розчинена органічна речовина
10. suspended solids [particles]	j. розчинені у воді речовини; загальна кількість органічних та неорганічних сполук, що містяться у воді або стічних водах
11. to be free from / of	k. ціанобактерії, синьо-зелені водорості (*група великих бактерій, здатних до фотосинтезу, що супроводжується виділенням кисню*)

READING PRACTICE

4. Read the text. Using a dictionary, translate it in writing.

TEXT A. Water Quality.

Water Pollution and Water Treatment

"High quality water is more than the dream of the conservationists, more than a political slogan; high quality water, in the right quantity at the right place at the right time, is essential to health, recreation, and economic growth."

EDMUND S. MUSKIE, U.S. Senator, speech, 1 March 1966

The development of human society, the growth of civilization and social and technological progress has resulted in the changing of the composition of natural water resources. Natural waters contain a considerable amount of the products of mechanical, chemical and biological pollution. Untreated water contains a number of contaminants of natural and manmade origin, the presence of which is undesirable or dangerous. For better understanding the process and objectives of water treatment, we should consider the nature of water pollution and the notion of water quality.

Water pollution is contamination of water by undesirable foreign matter (materials such as waste effluents, chemicals, detergents, and fertilizers and pesticides) which deteriorates water quality. Water quality has a microbiological and a physicochemical dimension. There are thousands of parameters of water quality. The type and extent of water treatment depends on the quality of the water source. The better the quality, the less treatment is needed. In its purest form, water is simply H2O; that is, two atoms of hydrogen attached to each atom of oxygen. Water is called the "universal solvent" because of its strong tendency to dissolve other substances. Because water is such a good solvent, in the environment it will always contain dissolved or suspended impurities.

The quality of water is determined by the presence of various substances of organic and inorganic origin, as well as microorganisms in it. Undesirable impurities can be contained in water in three different states:

1 – in suspension – as separate suspended solids (coarse suspension); 2 –

in colloidal state; 3 – in solution – as dissolved solids.

All identified water contaminants [pollutants] are typically divided into the following types:

- suspended solids (fine, non-settling particles of any solid);
- heavy metal ions (ions of metals of relatively high density);
- dissolved organic matter (compounds, chiefly of biological origin, containing carbon);
- microorganisms (microscopic organisms, esp. a bacterium, virus,
- or fungus);
- *phytoplankton* (plankton consisting of microscopic plants) / *zooplankton* (plankton consisting of small animals and the immature stages of larger animals).

Another classification of pollutant foreign matter can be made into:

- *non-living* water contaminants;
- *living* water contaminants (many of which are disease-causing).

The types of impurities found in water can be divided into four groups: ***microbial, physical, chemical,*** and ***radiological.***

Types of Impurities	Examples
Microbial (Microorganisms)	
Bacteria	Campylobacter, Legionella
Viruses	Hepatitis
Protozoa	Cryptosporidium, Giardia
Other	Cyanobacteria (blue-green algae)
Physical	
Colour	Iron, dissolved organic matter
Taste and odour	Methyl isoborneol
Appearance	Silt, suspended particles, plankton
Chemical	
Naturally occurring	Manganese, nitrate
Agricultural	Atrazine, chlordane

Water treatment	Chlorine, fluoride
Plumbing	Lead, copper
Industrial	Polyaromatic hydrocarbons, mercury
Radiological	
Naturally occurring	Radium, uranium

"***Water quality***" is a term used to describe the chemical, physical, and biological characteristics of water, usually in respect of its suitability for a particular purpose (for drinking, industrial purposes, irrigation, recreation, etc.) Although scientific measurements are used to define water quality, it's not a simple thing to say "this water is good/ pure", or "this water is bad/ impure". There are complex interconnections among factors such as surface and ground water, atmospheric and climatic factors, natural landscape features (such as geology, topography, and soils), human activities, and aquatic health which must be taken into account in analyzing water quality.

The quality of water from natural water sources as well as water quality requirements for various water users vary greatly. By analyzing water from natural sources the presence of various substances and microorganisms is determined. For obtaining the correct characteristics of water from the given water source, water sampling and analyses should be done for a long period of time in order to take into account seasonal changes of water quality.

Water treatment is purification of water to make it suitable (i.e. potable and palatable) for human consumption or for other purposes. It is any of several physical and chemical processes (or a combination of these processes) in which undesirable impurities and pollutants in water are removed or neutralized.

The primary objective of water treatment is the protection of the health of the community. Palatable potable water is the water that must be bacteriologically safe, free from toxic or harmful microorganisms, chemicals or substances, as well as crystal clear and comparatively free of turbidity, colour, odour and taste. Excessive hardness and high concentration of dissolved solids are also undesirable, particularly

for industrial purposes. Industrial requirements may be even more stringent; many industries provide special treatment on their own premises.

COMPREHENSION CHECK

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

1. Factors such as the development of human society, the growth of civilization and social and technological progress have resulted in the changing of the composition of natural water resources.
2. There is no obvious interconnection among water quality, water pollution and water treatment.
3. Water treatment is the presence of undesirable impurities in water.
4. Water pollution is the removal of undesirable foreign matter from water.
5. Water pollution is contamination of water by undesirable foreign matter which improves water quality.
6. There are no parameters of water quality.
7. The worse the quality of water, the more water treatment is needed.
8. In its purest form, water is simply H2O; that is, two atoms of hydrogen attached to one molecule of oxygen.
9. Since water is a good solvent, in the environment it will always contain dissolved or suspended impurities.
10. Undesirable impurities can be contained in water in three different states: in suspension, in colloidal state and in solution.
11. Water contaminants include dissolved solids and suspended organic matter.
12. Pollutants may be either living or non-living, either of natural or of man-made origin.
13. Many living microorganisms in water are disease-causing ones.
14. The types of impurities found in water can be divided into microbiological, physicochemical and radioactive.
15. Manganese, chlorine, copper, lead and mercury are examples of physical water impurities.

16. “Water quality” is a term which describes chemical and physical characteristics of water.

17. Water can be used for various purposes: for drinking, industrial purposes, irrigation, recreation, etc.

18. In analyzing water quality, numerous factors must be taken into account.

19. Water sampling and analyses are done to determine the presence of various substances and microorganisms in water from natural sources.

20. Only a combination of several physical and chemical processes in which undesirable impurities in water are removed or neutralized can be called water treatment.

21. Palatable drinking water must not contain toxic or harmful microorganisms, chemicals or substances.

22. Drinking water must always be purer than water for industrial purposes.

6. Answer the following questions.

1. What are the main reasons for the recent changing of the composition of natural water resources?

2. Why should we consider the nature of water pollution and the notion of water quality?

3. What is water pollution?

4. What dimensions does water quality have?

5. Is there the only one parameter of water quality?

6. What does the type and extent of water treatment depend on?

7. What are the classifications of water pollutants?

8. What does the term “water quality” describe?

9. Is it easy to say “this water is good/ pure” or “this water is bad/ impure”? Why? Why not?

10. What are the factors which must be taken into account in analyzing water quality?

11. What is water treatment?

12. What is the primary objective of water treatment?

13. What is palatable potable water?

14. Why do many industries provide special water treatment on their own premises?

7. Choose the right variant according to the text.

1. Water pollution is the presence of undesirable foreign matter which … water quality.

A. improves

B. guarantees

C. deteriorates

D. controls

2. Water contaminants are typically divided into suspended …, dissolved organic …, heavy metal …, etc.

A. solids, ions, matter

B. particles, matter, compounds

C. solids, compounds, density

D. solids, matter, ions

3. Dissolved organic matter is … of biological origin, containing carbon.

A. components

B. compounds

C. a mixture

D. particles

4. Microorganisms are microscopic organisms including … .

A. microscopic plants, small animals and immature stages of larger animals

B. bacteria, viruses, or fungi

C. phytoplankton and zooplankton

D. non-living and living water contaminants

5. Water treatment is the … of undesirable impurities and pollutants. ***(several answers possible)***

A. neutralization

B. concentration

C. consumption

D. removal

6. There are complex … among factors such as surface and ground water, atmospheric and climatic factors, natural landscape features, human activities, and aquatic health.

A. scientific measurements

B. purposes

C. requirements

D. interconnections

LANGUAGE FOCUS

8. Translate the following pairs of derivatives and memorize them.

Verb – Noun

to analyze – analysis

to classify – classification

to combine – combination

to compose – composition

to concentrate – concentration

to consume – consumption

to contaminate – contaminant / contamination

to develop – development

to drink – drinking

to fertilize – fertilizer

to grow – growth

to irrigate – irrigation

to measure – measurement

to pollute – pollutant / pollution

to protect – protection

to purify – purification

to require – requirement

to suit – suitability

to treat – treatment

Noun – Verb

change – to change

compound – to compound

progress – to progress

result – to result

sample – to sample

taste – to taste

Noun – Adjective

aqua – aquatic

atmosphere – atmospheric

bacteriology – bacteriological

biology – biological

chemistry – chemical

mechanic – mechanical

microscope – microscopic

nature – natural

organism – (in)organic

physics – physical

prime – primary

climate – climatic

danger – dangerous

excess – excessive

harm – harmful / harmless

Noun – Adjective

chemical – chemical

complex – complex

human – human

Adjective – Noun

dense – density

hard – hardness

present – presence

Noun – Noun

pest – pesticide

Adjective – Verb

neutral – to neutralize

Adjective – Adverb

bacteriological – bacteriologically

comparative – comparatively

Verb – Participle II

to contaminate – contaminated

to dissolve –dissolved

to identify – identified

Compound Nouns / Adjectives

disease-causing

landscape

man-made

microscopic

science – scientific

society – social

technology – technological

objective – objective

sample – sample

solid – solid

suitable – suitability

turbid – turbidity

sample – sampling

particular – particularly

relative – relatively

to pollute – polluted

to suspend – suspended

to treat – (un)treated

physicochemical

phytoplankton

topography

zooplankton

9. Translate the following pairs of derivatives paying attention to the meanings of prefixes.

biological – **micro**biological

connection – **inter**connection

danger – to **en**danger

desirable – **un**desirable

living – **non**-living

mature – **im**mature

natural – **un**natural

organic – **in**organic

organism – **micro**organism

pure – **im**pure

purity – **im**purity

settling – **non**-settling

soluble – **dis**soluble/ **in**soluble/ **non**soluble / **un**soluble

suitable – **un**suitable

to move – to **re**move

to solve – to **dis**solve

treated – **un**treated

10. Transform as in the models.

Model 1 "Verb → Noun": to pollute water → pollution of water

To treat water, to purify water, to remove undesirable impurities, to neutralize an impurity, to contaminate water resources, to divide into types, to deteriorate water quality, to describe the characteristics of water,→ to protect the health of the community, to provide special treatment, to classify pollutants.

Model 2 "Noun → Noun": quality of water → water quality

Treatment of water, purification of water, contamination of water resources, pollution of a water source, removal or neutralization of impurities, properties of water, water on the surface, water in the ground, features of landscape, life of plants and animals, characteristics of water, requirements for water quality, sampling and analyses of water.

11. Insert the appropriate word or word combination.

1)

disposal sites, dump, fertilizers, harmful wastes, leak, reduces, sewerage systems, wastes, water pollution

There are several kinds of ***environmental pollution***. They include air pollution, _____, soil pollution, and pollution caused by solid wastes, noise, and radiation.

Water pollution _____ the amount of pure, fresh water that is available for such necessities as drinking and cleaning, and for such activities as swimming and fishing. The pollutants that affect water come mainly from ***industries***, ***farms***, and ***sewerage***

systems. Industries _____ huge amounts of wastes into bodies of water each year. These _____ include chemicals, wastes from animal and plant matter, and hundreds of other substances. Some of these wastes may be hazardous. Industries dispose of much hazardous waste in _____ on land. But improperly-managed sites may _____ the wastes into underground water supplies that people use. Wastes from farms include animal wastes, _____ , and pesticides.

_____ carry wastes from homes, offices, and industries into water.

Nearly all cities have waste treatment plants that remove some of the most _____ from sewage. But even most of the treated sewage contains material that harms water.

2)

algal blooms, contaminated, disease-causing, drinking water quality, green algae, lead and mercury, microbe, microbiology, microorganisms, naturally occurring

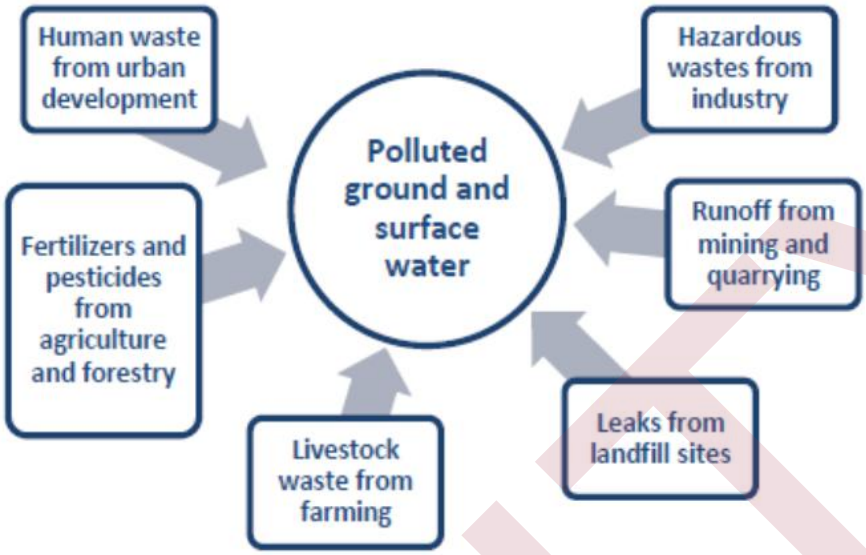
1. A microorganism, or _____, is a microscopic single-cell or multicellular organism (including bacteria, viruses, protozoa, fungi, algae, as well as microscopic plants such as _____).
2. The study of microorganisms is called _____, a subject that began with Anton van Leeuwenhoek's discovery of _____ in 1675, using a microscope of his own design.
3. Some microorganisms and chemical substances that can contaminate water supplies cause human disease. So, there are ***two broad categories of pathogenic (_____) contaminants:***

1. pathogenic microorganisms and

2. toxic substances, including:

- ***Cyanobacteria*** (or ***blue-green algae)*** are very widespread in the environment and cause _____.
- ***Chemicals.*** *Organic contaminants* include pesticides, industrial solvents, and chloroform. *Inorganic contaminants* include arsenic, nitrate, fluoride, and toxic metals such as _____ .

- ***Radioactive contaminants.*** *Strontium-90* and *tritium* are found in water as a result of nuclear weapons testing; *radium, uranium* and *radon gas* are _____ substances found in some groundwater sources.



4. There are also some ***nonpathogenic*** microorganisms in water. The most important microbiological measure of _____ is a group of bacteria called ***coliforms***.
Escherichia coli (E. coli) is a bacterium used as an indicator that water has been _____ with faeces.

12. Translate the words and word combinations in brackets.

Water is called the "universal (*розчинник*)" because of its strong tendency to dissolve other (*речовини*). Since pure water is not found in nature (i.e., outside chemical laboratories), any distinction between clean water and polluted water (*залежить від*) the type and (*концентрація*) of impurities found in the water as well as on its intended use*. Water is said to be polluted when it contains enough (*домішки*) to make it (*непридатний*) for a particular use, such as drinking, swimming, or fishing. Although the (*якість*) of water is affected by natural conditions, the word “pollution” usually implies human activity as the source of (*забруднення*). Water pollution is caused primarily by the drainage of contaminated waters into (*поверхневі води)* or

(*грунтові води*). Water pollution control, therefore, primarily involves the (*видалення*) of impurities before they reach natural *(водойми)* or aquifers.

****intended use*** – використання за призначенням

13. Match the terms and their definitions.

anthropogenic, impurity, insoluble / nonsoluble / unsoluble / unsolvable, pollution, pure, quality, soluble/ dissoluble / solvable, suspended, treatment, water pollutant

a. (chiefly of environmental pollution and pollutants) originating in human activity

b. (of a substance) able to be dissolved, *esp*. in water

c. (of a substance) incapable of being dissolved, *esp*. in water

d. a contaminant (contaminating material or agent) in water; in a broad sense, any physical, chemical, biological or radioactive matter in water

e. a thing or constituent that impairs the purity of something

f. being in suspension; not dissolved

g. free from dirt, pollutants or unpleasant substances; free from any contamination

h. the presence in or introduction into the environment of a substance or thing that has harmful or poisonous effects

i. the standard of something as measured against other things of a similar kind; the degree of excellence of something

j. the use of a chemical, physical, or biological agent to preserve or give particular properties to water

14. Choose the correct word.

1. coagulation / coagulants / to coagulate

_____ is clumping together of very fine particles into larger particles using chemicals (_____) that neutralize the electrical charges of the fine particles and destabilize the particles. During _____, different chemical additives cause particles _____ and thus to settle.

2. **flocculation / flocculants / to flocculate**

_____ is the process in which small particles clump together through gentle stirring.

3. **filtration / filters / to filtrate**

_____ is the process in which particulate matter in water is removed by passage through porous media. _____ through beds of fine sand or through crushed anthracite coal can trap the suspended matter.

4. **disinfection / disinfectants / to disinfect**

_____ is the process designed to kill most microorganisms in water, including essentially all disease-causing bacteria. _____ destroy harmful bacteria and deactivate viruses.

5. **aeration / aerator / air / to aerate**

_____ mixes air with water either by spraying the water into the air or by forcing small _____ bubbles through the water and is used primarily to reduce unpleasant odours and tastes.

6. **softening / softener / to soften**

_____ is the process of removing calcium and magnesium from the water either by chemical precipitation or by ion exchange.

SUMMARIZING

14. Make a summary of the text according to the following plan.

1. The title of the text is "…" .
2. The text is devoted to … .
3. Such problems as… are touched upon in the text.
4. The text consists of … parts.
5. The first part deals with … .
6. The second (third, forth, etc.) part describes … .
7. The main idea of the text is to show … (to underline … / to prove … / to inform the reader about ...).
8. In my opinion, the text is useful / informative / interesting. It is worth reading.

READING PRACTICE

15. Skim over the text. Answer the following questions.

Text B. Conventional Water Treatment.
Pretreatment. Coagulation and Flocculation

The conventional water treatment processes of greatest importance are ***coagulation*** and ***flocculation, sedimentation*** and ***flotation, filtration, disinfection,*** as well as some ***additional treatment methods (softening, aeration, carbon adsorption, distillation, deferrization, desalination, fluoridation, reverse osmosis,*** etc.***)***.

Preliminary treatment (pretreatment) is any physical, chemical or mechanical process used before water undergoes the main treatment process.

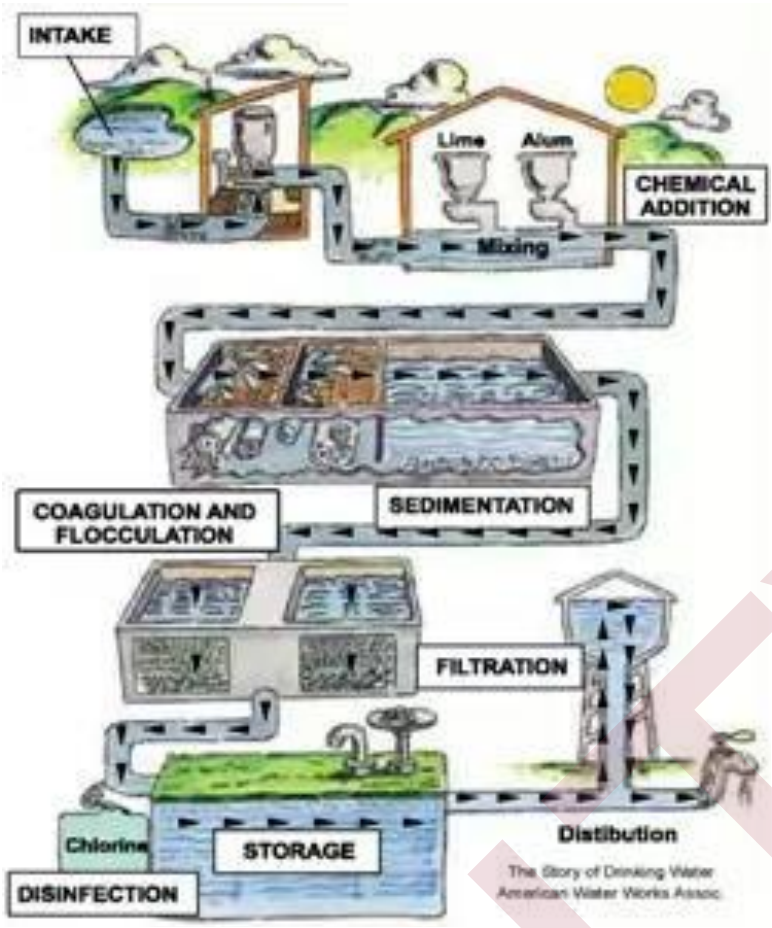
During pretreatment:

- *coarse* and *fine screens* or *microstrainers* may be used to remove rocks, sticks, leaves and other debris (***screening***);
- ***presedimentation*** settles out sand, grit and gravel from raw water.

Sedimentation occurs naturally in reservoirs and is accomplished in treatment plants by *settling basins* (also called *sedimentation basins* or *settling [settlement / sedimentation] tanks)*. Plain sedimentation will not remove extremely fine or colloidal material within a reasonable time, and the process is used principally as a preliminary to other treatment methods;

- adding of ***chemicals*** may be added to control the growth of algae.

Coagulation is a separation or precipitation from a dispersed state of suspensoid particles. Coagulation removes small particles made up of microbes, silt, and other suspended material in the water. By adding chemicals called *coagulants (coagulating agents)* to the water, fine non-settling particles and colloidal material form larger, heavier masses of solids by coagulation. These masses, called *floc*, are large enough to settle in basins and to be caught on the surface of filters.



A precipitate forms and causes a clumping of the bacteria and other foreign particles which then settle out during the several hours of sedimentation. In this way about 85% of the bacteria and suspended particles, as well as some of the mineral elements (such as certain forms of iron) can be removed. The 3 main types of coagulants are inorganic electrolytes (alum, lime, ferric chloride, ferrous sulfate), organic polymers, and synthetic polyelectrolytes.

Their application may have serious disadvantages because of possible negative effect on water consumers' health. Considerable attention is focused on the development of new coagulants and flocculants, preferably from natural and renewable sources, which are safe for human health and biodegradable.

Coagulation is usually accomplished in 2 stages: rapid mixing and slow mixing.

- *Rapid mixing* serves to disperse the coagulants evenly throughout the water and to ensure a complete chemical reaction.
- *Slow mixing* (also called ***flocculation***) is longer gentle agitation for promoting particle collisions and enhancing the growth of flocs. A *flocculant (flocculating*

agent) is a reagent added to a dispersion of solids in water to bring together the fine particles to form flocs. After flocculation the water flows into the sedimentation tanks where sedimentation or flotation is accomplished.

1. What are the most important conventional water treatment processes?
2. What is pretreatment (preliminary treatment)?
3. What is used to remove debris during pretreatment? How is this process called?
4. What is the purpose of presedimentation?
5. Where is sedimentation accomplished in water treatment plants?
6. Why is presedimentation used as a preliminary to other treatment methods?
7. What may be added to control the growth of algae during pretreatment?
8. What is coagulation? What is the purpose of this method?
9. What are coagulants (coagulating agents)? What are the three main types of coagulants?
11. How are heavier masses of solids formed by coagulation called?
10. Why may the application of coagulants and flocculants have serious disadvantages?
11. What are two stages of coagulation? How is slow mixing called?
12. For what purpose is a flocculant (flocculating agent) added?
13. Where are sedimentation and flotation accomplished?

16. Read the following text and speak on every stage of water treatment.

Text C. Conventional Water Treatment.

Sedimentation and Flotation. Filtration

Sedimentation is the process of precipitation of *sediment* (matter that settles to the bottom of a liquid under the force of gravity) which is accomplished in the sedimentation tank. A *settling [sedimentation / precipitation] tank* is a tank in which suspended matter is removed either by quiescent settlement or by continuous flow and extended retention time to allow deposition. Sedimentation is used to remove settleable suspended solids from waters which are high in sediment content after coagulation and flocculation processes. The sedimentation basin is located close to

the flocculation basin so the transit between does not allow settlement or floc break up. Types of sedimentation tanks include:

- rectangular with horizontal flow;
- circular with radial flow;
- hopper-bottomed with upward flow.

The amount of floc settling out of the water depends on the retention time of the water in the basin (minimum 4 hours) and the depth of the basin (there are shallow or deep basins). As particles settle, a layer of *sludge* is formed at the bottom of the tank. Sludge is thick, soft, wet mud or a similar viscous mixture of liquid and solid components which is then removed and treated. The amount of sludge is usually 3-5% of the total volume of water treated. The cost of treating and disposing of sludge is a significant part of the operation cost of a water treatment plant.

An alternative technique to sedimentation is ***flotation***. It is the use of gas bubbles for increasing the buoyancy of suspended solids and rising the particles through the water to float on the surface of the water to be collected by a skimmer. The advantage of flotation over sedimentation is more complete removal of small or light particles in a shorter time. ***Filtration*** is the process of separating particles from a liquid by passing the liquid through a medium (*filter*) that will not pass the particles. Even after coagulation and flocculation, sedimentation does not remove all suspended impurities from the water to make it crystal clear and safe. The remaining non-settling floc still causes turbidity and contains microorganisms. Suspended solids, colloidal material (algae, silt, iron, manganese), bacteria, germs, and other microorganisms are filtered out by passing the water through *a bed (a layer)* of granular material (usually fine sand, gravel, garnet, pulverized coal or related substances), or through a matrix of fibrous material supported on a perforated core*. However, soluble materials such as salts and metals in ionic form are not removed by filtration.

There are several ***classifications of filters***:

- according to *the direction of flow* through the filter bed (downflow, upflow, biflow, radial flow, horizontal flow);

- according to *the type of filter media* used (sand, coal, anthracite, coal-sand, multilayered);
- according to *flow rate* (slow, rapid).

Most modern water treatment plants now use *rapid dual-media filters* following coagulation and sedimentation. A dual-media filter consists of a layer of anthracite coal (for trapping most of the large floc) above a layer of fine sand (for trapping smaller impurities). This process is called *in-depth filtration*. In order to enhance in-depth filtration, *mixed-media filters* (with a third layer of fine-grained, dense mineral called garnet at the bottom of the bed) are used in some treatment plants. Rapid filters have certain advantages over slow filters: they require much less surface area, they are easier to clean and more reliable. *Backwashing [backwash / back-flushing]* is the reverse of the direction of flow through the filter for cleaning the filter bed clogged by particles removed from the water.

The development in filter technology doesn't stand still. Membrane filtration is increasingly becoming popular as an advanced water and wastewater treatment process. There are various possibilities of membrane filtration: microfiltration; ultrafiltration; reverse osmosis; nanofiltration.

After filtration, the water moves into a disinfection chamber.

****a matrix of fibrous material supported on a perforated core*** – решетка (сетка) из волокнистого материала, закрепленная на перфорированном каркасе

17. Read the following text and say what the purposes and characteristics of every stage of water treatment are and what activities each of them includes.

Text D. Conventional Water Treatment.

Disinfection. Additional Treatment

Disinfection is the complex of measures for destroying agents of infection in the water with the help of various disinfectants. It is accomplished both by filtering out harmful microorganisms and by adding disinfectant chemicals for killing any pathogens which pass through the

filters.

There are several methods of treatment of water to kill living organisms, particularly pathogenic bacteria; ***chlorination*** (the application of *chlorine* or chlorine compounds – chloramine and chlorine dioxide) is the most common. Chlorine is a strong oxidant and a toxic gas. Chlorine dioxide has more recently been found effective as a destroyer of bacteria, as well as a means of removing undesirable tastes and odours. Chlorine has limited effectiveness against protozoans that form cysts in the water.

Less frequently used methods include the use of *ozone*, *ultraviolet light*, or *silver ions*. *Boiling* is the favored household emergency measure.

The advantage of ***ozonation*** over chlorination is the production of fewer dangerous by-products and the absence of taste and odour. *Ozone* gas is a colourless toxic gas with powerful oxidizing properties, formed from oxygen by electrical discharges or ultraviolet light. It is an effective method to destroy harmful protozoans that form cysts in the water and to kill almost all other pathogens. Ozone is a very strong, broad spectrum disinfectant widely used in Europe.

UV radiation (light) is very effective against inactivating cysts.

The main disadvantage of ozonation and UV radiation is that they leave no disinfectant residual in the water, and it is sometimes necessary to add a residual disinfectant afterwards.

Some ***additional treatment methods*** include:

1. softening (the process of removing the dissolved calcium and magnesium salts that cause hardness in water, either by adding chemicals or by ion exchange);

2. aeration (the process of spraying water into the air used for taste and odour control and for removal of dissolved iron and manganese);

3. (activated) carbon adsorption (the process of adsorption impurities by activated carbon (saturation carbon with impurities) used for removing dissolved organic substances that cause tastes, odours, or colours);

4. distillation (the separation of dissolved solids from water by evaporation and condensation);

5. deferrization (the removal of iron from water);

6. desalination (desalinization) (any of several processes that remove excess salt and other minerals from water);

7. fluoridation (the addition of sodium fluoride or other fluorine compounds to filtered water for reducing tooth decay);

8. reverse osmosis (a process by which water passes through a porous membrane which passes the water, but does not pass the impurities dissolved in it).

Water treatment plants employ a variety of treatment methods. These processes are used in varying combinations, depending on the characteristics of water and on its intended use.

FOLLOW-UP ACTIVITIES

18. Read the texts of Module 3 again and make notes under the following headings. Then use your notes to talk about *Water Quality, Water Pollution and Water Treatment* and *Conventional Water Treatment*.

1. The interconnection among water quality, water pollution and water treatment.
2. Water composition. Types of water impurities.
3. Conventional water treatment.

Drinking water treatment: through the ages

before 1000 AD TURBIDITY

- **VISUAL CLARITY = WATER PURITY**
- **TREATMENT**: filtration through charcoal, exposing to sunlight, boiling, straining

1600's BIOLOGY

- **INVENTION OF THE MICROSCOPE** leads to the discovery of bacteria in water
- **TREATMENT**: percolation, filtration, boiling, distillation, coagulation

1700's MINERALS

- **ENLIGHTENMENT PERIOD PHILOSOPHY**: right to pure, clean water = right of humanity
- **TREATMENT**: filtration established an effective means of purification

1800's CHEMICALS

- **PHILOSOPHY BECOMES REALITY** with first municipal water plant in Scotland
- Dr. Snow proves **WATERBORNE DISEASES** in cholera outbreak
- **TREATMENT**: slow and fast sand filtration, the beginning of chlorination

1900's INDUSTRIAL POLLUTION

- **GOVERNMENT REGULATION** of clean water becomes standard
- Man-made **WATER POLLUTION** becomes concern - pesticides, industrial sludge, organic chemicals
- **TREATMENT**: chlorination becomes widespread

2000's WATERHEALTH purifies any local water source to WHO drinking water standards

- **ALWAYS PURE DRINKING WATER** for healthy communities
- **TREATMENT**: filtration, ultraviolet

Sewage (Wastewater) Treatment and Sludge Disposal

"Between earth and earth's atmosphere, the amount of water remains constant;
there is never a drop more, never a drop less.
This is a story of circular infinity, of a planet birthing itself."
LINDA HOGAN

Vocabulary Work

1. Read the following international words and guess their meaning. Mind the stressed syllables. Prove that these words are international ones.

Model: problem *['prɔbləm]* – **проблема**, задача, питання

agent *['eɪʤ(ə)nt]*
apartment *[ə'pa:tmənt]*
basin *['beɪsn]*
channel *['ʧæn(ə)l]*
cosmetics *[kɔz'metɪks]*
detergent *[dɪ'tɜ:ʤ(ə)nt]*
establishment *[ɪs'tæblɪʃmənt]*
fraction *['frækʃ(ə)n]*
fragment *['frægmənt]*
institution *[ˌɪnstɪ'tju:ʃ(ə)n]*
laboratory *[lə'bɔrət(ə)rɪ]*
machine *[mə'ʃi:n]*
manufacturing *[ˌmænjə'fækʧ(ə)rɪŋ]*
material *[mə'tɪərɪəl]*
microbe *['maɪkrəub]*
nutrient *['nju:trɪənt]*
parasitic *[ˌpærə'sɪtɪk]*
parking *['pa:kɪŋ]*
pathogen *['pæθəʤən]*
pharmaceuticals *[ˌfa:mə'sju:tɪk(ə)lz]*
recycle *[ˌri:'saɪk(ə)l]*
residence *['rezɪd(ə)ns]*
risk *[rɪsk]*
sanitary *['sænɪt(ə)rɪ]*
sedimentation *[ˌsedɪmen'teɪʃ(ə)n]*
separator *['sep(ə)reɪtə]*
service *['sɜ:vɪs]*
specific *[spə'sɪfɪk]*
storm *[stɔ:m]*
technical *['teknɪk(ə)l]*
toilet *['tɔɪlət]*

2. Translate the following words and phrases and memorize them.

NOUNS AND NOUN PHRASES

black water [blackwater]	effluent [effluent]	sewage [wastewater]
discharge	impurity	treatment plant
disposal	industrial sewage	sewer
domestic [sanitary / residential / household] sewage	remainder	storm sewage
	runoff	sullage
grey water [graywater / gray water]	sewage	waste
	sewage [wastewater] treatment	wastewater [waste water]

VERBS AND VERBAL PHRASES

to contain	to dispose of	to recycle
to convey	to flush	to release
to cope with	to handle with	to remove
to create	to maintain	to require
to discharge	to pick up	to water

ADJECTIVES AND PARTICIPLES

coarse	identifiable	sanitary
domestic	putrescible	untreated
household	raw	used

3. Match the English and Russian equivalents.

1. animal waste
2. black water [blackwater]
3. commercial establishment
4. dissolved and suspended impurities
5. domestic [sanitary, residential, household]

a. сіра вода *(побутові стічні води, що не містять змивів від туалетів)*
b. вихровий сепаратор [водовіддільник]
c. водоочисна станція, станцыя очищення стычних вод
d. комунально-побутові стічні води
e. зливові води, стічні води зливової каналізації, атмосферні стічні води

sewage	f. неочищені [необроблені] стічні води
6. grey water [graywater / gray water / sullage]	g. відходи тваринництва
	h. той що схильний до гниття [розкладання речовини]
7. human waste	i. продукти життєдіяльності людини
8. industrial sewage [effluent]	j. виробничі [технічні] відходи
9. process waste	k. промислові [виробничі] стічні води
10. putrescible materials	l. розчинені та завислі домішки
11. raw sewage	m. торгівельне підприємство
12. storm sewage [water]	n. чорна вода *(стічні води побутового та промислового походження, що включають змиви від туалетів, харчові виробничі відходи та інше)*
13. vortex separator	
14. wastewater treatment plant	

READING PRACTICE

4. Read the text. Using a dictionary, translate it in writing.

Text A. Sewage. Types of Sewage

Sewage is waste water that is created by residences, institutions, industrial enterprises and commercial establishments, and is conveyed and disposed of via sewers.

Wastewater is used water. Untreated wastewater in the underground pipes is badly contaminated and it can damage the environment and cause serious illnesses in humans. It needs to be made safe before sending it back into the environment. Wastewater is commonly treated at the sewage treatment plant (STP). Sewage treatment is essential to maintain clean aquatic environment, as well as people's health and quality of life.

There are three types of sewage (wastewater): ***domestic sewage, industrial sewage***, and ***storm sewage***.

Domestic sewage carries used water from houses and apartments; it is also called ***sanitary sewage, residential sewage*** or ***household wastewater***. Domestic sewage is slightly more than 99.9% pure water by weight. The rest, less than 0.1%, contains a wide variety of dissolved and suspended impurities. Although amounting to a very small fraction of the sewage by weight, the nature of these impurities and the large volumes of sewage in which they are carried make disposal of domestic wastewater a significant technical problem. The principal impurities are putrescible organic materials and plant nutrients, but domestic sewage is also very likely to contain pathogens (disease-causing microbes, bacteria, viruses) and parasitic worms. In addition to human wastes, raw sewage contains such substances as metals, dissolved gases, dirt particles, food fragments, oil and grease, soaps, detergents, bleaches, other cleaning agents, solvents, paint, pharmaceuticals, and cosmetics.

Sanitary sewage can be divided into two types: ***grey water*** (***sullage***, or wastewater from kitchen and bathroom sinks, baths, showers, washing machines, dishwashers, and laundry) and ***black water*** (wastewater from toilets). Black water is a health risk if not treated properly because it contains human waste. Grey water is a lesser health risk. The separation of household waste into grey water and black water is becoming more common in the developed world (grey water is used for watering plants or recycled for flushing toilets).

Industrial sewage, also called ***industrial effluent***, is used water from manufacturing or chemical processes. Industrial wastewater usually contains specific and readily identifiable chemical compounds, depending on the nature of the industrial process. Process wastes from industries can include, for example, silver from photofinishing laboratories, solvents from dry-cleaning services, and inks and dyes from printing houses.

Storm sewage, or ***storm water***, is runoff from precipitation that collects in a system of pipes or open channels. As rainfall runs over rooftops, roads, parking lots and the surface of the ground, it may pick up various contaminants including suspended and dissolved solids, soil particles and other sediment, heavy metals, organic materials and compounds, animal waste, and oil and grease. Some level of treatment is required before storm water is discharged directly into waterways. Examples of treatment processes include sedimentation basins, wetlands, or vortex separators for removing coarse solids.

COMPREHENSION CHECK

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

1. There are three types of sewage: domestic sewage, sanitary sewage, and industrial sewage.
2. Wastewater is treated in the underground pipes.
3. Household wastewater is more than 99.9% dissolved and suspended impurities by weight.
4. Pathogens are disease-causing microbes, bacteria, viruses and parasitic worms.
5. Grey water is wastewater from kitchen and bathroom sinks, baths, showers, washing machines, dishwashers and laundry which can be recycled for flushing toilets.
6. Industrial effluent contains specific biological compounds, depending on the nature of the industrial process.
7. Such contaminants as oil and grease can be found in both domestic and storm sewage.

6. Answer the following questions.

1. What is wastewater?
2. Why does sewage need to be made safe before sending it back into the environment?

3. Where is sewage usually treated?
4. What is the main purpose of sewage treatment?
5. What types of sewage are there? What are the sources of these types of sewage?
6. What substances and impurities does domestic sewage contain?
7. What is the classification of sanitary sewage?
8. What does the nature of chemical compounds in industrial effluent depend on?
9. Why is some level of storm sewage treatment required before storm water is discharged into waterways?

7. Choose the right variant according to the text.

1. **Wastewater is created … .** ***(several answers possible)***
   A. by residences
   B. by industrial enterprises
   C. by commercial establishments
   D. by pathogens (disease-causing microbes, bacteria and viruses)
2. **Household wastewater is also called … .**
   A. residential or domestic wastewater
   B. storm sewage
   C. industrial effluent
   D. sullage
3. **Grey water is … than black water.**
   A. more dangerous
   B. cleaner
   C. lesser
   D. a more health risk
4. **Grey water is used for watering plants or … for flushing toilets.**
   A. recirculates
   B. reused
   C. discharged

D. disposed of

5. **Storm water is runoff from … .**

A. photofinishing laboratories, dry-cleaning services and printing houses

B. kitchen and bathroom sinks, baths, showers, washing machines, dishwashers, and laundry

C. toilets

D. precipitation

6. **Sanitary sewage may contain … . (several answers possible)**

A. putrescible organic materials and plant nutrients

B. pathogens (disease-causing microbes, bacteria and viruses) and parasitic worms C. human wastes

D. metals, dissolved gases, dirt particles, food fragments, oil and grease, cleaning agents, solvents, paint, pharmaceuticals, and cosmetics

LANGUAGE FOCUS

7. **Translate the following pairs of derivatives and memorize them.**

Verb – Noun

to dispose – disposal
to environ – environment
to establish – establishment
to flush – flushing
to maintain – maintenance
to manufacture – manufacturing
to precipitate – precipitation
to recycle – recycling
to separate – separator / separation
to serve – service
to sew – sewer / sewage / sewerage
to solve – solvent / solution
to vary – variety
to weigh – weight

Noun – Adjective

commerce – commercial
industry – industrial
organ – (in)organic
parasite – parasitic
pathogen – pathogenic
residence – residential
sanitation – sanitary
significance – significant

Noun – Verb

cause – to cause
clean – to clean
compound – to compound
flush – to flush
need – to need
process – to process

Verb – Adjective

to identify – identifiable
to process – process
to vary – various

Adjective – Noun

ill – illness
pure – (im)purity

Adjective – Adverb

bad – badly
direct – directly
proper – properly
slight – slightly

Verb – Participle II

to call – called
to develop – developed
to dissolve – dissolved
to suspend – suspended
to treat – (un)treated
to use – used

Compound Nouns/ Adjectives

bathroom
dishwasher
dry-cleaning
household
percent
photofinishing
rainfall
rooftop
runoff
wastewater
waterway
wetland

9. Translate the following pairs of derivatives paying attention to the meanings of prefixes.

(to) cycle – (to) **re**cycle
common – **un**common
developed – **un**developed
ground – **un**derground
human – **in**human
pure – **im**pure
purification – **self-**purification
purity – **im**purity
safe – **un**safe
surface – **sub**surface

likely – **un**likely

metal – **non**metal

organic – **in**organic

to move – to **re**move

to solve – to **dis**solve

treated – **un**treated

10.Transform as in the models.

Model 1 "Verb → Noun": To treat wastewater → treatment of wastewater

To dispose of sludge, to contaminate waterways, to damage the environment, to maintain clean aquatic environment, to divide into types, to separate and drain waste, to water plants, to recycle grey water, to identify chemical compounds, to discharge into waterways, to remove solids.

Model 2 "Noun → Noun": treatment of wastewater → wastewater treatment

Particles of soil and dirt, sinks in kitchens and bathrooms, fragments of food, watering of plants, a system of pipes, processes of treatment, lots for parking, the surface of the ground, a basin for sedimentation, disposal of wastewater, disposal of sludge, discharge of water, recycling of grey water.

11. Insert the appropriate word or word combination.

1)

effluent, large, origin, rain, remainder, reuse, secondary, suspended solids, wash off, wastewater

1. All the water we use inside our houses and workplaces becomes ___ in the wastewater, or sewer pipes.
2. Wastewater from houses is 99.9% water, and the ___ (0.1%) is impurities, organic and inorganic in ___ .
3. Many ___ industries have wastewater management systems to collect, treat, and ___ (where feasible) their own process waters*, while using public sewers** to discharge the human component of their wastewater.

4. Although some people assume that the ___ that runs down the street isn't quite clean. Harmful substances that ___ roads, parking lots, and rooftops can harm waterways.
5. The major aim of wastewater treatment is to remove as much of the ___ as possible before the remaining water, called ___ , is discharged back into the environment. Primary treatment removes 50- 60% of suspended solids. ___ treatment removes more than 90% of suspended solids.

***process water** – виробнича, технічна вода, відпрацьована вода

****public sewers** – колектори міської каналізації

2)

composition, depending on, drain water, eutrophication, foundations, grey water, industrial process, microorganisms, mixture, pollutants, process water, surfaces

Wastewater is a ___ of toilet water, grey water, industrial wastewater, drainage water, and, in a combined sewerage system*, also storm water. The composition of wastewater is a mixture of ___ coming from the different sources.

Principal pollutants in wastewater include organic material, ___ (bacteria, viruses, protozoa, microscopic fungi and algae), suspended solids, plant nutrients, pollutants from agriculture, and ___ .

Domestic wastewater contains ___ from washing dishes, washing and bathing and toilet water urine and faeces.

The content of ***industrial wastewater*** can vary greatly and depends on the type of ___ used. Source control and demand of treatment of ___ have gradually decreased the pollutants originating from industrial wastewater.

Wastewater from restaurants and offices has a ___ similar to domestic wastewater.

Drainage water is water from house ___ and groundwater leaking into the sewer pipes. The water originates from rainwater that has infiltrated in the soil. The content of ___ is the same as that of groundwater.

Storm water is runoff of rainfall that collects in a system of pipes or open channels. Pollutants in storm water originate from ___ such as streets and roofs that are washed with the rainwater. Pollutant content varies ___ the type of surface that the runoff comes from.

*a combined sewerage system – загальнозплавна [комбінована] каналізаційна система

12. Translate the words and word combinations in brackets.

Domestic (стічні води) goes to a sewage treatment plant, where it is purified and recycled; much industrial wastewater, however, is funneled* into a (річка), (струмок), or (океан) for subsequent recycling** by nature. Though nature can handle small quantities of certain wastes, (тимчасовий) or (довготривалий / постійний) damage has resulted from widespread disposal of this type. In some cases, legislation has prohibited the (скидання) of harmful (відходи), while in others (попередня очистка) has been required.

to funnel - просачиваться, выходить наружу

****recycling*** - переработка отходов

13. Match the terms and their definitions.

discharge, disposal, putrescible, sanitary, sewage sludge, sludge, sullage, waste, wastewater / sewage

a. liable to decay; subject to putrefaction or decomposition
b. material or substance that is not wanted; the unusable remains or byproducts of something
c. of or relating to the conditions that affect hygiene and health, esp. the supply of clean drinking water; hygienic and clean
d. semiliquid waste obtained from the processing of municipal sewage, often used as a fertilizer
e. the action or process of throwing away or getting rid of something

f. thick, soft, wet mud or a similar viscous mixture of liquid and solid components, esp. the product of an industrial or refining process
g. to allow a liquid, gas, or other substance to flow out from where it has been confined; the action of allowing a liquid, gas, or other substance to flow out from where it is confined
h. waste from household sinks, showers, and baths, but not toilets
i. waste water and excrement conveyed in sewers

SUMMARIZING

14. Make a summary of the text according to the following plan.

1. The title of the text is "…" .
2. The text is devoted to … .
3. Such problems as… are touched upon in the text.
4. The text consists of … parts.
5. The first part deals with … .
6. The second (third, forth, etc.) part describes … .
7. The main idea of the text is to show … (to underline … / to prove … / to inform the reader about ...).
8. In my opinion, the text is useful / informative / interesting. It is worth reading.

READING PRACTICE

15. Skim over the text. Answer the following questions.

Text B. Sewage Treatment Process

Sewage (wastewater) treatment is the process of removing contaminants from wastewater, both industrial and domestic. It includes physical, chemical, and biological processes to remove physical, chemical, and biological contaminants. Its objective is to produce environmentally safe sewage water ***(treated effluent***) and a solid waste (sludge or biosolids) suitable for discharge or reuse back into the environment. Reuse is often for agricultural purposes, but more recently, sludge is being used as a fuel source.

It used to be said that "the solution to pollution is dilution". Nature has an amazing ability to cope with small amounts of water wastes and pollution discharged into a body of water. A natural process of stream self-purification occurs. Densely populated communities generate such large quantities of sewage, however, that dilution alone does not prevent pollution. This makes it necessary to treat wastewater to some degree before disposal. Sewage treatment plants (STPs) reduce pollutants in sewage to a level which nature can handle. The sewage treatment plant plays vital role in the process of removing the contaminants from sewage to produce liquid and solid (sludge) suitable for discharge to the environment or for reuse.

Sewage can be treated close to where it is created (in septic tanks, biofilters, aerobic wastewater treatment systems), or collected and transported via a network of pipes and pump stations to a municipal wastewater treatment plant. Industrial wastewater often requires specialized treatment processes.

Stages of conventional sewage treatment at the wastewater treatment plant involve:

1. pretreatment (preliminary treatment);

2. primary treatment;

3. secondary treatment;

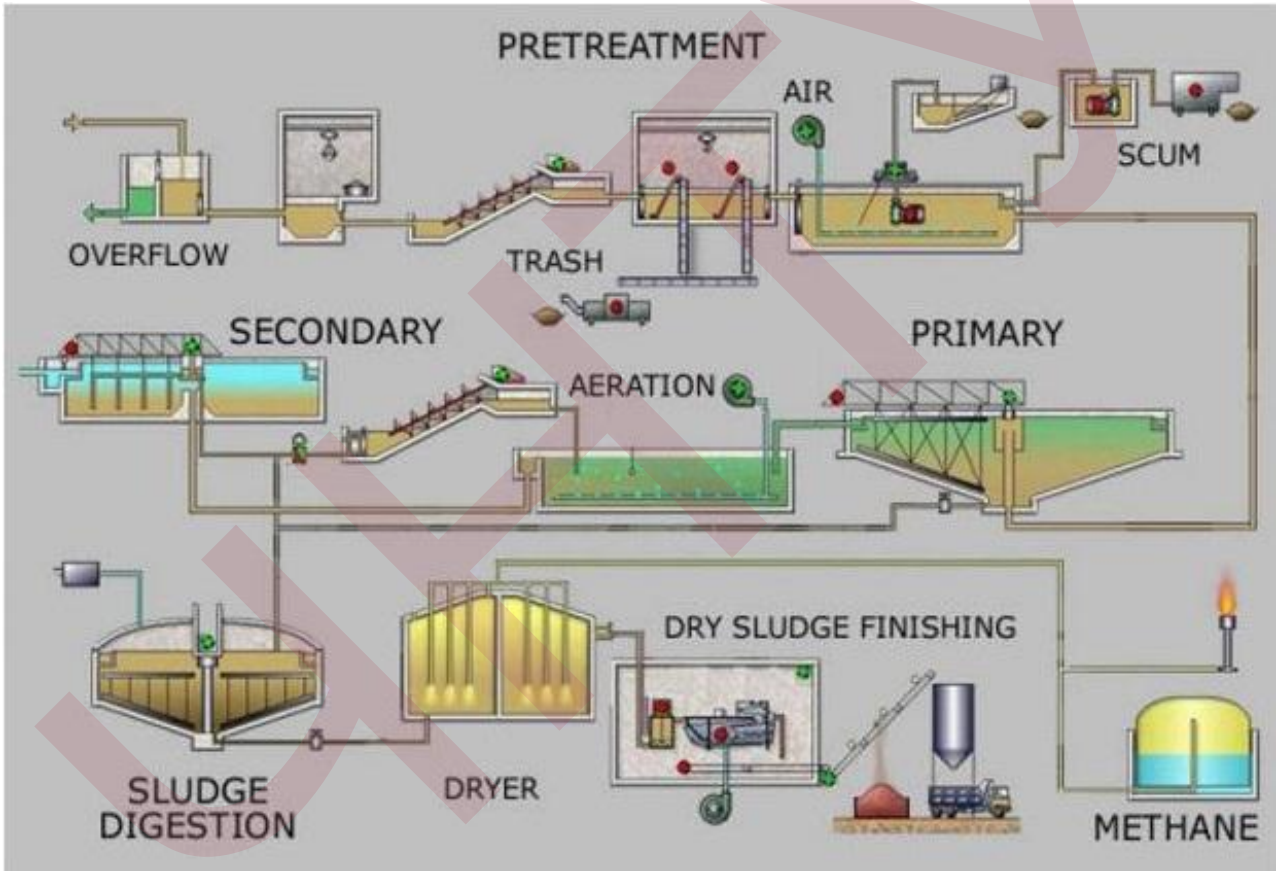
4. tertiary treatment.

Here is step-by-step guide describing what happens at each stage of the treatment process.

Preliminary treatment removes materials that can be easily collected from the raw wastewater before they damage or clog the pumps and skimmers of primary treatment clarifiers. Pretreatment includes: screening, grinding, sand and grit removal, dissolved air flotation, wastewater flocculation, prechlorination or preaeration, equalization.

Screening (straining) is the removal of all large objects (wood, stones, dead animals) in the influent sewage water using a screen (a trash rake, a mechanically cleaned bar screen, a manually cleaned screen in smaller or less modern plants); the materials are then sent to a landfill. Sand and grit settlement is accomplished in ***a***

sand trap or ***a grit chamber*** where the velocity of the incoming wastewater is carefully controlled to allow the materials to settle. Screens, grinders, and sand and grit traps are provided for the protection of other equipment in the STP. ***Dissolved air flotation*** and ***wastewater flocculation*** aid in the removal of suspended solids and oil in the primary clarifier and reduce the biological loading on secondary treatment processes. ***Prechlorination*** or ***preaeration*** may be required to prevent odour problems and to eliminate septic conditions where wastewater has abnormally long runs to the plant. ***Equalization*** structures are used to regulate diurnal flow variations and to equalize flows to treatment facilities.



Process flow* diagram for a typical large-scale wastewater treatment plant

****process flow*** – технологічний маршрут; послідовність технологічних операцій

1. What is sewage (wastewater) treatment?
2. What is the purpose of sewage treatment?
3. What amazing ability does nature have?

4. Why doesn't dilution alone prevent pollution in densely populated communities?
5. Industrial wastewater requires specialized treatment processes, doesn't it?
6. What do stages of conventional sewage treatment involve?
7. What kinds of materials does pretreatment remove?
8. What methods does preliminary treatment include?
9. How are all large objects removed during screening (straining)?
10. Where is sand and grit settling accomplished?
11. Is prechlorination used to eliminate septic conditions, to remove suspended solids and oil, or to equalize diurnal flow variations?

16. Read the following text and speak on every stage of sewage (wastewater) treatment.

Text C. Sewage Treatment Process (continuation)

Primary treatment consists in temporarily holding the sewage in a quiescent basin called "primary clarifier" or "primary sedimentation/ settling tank". The main purpose of primary treatment is the physical separation of solids and grease from the wastewater (heavy solids settle to the bottom while oil, grease and lighter solids float to the surface to be skimmed off). The settled and floating materials (sludge) are removed, separately treated or processed, and a homogeneous liquid is subjected to secondary (biological) treatment. As a result of primary treatment, 30- 40% of Biological Oxygen Demand (BOD) and 50% of Total Suspended Solids are removed. Primary clarifiers are equipped with mechanically driven scrapers that continually drive the collected sludge towards a hopper in the base of the tank from where it can be pumped to further sludge treatment stages.

Secondary treatment is designed to degrade the biological content of the sewage (dissolved and suspended biological matter derived from human waste, food waste, soaps and detergent) using aerobic biological processes. The purpose of biological treatment is BOD reduction. The principle of the process is that simple

bacteria (cells) eat the organic matter which is transformed into cellular mass (floc) through their metabolism. The floc is precipitated at the bottom of a settling tank or retained as slime on solid surfaces. There are two broad types of biological treatment:

1. the treatment that includes mechanical means to create contact between wastewater, cells and oxygen:

- ***activated sludge*** (aerated sewage containing aerobic microorganisms that help to break it down); such aerobic biological wastewater treatment is accomplished in activated sludge tanks;
- ***trickling filters*** and ***rotating biological contactors*** where the biomass (biological films of bacteria, protozoa and fungi) grows on the media's surface and eats or otherwise reduces the organic content.

2. the treatment without mechanical means:

- the sewage is made to flow by gravity through specially constructed lagoons or wetlands where vegetation acts as a biological filter to the water.

Tertiary treatment provides a final treatment stage to remove diseasecausing organisms and to increase the effluent quality (of 10 parts per million BOD and 10 parts per million Total Suspended Solids) before it is discharged back into the environment. Tertiary treatment processes can be physical, biological, or chemical including:

- ***sand filtration*** (to remove residual suspended matter) or activated carbon filtration (to remove residual toxins);
- ***lagooning*** (to provide further biological improvement through storage in large artificial ponds or lagoons);
- ***nitrogen and phosphorus removal***;
- ***disinfection*** (to reduce the number of microorganisms) using chlorine, ozone O3, or ultraviolet (UV) light;
- ***odour removal***.

More than one tertiary treatment process may be used at any treatment plant.

17. Read the following text and say what the purposes of sludge treatment and disposal are.

Text D. Sludge Treatment and Disposal

Sludge is the residue that accumulates in the STP. It is solid matter that has settled out of suspension in sewage undergoing sedimentation in tanks or basins. Since a considerable quantity of sludge is produced during the sewage treatment process, treatment and disposal of sewage sludge are major factors in the design and operation of all water pollution control plants. Two basic goals of sludge treatment before final disposal are:

- the reduction of sludge volume, which, in turn, reduces the costs of pumping and storage;
- the stabilization of the organic materials (stabilized sludge does not have an offensive odour and can be handled without causing a nuisance or health hazard).

Treatment methods of sewage sludge may include a combination of the following processes:

- thickening,
- digestion,
- dewatering,
- disposal.

Thickening is usually the first step in sludge treatment, because it is impractical to handle thin sludge, slurry of solids suspended in water. Thickening is usually accomplished in a tank called a gravity thickener. An alternative to gravity thickening is dissolved-air flotation.

Digestion is a biological process in which organic solids are decomposed into stable substances. Digestion reduces the total mass of solids, destroys pathogens, and makes it easier to dewater or dry the sludge. Most large STPs use a digestion system in which organics are metabolized by bacteria anaerobically (in the absence of oxygen), and in some STPs sludge digestion takes place aerobically (in the presence of oxygen). Both aerobic and anaerobic digestion converts about half of the organic sludge solids to liquids and gases.

Dewatering is dehydration, or water removal. Digested sewage sludge is usually dewatered before disposal. Dewatered sludge still contains a significant amount of water (about 70%), but even at that moisture content, sludge no longer behaves as a liquid and can be handled as a solid material. Sludge drying beds provide the simplest method of dewatering. Drying is a combination of evaporation and gravity drainage through the sand. After about six weeks of drying, the sludge cake may have a solids content of about 40%. Alternatives to sludge drying beds include the rotary-drum vacuum filter and the centrifuge.

Disposal. The final destination of treated sewage sludge usually is the land. Dewatered sludge can be:

- buried underground in a sanitary landfill;
- spread on agricultural land as a soil conditioner and fertilizer;
- incinerated if a suitable site for land disposal is not available, as in urban areas (in the case of incineration, air pollution control is a very important factor);
- dumped in the ocean (once an economical disposal method for many coastal communities, it is no longer considered a viable option);
- reutilized as an energy resource in many advanced countries.

FOLLOW-UP ACTIVITIES

18. Read the texts of Module 4 again and make notes under the following headings. Then use your notes to talk about Types of Sewage and Sewage Treatment.

1. Sewage. Types of sewage.
2. Wastewater composition.
3. Sewage treatment.
4. Sludge disposal.

Рекомендована література

1. Зозон, Н. А. Учебно-методическое пособие для студентов заочной формы обучения специальности «Водоснабжение, водоотведение и охрана водных ресурсов» / Н. А. Зозон, А. Н.Пучко. — Минск : БНТУ, 2014. - 110 с.

2. Кравченко, В. С. Водопостачання та каналізація : підруч. для вищ. навч. закл. / В. С. Кравченко. - Київ : Кондор, 2007. - 286 с.

3. Орлов, В. О. Технологія підготовки питної води : навч. посіб. / В. О. Орлов, А. М. Орлова, В. О. Зощук. – Рівне : НУВГП, 2010. - 176 с.

4. Cox, W.G. Artesian wells as a means of water supply / W.G. Cox. – Sapsford and Co., Adelaide Street, Brisbane, 1985. – 194 p.

5. Goncharuk, V.V. Drinking Water: Physics, Chemistry and Biology. – Springer, 2014. - 446 p.

6. Glendinning Eric H. Oxford English for Carrers.Technology 1: Student's Book / Eric H. Glendinning. – Oxford University Press, 2002. – 137 p.

7. Glendinning Eric H. Oxford English for Carrers.Technology 2: Student's Book / Eric H. Glendinning. – Oxford University Press, 2009. – 224 p.

8. Kurita Handbook of Water Treatment. 2nd Ehglish edition. Tokyo: Kurita Water Industries Ltd., 1999. - 499 p.

9. Lehr J. Water encyclopedia. Domestic, municipal and industrial water supply and waste disposal / J. Lehr, J. Keelye. – A John Wiley and Sons, Inc., Publication, 2005. – 966 p.

10. Mays Larry W. Ancient Water Technologies / W. Larry Mays. – Springer, 2010. – 287 p.

11. Shammas, N.K. Water Engineering: Hydraulics, Distribution and Treatment / N. K. Shammas, L. K. Wang. – John Wiley and Sons, Inc., Publication, 2016. – 807 p.

12. Yatel, G. «Senior English for Technical Students» / G. Yatel, B. Knyazevsky, F. Kuzyk. — Вища школа, Київ, 1995. – 252 p.