

**Міністерство освіти і науки України
НАЦІОНАЛЬНИЙ УНІВЕРСИТЕТ
«ОДЕСЬКА ПОЛІТЕХНІКА»
Кафедра іноземних мов**

**МЕТОДИЧНІ ВКАЗІВКИ ДО ПРАКТИЧНИХ ЗАНЯТЬ
З АНГЛІЙСЬКОЇ МОВИ
для здобувачів першого (бакалаврського) рівня
за спеціальністю
Е2 «Екологія»**

Одеса
Одеська політехніка

2026

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Затверджено
на засіданні кафедри
іноземних мов
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Одеса
Одеська політехніка
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Методичні вказівки до практичних занять з англійської мови за спеціальністю
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ПЕРЕДМОВА

Метою “Методичних вказівок” є формування впродовж 90 годин занять у студентів (вихідний рівень володіння мовою – B1) вмінь та навичок читання за тематикою спеціальності E2 «Екологія» на I курсі навчання ІМІ (вихідний рівень володіння мовою – B2). За рахунок тренування і виконання читання текстів і комунікативних завдань студенти зможуть досягти практичного володіння англійською мовою за фахом.

Практичне володіння іноземною мовою в рамках даного курсу припускає наявність таких умінь, які дають можливість:

- вільно читати оригінальну літературу іноземною мовою у відповідній галузі знань;
- оформляти витягнуту з іноземних джерел інформацію у вигляді перекладу або резюме;
- робити повідомлення і доповіді іноземною мовою на теми, пов'язані з науковою роботою майбутнього фахівця;
- вести бесіду за фахом.

Кожний урок складається з тексту й комплексу мовних вправ, які розраховані на удосконалення навичок активізації словарного і граматичного мінімуму професійного спрямування.

“Методичні вказівки” забезпечують підготовку до міжнародного усного спілкування англійською мовою для спеціальних цілей, а саме - оволодіння лексичними, граматичними і стилістичними навичками, а також умінням читати, перекладати, згортати і розгортати усну англомовну інформацію наукового функціонального стилю, що передбачено вимогами Програми вивчення іноземних мов у нефілологічному ВНЗ.

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Lesson 1

ECOLOGY

Мета заняття: здатність працювати з різними джерелами, розшукувати, обробляти, аналізувати і синтезувати отриману інформацію.

The word ecology was coined in 1870 by the German zoologist Ernst Haeckel from the Greek words oikos (house) and logos (logic or knowledge) to describe the scientific study of the relationships among organisms and their environment. Biologists began referring to themselves as ecologists at the end of the nineteenth century and shortly thereafter the first ecological societies and journals appeared. The contextual, historical understanding of organisms as well as the systems basis of ecology set it apart from the reductionist, experimental approach prevalent in many other areas of science.

This broad ecological view is gaining significance today as modern resource-intensive lifestyles consume much of nature's supplies. Although intuitive ecology has always been a part of some cultures, current environmental crises make a systematic, scientific understanding of ecological principles especially important.

For many ecologists the basic structural units of ecological organization are species and populations. A biological species consists of all the organisms potentially able to interbreed under natural conditions and to produce fertile offspring. A population consists of all the members of a single species occupying a common geographical area at the same time. An ecological community is composed of a number of populations that live and interact in a specific region.

This population-community view of ecology is grounded in natural history—the study of where and how organisms live—and the Darwinian theory of natural selection and evolution. Proponents of this approach generally view ecological systems primarily as networks of interacting organisms. Abiotic forces such as weather, soils, and topography are often regarded as external factors that influence but are apart from the central living core of the system.

In the past three decades the emphasis on species, populations, and communities in ecology has been replaced by a more quantitative, thermodynamic analysis of the processes through which energy flows and the cycling of nutrients and toxins are carried out in ecosystems. This process-functional approach is concerned more with the ecosystem as a whole than the particular species or populations that make it up. In this perspective, both the living organisms and the abiotic physical components of the environment are equal members of the system.

The feeding relationships among different species in a community are a key to understanding ecosystem function. Who eats whom, where, how, and when determine how energy and materials move through the system. They also influence natural selection, evolution, and species adaptation to a particular set of environmental conditions. Ecosystems are open systems, insofar as energy and materials flow through them. Nutrients, however, are often recycled extremely efficiently so that the annual losses to sediments or through surface water runoff are relatively small in many mature ecosystems. In undisturbed tropical rain forests, for instance, nearly 100% of leaves and detritus are decomposed and recycled within a few days after they fall to the forest floor.

Because of thermodynamic losses every time energy is exchanged between organisms or converted from one form to another, an external energy source is an indispensable component of every ecological system. Green plants capture solar energy through photosynthesis and convert it into energy-rich organic compounds that are the basis for all other life in the community.

Exercise 1. Read and memorize using a dictionary:

relationships, environment, structural unit, species, populations, an ecological community, abiotic forces, nutrients, cycling, toxins, natural selection, adaptation, sediments, surface water runoff, rain forests, detritus, an external energy source, green plants, solar energy, energy-rich organic compounds

Exercise 2. Answer the questions:

- 1) What is ecology?
- 2) What are the basic structural units of ecological organization?
- 3) What does an ecological community consist of?
- 4) In what way do green plants convert solar energy into organic compounds?

Exercise 3. Match the left part with the right:

1. A biological species consists of	a) all the members of a single species occupying a common geographical area at the same time.
2. A population consists of	b) are a key to understanding ecosystem function.
3. The living organisms and the abiotic physical components of the environment	c) all the organisms potentially able to interbreed under natural conditions and to produce fertile offspring.
4. The feeding relationships among different species	d) are equal members of the system.

Exercise 4. Complete the sentences with the suggested words:

under; a number of; at; consists of; single.

A biological species _____ all the organisms potentially able to interbreed _____ natural conditions and to produce fertile offspring. A population consists of all the members of a _____ species occupying a common geographical area _____ the same time. An ecological community is composed of _____ populations that live and interact in a specific region.

Exercise 5. Compose a story on one of the topics (up to 100 words):

“Background of ecology”

“Population-community view of ecology”

“Process-functional approach in ecology”

Lesson 2 BIOSPHERE

Мета заняття: здатність працювати з різними джерелами.

Ecology can be studied at several levels: population level (individuals of the same species in the same or similar environment), biocenosis level (or community of species), ecosystem level, and biosphere level.

The outer layer of the planet Earth can be divided into several compartments: the hydrosphere (or sphere of water), the lithosphere (or sphere of soils and rocks), and the atmosphere (or sphere of air). The biosphere (or sphere of life) is all living matter on the planet or that portion of the planet occupied by life. It reaches well into the other three spheres, although there are no permanent inhabitants of the atmosphere. Relative to the volume of the Earth, the biosphere is only the very thin surface layer which extends from 11,000 meters below sea level to 15,000 meters above.

It is thought that life first developed in the hydrosphere, at shallow depths, in the photic zone. (Recently, though, a competing theory has emerged, that life originated around hydrothermal vents in the deeper ocean.) Multicellular organisms then appeared and colonized benthic zones. Photosynthetic organisms gradually produced the chemically unstable oxygen-rich atmosphere that characterizes our planet. Terrestrial life developed later, after the ozone layer protecting living beings from UV (ultra-violet) rays formed. Diversification of terrestrial species is thought to be increased by the continents drifting apart, or alternately, colliding. Biodiversity is expressed at the ecological level (ecosystem), population level (intraspecific diversity), species level (specific diversity), and genetic level. Recently technology has allowed the discovery of the deep ocean vent communities. This remarkable ecological system is not dependent on sunlight but bacteria, utilizing the chemistry of the hot volcanic vents, are at the base of its food chain.

The biosphere contains great quantities of elements such as carbon, nitrogen, hydrogen and oxygen. Other elements, such as phosphorus, calcium, and potassium, are also essential to life, yet are present in smaller amounts. At the ecosystem and biosphere levels, there is a continual recycling of all these elements, which alternate between the mineral and organic states.

While there is a slight input of geothermal energy, the bulk of the functioning of the ecosystem is based on the input of solar energy. Plants and photosynthetic microorganisms convert light into chemical energy by the process of photosynthesis, which creates glucose (a simple sugar) and releases free oxygen. Glucose thus becomes the secondary energy source which drives the ecosystem. Some of this glucose is used directly by other organisms for energy. Other sugar molecules can be converted to other molecules such as amino acids.

Cellular respiration is the process by which organisms (like mammals) break the glucose back down into its constituents, water and carbon dioxide, thus regaining the stored energy the sun originally gave to the plants. The proportion of photosynthetic activity of plants and other photosynthesizers to the respiration of other organisms determines the specific composition of the Earth's atmosphere, particularly its oxygen level.

Exercise 1. Read and memorize using a dictionary:

biocenosis level; biosphere level; photic zone; benthic zone; multicellular organisms; terrestrial species; ozone layer; UV rays; biodiversity; community; food chain; nitrogen, potassium; recycling; energy source; cellular respiration; mammals; carbon dioxide; photosynthesizer; specific composition.

Exercise 2. Answer the questions:

- 1) What is the biosphere?
- 2) Where did life first develop?

- 3) What elements are present in the biosphere and in what amounts?
- 4) What is the functioning of the biosphere based on?

Exercise 3. Match the left part with the right:

1. Photosynthetic organisms produced	a) at ecosystem and biosphere levels
2. The biosphere contains	b) the chemically unstable oxygen-rich atmosphere
3. A continual recycling of elements takes place	c) at population, biocenosis, ecosystem, and biosphere level
4. Biodiversity is expressed	d) hydrogen, oxygen, nitrogen and carbon

Exercise 4. Ask questions to the given answers:

1) Question: _____ ?

Answer: The population consists of individuals of the same species in the same or similar environment.

2) Question: _____ ?

Answer: It extends from 11,000 meters below sea level to 15,000 meters above.

3) Question: _____ ?

Answer: It's function is to protect living beings from UV rays.

Exercise 5. Complete the sentences with the suggested words:

which; into; input; there is; thus

While _____ a slight input of geothermal energy, the bulk of the functioning of the ecosystem is based on the _____ of solar energy. Plants and photosynthetic microorganisms convert light _____ chemical energy by the process of photosynthesis, which creates glucose (a simple sugar) and releases free oxygen. Glucose _____ becomes the secondary energy source _____ drives the ecosystem.

Exercise 6. Compose a story on one of the topics (up to 100 words):

“The outer layer of our planet”;

“How and where did life originated?”

“Photosynthesis and cellular respiration”

Lesson 3

Community and Ecosystem Interactions

Мета заняття: вміти використовувати іноземну мову, включаючи усну та письмову форми в обсязі програмних вимог у продуктивних та рецетивних видах мовленнєвої діяльності.

Interacting groups of species are thought of as communities in which each kind of organism has a specific niche or role to play. Some organisms play minor roles while others play major roles, but all are part of the community. For example, the grasses of the prairie have a major role since, without them, there would be no prairie. Grasshoppers, prairie dogs, and bison are important consumers of grass. A meadowlark, though a colourful part of the prairie scene, has a relatively minor role that has little to do with maintaining a prairie community.

Communities consist of interacting species, but these species do not interact in vacuum. They must interact with the physical world around them as well. The physical world has a major impact on what kinds of plants and animals can live in an area. The kind of soil and the amount of moisture influence the kinds of organisms found in the area.

Organisms can also impact their physical surroundings. Trees break the force of the wind, grazing animals form paths, and earthworms create holes in the soil. This system of interacting organisms and their nonliving surroundings is frequently referred to as an ecosystem. While the concepts of community and ecosystem are closely related, an ecosystem is a broader concept because it involves the physical as well as the biological realm.

Major Roles of Organisms

Several categories of organisms are found in any ecosystem. Producers are able to make new, complex, organic material from the atoms in their environment. To do this, they must have a source of energy. In nearly all ecosystems, this energy is supplied by the sun, and the organisms that utilize this energy are plants that carry on photosynthesis. Since producers are the only organisms in an ecosystem that can trap energy and make new organic material from inorganic material, all other organisms rely on producers as a source of food, either directly or indirectly. These other organisms are called consumers because they consume organic matter to provide themselves with energy and the organic molecules necessary to build their own bodies. Primary consumers eat producers (plants) as a source of food. They are also known as herbivores. Secondary consumers or carnivores eat other animals. Some carnivores eat herbivores, while others may eat other carnivores. In addition, many animals, called omnivores, have mixed diets that include both plants and animals.

A final category of consumer is the decomposer. Decomposers use nonliving organic matter as a source of food. Many small animals, fungi, and bacteria fill this niche.

Table 1

Category	Major role or action	Examples
Producer	Converts simple inorganic molecules into organic molecules by the process of photosynthesis	Trees, flowers, grasses, ferns, mosses, algae
Consumer	Uses organic matter as a source of food	Animals, fungi, bacteria
Herbivore	Eats plants directly	Grasshopper, elk, human vegetarian
Carnivore	Kills and eats animals	Wolf, pike, dragonfly
Omnivore	Eats both plants and animals	Rats, raccoons, most humans

Scavenger	Eats meat, but often gets it from animals that died by accident or illness, or that were killed by other animals	Coyote, vulture, blowflies
Parasite	Lives in or on another living organism and gets food from it	Tapeworm, many bacteria, some insects
Decomposer	Returns organic material to inorganic material; completes recycling of atoms	Fungi, bacteria, some insects and worms

Exercise 1. Read and memorize using a dictionary:

communities; interacting species; ecosystem; nonliving surroundings; grazing animals; producers; primary consumers; secondary consumers; organic/inorganic matter; herbivore; carnivore; omnivore; decomposer; source of food; fungi; algae; scavenger; insect; worm

Exercise 2. Answer the questions:

- 1) What is the name for interacting groups of species?
- 2) What is an ecosystem?
- 3) Why are some organisms called “consumers”?
- 4) Why do all other organisms rely on producers as a source of food?

Exercise 3. Match the left part with the right:

1. Community consists of	a) interacting organisms and their nonliving surroundings
2. Ecosystem consists of	b) organic matter to provide themselves with energy
3. Producers can make	c) interacting species
4. Consumers consume	d) new organic material from inorganic material

Exercise 4. Give the English equivalents and use them in the sentences of your own:

продуценти; консументи; редуценти; травоядні; м'ясоїдні; всеїдні

Exercise 5. Ask questions to the given answers:

1) Question: _____?

Answer: Some organisms play minor roles while others play major roles, but all are part of the community.

2) Question: _____?

Answer: An ecosystem is a broader concept because it involves the physical as well as the biological realm.

3) Question: _____?

Answer: This source of energy is the sun.

Exercise 6. Compose a story “Roles of Organisms in an Ecosystem” on the basis of the text and Table 1 (up to 100 words).

Lesson 4

The health effects of industrial pollution

Мета заняття: здатність працювати з різними джерелами, розшикувати, обробляти, аналізувати і синтезувати отриману інформацію.

Industrial activities are a major source of air, water and land pollution, leading to illness and loss of life all over the world. The World Health Organisation estimates that outdoor air pollution alone accounts for around 2% of all heart and lung diseases, about 5% of all lung cancers, and about 1% of all chest infections.

One of the worst industrial disasters of all time took place in Bhopal, India, in December 1984. In the three days after the first gas leak occurred, around 8,000 people died. Many thousands more still feel the effects two decades on.

While Bhopal was a single event that caused the death of thousands of people in a very short period of time, pollution is often a slow, continuous process. An example is air pollution caused by industrial activity, motor vehicle exhaust and the burning of household stoves. Research on the relationship between levels of daily outdoor air pollution and the prevalence of diseases, based on hospital admission reports, shows that for every 10 microgram increment in the concentration of respirable particulate matter in the air, the risk of death from respiratory illness increases by 1%. Inside homes, air pollution caused by burning fossil fuel (such as coal or wood), used in many Indian households, is linked to tuberculosis and respiratory illnesses among women and children. Worldwide, indoor air pollution accounts for about 34% of all respiratory illnesses.

Pollution and pollutants

A simple definition of pollution could be the presence of high quantities of any entity in the wrong place. This indicates that a specific substance cannot in itself be labelled a pollutant. It becomes a pollutant when concentrations of the substance are too great to sustain health in any given place. For example, high concentrations of respirable particulate matter in lung tissue harm the respiratory system. Another example is inorganic arsenic. When concentrations of inorganic arsenic exceed 10 micrograms/L in the groundwater, significant adverse health effects occur in people who consume that water.

Pollutants are present everywhere in our environment and enter our body through the air we breathe (respiratory system), the food we eat and water we drink (gastrointestinal system), or through skin contact.

Health effects

Pollutants affect our health in several ways. These include direct irritation of target organs or metabolic changes within cells. Sometimes, the effects may take years to develop. Asbestos fibres, for example, are small needle-shaped silicate crystals that penetrate deep into lung tissue and evoke reactions. It takes around 20 years for some illnesses to manifest.

Other health effects involve metabolic pathways in our bodies -- pathways of chemical reactions in our cells -- where they may interfere with energy production or cellular repair mechanisms. For example, exposure to inorganic arsenic is common among people who work in copper smelters or live around them. Exposure to inorganic arsenic also occurs among people who consume water from shallow tubewells in areas where the groundwater contains high levels of inorganic arsenic.

When it enters the body, inorganic arsenic is transformed through the same chemical reactions that are necessary to maintain the repair processes of DNA molecules within the cells. As a result of excess exposure to arsenic, and demands on these reactions, faulty repair of DNA molecules causes tumours to form.

Exercise 1. Read and memorize using a dictionary:

air/water/land pollution; heart/lung diseases; motor vehicle exhaust; increment;

particulate matter; respiratory illness; fossil fuel; pollutant; inorganic arsenic; groundwater; health effect; asbestos fibres; cells; cellular repair mechanisms; exposure (to)

Exercise 2. Answer the questions:

- 1) What is the major source of pollution?
- 2) When and where did one of the worst industrial disasters of all times take place?
- 3) When does a specific substance become a pollutant?
- 4) What are the ways in which pollutants affect our health?

Exercise 3. Match the left part with the right:

1. Air, water and land pollution leads to	a) chemical reactions in our cells
2. Burning fossil fuels inside homes leads to	b) direct irritation of target organs
3. The ways pollutants affect our health include	c) tuberculosis and respiratory illnesses
4. Other health effects involve	d) Illness and loss of life

Exercise 4. Ask questions to the given answers:

1) Question: _____?

Answer: Air pollution can be caused by industrial activity, motor vehicle exhaust and burning household stoves.

2) Question: _____?

Answer: Pollutants can enter our bodies through the respiratory system, through the gastrointestinal system or through skin contact.

3) Question: _____?

Answer: Sometimes, health effects take years to develop.

Exercise 5. Complete the sentences with the suggested words:

for example ; ways; into; within; around; take

Pollutants affect our health in several _____. These include direct irritation of target organs or metabolic changes _____ cells.. Sometimes, the effects may _____ years to develop. Asbestos fibres, _____, are small needle-shaped silicate crystals that penetrate deep _____ lung tissue and evoke reactions. It takes _____ 20 years for some illnesses to manifest.

Exercise 6. Compose a story on one of the topics (up to 100 words):

“Pollution and Pollutants”

“Health Effects of Pollution”

Lesson 5

DYNAMICS AND STABILITY

Мета заняття: здатність працювати з різними джерелами, розширювати, обробляти, аналізувати і синтезувати отриману інформацію.

Ecological factors which affect dynamic change in a population or species in a given ecology or environment are usually divided into two groups: abiotic and biotic. Abiotic factors are geological, geographical, hydrological and climatological parameters. A biotope is an environmentally uniform region characterized by a particular set of abiotic ecological factors. Specific abiotic factors include:

- Water, which is at the same time an essential element to life and a milieu
- Air, which provides oxygen, nitrogen, and carbon dioxide to living species and allows the dissemination of pollen and spores
- Soil, at the same time source of nutriment and physical support
- Soil pH, salinity, nitrogen and phosphorus content, ability to retain water, and density are all influential
- Temperature, which should not exceed certain extremes, even if tolerance to heat is significant for some species
- Light, which provides energy to the ecosystem through photosynthesis
- Natural disasters can also be considered abiotic

Biocenose, or community, is a group of populations of plants, animals, micro-organisms. When a population consists of an insufficient number of individuals, that population is threatened with extinction; the extinction of a species can approach when all biocenoses composed of individuals of the species are in decline. Biotic ecological factors also influence biocenose viability; these factors are considered as either intraspecific or interspecific relations. Intraspecific relations are those which are established between individuals of the same species, forming a population. They are relations of co-operation or competition, with division of the territory, and sometimes organization in hierarchical societies.

An antlion lies in wait under its pit trap, built in dry dust under a building, awaiting unwary insects that fall in. Many pest insects are partly or wholly controlled by other insect predators.

Interspecific relations—interactions between different species—are numerous, and usually described according to their beneficial, detrimental or neutral effect. The most significant relation is the relation of predation (to eat or to be eaten), which leads to the essential concepts in ecology of food chains (for example, the grass is consumed by the herbivore, itself consumed by a carnivore, itself consumed by a carnivore of larger size). A high predator- to- prey ratio can have a negative influence on both the predator and prey biocenoses in that low availability of food and high death rate prior to sexual maturity can decrease (or prevent the increase of) populations of each, respectively. Selective hunting of species by humans which leads to population decline is one example of a high predator- to- prey ratio in action. Other interspecific relations include parasitism, infectious disease and competition for limited resources, which can occur when two species share the same ecological niche.

The existing interactions between the various living beings go along with a permanent mixing of mineral and organic substances, absorbed by organisms for their growth, their maintenance and their reproduction, to be finally rejected as waste. These permanent recyclings of the elements (in particular carbon, oxygen and nitrogen) as well as the water are called biogeochemical cycles. They guarantee a durable stability of the biosphere (at least when unchecked human influence and extreme weather or geological phenomena are left aside).

Exercise 1. Read and memorize using a dictionary:

biotope; biocenose; natural disaster; extinction of a species; competition; predation; predator and prey; food chain; death rate, population decline; ecological niche; reproduction; waste; recycling.

Exercise 2. Answer the questions:

- 1) What is a biotope?
- 2) What is the difference between intraspecific and interspecific relations?
- 3) How do you understand the concept “food chain”?
- 4) What is the role of biogeochemical cycles in the biosphere?

Exercise 3. Match the left part with the right:

1. Abiotic factors include	a) predation, parasitism, infectious disease and competition for limited resources
2. Intraspecific relations include	b) oxygen, carbon, nitrogen and water
3. Interspecific relations include	c) water, air, soil, temperature, light and natural disasters
4. Recyclings of elements include	d) cooperation or competition

Exercise 4. Ask questions to the given answers:

1) Question: _____ ?

Answer: Air provides oxygen, nitrogen, and carbon dioxide to living species.

2) Question: _____ ?

Answer: Intraspecific relations are usually described according to their beneficial, detrimental or neutral effect.

3) Question: _____

Answer: Competition for limited resources can occur when two species share the same ecological niche.

Exercise 5. Complete the sentences with the suggested words:

respectively; by; both; and; prior to; have.

A high predator- to- prey ratio can _____ a negative influence on _____ the predator _____ prey biocenoses in that low availability of food and high death rate _____ sexual maturity can decrease (or prevent the increase of) populations of each, _____. Selective hunting of species _____ humans which leads to population decline is one example of a high predator- to- prey ratio in action.

Temperature and light are considered			
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Exercise 6. Compose a story on one of the topics (up to 100 words):

“Abiotic Ecological Factors”;

“Biotic Ecological Factors”.

Lesson 6

ENVIRONMENTAL MANAGEMENT

Мета заняття: здатність працювати з різними джерелами, розшичувати, обробляти, аналізувати і синтезувати отриману інформацію.

Environmental Management is not, as the phrase could suggest, the management of the *environment* as such but rather the management of man's interaction with and impact upon the environment. The three main issues that affect managers are issues involving politics (networking), programs (projects), and resources (i.e. money, facilities, etc). The need for environmental management can be viewed from a variety of perspectives. A more common philosophy and impetus behind environmental management is the concept of carrying capacity. Simply put, carrying capacity refers to the maximum number of organisms a particular resource can sustain. The concept of carrying capacity, whilst understood by many cultures over history, has its roots in Malthusian theory. Environmental management is therefore not the conservation of the environment solely for the environment's sake, but rather the conservation of the environment for humankind's sake. This element of sustainable exploitation, getting the most out of natural assets, is visible in the EU Water Framework Directive.

Environmental management involves the management of all components of the bio-physical environment, both living (biotic) and non-living (abiotic). This is due to the interconnected network of relationships amongst all living species and their habitats. The environment also involves the relationships of the human environment, such as the social, cultural and economic environment with the bio-physical environment.

As with all management functions, effective management tools, standards and systems are required. An environmental management standard or system or protocol attempts to reduce environmental impact as measured by some objective criteria. The ISO 14001 standard is the most widely used standard for environmental risk management and is closely aligned to the European Eco Management & Audit Scheme (EMAS). As a common auditing standard, the ISO 19011 standard explains how to combine this with quality management. The UK has developed a phased standard (BS8555) that can help smaller companies move to ISO 14001 in six manageable steps.

Other environmental management systems tend to be based on this standard and to extend it in various ways:

The Natural Step focuses on basic sustainability criteria and helps focus engineering on reducing use of materials or energy use that is unsustainable in the long term

Natural Capitalism advises using accounting reform and a general biomimicry and industrial ecology approach to do the same thing

US Environmental Protection Agency has many further terms and standards that it defines as appropriate to large-scale EMS.

The UN and World Bank has encouraged adopting a "natural capital" measurement and management framework.

The European Union Eco-Management and Audit Scheme (EMAS)

Other strategies exist that rely on making simple distinctions rather than building top-down management "systems" using performance audits and full cost accounting. For instance, Ecological Intelligent Design divides products into consumables, service products or durables and unsaleables - toxic products that no one should buy, or in many cases, do not realize they are buying. By eliminating the unsaleables from the comprehensive outcome of any purchase, better environmental management is achieved without "systems".

Exercise 1. Read and memorize using a dictionary:

environmental management; carrying capacity; conservation of the environment; living species; habitat; management tools; environmental impact; risk management; quality management; sustainability; engineering; biomimicry; industrial ecology; consumables; durables; unsaleables.

Exercise 2. Answer the questions:

- 1) What does the term environmental management mean?
- 2) What does carrying capacity refer to?
- 3) Does environmental management only involve the management of living components of the environment?
- 4) What is ISO 14001?

Exercise 3. Match the left part with the right:

1. Environmental management involves	a) management tools
2. Environment involves	b) types of products
3. Standards, systems and protocols are	c) the management of all components of bio-physical environment
4. Consumables, durables and unsaleables are	d) the relationships of the human environment with the bio-physical environment

Exercise 4. Ask questions to the given answers:

1) Question: _____?

Answer: An environmental management standard or system or protocol attempts to reduce environmental impact as measured by some objective criteria.

2) Question: _____?

Answer: The UK has developed a phased standard (BS8555) that can help smaller companies move to ISO 14001 in six manageable steps.

3) Question: _____?

Answer: By eliminating the unsaleables from the comprehensive outcome of any purchase, better environmental management is achieved without "systems".

Exercise 5. Complete the sentences with the suggested words:

that; rather than; into; on; and; for instance; other; not

_____ strategies exist that rely _____ making simple distinctions _____ building top-down management "systems" using performance audits _____ full cost accounting. _____, Ecological Intelligent Design divides products _____ consumables, service products or durables and unsaleables - toxic products _____ no one should buy, or in many cases, do _____ realize they are buying.

Exercise 6. Compose a story on one of the topics (up to 100 words):

“The Concept of Carrying Capacity”;

“Management Standards and Systems”

Lesson 7

AIR POLLUTION

Мета заняття: вміти використовувати іноземну мову, включаючи усну та письмову форми в обсязі програмних вимог в продуктивних та рецензивних видах мовленнєвої діяльності.

Air pollution is a general term that covers a broad range of contaminants in the atmosphere. Pollution can occur from natural causes or from human activities. Discussions about the effects of air pollution have focused mainly on human health but attention is being directed to environmental quality and amenity as well. Air pollutants are found as gases or particles, and on a restricted scale they can be trapped inside buildings as indoor air pollutants. Urban air pollution has long been an important concern for civic administrators, but increasingly, air pollution has become an international problem.

The most characteristic sources of air pollution have always been combustion processes. Here the most obvious pollutant is smoke. However, the widespread use of fossil fuels have made sulfur and nitrogen oxides pollutants of great concern. With increasing use of petroleum-based fuels, a range of organic compounds have become widespread in the atmosphere.

In urban areas, air pollution has been a matter of concern since historical times. The use of coal throughout the centuries has caused cities to be very smoky places. Along with smoke, large concentrations of sulfur dioxide were produced. It was this mixture of smoke and sulfur dioxide that typified the foggy streets of Victorian London, paced by such figures as Sherlock Holmes and Jack the Ripper, whose images remain linked with smoke and fog (smog). Such situations are far less common in the cities of North America and Europe today. However, until recently, they have been evident in other cities, such as Ankara, Turkey, and Shanghai, China, that rely heavily on coal.

Coal is still burnt in large quantities to produce electricity or to refine metals, but these processes are frequently undertaken outside cities. Within urban areas, fuel use has shifted towards liquid and gaseous hydrocarbons (petrol and natural gas). These fuels typically have a lower concentration of sulfur, so the presence of sulfur dioxide has declined in many urban areas. However, the widespread use of liquid fuels in automobiles has meant increased production of carbon monoxide, nitrogen oxides, and volatile organic compounds (VOCs).

Primary pollutants such as sulfur dioxide or smoke are the direct emission products of the combustion process. Today, many of the key pollutants in the urban atmospheres are secondary pollutants, produced by processes initiated through photochemical reactions. The photochemical smog is now characteristic of urban atmospheres dominated by secondary pollutants.

Although the automobile is the main source of air pollution in contemporary cities, there are other equally significant sources. Stationary sources are still important and the oil-burning furnaces that have replaced the older coal-burning ones are still responsible for a range of gaseous emissions and fly ash. Incineration is also an important source of complex combustion products, especially where this incineration burns a wide range of refuse. These emissions can include chlorinated hydrocarbons such as dioxin. When plastics, which often contain chlorine, are incinerated, hydrochloric acid results in the waste gas stream. Metals, especially where they are volatile at high temperatures, can migrate to smaller, respirable particles. The accumulation of toxic metals, such as cadmium, on fly ash gives rise to concern over harmful effects from incinerator emissions.

Exercise 1. Read and memorize using a dictionary:

air pollution; combustion processes; smoke; nitrogen oxide; sulfur dioxide; petroleum-based fuels; liquid and gaseous hydrocarbons; carbon monoxide; volatile organic compounds;

primary pollutants; emission products; secondary pollutants; fly ash; incineration plastics, acid; respirable particles

Exercise 2. Answer the questions:

- 1) What is the most characteristic source of air pollution?
- 2) Why have a range of organic compounds become widespread in the atmosphere?
- 3) What kind of equipment is still responsible for gaseous emissions and fly ash?
- 4) Is the automobile the only source of air pollution in contemporary cities?

Exercise 3. Match the left part with the right:

1. Air pollutants include	a) the direct emission products of the combustion process.
2. Primary pollutants are	b) chlorinated hydrocarbons such as dioxin.
3. Secondary pollutants are	c) gases or particles.
4. Incineration emissions include	d) produced by processes initiated through photochemical reactions.

Exercise 4. Ask questions to the given answers:

1) Question: _____?

Answer: Pollution can occur from natural causes or from human activities.

2) Question: _____?

Answer: The photochemical smog is now characteristic of urban atmospheres dominated by secondary pollutants.

3) Question: _____?

Answer: These emissions can include chlorinated hydrocarbons such as dioxin.

Exercise 5. Complete the sentences with the suggested words:

here; always; however; in ; with; most.

The _____ characteristic sources of air pollution have _____ been combustion processes. _____ the most obvious pollutant is smoke. _____, the widespread use of fossil fuels have made sulfur and nitrogen oxides pollutants of great concern. _____ increasing use of petroleum-based fuels, a range of organic compounds have become widespread in the atmosphere.

Exercise 6. Compose a story on one of the topics (up to 100 words):

“Types of Fuels”;

“Types of Pollutants”.

Lesson 8

BIO-DIESEL, A RENEWABLE ALTERNATIVE TO PETRO-DIESEL FOR MOTOR VEHICLE

Мета заняття: здатність працювати з різними джерелами, розшикувати, обробляти, аналізувати і синтезувати отриману інформацію.

As its name suggests biodiesel is a fuel oil derived from biological sources. Mainly these are vegetable oils and recycled cooking greases or oils, and it is a viable alternative to traditional petro-diesel for fuelling diesel engines. It has other uses, for example in heating boilers, but our main concern is its use in cars and other motor vehicles. As a motor fuel, it may be used 100% pure (in compatible engines) or combined with petro-diesel in proportions as low as 2%. Although on combustion it releases greenhouse gases (mainly, but not only, CO₂) it is described as carbon-neutral, since it is derived indirectly from living plant sources. It is argued that the plants absorb essentially the same amount of these gases during the growing stage and this is in stark contrast to fossil-based fuels. The benefits of biodiesel exceed its carbon-neutral property and some of the other advantages are identified below. Biodiesel can also be manufactured from animal oils and greases for which the arguments are different. However, if these oils and greases are normally discarded then taking them out of the waste stream and converting them to a fuel has obvious, substantial environmental benefits. First, let's briefly see how it is manufactured then identify some limitations before identifying its main advantages.

How is it manufactured, its byproducts and what does it cost?

Put simply, vegetable and/or animal oils, fats or greases are combined with methanol in the presence of sodium or potassium hydroxide (as a catalyst). The chemical reaction is called transesterification, and the products are fatty acid methyl esters (the biodiesel) plus glycerine. The latter is an alcohol with many useful properties for example it is sweet, a lubricant and a humectant which means it retains moisture. These properties give rise to many commercial applications in commodities such as drugs, paints, personal-care products, foods, flexible plastics etc. Popular raw sources for biodiesel processing include rapeseed oil (Europe), soybean oil (USA), palm oil (SE Asia). Various cooking oils and fats are suitable (new and recovered). Some keen individuals make their own biodiesel, especially in the States, and there are sites describing the methods, but the chemicals produce toxic fumes and the liquids are corrosive (e.g. caustic soda) so great care is needed. It is possible for individuals to buy small and medium sized purpose-made plant for production. Reading some articles on the net we see examples where experimenters are pouring neat untreated oils into their wagons and claiming to get away without processing, however, there are serious drawbacks to such a method which can result in expensive damage to the engine. The cost of manufacturing biodiesel currently is greater than petro-diesel although with the volatility of conventional oil prices we are not giving a figure. Even so, at the point of sale the difference may be negligible due to the imposition of tax. In the UK, for example, where taxes are high and biodiesel gets some preference the prices of commercially produced diesels are similar. If the biodiesel is home produced it can be significantly cheaper in the tank.

Exercise 1. Read and memorize using a dictionary:

Biodiesel, petrodiesel, vegetable oil, cooking grease, heating boiler, greenhouse gases, animal oils/greases, byproduct, sodium, transesterification, fatty acid methyl esters, lubricant, humectant, rapeseed, soybean/palm oil, toxic fumes, wagon, engine

Exercise 2. Answer the questions:

- 1) What kind of a fuel is biodiesel ?
- 2) In what way may it be used as a motor fuel?
- 3) From what products can biodiesel be manufactured?
- 4) Is the cost of manufacturing biodiesel higher than that of petro-diesel?

Exercise 3. Match the left part with the right:

1. Biodiesel may be used	a) rapeseed oil, soybean oil, palm oil
2. Popular raw sources for biodiesel processing include	b) expensive damage to the engine.
3. The products of transesterification include	c) 100% pure or combined with petro-diesel in proportions as low as 2%.
4. The drawbacks to the method can result in	d) fatty acid methyl esters plus glycerine.

Exercise 4. Describe *biofuel*, *greenhouse gases*, *byproduct*, *transesterification*, *lubricant*, *engine* using the suggested words and expressions as in example:

biofuel

gaseous, liquid, solid, substance, biological, origin, used, fuel

Example:

Biofuel is a gaseous, liquid, or solid substance of biological origin that is used as a fuel.

greenhouse gases

emissions, cause, burning, coal, gas, oil, carbon, dioxide

byproduct

product, manufacturing, process, considered, principal, material

transesterification

conversion, organic, acid, ester, another, ester, same acid

lubricant

substance, used, reduce, friction, between, parts, objects, relative, motion

engine

machine, power, applied, do, work, conversion, various, forms, energy, mechanical, force, motion

Exercise 5. Complete the sentences with the suggested words: *but, in, some, there, so, for, own*
_____ keen individuals make their _____ biodiesel, especially _____ the States, and _____ are
sites describing the methods, _____ the chemicals produce toxic fumes and the liquids are corrosive
(eg caustic soda) _____ great care is needed. It is possible _____ individuals to buy small and medium
sized purpose-made plant for production.

Exercise 6. Compose a story on one of the topics (up to 100 words):

“The Ways of Manufacturing Biodiesel”

“Advantages vs Disadvantages of Using Biodiesel”

Lesson 9

BIO-DIESEL. ADVANTAGES AND DISADVANTAGES

Мета заняття: вміти використовувати іноземну мову, включаючи усну та письмову форми обсязі програмних вимог в продуктивних та рецептивних видах мовленнєвої діяльності.

The carbon-neutral feature of biodiesel can be reduced to some extent because fossil fuels may be used in general transportation and in the manufacturing process. That is a variable depending on the detailed procedures but in any case, should not be as much as a third. Where specialised crops are grown on a vast commercial scale there is a distinct threat to diversity, natural forestation and the provision of foods.

Frequently biodiesel is combined with petro-diesel to ensure greater compatibility with unmodified engines. When used in standard compression-ignition engines biodiesel can increase nitrogen oxide emissions. This phenomenon is not due to nitrogen in the fuel but comes from the intake air as a result of the particular combustion process. This phenomenon is not replicated in some other applications such as oil-fired boilers and the effect can be reduced in vehicle engines by refining the tuning. Now let's review some of the additional benefits of biodiesel.

Biodiesel produces less noxious emissions than petro-diesel.

Biodiesel reduces tailpipe particulate matter, hydrocarbon, and carbon monoxide emissions from most modern four-stroke compression ignition engines. The reason is mainly associated with the presence of oxygen in the fuel which allows more complete combustion. Particulates are mainly carbon dust, commonly described as soot, and contain very fine particles that can be dangerous since they can get into the lungs by bypassing the body's natural filter mechanisms. Together with the unburned hydrocarbons, particulates are suspected of being carcinogens and can cause other serious toxic effects. Carbon monoxide is well known for its lethal action in the bloodstream. Obviously, the higher the proportion of biodiesel in a mixture, the more these noxious exhausts are reduced. Biodiesel has a very low concentration of sulphur, which can lead to SO₂ and acidic precipitation. The amount is very much less than traditional diesel oils.

And there are other fringe benefits of biodiesel.

The overarching benefit of biodiesel is that as a renewable fuel it is nominally carbon-neutral. An associated factor is that the global petroleum resources are being depleted rapidly and the term renewable is more significant than just reducing emissions. Biodiesel improves the lubricating power of the fuel and therefore ensures correct operation of key components in the engine system.

The fuel can be used in existing diesel engines especially at low proportions. Some modifications may be necessary, especially at higher concentrations of bio, and vehicle purchasers should be aware of engine specifications. The modifications are usually only minor and do not represent a basic change in the technology.

The fact that one possible raw material is used cooking oils etc gives a special advantage. Large caterers (think McDonald's) will have residues contaminated with meat. To be able to use this product for biodiesel is an opportunity to be welcomed, the only downside being that the contaminated materials would need to be filtered and 'washed' first.

Some disadvantages.

Biodiesel has a lower energy density than petro-diesel and because it is a denser fuel, the statistics vary slightly depending on whether you want a figure of energy per gallon or per pound. Roughly speaking the reductions are in the vicinity of 10%. Viscosity at low temperatures is important with diesel, sometimes making cold-weather starting difficult; biodiesel can be at a disadvantage in this respect. We have read of occasional use of dual tank vehicles where petro-diesel is used to start and shut down but switched to biodiesel for main running. A more practical solution is to introduce some special additive or a proportion of petro-diesel.

The properties of biodiesel mean that rubber pipes may have to be replaced by plastic ones and it may remove engine deposits hence filters may need changing more frequently.

If biodiesel-from-crops was widely adopted as a motor fuel then there would be a knock-on effect with serious problems caused by reduced biodiversity, displaced forests and the disrupted supply of other vital agricultural products. There is no reasonable expectation that petro-diesel could be completely replaced by bio-diesel. There are already signs that over development of crops for bio fuels can be damaging to the environment.

Exercise 1. Read and memorize using a dictionary:

natural forestation, provision of foods, compression-ignition engines, nitrogen oxide, intake air, tailpipe particulate matter, four-stroke compression ignition engines, hydrocarbon, soot, exhausts, sulphur, acidic precipitation, fringe benefits, raw material, residues, contaminated materials, energy density, viscosity, additive, engine deposits

Exercise 2. Answer the questions:

- 1) What are the major limitations of using biodiesel?
- 2) What are the advantages of using biodiesel?
- 3) What are the disadvantages of biodiesel?
- 4) Is overdevelopment of crops for bio fuels damaging to the environment?

Exercise 3. Match the left part with the right:

1. Using biodiesel in standard compression-ignition engines can	a) in existing diesel engines.
2. The unburned hydrocarbons and particulates can	b) increase nitrogen oxide emissions.
3. Biodiesel can be used	c) for biodiesel.
4. Residues contaminated with meat can be used	d) cause serious toxic effects.

Exercise 4. Describe *nitrogen oxide*, *hydrocarbon*, *exhaust*, *residue*, *energy density*, *additive* using the suggested words and expressions as in example:

nitrogen oxide

N₂O, colorless, sweet-tasting, gas, boiling, -90°C; slightly, soluble, water, soluble, alcohol; used food, aerosol, anesthetic, dentistry, surgery, known, laughing, gas

Example:

N₂O Colorless, sweet-tasting gas, boiling at -90°C; slightly soluble in water, soluble in alcohol; used as a food aerosol, and as an anesthetic in dentistry and surgery. Also known as laughing gas.

hydrocarbon

one, very, large, group, chemical, compounds, composed, only, carbon, hydrogen; largest, source, hydrocarbons, petroleum, crude, oil

exhaust

working, substance, discharge, engine, cylinder, turbine, performing, work, moving, parts, machine

residue

substance, left, distilling, heaviest, component, crude, oil, petroleum, refinery, operations
solids, deposited, filter, medium, filtration

energy density

energy, per, unit, volume, medium; case, electric, magnetic, field, energy, needed, set up, field, thought, residing, field

additive

substance, added, another, strengthen, otherwise, alter, purpose, improving, performance, finished, product

Exercise 5. Complete the sentences with the suggested words: *with, as, if, could, there, by, no*
 _____ biodiesel-from-crops was widely adopted ____ a motor fuel then _____ would be a knock-on effect _____ serious problems caused ____ reduced biodiversity, displaced forests and the disrupted supply of other vital agricultural products. There is _____ reasonable expectation that petro-diesel _____ be completely replaced by bio-diesel.

Exercise 6. Fill in the table with words and expressions from the text:

	processes	chemical elements	raw materials
Example: Nitrogen oxide emissions are the result of	the particular combustion process.	-	-

Production of biodiesel may need			
Biodiesel has a low concentration of			
Fossil fuels may be used in			

Exercise 7. Compose a story on one of the topics (up to 100 words):

“Benefits of Biodiesel”

“Limitations of Biodiesel”

“Disadvantages of Biodiesel”

Lesson 10

POLLUTION CONTROL

Мета заняття: знати професійний дискурс; уміти спілкуватися англійською мовою у професійному середовищі, дотримуватись етики ділового спілкування.

Pollution control is the process of reducing or eliminating the release of pollutants into the environment. It is regulated by various environmental agencies which establish pollutant discharge limits for air, water, and land.

Air pollution control strategies can be divided into two categories, the control of particulate emissions and the control of gaseous emissions. There are many kinds of equipment which can be used to reduce particulate emissions. Physical separation of the particulates from the air using settling chambers, cyclone collectors, impingers, wet scrubbers, electrostatic precipitators, and filtration devices, are all processes that are typically employed.

Settling chambers use gravity separation to reduce particulate emissions. The air stream is directed through a settling chamber, which is relatively long and has a large cross section, causing the velocity of the air stream to be greatly decreased and allowing sufficient time for the settling of solid particles.

A cyclone collector is a cylindrical device with a conical bottom which is used to create a tornado-like air stream. A centrifugal force is thus imparted to the particles, causing them to cling to the wall and roll downward, while the cleaner air stream exits through the top of the device.

An impinger is a device which uses the inertia of the air stream to impinge mists and dry particles on a solid surface. Mists are collected on the impinger plate as liquid forms and then drips off, while dry particles tend to build up or reenter the air stream.

Wet scrubbers control particulate emissions by wetting the particles in order to enhance their removal from the air stream. Wet scrubbers typically operate against the current by a water spray contacting with the gas flow. The particulate matter becomes entrained in the water droplets, and it is then separated from the gas stream.

Electrostatic precipitators are devices which use an electrostatic field to induce a charge on dust particles and collect them on grounded electrodes. Electrostatic precipitators are usually operated dry, but wet systems are also used.

One of the oldest and most efficient methods of particulate control, however, is filtration. The most commonly used filtration device is known as a baghouse and consists of fabric bags through which the air stream is directed. Particles become trapped in the fiber mesh on the fabric bags.

Gaseous emissions are controlled by similar devices and typically can be used in conjunction with particulate control options. Such devices include scrubbers, adsorption systems, condensers, flares, and incinerators.

Scrubbers utilize the phenomena of adsorption to remove gaseous pollutants from the air stream. A wide variety of solutions can be used in this process as absorbing agents. Lime, magnesium oxide, and sodium hydroxide are typically used.

Adsorption can also be used to control gaseous emissions. Activated carbon is commonly used as an adsorbent in configurations such as fixed bed and fluidized bed adsorbers.

Condensers operate in a manner so as to condense vapors by either increasing the pressure or decreasing the temperature of the gas stream.

Flaring and incineration take advantage of the combustibility of a gaseous pollutant. In general, excess air is added to these processes to drive the combustion reaction to completion, forming carbon dioxide and water.

Exercise 1. Read and memorize using a dictionary:

discharge; particulate emissions; gaseous emissions; settling chamber; cyclone collector; impinger; wet scrubber; electrostatic precipitator; filtration device; baghouse; absorption system; condenser; flare; incinerator; absorbing agent; lime; adsorbent

Exercise 2. Answer the questions:

- 1) What is pollution control?
- 2) What kind of devices are used to separate the particulates from the air?
- 3) Which of the particulate control methods is considered the most efficient?
- 4) In what way do condensers operate?

Exercise 3. Match the left part with the right:

1. Settling chambers use	a) the phenomena of adsorption to remove gaseous pollutants from the air stream
2. Impingers use	b) gravity separation to reduce particulate emissions
3. Scrubbers use	c) the inertia of the air stream to impinge mists and dry particles on a solid surface
4. Electrostatic precipitators use	d) an electrostatic field to induce a charge on dust particles and collect them on grounded electrodes

Exercise 4. Ask questions to the given answers:

1) Question: _____?

Answer: Pollution is regulated by various environmental agencies which establish pollutant discharge limits for air, water, and land.

2) Question: _____?

Answer: Air pollution control strategies can be divided into two categories, the control of particulate emissions and the control of gaseous emissions.

3) Question: _____?

Answer: Lime, magnesium oxide, and sodium hydroxide can be used as absorbing agents.

Exercise 5. Complete the sentences with the suggested words:

however; as; of; in; through; most; in; on

One of the oldest and _____ efficient methods of particulate control, _____, is filtration. The most commonly used filtration device is known _____ a baghouse and consists _____ fabric bags _____ which the air stream is directed. Particles become trapped _____ the fiber mesh _____ the fabric bags.

Exercise 6. Compose a story on one of the topics (up to 100 words):

“Gaseous Emissions Control”

“Particulate Emissions Control”

Lesson 11

POLLUTION CONTROL METHODS

Мета заняття: здатність працювати з різними джерелами, розшикувати, обробляти, аналізувати і синтезувати отриману інформацію.

Water pollution control methods can be subdivided into physical, chemical, and biological treatment systems. Most treatment systems use combinations of any of these three technologies.

Physical treatment systems are processes which rely on physical forces to aid in the removal of pollutants. Physical processes used in water pollution control include screening, filtration, sedimentation, and flotation. Screening and filtration are similar methods which are used to separate coarse solids from water. Suspended particles are also removed from water with the use of sedimentation processes. Just as in air pollution control, sedimentation devices utilize gravity to remove the heavier particles from the water stream. The wide array of sedimentation basins in use slow down the water velocity in the unit to allow time for the particles to drop to the bottom. Likewise, flotation uses differences in particle densities, which in this case are lower than water, to effect removal.

Chemical treatment systems in water pollution control are those processes which utilize chemical reactions to remove water pollutants or to form other, less toxic, compounds. Typical chemical treatment processes are chemical precipitation, adsorption, and disinfection reactions. Chemical precipitation processes utilize the addition of chemicals to the water in order to bring about the precipitation of dissolved solids. The solid is then removed by a physical process such as sedimentation or filtration. Chemical precipitation processes are often used for the removal of heavy metals and phosphorus from water streams. Adsorption processes are used to separate soluble substances from the water stream. Water may be passed through beds of granulated activated carbon (GAC), or powdered activated carbon (PAC) may be added in order to facilitate the removal of dissolved pollutants. Disinfection processes selectively destroy disease-causing organisms such as bacteria and viruses. Typical disinfection agents include chlorine, ozone, and ultraviolet radiation.

Biological water pollution control methods are those which utilize biological activity to remove pollutants from water streams. These methods are used for the control of biodegradable organic chemicals, as well as nutrients such as nitrogen and phosphorus. In these systems, microorganisms consisting mainly of bacteria convert carbonaceous matter as well as cell tissue into gas. There are two main groups of microorganisms which are used in biological treatment, aerobic and anaerobic microorganisms. Each requires unique environmental conditions to do its job. Aerobic processes occur in the absence of oxygen. Both processes may be utilized whether the microorganisms exist in a suspension or are attached to a surface. These processes are termed suspended growth and fixed film processes, respectively.

Solid pollution control methods include landfilling, composting, and incineration. Sanitary landfills are operated by spreading the solid waste in compact layers which are separated by a thin layer of soil. Aerobic and anaerobic microorganisms help to break down the biodegradable substances in the landfill and produce carbon dioxide and methane gas which is typically vented to the surface. Landfills also generate a strong wastewater called leachate which must be collected and treated to avoid groundwater contamination.

Exercise 1. Read and memorize using a dictionary:

sedimentation; flotation; screening; sedimentation basin; suspended particles; dissolved solids; biodegradable organic chemicals; nutrients; cell tissue; carbonaceous matter; biological treatment; suspended growth; landfilling; composting; solid waste; soil; aerobic/anaerobic microorganisms; groundwater

Exercise 2. Answer the questions:

- 1) What physical processes are used in water pollution control?
- 2) What are typical chemical treatment processes?
- 3) Under what conditions do aerobic processes occur?
- 4) In what way are sanitary landfills operated?

Exercise 3. Match the left part with the right:

1. Sedimentation devices utilize	a) to separate coarse solids from water.
2. Biological water pollution control methods utilize	b) gravity to remove heavier particles from the water stream.
3. Screening and flotation are used	c) biological activity to remove pollutants from the water stream.
4. Landfilling, composting and incineration are used	d) for solid pollution control.

Exercise 4. Ask questions to the given answers:

- 1) Question: _____?
Answer: Physical treatment systems rely on physical forces to aid in the removal of pollutants.
- 2) Question: _____?
Answer: There are two main groups of microorganisms which are used in biological treatment, aerobic and anaerobic microorganisms.
- 3) Question: _____?
Answer: These processes are termed suspended growth and fixed film processes.

Exercise 5. Complete the sentences with the suggested words:

such as ; in order to; and; through ; of ; or; may;

Water ____be passed _____beds of granulated activated carbon (GAC), ____powdered activated carbon (PAC) may be added _____facilitate the removal ____dissolved pollutants. Disinfection processes selectively destroy disease-causing organisms _____bacteria and viruses. Typical disinfection agents include chlorine, ozone, _____ultraviolet radiation.

Exercise 6. Compose a story on one of the topics (up to 100 words):

“Physical Processes Used in Water Pollution Control”

“Chemical Treatment Processes”

“Biological Water Pollution Control Methods”

Lesson 12

INTRODUCTION TO GLOBAL WARMING

Мета заняття: здатність працювати з різними джерелами.

Measurements of temperature taken by instruments all over the world, on land and at sea have revealed that during the 20th century the Earth's surface and lowest part of the atmosphere warmed up on average by about 0.6°C. During this period, man-made emissions of greenhouse gases, including carbon dioxide, methane and nitrous oxide have increased, largely as a result of the burning of fossil fuels for energy and transportation, and land use changes including deforestation for agriculture. In the last 20 years, concern has grown that these two phenomena are, at least in part, associated with each other. That is to say, global warming is now considered most probably to be due to the increases in greenhouse gas emissions and concurrent increases in atmospheric greenhouse gas concentrations, which have enhanced the Earth's natural greenhouse effect. Whilst other natural causes of climate change can cause global climate to change over similar periods of time, computer models demonstrate that in all probability there is a real discernible human influence on the global climate.

If the climate changes as current computer models have projected, global average surface temperature could be anywhere from 1.4 to 5.8°C higher by the end of the 21st century than in 1990. To put this temperature change into context, the increase in global average surface temperature which brought the Earth out of the last major ice age 14,000 years ago was of the order of 4 to 5°C. Such a rapid change in climate will probably be too great to allow many ecosystems to suitably adapt, and the rate of species extinction will most likely increase. In addition to impacts on wildlife and species biodiversity, human agriculture, forestry, water resources and health will all be affected. Such impacts will be related to changes in precipitation (rainfall and snowfall), sea level, and the frequency and intensity of extreme weather events, resulting from global warming. It is expected that the societies currently experiencing existing social, economic and climatic stresses will be both worst affected and least able to adapt. These will include many in the developing world, low-lying islands and coastal regions, and the urban poor.

The Framework Convention on Climate Change (1992) and the Kyoto Protocol (1997) represent the first steps taken by the international community to protect the Earth's climate from dangerous man-made interference. Currently, nations have agreed to reduce greenhouse gas emissions by an average of about 5% from 1990 levels by the period 2008 to 2012. The UK, through its Climate Change Programme, has committed itself to a 12.5% cut in greenhouse gas emissions. Additional commitments for further greenhouse gas emission reduction will need to be negotiated during the early part of the 21st century, if levels of greenhouse gas concentrations in the atmosphere are to be stabilised at reasonable levels. Existing and future targets can be achieved by embracing the concept of sustainable development - development today that does not compromise the development needs of future generations. In practical terms, this means using resources, particularly fossil-fuel-derived energy, more efficiently, re-using and recycling products where possible, and developing renewable forms of energy which are inexhaustible and do not pollute the atmosphere.

Exercise 1. Read and memorize using a dictionary:

global warming; emissions; greenhouse gases; deforestation; climate change; average surface temperature; species extinction; impacts; wildlife; species biodiversity; forestry; precipitation; sea level; extreme weather events; coastal regions; sustainable development; recycling; renewable forms of energy

Exercise 2. Answer the questions:

- 1) Why have man-made emissions of greenhouse gases increased?

- 2) What is the relationship of greenhouse gas emissions, greenhouse effect and global warming?
- 3) What could be the impacts of a rapid climate change on biosphere?
- 4) How do you understand the concept of sustainable development?

Exercise 3. Match the left part with the right:

Man-made emissions of greenhouse gases include	using resources more efficiently, re-using and recycling products.
The impacts of global warming on ecosystems include	carbon dioxide, methane and nitrous oxide.
Sustainable development means	the increase of the rate of species extinction
A rapid change in climate means	forestry, water resources and health.

Exercise 4. Ask questions to the given answers:

- 1) Question: _____?
Answer: Global warming is now considered to be due to the increases in greenhouse gas emissions and concurrent increases in atmospheric greenhouse gas concentrations.
- 2) Question: _____?
Answer: It is expected that the societies currently experiencing existing social, economic and climatic stresses will be both worst affected and least able to adapt.
- 3) Question: _____?
Answer: The Framework Convention on Climate Change and the Kyoto Protocol represent the first steps taken by the international community to protect the Earth's climate from dangerous man-made interference.

Exercise 5. Complete the sentences with the suggested words:

of the order; than; to; from; if; into; as; by; out of

_____ the climate changes _____ current computer models have projected, global average surface temperature could be anywhere _____ 1.4 _____ 5.8°C higher _____ the end of the 21st century _____ in 1990. To put this temperature change _____ context, the increase in global average surface temperature which brought the Earth _____ the last major ice age 14,000 years ago was _____ of 4 to 5°C.

Exercise 6. Compose a story on one of the topics (up to 100 words):

“Global Warming vs Greenhouse Effect”

“The First Steps to Protect the Earth’s Climate”

Lesson 13

ALTERNATIVE ENERGY SOURCES

Мета заняття: вміти використовувати іноземну мову, включаючи усну та письмову форми в обсязі програмних вимог у продуктивних та рецензивних видах мовленнєвої діяльності.

Read the text:

In our modern industrial society we consume vast amounts of energy to make our daily life more comfortable and productive. We use energy every day - for heat and light in living and working areas, cooking, transportation, manufacturing, and entertainment. The choices we make about how we use energy impact our environment and our lives.

Energy comes from several different sources. These sources can be split into two main categories: non-renewable and renewable. Non-renewable types of energy include the three major types of fossil fuels – coal, oil and natural gas. Fossil fuels supply more than 90% of the world's energy. Oil leads with a share of about 40 % of total world energy consumption, followed by coal (24%) and natural gas (22%).

Fossil fuels are relatively easy to use to generate energy because they only require a simple direct combustion. However, a problem with fossil fuels is their environmental impact. Not only does their excavation from the ground significantly alter the environment, but their combustion leads to air pollution. Carbon dioxide (CO₂) from burning fossil fuels is the largest source of greenhouse gases from human activities. Extra greenhouse gases are causing global warming and climate change. Besides, these are fuels that are being consumed more rapidly than they are being replaced. That means that someday we could run out of these fuels.

Another non-renewable source is uranium. Uranium is an element that gives us nuclear energy by splitting an atom's nucleus, and this process is called fission. Nuclear energy is a better source of energy because it doesn't put carbon dioxide into the atmosphere. But like all industrial processes, nuclear power generation has by-product wastes: radioactive products and heat. Hazardous wastes and the possibility of a nuclear disaster are the principal concerns for nuclear power.

With the growing concerns over the environmental problems today (air pollution, global climate change, etc.) and the price of non-renewable energy sources soaring, we have to take a closer look at the alternative energy sources. Alternatives to the fossil fuels and nuclear power are renewable sources of energy and they are considerably more attractive in many ways. Renewable sources are derived and replenish quickly from nature and usually do not pollute our environment when used to generate electricity. The five renewable sources used most often include hydropower, solar, wind, biomass, and geothermal.

Alternative Energy and Renewable Energy Sources

Energy Suppliers offer consumers a part in the greening of society by deriving their energies from renewable or alternative sources and in some cases they will support environmentally friendly projects. The terms renewable and alternative do not necessarily mean the same thing but the distinction is blurred. There are two main objectives in this context, the most obvious of which is to reduce the net emission of greenhouse gases, especially carbon. The other is that the resources should remain constant and not run out in any foreseeable future.

'Renewable' energy implies that it is derived from a source which is automatically replenished or one that is effectively infinite so that it is not depleted as it is used. The term 'Alternative' refers to energy sources which could replace coal, traditional gas and oil or their close derivatives, all of which increase the atmospheric carbon when burned as fuel.

It is evident why the terms alternative and renewable are often considered to be interchangeable but the concepts are sometimes ambiguous. However, the term 'renewable' is preferable and any sources that are renewable are also alternative.

Exercise 1. Read, translate and memorize using a dictionary:

alternative energy sources, renewable energy, non-renewable energy, fossil fuel(s), energy consumption, combustion, environment, environmental impact, air pollution, greenhouse gases, global warming, nuclear power generation, waste, by-product, nuclear power, net emission, carbon, to replenish, to deplete, obvious

Exercise 2. Answer the questions:

Why do we consume energy?

What are the major types of fossil fuels?

In what way is nuclear energy obtained?

Why do we have to take a closer look at alternative energy sources?

Exercise 3. Match the left part with the right:

1. Fossil fuels include	a) automatically replenished or effectively infinite
2. Sources of energy include	b) coal, oil and natural gas
3. Alternative energy sources are	c) non-renewable and renewable ones
4. Renewable energy sources are	d) those that can replace traditional coal, oil and gas

Exercise 4. Ask questions to the given answers:

Question: _____?

Answer: A problem with fossil fuels is their environmental impact.

Question: _____?

Answer: Hazardous wastes and the possibility of a nuclear disaster are the principal concerns for nuclear power.

Question: _____?

Answer: The term 'Alternative' refers to energy sources which could replace coal, traditional gas and oil.

Exercise 5. Complete the sentences with the suggested words: *are, the other, not, in, to*

The terms renewable and alternative do _____ necessarily mean the same thing but the distinction is blurred. There _____ two main objectives in this context, the most obvious of which is _____ reduce the net emission of greenhouse gases, especially carbon. _____ is that the resources should remain constant and not run out _____ any foreseeable future.

Exercise 6. Compose a story on one of the topics (up to 100 words):

“The Ways of Using Energy”

“Renewable and Non-renewable Energy Sources”

“World Renewable Energy 2005” (according to the after-text diagram)

Lesson 14

WIND ENERGY

Мета заняття: здатність працювати з різними джерелами, розширювати, обробляти, аналізувати і синтезувати отриману інформацію.

One of the most important questions we face as a civilization is – how to make the best use of renewable energy? There are plenty of different sources of renewable energy that are at our disposal, but, unfortunately, it seems that we are not using them properly. One of those sources is, of course, wind energy. A lot of companies and corporations are trying their best to utilize the power of wind and convert it into electricity and it seems that wind energy has become a go-to choice for many companies and households. However, even though it's a renewable source of energy, the wind has its pros and cons. Here's what they are.

PROS:

Free fuel. The ultimate goal of every renewable energy source is to produce free fuel. However, most of those sources require some sort of investment even once they are manufactured and installed. Wind energy, on the other hand, does not. The only investment required is the production of wind turbines. Once the turbines are made and installed, there's no need for more investments. The turbines are using the wind to produce electricity and this is how they make free fuel.

Wind Energy Is Clean. Considering the fact that turbines don't require fossil fuels to run, they don't leave gases behind them when they work. In other words, their carbon footprint is non-existent. Sure, fossil fuels and electricity are required for the making of the turbines and their transportation, but once the turbines are made and installed, they don't produce greenhouse gases. This is one of the main reasons why wind energy is considered to be one of the cleanest sources of energy today.

Wind Turbines Don't Disrupt the Farmland Operations. Why is this important? Well, the answer is pretty simple. In order to utilize the power of wind energy, the government has to find a big piece of land where they will put the turbines. The only option is to put the turbines on the farms.

CONS:

It Poses a Danger to Some Animals. However, wind turbines may pose a threat to some animals. Logically, birds and bats are the species that are in the most obvious danger by the turbines. If the turbines are not set properly, the fans might stand in the migration way of some birds. If this happens, thousands of birds might be killed. Plenty of farmers point out this as their main concern when it comes to the installation of wind turbines.

Upfront Costs. This reduces the costs drastically and that's why governments are interested in this energy source. On paper, this is a no-brainer. However, in order to install wind turbines, the

government has to invest a lot of money. This is why one of the main disadvantages of wind energy is the upfront costs.

Wind Energy Is Unpredictable. The noise pollution and upfront costs are two issues the government and manufacturers have to consider before installing the turbines, but there's one more thing that's, perhaps, more important. Wind energy can be rather unpredictable. Why is that? Well, the answer is quite simple. Considering the fact that wind turbines don't require fuel to work, they rely solely on the wind. As you probably know, wind can be unpredictable. During a single day, there can be windy periods and periods when there's no wind. This means that the daily output of electricity is rather unpredictable. Manufacturers and electricity companies can't afford to guess how much electricity the turbines will produce. It's too much of a gamble for them. This is why this unpredictability is considered to be one of the main disadvantages of wind energy.

Exercise 1. Read and memorize using a dictionary:

Disposal, properly, fossil fuels, footprint, non-existent, greenhouse gases, option, pose, species, obvious, drastically, upfront costs, issue, unpredictable, solely, gamble

Exercise 2. Answer the questions:

- 1) Why wind energy is considered a clean source of energy?
- 2) What makes wind turbines a favorable option for farmland operations?
- 3) What is one major risk that wind turbines pose to wildlife?
- 4) Why might the government still be interested in investing in wind energy despite its cons?

Exercise 3. Match the left part with the right:

1)The ultimate goal of every renewable energy source	a) might be killed.
2)In order to utilize the power of wind energy,	b) how much electricity the turbines will produce.
3)If this happens, thousands of birds	c) is to produce free fuel.
4)Electricity companies can't afford to guess	d) the government has to find a big piece of land

Exercise 4. Describe *installation, renewable energy, greenhouse gases, turbine, advantage, to invest* using the suggested words and expressions as in example:

Installation

A machine, equipment, position, ready to use

example:

The act of putting a machine, or a piece of equipment into position and making it ready to use

renewable energy

naturally replenished, comes from , unlimited, the sun, wind, resources, such as, tides.

greenhouse gases

emitted from, category of gases, absorb, remain in Earth's atmosphere, heat energy, the planet's surface, for a long time

turbine

various devices, in a stream of fluid, into mechanical, convert the energy, .

advantage

condition, greater chance, success

to invest

make a profit, to put money into, shares in a company, etc., get an advantage.

Exercise 5. Complete the sentences with the suggested words: *installed, require, wind, every, electricity*

The ultimate goal of renewable energy source is to produce free fuel. However, most of those sources some sort of investment even once they are manufactured and Wind energy, on the other hand, does not. The only investment required is the production of turbines. Once the turbines are made and installed, there's no need for more investments. The turbines are using the wind to produce and this is how they make free fuel.

Exercise 6. Compose a story on one of the topics (up to 100 words):

“Wind turbines – advantages and disadvantages”

“Wind power and our environment”

“The prices of wind turbines – cheap or expensive?”.

Lesson 15

RENEWABLE ENERGY AND ENVIRONMENT

Мета заняття: здатність працювати з різними джерелами, розшикувати, обробляти, аналізувати і синтезувати отриману інформацію.

In any discussion about climate change, renewable energy usually tops the list of changes the world can implement to stave off the worst effects of rising temperatures. That's because renewable energy sources such as solar and wind don't emit carbon dioxide and other greenhouse gases that contribute to global warming.

Clean energy has far more to recommend it than just being "green." The growing sector creates jobs, makes electric grids more resilient, expands energy access in developing countries, and helps lower energy bills. All of those factors have contributed to a renewable energy renaissance in recent years, with wind and solar setting new records for electricity generation.

For the past 150 years or so, humans have relied heavily on coal, oil, and other fossil fuels to power everything from light bulbs to cars to factories. Fossil fuels are embedded in nearly everything we do, and as a result, the greenhouse gases released from the burning of those fuels have reached historically high levels.

As greenhouse gases trap heat in the atmosphere that would otherwise escape into space, average temperatures on the surface are rising. Global warming is one symptom of climate change, the term scientists now prefer to describe the complex shifts affecting our planet's weather and climate systems. Climate change encompasses not only rising average temperatures but also extreme weather events, shifting wildlife populations and habitats, rising seas, and a range of other impacts.

Of course, renewables—like any source of energy—have their own trade-offs and associated debates. One of them centers on the definition of renewable energy. Strictly speaking, renewable energy is just what you might think: perpetually available, or as the U.S. Energy Information Administration puts it, "virtually inexhaustible." But "renewable" doesn't necessarily mean sustainable, as opponents of corn-based ethanol or large hydropower dams often argue. It also doesn't encompass other low- or zero-emissions resources that have their own advocates, including energy efficiency and nuclear power.

Types of renewable energy sources

Hydropower: For centuries, people have harnessed the energy of river currents, using dams to control water flow. While hydropower is theoretically a clean energy source replenished by rain and snow, it also has several drawbacks.

Large dams can disrupt river ecosystems and surrounding communities, harming wildlife and displacing residents. Hydropower generation is vulnerable to silt buildup, which can compromise capacity and harm equipment. Drought can also cause problems.

Wind: Harnessing the wind as a source of energy started more than 7,000 years ago. Some people may object to how wind turbines look on the horizon and to how they sound, but wind energy, whose prices are declining, is proving too valuable a resource to deny. While most wind power comes from onshore turbines, offshore projects are appearing, too. Another problem with wind turbines is that they're a danger for birds and bats, killing hundreds of thousands annually, not as many as from glass collisions and other threats like habitat loss and invasive species, but enough that engineers are working on solutions to make them safer for flying wildlife.

Solar: In addition to solar panels, which convert the sun's light to electricity, concentrating solar power (CSP) plants use mirrors to concentrate the sun's heat, deriving thermal energy instead.

Biomass: Biomass energy includes biofuels such as ethanol and biodiesel, wood and wood waste, biogas from landfills, and municipal solid waste. Like solar power, biomass is a flexible energy source, able to fuel vehicles, heat buildings, and produce electricity. But biomass can raise thorny issues. Critics of corn-based ethanol, for example, say it competes with the food

market for corn and supports the same harmful agricultural practices that have led to toxic algae blooms and other environmental hazards.

Geothermal: Unlike solar and wind energy, geothermal energy is always available, but it has side effects that need to be managed, such as the rotten egg smell that can accompany released hydrogen sulfide.

Exercise 1. Read and memorize using a dictionary:

Implement, stave off, emit carbon dioxide, contribute, resilient, rely on, release, embed, encompass, sustainable, harness, capacity, deny, habitat loss, concentrating solar power, municipal solid waste

Exercise 2. Answer the questions:

1. Why are renewable energy sources like solar and wind considered key solutions to climate change?
2. What is the role of greenhouse gases in the Earth's atmosphere?
3. How long ago did humans begin harnessing wind as a source of energy?
4. How can the use of biomass energy be balanced with concerns about food supply and environmental impacts?
5. What is the advantage of geothermal energy?

Exercise 3. Match the left part with the right:

1) Most wind power comes from onshore turbines,	a) ecosystems and surrounding communities.
2) Renewable energy sources such as solar and wind don't	b) side effects that need to be managed
3) Dams can disrupt river	c) offshore projects are appearing, too.
4) Geothermal energy is always available, but it has	d) emit carbon dioxide and other greenhouse gases

Exercise 4. Describe *renewable energy*, *greenhouse gases*, *onshore wind energy*, *solar panels*, *biomass energy*, and *geothermal energy*, using the suggested words and expressions as in example:

cogeneration

simultaneous, on-site, generation, electric, energy, process, steam, heat, same, plant

example:

The simultaneous on-site generation of electric energy and process steam or heat from the same plant

renewable energy

natural, replenished, rate, energy derived, consumed, from, sources, that, are, higher, they, are, at, a, than

greenhouse gases

the, the, the, that, as, in, of, gases, the, surface, atmosphere, Earth, temperature, raise, planets, such.

onshore wind energy

turbines, wind, generated, onshore, natural, land, wind, located, movement, air, energy, power, is, the, that, is, by, on, driven, by, the, of, the.

solar panel

a, that, photovoltaic, into, sunlight, device, electricity, using, converts, by cells.

biomass energy

material, plants, renewable, animals, comes, organic that, from, and.

geothermal energy

heat, renewable, the, source, continuously, energy, because, produced, earth, is, inside.

Exercise 5. Complete the sentences with the suggested words: *extracted, governments harmful, sources, form, power*

Fossil fuels, such as coal, natural gas and oil, are examples of non-renewable energy 1. _____. These sources can occur naturally, but they are finite in their amount. A disadvantage of non-renewable energy sources is that they often take hundreds of thousands of years to 2. _____, and have to be 3. _____ from the earth and burned in order to create the energy that generates electricity. They also emit 4. _____ greenhouse gases like CO₂ when they're burned. There are several reasons why harnessing the 5. _____ of renewable energy sources is so important for our future. As they're in much more plentiful supply, compared to fossil fuels, 6. _____ across the world are looking to develop renewables to exclusively power their nations.

Exercise 6. Fill in the table with information from the text:

Source of power	materials	advantages	drawbacks
	-		-

Exercise 7. Compose a story on one of the topics (up to 100 words):

“The Alternative Sources of Power ”

“Geothermal Energy and its Innovative Application”

“Pros and Cons in Greenness when Sourcing and Producing Energy”.

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