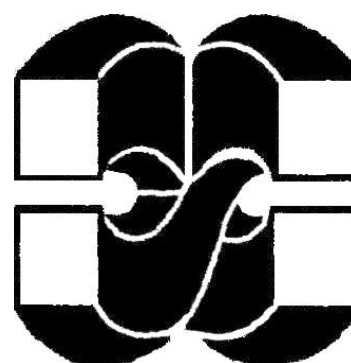


МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ  
НАЦІОНАЛЬНИЙ ТЕХНІЧНИЙ УНІВЕРСИТЕТ  
«ХАРКІВСЬКИЙ ПОЛІТЕХНІЧНИЙ ІНСТИТУТ»

КАФЕДРА ІНОЗЕМНИХ МОВ

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**Методичні вказівки  
з розвитку мовленнєвих  
навичок у курсантів 1-2  
курсів РХБЗ та ЕБ  
факультету ВІТВ НТУ «ХПІ»  
за темами: «Хімія»,  
«Екологія», «Захист  
навколишнього середовища»**



Харків - 2021

Методичні вказівки з розвитку мовленнєвих навичок у курсантів 1-2 курсів РХБЗ та ЕБ факультету ВІТВ НТУ «ХПІ» за темами: «Хімія», «Екологія», «Захист навколишнього середовища» / Укладачі: Гармаш С. В., Садковська В. А., Шеїна Л. О. – Харків : НТУ “ХПІ”, 2021. – 47 с.

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Затверджено на засіданні кафедри  
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## ВСТУП

Метою методичних вказівок є розвиток у курсантів 1-2 курсів РХБЗ та ЕБ факультету (факультет радіаційного, хімічного, біологічного захисту та екологічної безпеки) Військового інституту танкових військ НТУ «ХП» мовленнєвих навичок за темами: «Хімія», «Екологія», «Захист навколишнього середовища», що сприятиме подальшому поповненню їхнього лексичного запасу загального вжитку та лексики професійного спрямування.

Методичні вказівки складаються з текстів за темами, словника термінів, вправ на опанування лексики (діалоги, моделі та завдання на закріплення мовного матеріалу). Це сприятиме підготовці курсантів до мовного тестування відповідно до «Основних засад мовної підготовки особового складу у системі Міністерства оборони України» та набуттю мовленнєвих навичок у межах стандартизованих мовленнєвих рівнів (СМР), що відповідають рівням мовленнєвої компетентності за мовним стандартом НАТО STANAG 6001.

Структура методичних вказівок: методичні вказівки складаються з двох частин за темами в залежності від рівня підготовки курсантів у володінні англійською мовою. PART I складається з коротких текстів за темою «Екологія» [1], словника з активної лексики до кожного тексту, діалогів, різноманітних вправ на закріплення лексики професійного спрямування, а також частини з додаткового читання за темою «Хімія» [2] з відповідними завданнями. PART II складається з текстів, завдань до них [3] та оригінальних сучасних статей (додаткове читання) [4; 5] за темами: «Екологія» та «Захист навколишнього середовища», що містять більш об'ємний лексичний матеріал професійного спрямування.

В методичних вказівках було використано нароби викладачів кафедри іноземних мов НТУ «ХП» попередніх років, матеріал з інших навчальних джерел та інет-ресурсу.

## PART I

### ECOLOGY AND ENVIRONMENT

#### 1. Read and translate the text:

#### What Is Ecology?

Today the word “ecology” is on everyone's lips. Ecology is the study of plants and animals in relation to their environment. A community of plants and animals within a particular habitat is called an ecosystem. Every plant or animal of an ecosystem plays a definite role in maintaining a balance in its system. Man-made pollution often changes the environment. Pollution produces numerous harmful effects and disturbs the ecosystem.

Homo sapiens is a part of the world ecosystem. In primitive societies men went hunting and food gathering: they ate roots and berries, or animals for food. But they began to disturb the balance of nature when they started to practice farming and keep grass-eating animals.

Nowadays, the existence of enormous noxious wastes in the environment is due to the growth of industrial enterprises, transportation devices, new synthetic materials, such as plastics, and so on.

The study of pollution could be divided into three main parts: pollution of air, water and land. We should protect the environment because it is endangered by human activity.

(After Bagg J. Chemistry: Key to the Earth. - London)

#### Active Vocabulary:

environment	навколишнє середовище	noxious	шкідливий
habitat [ 'hæbitæt ]	житло; середовище проживання	wastes	відходи
to maintain	підтримувати, зберігати	enterprise	підприємство
pollution	забруднення	due to	через те, що; завдяки
harmful	шкідливий	device	механізм, прилад, пристрій
ecosystem	екосистема	homo sapiens	людина
to disturb	порушувати	to protect	захищати, охороняти
roots	коріння	to endanger	погрожувати

## Exercises

### 1. Choose the Ukrainian equivalents of the following word-combinations:

to maintain the balance	- займатися землеробством
to produce harmful effects	- тримати домашніх тварин
to disturb the ecosystem	- первісне суспільство
man-made pollution	- шкідливі відходи
a primitive society	- транспортні засоби
to practice farming	- здійснювати шкідливий вплив
to keep grass-eating animals	- порушувати екосистему
noxious wastes	- викликане людиною забруднення
transportation devices	- підтримувати (зберігати) рівновагу

### 2. Give affirmative answers to the following questions according to the given model:

- Does man-made pollution change the environment?
- Yes, of course. Man-made pollution changes the environment.

1. Is the word “ecology” on everyone's lips?
2. Is ecology the study of plants and animals in relation to their environment?
3. Does pollution produce harmful effects?
4. Does it disturb the ecosystem?
5. Is the existence of noxious wastes in the environment due to the growth of industrial enterprises and transportation devices?
6. Is the environment endangered by human activity?

### 3. Answer the following questions (work in pairs or in chain). Begin each sentence with:

- a) I think (believe, guess, suppose);
- b) to my mind; in my opinion;
- c) as far as I know; as far as I remember; as far as I understand;
- d) the thing is that...

1. What is ecology?
2. What is an ecosystem?
3. What are the roles of plants and animals in ecosystems?
4. How does man-made pollution influence the environment?
5. How did men live and behave in primitive societies?
6. When did people begin to disturb the balance of nature?

7. What is the cause of the enormous amounts of noxious wastes in environment nowadays?

8. Why should we protect the environment?

**4. Discuss some problems of ecology and environment with your fellow students:**

- a) pollution and environment;
- b) the disturbance of the balance of nature;
- c) noxious wastes and protection of nature.

**5. Retell the text**

**6. Study the dialogues given below and role-play them:**

### **Dialogue 1**

A.: I suggest a new subject for our discussion. What about “The Problems of Ecology”? I’m sure it will interest you.

B.: As for me, I’m all for it.

A.: Can you guess what I mean by ecology?

B.: I’m afraid, I can’t. Will you explain it to me?

A.: Certainly. Ecology is the study of plants and animals in relation to their environment.

B.: I see, thank you.

### **Dialogue 2**

Peter: I say, Helen. Do you pretty much understand what environmental pollution is?

Helen: Yes, certainly. All of us know it very well. I believe, the main cause of it is the growth of industrial enterprises and transportation devices.

P.: Of course, but there are some other reasons besides that for example, the appearance of many new synthetic materials, such as plastics.

H.: You're right. We should protect the natural environment for it is endangered by human activity.

P.: Yes, unfortunately, it is. Besides, there is another trouble. During the last few years holes have appeared in the ozone layer.

H.: You see, I've heard that the major cause of it is the growth (increase) of harmful chemicals called chlorofluorocarbons (CFCs) that are being released into the atmosphere.

P.: I see. The thing is that the pollution problems are known to be of great concern to humanity as a whole.

### Dialogue 3

Teacher: Can you tell me anything about smoggy cities?

Student: I know that the smoggiest cities in the world are Lahore, Teheran, Baghdad, Delhi, Calcutta, Athens and Madrid.

T.: And what is the reason?

S.: It's the presence of great amounts of sulphur dioxide and suspended particles in the air. Rain washes these harmful substances out of the air, but this creates "acid rain".

T.: Are acid rains harmful?

S.: Certainly. They pollute water, damage crops, forests and buildings.

T.: Do they affect people's health?

S.: Of course, they do.

### Dialogue 4

- Do you know anything about the "greenhouse" effect?

- Certainly, I do. I've heard that it will begin altering the earth's climate by the 1990s.

- Can you say when this effect occurs (takes place)?

- It results when CO<sub>2</sub> and certain other gases in the atmosphere allow the sun's ultraviolet rays to penetrate and warm the earth, but then the absorbed infrared energy is radiated from the earth back into space.

- Oh, I see that it is like glass in a greenhouse. It forms a kind of "thermal blanket" around the planet.

- Yes, that's right. The thing is that the greenhouse effect will cause not only hotter summers and milder winters, but it may alter rainfall, affect crop yields and raise sea levels.

## *II. Read and translate the text:*

### **Air Pollution**

Air pollution has probably been with us since the very beginning of our existence on this planet, and even when men were not present.

At present industrial activity is so great and fuel-powered transportation devices are so numerous that air pollution of human origin is starting to produce noticeable effects on a global scale. Carbon monoxide (CO) emitted by automobile engines arises from incomplete combustion of hydrocarbons found in gasoline in which the fuel reacts with less oxygen than it is theoretically possible. It is estimated that as a result of human activity, about 260 million tons of carbon monoxide are released into Earth's atmosphere every year. Automobile exhaust gases contain an average of 4-5 % CO. As to sulphur oxides, they have other bad effects in addition to those concerning human health. In high concentrations they

are lethal to vegetation.

There has appeared one more type of pollution which is threatening the globe as a whole. The protective layer of ozone around our planet is under severe attack. Alarm bells sounded in 1982 when researchers in the Antarctic first identified a yawning hole where the ozone layer is the thinnest. Five years later it was reported that the hole had grown to an area the size of the United States. The fundamental importance of the ozone layer is that it acts as a filter intercepting most of the sun's radiation including potentially harmful Ultra Violet  $\beta$ -rays which can cause melanoma - skin cancer.

The cause of the appearance of the Antarctic hole is the growing industrial use of chlorine compounds called chlorofluorocarbons (CFCs). CFCs are a propellant gas commonly used in aerosol sprays, air cooling systems in fridges and air-conditioning. There is the need for an international agreement that would completely stop CFC production.

### Exercises

**1. Look through the text and find the English equivalents to the following Ukrainian phrases:**

з самого початку нашого існування на планеті; неповне згоряння вуглеводнів; ще один вид забруднення; загрозливий для всього світу; транспортні засоби, що працюють на паливі; захисний шар озону; здійснювати значний вплив; вихлопні гази автомобілів; величезна діра; кондиціонування повітря; озонний шар найтонший; зростаюче промислове застосування; потенційно шкідливі ультрафіолетові  $\beta$ -промені; аерозольні розпилення.

**2. Answer the questions, using the words given in brackets:**

1. If you were a director of a chemical plant, what measures would you take to prevent pollution of air, water, soil?

(filter, modernization of equipment, modern technology, zero-waste technologies, wasteless production, etc.)

2. What steps (measures) should be taken on a global scale to prevent the appearance of ozone holes?

(aerosol sprays, chlorine compounds, CFC production, international agreement)

**3. Answer the following questions. Express your opinion using the following phrases:**

I think (believe, consider) (so);

I don't think (believe, consider) (so);

I hope not;  
probably, certainly, of course

1. Do you think pollution began its existence when a man appeared on this planet?
2. Do you think millions of tons of carbon monoxide (CO) are released into the Earth's atmosphere as a result of human activity?
3. Do you think sulphur oxides are harmless to human health and vegetation?
4. Do you think the cause of the appearance of the Antarctic ozone hole is the growing industrial use of chlorine compounds (CFCs) or any other substances?
5. Do you think there is the need to take measures to stop CPC production?

### ***III. Look through the article given below:***

#### **The Guilty Were Punished**

The article “Red Dye Spill” dealt with the incident at the chemical plant, as a result of which the snow in the centre of the city became pink.

The newspaper got a report from the plant management. “The spill of 10 kg of the dye ‘2K blue chrome’ into the atmosphere” occurred in the drying department of shop No.10 as a result of violating the rules of operating dust and gas collectors. The spill did not pose any health hazard.

“The officials are intending to change the work of the plant. Experimental production of dyes, consumer goods and articles of plastics will be set up. This will lead to a considerable improvement of the ecological situation in the neighborhood of the plant”.

“The department in which the spill took place”, reads the letter, “has been closed while new equipment is installed. After an investigation by the official commission, the persons guilty of violating the rules of operating dust and gas collectors were called to account”.

From the newspaper: “We would like to get a clear reply from the official commission to the question put in our paper. If the cause of the incident is the carelessness of some workers, then why was the equipment on which the dye spill occurred replaced immediately after the accident?”

#### **Active Vocabulary:**

dye	фарба, барвник	hazard	небезпека, ризик
spill	розлив, викид	to punish	карати
guilty	винний	to violate	порушувати

## Exercises

### ***1. Give short affirmative or negative answers to the following general questions:***

Model 1: - Is chemistry a science?

- Yes, it is.

Model 2: - Do you speak French?

- Yes, I do. No, I don't.

1. Does this article deal with the incident at a chemical plant?
2. Did the workers of shop No.10 violate the rules of operating dust and gas collectors?
3. Did the spill pose any health hazards?
4. Has the drying department been closed after the accident?
5. Were the persons guilty of violating the rules called to account?
6. Was the reason of the incident the carelessness of some workers?

### ***2. Change for the 3rd person singular:***

Model 3: They study at the Institute.

He (she) studies at the Institute.

Model 4: They are in the hall.

He (she) is in the hall.

1. Automobile gases are the cause of increasing CO concentration in air.
2. Industrial enterprises use filters for exhaust gases to be purified.
3. They investigate carbon monoxide and sulphur oxide for the reason of their toxic properties.
4. The experiments last for three hours.
5. Many countries on the globe fail to fight man-made pollution.

### ***3. Replace the infinitive given in brackets using the corresponding form of the verb:***

1. About 260 mln tons of carbon monoxide (to be released) into the Earth's atmosphere every year.
2. CFC (to be) a propellant gas.
3. The equipment on which the dye spill occurred (to be replaced) immediately after the accident.
4. The spill (not to pose) any health hazard.
5. Carbon monoxide (to cause) the pollution of air.
6. An accident (to take place) at the chemical plant.
7. This (to lead) to a considerable improvement of the ecological situation in the neighborhood of the plant during the two coming years.
8. The guilty (to be punished) two months ago.

#### ***IV. Conversation and Discussion***

- 1. Read the text. Find the sentence which gives the author's point of view on the problems of noise and silence:***

#### **Noise Pollution**

If indeed silence is golden, it is also becoming as rare as gold. It seems that the progress of man includes a rising volume of noise. In every home a stereo or television will fill the rooms with sound. Between sunrise and sunset, streets and highways are a constant source of noise from cars, buses, and trucks. You can pass any factory or construction area and the roar of its machinery will make your ears ring. Music is played in every supermarket, most restaurants and many offices. Big cities of the world such as Los Angeles (California, USA), Osaka (Japan) are well-known for their noisiness.

Noise pollution is the new side effect of our technological age. Day or night, the sound of work fills the air. It seems that the soothing effects of silence are nowhere to be found. Even the quiet of our carefully protected wilderness areas can be invaded at any moment by a passing jet.

We are learning, finally, that silence is a natural resource and must be protected by law.

- 2. Answer the following questions:***

1. Is noise pollution a serious problem everywhere?
2. What are some of the causes (sources) of noise pollution in your city / town?
3. Is there a way to solve the problem of noise pollution in our cities? How could this be done?

- 3. Make up your own dialogues on the basis of the text and the questions to it.***

- 4. Read the statements expressing your doubt and surprise («невъе?»)***

Model 5: - Day and night the sound of work fills the air.

- Does it really?

1. Silence is becoming as rare as gold.
2. Streets and highways are a constant source of noise from cars, buses and trucks.
3. Big cities of the world such as Los Angeles (USA, California) and Osaka (Japan) are well-known for their noisiness.
4. Silence is a natural resource and must be protected by law.

***V. Read and retell the text to your friend:***

Pollutions are not only harmful to health but to buildings as well. In most metropolitan centers some of the oldest and finest buildings are being destroyed. On the one hand, the constructions are being shaken by traffic, and on the other hand, the bricks are being eaten away by the gases from cars. It is a slow process but it is going on daily.

**Exercise**

***Complete the following sentences:***

1. Pollutants are not only harmful to health but...
2. On the one hand, the constructions are being shaken by traffic, and on the other hand...
3. It is a slow process but...

***VI. Read and translate the text:***

**Water Pollution**

One more aspect of our ecological problems is water pollution. Sea and river-going ships often pollute sea and river water with various oil products. No less than five million tons of oil are discharged into seas and oceans each year and one ton of oil can spread over about twelve square kilometres of water surface as a fine film which prevents air-water oxygen exchange. One litre of oil makes one million litres of fresh water unfit for drinking. We must stop the pollution of our water-ways which comes from many sources: chemical waste from factories, thermal waste from power stations, domestic waste from cities and towns, and so on.

Pollution of water resources always demands a choice between which more advantageous is to purify the polluted water and use fresh water for production or create closed cycle water supplies, so the same water can be used several times. We favour the second alternative. Recycling technology demands more capital investment, but on the end it is more effective.

**Exercises**

1. Find the sentence which gives the author's point of view on the water pollution problem. Do you agree with the author?
2. Tell a foreigner about water protection resources.

## VII. Read and translate the text:

Transportation is a major source of environmental pollution. Every car consumes several tons of air. Its exhaust gases contain poisonous carbon dioxide which complicates the emission of the earth's heat into space. Many cities now are too noisy to live in. Los Angeles in the USA and Osaka in Japan are known to be the air pollution champions among major industrial cities.

### Exercise

*Look through the microtext and ask your fellow student about:*

- 1) the major source of environmental pollution;
- 2) the contents of car exhaust gases;
- 3) the world's cities - champions in the air pollution.

### Word List

aerosol spray	аерозольний спрей	poison (n, v)	отрута; отруїти
air-conditioning	кондиціонер	poisonous (adj)	отруйний
CFC – chlorofluorocarbons	хлорфторвуглеці	pollute (v)	забруднювати
damage (n, v)	пошкодження; пошкодити	pollutant (n)	забруднююча речовина
danger	небезпека	pollution (n)	забруднення
dangerous	небезпечний	man-made pollution	забруднення, яке завдається людиною
device	пристрій	protect (v)	захищати, охороняти
discharge (n, v)	викид; виділяти, викидати	protect the environment (people's health, nature)	охороняти навколишнє середовище (здоров'я людей, природу)
disturb (v)	турбувати, порушувати	produce (v)	виробляти
disturb the balance of nature	порушувати рівновагу у природі	produce harmful effects (on)	справляти шкідливий вплив (на)

disturb the ecosystem	порушувати екосистему	release (v)	звільняти, виділяти, викидати
disturbance (n)	порушення	release harmful substances into atmosphere	викидати шкідливі речовини в атмосферу
endanger (v)	погрожувати, ризикувати	scale (n)	масштаб
environment	навколишнє середовище	on a global scale	в глобальному масштабі
exhaust (n, v)	вихлоп, викид; викидати	smog (n)	“смог”
fuel	паливо	spray (n,v)	розпилення; обприскувати
fossil fuels	горючі корисні копалини	substance (n)	речовина
fridge	холодильник	harmful substances	шкідливі речовини
harmful	шкідливий	sulphur (n)	сірка
hole	отвір, діра	sulphur dioxide	діоксин сірки
ozone hole	озонова діра	suspend (v)	вішати
layer (n)	шар	suspended particles (substances)	зважені частинки (речовини)
ozone layer	озоновий шар	threat (n,v)	загроза; погрожувати
lethal (to vegetation)	смертельний для рослинності	toxic	токсичний
level (n, v)	рівень; вирівнювати	toxic substances	токсичні речовини
noise (n)	шум	violate (v)	порушувати
noisy (adj)	шумний	wash out (v)	вимивати
noxious	шкідливий	waste (v)	витрачати
occur (v) - syn. to take place, to happen	мати місце, траплятися	wastes (n)	відходи
penetrate (v)	проникати	noxious wastes	шкідливі відходи

## Supplementary Reading with Exercises

*Read and translate the text:*

### Notes on the Text:

to deal with	мати справу з, розглядати, стосуватися	to devote to	присвячувати
to take place	мати місце, відбуватися	to make a contribution to	зробити внесок

## CHEMISTRY

Chemistry is the science which deals with materials, their properties and the transformations they undergo. So chemistry is the study of the composition and properties of matter, their changes, the conditions under which such changes take place, and the energy changes which accompany them.

Chemistry is concerned with the nature of fire and the structure of water, it deals with colours, catalysis and crystal structure, with physical properties and chemical reactivity.

Chemistry is one of the fundamental sciences. It plays an important part in the development of biochemistry, physics, geology, and many other fields of science. Chemistry's origin goes back to ancient times, with the manufacture of bronze, iron, ceramics, glass.

At the end of the sixteenth century sufficient, facts, entirely free of magic which surrounded the work of the alchemists, appeared.

In the 17th century modern chemistry began with the work of Robert Boyle. He was the first one who studied quantitatively the relationship between the volume of a gas and the external pressure upon it. Later A. Lavoisier introduced the concept of the chemical elements.

In the 19th century A. Avogadro introduced the concept of molecules. He stated that equal volumes of gases under the same conditions of temperature and pressure contain the same number of molecules.

F. A. Kekule and A. M. Butlerov introduced the structural theory of organic chemistry.

In 1869 D. I. Mendeleev discovered regularities in the properties of the elements. D. I. Mendeleev's discovery was the greatest one in chemistry.

Many great scientists devoted their life to the development of chemistry, among them Bohr whose theory of the hydrogen atom was very important, the Curies who in 1934 announced the preparation of artificially radio-active elements, Marie Curie who discovered radium and the element polonium.

Many great chemists made a great contribution to the world science. Among them, the outstanding chemists M. V. Lomonosov, D. I. Mendeleev, A. M. Butlerov, Academician N. N. Semenov, and many others.

Everyone now understands the importance of chemistry. The future of chemistry is practically unlimited. Rapid development of chemical industry will make it possible to create many new goods, machines, plastics, polymers, it will help to understand many new phenomena.

In your study of chemistry you will learn many things about substances, compounds, materials, chemical and physical changes, chemical properties, reactions and many other interesting and important things. It is to be remembered that:

1. Chemistry is the study of substances, their structure, their properties, and their reactions.
2. Matter exists as solids, liquids, or gases.
3. Homogeneous material is material with the same properties throughout.
4. Heterogeneous material is material consisting of parts with different properties.
5. Compound is a substance that can be decomposed into two or more substances.
6. Substance is a homogeneous species of matter with definite chemical composition.
7. Chemical reactions are the processes that convert substances into other substances.
8. Alloy is a metallic material containing two or more elements.

***Remember the following words and word combinations***

**Active Vocabulary:**

to deal with	мати справу з	to discover	відкривати
property	властивість	discovery	відкриття
to undergo	зазнавати (змін)	practically	практично
entirely	повністю	phenomena	явища
to surround	оточувати	to develop	розвивати
relationship	відносини	development	розвиток
external	зовнішній	origin	походження
internal	внутрішній	to learn	вчити
to introduce	ввести	substance	речовина
composition	склад	to exist	існувати

to accompany	супроводжувати	homogeneous	однорідний
to be concerned with	мати справу з	heterogeneous	неоднорідний
equal	рівний	to consist of	складатися з

***Answer the following questions:***

1. What do you know about chemistry?
2. What does chemistry study?
3. What does chemistry deal with?
4. Why is chemistry one of the fundamental sciences?
5. When did sufficient facts about chemistry appear?
6. When did modern chemistry begin?
7. Who was the first to study quantitatively the relationship between the volume of a gas and the external pressure upon it?
8. What did Lavoisier introduce?
9. Who discovered regularities in the properties of the elements?
10. What can you tell about the future of chemistry?

***Retell the text according to the following plan:***

1. The definition of chemistry.
2. The relation of chemistry to other fields of science.
3. The origin of chemistry.
4. The great chemist Robert Boyle and his theory.
5. A. Avogadro's formulation of molecules.
6. D. I. Mendeleev's Periodic Law.
7. Great scientists of the 19th century.
8. The future of chemistry.

***Find the line where all the words are adjectives:***

- 1) chemical, naturally, fundamental;
- 2) entirely, practically, possible, physically;
- 3) possibly, artificially, entirely, naturally;
- 4) practically, artificially, original, possibly;
- 5) different, impossible, original.

***Find the pairs of antonyms and remember them:***

internal, to appear, natural, old, to disappear, artificial, new, external.

***Find the pairs of synonyms and remember them:***

to deal with, to change, to start, field, to be concerned with, to alter, branch, to begin.

***Give the Past Indefinite Tense of the following verbs:***

to learn, to deal with, to accompany, to create, to study, to change, to undergo, to place, to take, to begin, to contain, to make, to go, to be.

***Translate the following sentences paying attention to the different meanings of the word "matter":***

1. Mass is the quantity of matter in a special specimen.
2. Chemistry is the branch of science which deals with different substances or varieties of matter.
3. It is a matter of common observation that matter exists in three states.
4. Though this substance is of organic origin it is still a matter of some doubt whether it is of animal or vegetable origin.
5. As a matter of fact this discovery was not a new one, but still it was very interesting.
6. No matter what results we get we shall continue our work.
7. It doesn't matter when he comes, we shall begin our experiment without him, and later we shall show him the results.
8. Changes in matter can't be without changes in energy.
9. Matter is that which makes up the universe, matter is the reality.
10. It is known that mass is a quantity of matter that makes a body.
11. The concentration of mineral matter in sea water slowly increases.
12. Sea water contains approximately 3.6 per cent of mineral matter in solution.
13. The forms of motion of matter are diverse.

***Translate the words in the brackets into English:***

1. Chemistry is the science which (**розглядає**) with materials and their properties.
2. We think that the exhibition of our achievements (**складається**) at the end of September.
3. This scientist (**зробив великий внесок**) both in chemistry and physics.
4. All his life he worked in the field of chemistry, and we can say that he (**присвятив**) his life to science.
5. All the changes which (**супроводжували**) this reaction play a very important role.

6. Later Lavoisier (**запровадив**) the concept of the chemical elements.
7. Though these two teams work under (**однакові**) conditions the results of their work are different.
8. This article (**стосується**) the development of our industry.

***Translate the text using a dictionary. Reproduce the text:***

Analytical chemistry deals with the methods of separation. Synthetic chemistry deals with the methods by which complex bodies can be built from simpler substances. Physical chemistry deals with changes of state and with the motions of molecules. But at the present time the scientists don't maintain this definition.

The discovery of X-rays, an electron, and radioactivity marked a new era in all sciences and in chemistry. It was a very important discovery in science. It plays an important part in the development of geology and physiology, in technology and in chemical engineering.

Chemistry deals with medicine and agriculture as they are all concerned with the properties and changes of chemical substances.

***Read the text and discuss it:***

### **Some Facts about Chemistry**

The science of chemistry deals with substances. Chemistry is the investigation and discussion of the properties of substances.

Common examples of substances are: water, sugar, salt, copper, iron and many others.

Chemists study substances in order to learn as much as they can about their properties and about the reactions that change them into other substances. This knowledge is very important as it can make the world a better place to live in, it can make people happier, it can false their standard of living.

Chemists discovered many laws, investigated many important phenomena in life. They produced many artificial substances which have valuable properties.

Chemistry has two main aspects: descriptive chemistry, the discovery of chemical facts, and theoretical chemistry, the formation of theories.

The broad field of chemistry may also be divided in other ways. An important division of chemistry is that into the branches of organic chemistry and inorganic chemistry.

Organic chemistry is the chemistry, of the compounds of carbon that occur in plants and animals?

Inorganic chemistry is the chemistry of the compounds of elements other than carbon. Each of these branches of chemistry is in part descriptive and in part theoretical.

***Read the text and retell it:***

Chemistry is a very large subject. Chemistry is a complex subject. It is the investigation and discussion of the properties of substances.

If we ask—why do we study chemistry, the answer can be—it is through chemistry we obtain the knowledge of matter, its changes and transformations.

Everyone understands that science of chemistry plays an important part in the modern world.

Chemistry plays an important part in the development of other sciences such as physics, biochemistry, geology and a lot of other fields of science.

***Read the text and discuss it:***

### **D. I. MENDELEYEV**

D. I. Mendeleev, the great Russian chemist, was born in Siberia on February 8, 1834. When seven years old he went to gymnasium at Tobolsk. He studied very hard, he especially liked mathematics, physics and history. At the age of 16 he entered the Pedagogical Institute in St. Petersburg, physico-mathematical department. He graduated from the Institute in 1855 and began to teach chemistry at the Technological Institute and then at the University. In 1865 Mendeleev was granted the Doctor of Science degree for the thesis on the combination of alcohol with water. This work was both of great theoretical and practical significance. Soon after that D. I. Mendeleev was appointed Professor of General Chemistry of St. Petersburg University. Despite lectures and supervision of the laboratory, D. I. Mendeleev carried on great research work.

Mendeleev's greatest discovery was the Periodic Law. The Periodic Law suggested by Mendeleev stated that the properties of the elements were a periodic function of their atomic masses. He presented this work to the Russian Chemical Society. Mendeleev's Periodic Law opened a new era in the history of chemistry.

Mendeleev was interested in many branches of science, indeed there is hardly any field of science that was not enriched by his contribution. His numerous

works dealt with many subjects: properties of liquids, theories of solutions, the development of the gas law, the use of oil and many others.

D. I. Mendeleev was a great patriot. He did everything for the development and progress of his country.

D. I. Mendeleev continued his research work to the very last day of his life. He died in 1907.

The world is thankful to Mendeleev for his great contribution to the world science. At present there is hardly anybody who doesn't know this Russian scientist and his Periodic Law. We are proud of D. I. Mendeleev who did so much for his country, for the development of the world science.

***Give answers according to the model:***

Model: Was your Institute founded in 1920?

Yes, it was. No, it was not.

Yes, it was founded in 1920. No, it was not founded in 1920.

1. Was the experiment carried out in the analytical laboratory?
2. Was this article translated into many languages?
3. Was D. I. Mendeleev appointed Professor of General Chemistry?
4. Was this substance purified before the experiment?

***Answer the following questions:***

1. When was D. I. Mendeleev born?
2. Where was he born?
3. When did he go to gymnasium?
4. What subjects did he like?
5. What Institute did he enter?
6. Where did he work after the graduation from the Institute?
7. When was he granted the Doctor of Science degree?
8. What was he granted this degree for?
9. What was Mendeleev's greatest discovery?
10. What did he present to the Chemical Society?
11. What other problems was Mendeleev interested in?
12. What subjects did his numerous works deal with?
13. When did he die?

***Retell the text according to the following plan:***

1. D. I. Mendeleev's childhood.
2. The gymnasium and the Pedagogical Institute.

3. D. I. Mendeleev's work at the Technological Institute and at the University.
4. His research work.
5. D. I. Mendeleev's greatest discovery.
6. D. I. Mendeleev's greatest contribution to science.
7. D. I. Mendeleev is a great chemist and patriot.

***Translate the following sentences paying attention to the passive constructions:***

1. Physics and chemistry are taught at school.
2. Some of the experiments were carried out in our Institute.
3. Our Institute was named after the great chemist D. I. Mendeleev.
4. Some of the properties of this substance will be predicted.
5. He was appointed Rector when he was 35 years old.
6. Almost all branches of chemistry and physics will be enriched by this new theory.
7. I was told about that great chemist who devoted his life to chemistry.
8. A new laboratory will be built in May.
9. The professor was asked many questions after the lecture.
10. He was sent abroad to continue his studies.
11. This problem is dealt with in many textbooks.
12. This article will be presented as soon as we finish it.
13. This problem is being discussed by many scientists both in our country and abroad.
14. Some new results were obtained by a group of research workers.
15. This substance cannot be used, it has many impurities.

***Translate the sentences paying attention to the verb "to be":***

1. He was carrying out his experiments when I entered the laboratory.
2. The substance was examined under the microscope.
3. He was born in Siberia.
4. He was interested in chemistry when he was a schoolboy.
5. He was sent to Petersburg to continue his studies.
6. This student was present at the lecture.
7. This work was interesting both for him and for his students.
8. He was appointed Professor of Moscow University.
9. His work was devoted to physics.
10. He was not present at the Institute yesterday.

***Find the correct translations of the following English sentences:***

1. The professor was asked many questions by the students after the lecture.
  - a) Професор задав студентам багато питань після лекції.
  - b) Після лекції професору задали багато питань.

- c) Професору задали багато питань студенти після лекції.  
 d) Після лекції студенти задали професору багато питань.
2. Chemistry is taught at our Institute by a well-known scientist.  
 a) Хімія викладається у нашому інституті відомим вченим.  
 b) Відомий вчений читає (викладає) курс хімії у нашому інституті.

***Open the brackets choosing the suitable word. Translate the sentences into Ukrainian:***

1. Many scientists before D. I. Mendeleev tried to classify elements (despite, according to) their atomic weights.
2. He worked (hardly, hard) at the new problem.
3. It was (very, the very) important to solve this problem in time.
4. They could (hard, hardly) finish their work without his supervision.
5. Elements with (very, the same) properties are at definite intervals in the Periodic Table.
6. When D. I. Mendeleev went to gymnasium he was interested (both, both . . . and) in mathematics, physics.
7. Give me (very, the very) book you brought.
8. He was very (interested, interesting) in chemistry from (very, the very) childhood.
9. I like (both, both ... and) these pictures.
10. One may think that (the very, very) amount of heat which will raise the temperature of one gram of water from 0°C to 1°C will also raise the temperature of the same mass of water from 60°C to 61 °C.

***Read the text and render the main idea:***

In more than a hundred years of its existence the Periodic Law did not lose <sup>1</sup> its significance. The Periodic Law became the property of all nations, like the works of Newton, Lomonosov, Einstein and other great scientists.

The importance of D. I. Mendeleev's discovery is not limited to chemistry alone. The Periodic Law opened up <sup>2</sup> the way to the structure of the atom and its nucleus.

At the time when D. I. Mendeleev published his Table only 63 elements were known. Now 104 elements are known. Thus the Periodic Law discovered a hundred years ago plays a great part in the development of modern chemistry and physics.

***Notes:***

1. to lose – втрачати
2. to open up – відкривати

## PART II

## ENVIRONMENTAL PROTECTION

## Active Vocabulary of the Unit:

environment	навколишнє середовище	to maintain balance of nature	підтримувати рівновагу в природі
to protect	захищати	to endanger	загрожувати; ризикувати
to cause	спричиняти	harmful	шкідливий
to increase	збільшувати	noxious	згубний; отруйний
to reduce	зменшувати	wastes	відходи
to accumulate	накопичувати	substance	речовина
to discharge	спорожнювати; розряджати; випускати	acid rain	кислотний дощ
to emit	випромінювати	greenhouse effect	парниковий ефект
to eject	виштовхувати	smog	смог
to release	звільнити	global warming	глобальне потепління
to dump	скинути	holes in the ozone layer	діри в озоновому шарі
to threaten	загрожувати	suspended particles	зважені частинки
to poison	отруїти	artificial	штучний
poisonous	отруйний	exhaust gases (fumes)	вихлопні гази (чад)
toxic	токсичний	garbage	сміття (відходи)
to avert	відвертати	trash	сміття (погань)
to pollute	забруднювати	litter	сміття (послід)
pollution control facilities	засоби контролю забруднення	junk	мотлох; брукхт
pollutants	забруднюючі речовини	purification system	система очищення
to contaminate	забруднювати; заражати	sewage	стічні води; нечистоти
to damage	пошкодити	hazard	небезпека
to disturb	турбувати; вередити	soil erosion	ерозія ґрунту

***Read and translate the text:***

## **Ecology**

For millennia man had to struggle against nature in order to survive and develop. However, as economy developed and the scientific and technological revolution increased, the correlation of forces between man and nature changed. As a result, economic achievements began to have an increasingly negative effect on nature, on the biosphere.

Road and factory construction and industrial development take away up to 7 million hectares of land every year. Forests disappear at a rate of some 20 hectares a minute. 76 animal species and several hundred plant species of the Earth became extinct in the last 60 years alone. Each year the world economy ejects into the atmosphere over 200 million of carbon monoxide, more than 50 million tons of diverse hydrocarbons, over 120 million tons of ash and nearly 150 million tons of sulphur dioxide. They fall back upon the Earth in the form of “acid rains”.

There are lots of ecological problems: pollution and impoverishment of the seas, oceans, rivers, underground waters; pollution and destruction of woods and agricultural grounds; pollution of the atmosphere; reduction of the protective ozone layer; dramatic changes of climate; rising of the ocean level; accumulation of deadly radioactive substances made by nuclear power stations; impoverishment of the vegetative and animal world; exhaustion of planet’s resources.

All these ecological problems are caused by disturbing the natural balance in the Earth’s ecosystem. Ecosystem is a community of plants, animals and homo sapiens (as a part of the world ecosystem) within a particular habitat. To study the ecosystem in relation to their environment is the aim of the science called ecology. Today most countries pay great attention to the environmental protection because our everyday life, our health and, in the end, the survival of the mankind depend on the solution of ecological problems facing the man.

## **Exercises**

***Decide which of these statements are true and which are false:***

1. All ecological problems are caused by solar activity.
2. Carbon monoxide is produced only by cars.
3. People are a part of ecosystem.
4. Ecology is a science studying insects.
5. Economic activity usually has a negative effect on nature.

***Make sentences from the parts given in the left and right columns of the table:***

A drought happens	when there aren't enough trees
A famine happens	when there isn't enough rain
A flood happens	when there is too much carbon dioxide
Trees fall down	when there is too much rain
The world produces less oxygen	when the wind is too strong
The atmosphere becomes warmer	when there is too much ultraviolet radiation
There is more skin cancer	when there isn't enough food

***Read the text. Complete the list of necessary environmental protection measures:***

People still do not have so much needed ecological conscience and do not see that they are only ones responsible for salvation of our planet. It is probably too painful to admit our own mistakes and try to fix them before it is too late. Some small steps have been already done but it will take much more these steps on global level in order to make the difference. If we realize the coming danger we should find solutions to all ecological problems to survive.

- We must change people's attitude towards the environment.
- We should stop the pollution of air and water.
- We should save more energy and water and try to use other sources of energy (solar and tidal energy, the energy of the wind, subterranean hot waters, etc.).
- We must protect the ozone layer from the harmful industrial products.
- We should protect animals from extinction.

***Complete the sentences based on information from the text:***

1. We must change people's attitude \_\_\_\_.
2. We should protect animals \_\_\_\_.
3. We should use other sources of energy such as \_\_\_\_.
4. We must protect the ozone layer from \_\_\_\_.
5. We should solve our ecological problems before \_\_\_\_.

***Read the text and translate it:***

## **Water Pollution**

Fresh water is fundamental to the survival of humans and most other land-based life forms.

Ninety seven per cent of the earth's water is the salt water of oceans and seas. Most of the remaining 3 per cent is in polar ice caps, glaciers, the atmosphere or underground and hard to reach. Only 0.4 per cent is available for use. However, growing population, increased economic activity and industrialization has resulted in an increased demand for fresh water and has caused a severe misuse of water resources and their increasing pollution.

Following are the main sources of water pollution.

- Oil spills from ships and super-tankers, and from off-shore oil drilling operations. Oil forms a thin layer on top of water. Animals and plants living in the water can't breathe; the oil coats the feathers of water birds, and the fur of animals causing them to become sick or even to die.
- Fertilizers used by farmers. When fertilizers are washed into rivers and streams, the nitrates and phosphates cause excessive growth of water plants. It is harmful to the fish and other invertebrates that live in water because it makes it hard for them to breathe.
- Sewage and other organic pollutants. When leaves, grass and wastes from farm animals enter the water, they rot and use up the oxygen in the water. A lot of types of fish and other aquatic animals cannot survive. Such microscopic pollutants as bacteria and viruses cause sickness in people and in animals that drink or live in polluted water.
- Chemicals. Chemical pollution entering rivers and streams causes great destruction of water environment. The chemicals can come from factories, construction sites, mining operations, and from homes.
- Plastics. Floating plastic is ugly and harmful to the environment. It can choke animals that try to eat it and drown those that get tangled in it.

***Answer the questions:***

1. Why is fresh water so important?
2. How much fresh water available to people is there on the Earth?
3. How much salt water is there on our planet?
4. What are the main sources of water pollution?
5. To whom are oil spills mostly harmful?
6. What is caused by fertilizers washed into streams or lakes?

***Translate the text into Ukrainian:***

**How we use up water  
(22 March – world day for water)**

- 30 litres of water go down to the drain when you shower for five minutes.
- 80 litres are used in the average bath.
- 5 litres are wasted by running the tap while brushing your teeth.
- 1,000 litres an hour are used by a garden sprinkler.
- 4 litres a day are wasted by a dripping household tap.
- 650 litres of water are used per guest per day in a hotel.
- 10,000 litres a day irrigates an 18-hole golf course.
- 1 flush of the lavatory uses as much water as the average person in the developing world uses for one day's washing, drinking, cleaning and cooking.

***Read the text and ask five questions about its content:***

**The Black Sea Pollution**

The story about the Black Sea pollution starts like almost any other pollution story. Once, about half a decade ago, the Black Sea had very rich and diverse marine ecosystems. It also had major economic benefits in the form of millions of tourists coming from all over the world, not to mention the abundant fisheries.

But in the 1990s, this important natural resource has been brought at the brink of destruction. Once rich biodiversity became only a fond memory, and foreign tourists are no longer coming to enjoy the natural beauties that this area once offered. There is also no more fish, and tragically the Black Sea has become an area to dump all forms of solid and liquid waste.

The Black Sea is full of different pollutants such as toxic metals and agrochemicals. These substances have caused an overproduction of phyto-plankton which prevents light from reaching the sea grasses and algae, thus making a huge damage to marine life.

Many tanker accidents caused oil pollution, while coastal industries continue to discharge waste products directly, with little or no treatment. This, along with huge industrial activity in the area, shipping and offshore oil exploration have created critical environmental situation.

In order to fight this pollution, the six surrounding countries signed the Bucharest convention in 1992 but this convention has so far had very little impact

because several governments have not yet released the funds needed to fulfill their commitments in fight against the Black Sea pollution.

And so the pollution still continues.

***Read and translate the following text in writing:***

Air pollution is a mixture of solid particles and gases in the air. Car emissions, chemicals from factories, dust, pollen and mold spores may pollute the air in big cities and small towns.

Some air pollutants are poisonous. Inhaling them can increase the chance you'll have health problems. People with heart or lung disease, older adults and children are at greater risk from air pollution. Air pollution isn't just outside – the air inside buildings can also be polluted and affect your health. Sources of indoor pollution include biological contaminants like mold and pollen, tobacco smoke, household products and pesticides, gases such as radon and carbon monoxide, materials used in the building such as asbestos, formaldehyde and lead.

Indoor air quality problems usually only cause discomfort, and most people feel better as soon as they eliminate the source of the pollution. However, some pollutants can cause diseases that show up much later, such as respiratory diseases or cancer. Making sure that your building is well-ventilated and eliminating pollutants can improve the quality of your indoor air.

***Read and translate the dialogue. Make sentences with the underlined expressions :***

### **Land Pollution**

A: You know, lots of people in the world think it's important to live green.

B: Yes, but some of them are not aware of how much pollution exists.

A: So, do you know where it comes from?

B: As far as I know, most land pollution is caused by industrial and commercial sources, such as factories, oil refineries and so on.

A: Does it mean that we are not able to influence it?

B: Nothing of the kind. First, we can help to make it known. The more people learn about the pollution facts, the more attention will be drawn to them and, I hope, the sooner these problems will be solved.

A: I know there are new laws and regulations that are aimed at reducing the amount of commercial and industrial pollution.

B: Sure, but there is still more work to be done and besides – everyone can contribute to preserving our land clean.

A: You are right. We must learn to care for the earth in a responsible way to sustain life for ourselves and for the generations to come.

***Read the passage and translate it in writing:***

Garbage is another important source of pollution. Every year households discard 41 million cubic metres of domestic waste – 1.18 cubic per urban resident. Nearly all this waste – 95.7% – is dumped at one of the 656 open-air sites; only a small part is processed at one of the four garbage disposal plants operating in Ukraine. Four out of five of the open-air dumps have no facilities to protect the underground water or the air and are huge toxic areas. As a result it is necessary to prohibit the use of large land areas for 50 years since the agricultural lands around dumps suffer low productivity due to pollution of the soil and the destruction of natural micro-organisms.

***Read the text and discuss what you can do to reduce land pollution:***

**Here are a few land pollution facts that pertain to littering.**

- Some studies show that more than 8 million gallons of litter is thrown from car windows every day.
- Of all of the items placed in landfills each year, nearly 80% of them could have been recycled.
- More than 30 billion non-biodegradable foam cups are used each year.
- More than 20 billion tons of topsoil is lost each year due to land pollutions.

In addition to using your voice to spread the word about how important it is to stop commercial land pollution, there are also action steps you can take today that will cut down on your personal contribution to land pollution.

**Here are a few land pollution facts how to reduce your own waste.**

**Buy Used**

- Many of the items that you use every day can be found used. This includes clothes, furniture, household items and many more.
- You should also donate all of your old items to a local thrift store rather than throwing them away. This will not only cut down on what ends up in a landfill, but will give someone else a chance to find what they need used rather than having to buy new.

- Of course, you won't be able to find everything you need used, but you should always start your search looking for used items and only buy new when you must. This will not only help the environment, but it will save you money as well.

### **Eat Organic**

- When you eat organic foods, you are supporting farmers that do not use pesticides which are harmful to the environment.
- Organic foods will cost a bit more, but they are better both for the environment and for your health.

### **Watch the Packaging**

- When you do need to buy something new, try to find products that do not use unnecessary packaging. Such packaging accounts for a lot of what is thrown away by consumers each year.
- Write to companies that use too much packaging and let them know that you would love to buy their products, but that you will not do so until they eliminate what will potentially become land pollution.

## **Ecological Dangers**

*Read the texts and translate them. Write a story about one of the environmental threats using active vocabulary:*

### **Global warming**

Today our planet is warming. Some impacts from increasing temperatures are already happening: ice is melting worldwide, especially at the Earth's poles; the number of penguins on Antarctica have fallen from 32,000 to 11,000 in 30 years; sea level rise became faster over the last century; some butterflies, foxes, and alpine plants have moved farther north or to higher, cooler areas; precipitation (rain and snowfall) has increased across the globe, on average.

Other effects could happen later this century, if warming continues: sea levels are expected to rise between 7 and 23 inches (18 and 59 centimeters) by the end of the century; hurricanes and other storms are likely to become stronger; species that depend on one another may become asynchronous. For example, plants could bloom earlier than their pollinating insects become active; floods and droughts will become more common; less fresh water will be available; some diseases will spread, such as malaria carried by mosquitoes; ecosystems will change.

## **Overpopulation**

With the number of people on the globe over 7 billion, the impact of human populations on the environment has been severe. Every year, more than 81 million people add the world-wide population. Every 10 years almost one billion more inhabitants are added.

The current effects of overpopulation are as follows: to build new settlements 16 million hectares of forest are chopped down each year; the accelerated growth of the human populations has caused the destruction of natural habitats of many bird and animal species and their extinction; about 5 million people die every year from illnesses associated to organic wastes; water necessities will increase to 20% by 2025; in USA only, consumption of materials (wood, metals, synthetics, etc.) has grown 18-fold since 1900; the ozone layer has been gradually ruined by the effect of the CFCs and as a result of huge industrial activity.

***Read the text and translate it into Ukrainian:***

### **Jet Planes Keep Us Warm at Night**

Scientists have discovered an unexpected reason for climatic change: airplanes. New research has revealed that vapour trails from jet aircraft flying across the country make nights up to 1<sup>0</sup>C (1.8<sup>0</sup>F) warmer, and days 1<sup>0</sup>C cooler. The study was conducted by checking the records at 4,000 weather stations when aircrafts were grounded across the US in the aftermath of the September 11 attacks. When compared with historical averages, they discovered that those nights were colder and the days warmer, with the temperature difference between night and day rising by an average of 1.8<sup>0</sup>C. The vapour trails, which can turn into high altitude cirrus clouds in the right conditions, reflect sunlight back during the day reducing air temperature at ground level and act as an insulating layer at night helping keep warm air in.

***Read the text and translate it:***

### **Cruise Liners Are Contaminating Our Oceans**

Luxury cruise liners that carry millions of passengers to remote corners of the globe are polluting the seas and endangering marine life. The new super-liners, which can accommodate up to 4,000 passengers and crew, are pumping thousands

of gallons of sewage and oily bilge water into the sea every day with potentially disastrous effects on fragile ecosystems. These cruise holidays are increasingly popular but the ships are like floating cities without any rules on sewage and waste disposal. A study conducted by the American environmental group, which is dedicated solely to the protection of the Earth's oceans, has revealed that a typical ship's daily waste will include 37,000 gallons of oily bilge water; 30,000 gallons of sewage; 255,000 gallons of waste water (from showers etc.); and seven tons of rubbish. The number of cruise ships is growing every year – in 2000, 240 liners carried ten million passengers – and they are travelling to ever more exotic locations. As a result, even remote waters in Alaska are now polluted.

*Decide which of these statements are true and which are false:*

1. Cruise liners often pollute seas and oceans.
2. Big liners can accommodate up to 100,000 people.
3. There are strict rules for treating wastes of ocean-going liners.
4. Ships throw no rubbish overboard.
5. Waters near Alaska are polluted with garbage thrown from the ships.
6. The activity of the American environmental group is aimed at the protection of American rivers.

## **SUPPLEMENTARY READING**

*Read the article, translate it and discuss in groups:*

### **Air Pollution: Everything You Need to Know**

How smog, soot, greenhouse gases, and other top air pollutants are affecting the planet – and your health.

June 22, 2021 Jillian Mackenzie & Jeff Turrentine

<https://www.nrdc.org/stories/air-pollution-everything-you-need-know>

### **What Is Air Pollution?**

Air pollution refers to the release of pollutants into the air – pollutants which are detrimental to human health and the planet as a whole. According to the World Health Organization (WHO), each year air pollution is responsible for nearly seven million deaths around the globe. Nine out of ten human beings currently breathe air that exceeds the WHO's guideline limits for pollutants, with those living in low- and middle-income countries suffering the most. In the United States, the Clean Air Act, established in 1970, authorizes the U.S. Environmental Protection Agency

(EPA) to safeguard public health by regulating the emissions of these harmful air pollutants.

### **What Causes Air Pollution?**

“Most air pollution comes from energy use and production,” says John Walke, director of the Clean Air Project, part of the Climate and Clean Energy program at NRDC. “Burning fossil fuels releases gases and chemicals into the air.” And in an especially destructive feedback loop, air pollution not only contributes to climate change but is also exacerbated by it. “Air pollution in the form of carbon dioxide and methane raises the earth’s temperature,” Walke says. “Another type of air pollution, smog, is then worsened by that increased heat, forming when the weather is warmer and there’s more ultraviolet radiation.” Climate change also increases the production of allergenic air pollutants, including mold (thanks to damp conditions caused by extreme weather and increased flooding) and pollen (due to a longer pollen season).

“We’ve made progress over the last 50 years improving air quality in the United States thanks to the Clean Air Act,” says Kim Knowlton, senior scientist and deputy director of the NRDC Science Center. “But climate change will make it harder in the future to meet pollution standards, which are designed to protect health.”

### **Effects of Air Pollution**

The effects of air pollution on the human body vary depending on the type of pollutant and the length and level of exposure – as well as other factors, including a person’s individual health risks and the cumulative impacts of multiple pollutants or stressors.

#### **Smog and soot**

These are the two most prevalent types of air pollution. Smog (sometimes referred to as ground-level ozone) occurs when emissions from combusting fossil fuels react with sunlight. Soot (also known as particulate matter) is made up of tiny particles of chemicals, soil, smoke, dust, or allergens - in the form of either gas or solids – that are carried in the air. The sources of smog and soot are similar. “Both come from cars and trucks, factories, power plants, incinerators, engines, generally anything that combusts fossil fuels such as coal, gas, or natural gas,” Walke says.

Smog can irritate the eyes and throat and also damage the lungs, especially those of children, senior citizens, and people who work or exercise outdoors. It’s even worse for people who have asthma or allergies: these extra pollutants can intensify their symptoms and trigger asthma attacks. The tiniest airborne particles in soot, whether gaseous or solid, are especially dangerous because they can

penetrate the lungs and bloodstream and worsen bronchitis, lead to heart attacks, and even hasten death. In 2020 a report from Harvard's T. H. Chan School of Public Health showed COVID-19 mortality rates in areas with more soot pollution were higher than in areas with even slightly less, showing a correlation between the virus's deadliness and long-term exposure to fine particulate matter and illuminating an environmental justice issue.

Because highways and polluting facilities have historically been sited in or next to low-income neighborhoods and communities of color, the negative effects of this pollution have been disproportionately experienced by the people who live in these communities. In 2019 the Union of Concerned Scientists found that soot exposure was 34 percent higher for Asian Americans, on average, than for other Americans. For Black people, the exposure rate was 24 percent higher; for Latinos, 23 percent higher.

### **Hazardous air pollutants**

A number of air pollutants pose severe health risks and can sometimes be fatal even in small amounts. Almost 200 of them are regulated by law; some of the most common are mercury, lead, dioxins, and benzene. "These are also most often emitted during gas or coal combustion, incinerating, or—in the case of benzene—found in gasoline," Walke says. Benzene, classified as a carcinogen by the EPA, can cause eye, skin, and lung irritation in the short term and blood disorders in the long term. Dioxins, more typically found in food but also present in small amounts in the air, can affect the liver in the short term and harm the immune, nervous, and endocrine systems as well as reproductive functions. Mercury attacks the central nervous system. In large amounts, lead can damage children's brains and kidneys, and even minimal exposure can affect children's IQ and ability to learn.

Another category of toxic compounds, polycyclic aromatic hydrocarbons (PAHs), are by-products of traffic exhaust and wildfire smoke. In large amounts they have been linked to eye and lung irritation, blood and liver issues, and even cancer. In one study, the children of mothers exposed to PAHs during pregnancy showed slower brain-processing speeds and more pronounced symptoms of ADHD.

### **Greenhouse gases**

By trapping the earth's heat in the atmosphere, greenhouse gases lead to warmer temperatures, which in turn lead to the hallmarks of climate change: rising sea levels, more extreme weather, heat-related deaths, and the increased transmission of infectious diseases. In 2018 carbon dioxide accounted for 81 percent of the country's total greenhouse gas emissions, and methane made up 10 percent. "Carbon dioxide comes from combusting fossil fuels, and methane comes

from natural and industrial sources, including large amounts that are released during oil and gas drilling,” Walke says. “We emit far larger amounts of carbon dioxide, but methane is significantly more potent, so it’s also very destructive.” Another class of greenhouse gases, hydrofluorocarbons (HFCs), are thousands of times more powerful than carbon dioxide in their ability to trap heat. In October 2016 more than 140 countries reached an agreement to reduce the use of these chemicals – which are found in air conditioners and refrigerators – and develop greener alternatives over time. Though President Trump was unwilling to sign on to this agreement, a bipartisan group of senators overrode his objections in 2020 and set the United States on track to slash HFCs by 85 percent by 2035. According to David Doniger, senior strategic director of NRDC’s Climate and Clean Energy program, “the agreed-to HFC phasedown will avoid the equivalent of more than 80 billion tons of carbon dioxide over the next 35 years.”

### **Pollen and Mold**

Mold and allergens from trees, weeds, and grass are also carried in the air, are exacerbated by climate change, and can be hazardous to health. Though they aren’t regulated and are less directly connected to human actions, they can be considered a form of air pollution. “When homes, schools, or businesses get water damage, mold can grow and can produce allergenic airborne pollutants,” Knowlton says. “Mold exposure can precipitate asthma attacks or an allergic response, and some molds can even produce toxins that would be dangerous for anyone to inhale.”

Pollen allergies are worsening because of climate change. “Lab and field studies are showing that pollen-producing plants – especially ragweed – grow larger and produce more pollen when you increase the amount of carbon dioxide that they grow in,” Knowlton says. “Climate change also extends the pollen production season, and some studies are beginning to suggest that ragweed pollen itself might be becoming a more potent allergen.” If so, more people will suffer runny noses, fevers, itchy eyes, and other symptoms.

Air pollution is now the world’s fourth-largest risk factor for early death. According to the most recent State of Global Air report – which summarizes the latest scientific understanding of air pollution around the world – 4.5 million deaths were linked to outdoor air pollution exposures in 2019, and another 2.2 million deaths were caused by indoor air pollution. “Despite improvements in reducing global average mortality rates from air pollution, the world’s most populous countries, India and China, continue to bear the highest burdens of disease,” says Vijay Lamaye, staff scientist at the NRDC Science Center. “This

report is a sobering reminder that the climate crisis threatens to worsen air pollution problems significantly if we fail to act to cut carbon pollution.”

### **Air Pollution in the United States**

Some four out of ten U.S. residents – 135 million people – live in counties with unhealthy levels of air pollution, according to the 2021 State of the Air report by the American Lung Association (ALA). Since the annual report was first published, in 2000, its findings have shown how the Clean Air Act has been able to reduce harmful emissions from transportation, power plants, and manufacturing.

Recent findings, however, reflect how climate change-fueled wildfires and extreme heat are adding to the challenges of protecting public health. The latest report – which focuses on ozone, year-round particle pollution, and short-term particle pollution – also finds that people of color are 61 percent more likely than white people to live in a county with a failing grade in at least one of those categories, and three times more likely to live in a county that fails in all three.

In rankings for each of the three pollution categories covered by the ALA report, California cities occupy the top three slots (i.e., were highest in pollution) despite significant gains the Golden State has made in the past half-century. At the other end of the spectrum, Burlington, Vermont; Honolulu; and Wilmington, North Carolina, consistently rank among the country’s best cities for air quality. (You can check the air quality of your own city or state on this map.)

### **Air Pollution and Environmental Justice**

No one wants to live next door to an incinerator, oil refinery, port, toxic waste dump, or other polluting site. Yet millions of people around the world do, and this puts them at a much higher risk for respiratory disease, cardiovascular disease, neurological damage, cancer, and death. In the United States, people of color are 1.5 times more likely than whites to live in areas with poor air quality, according to the ALA.

Historically, racist zoning policies and the discriminatory lending practices known as redlining have combined to keep polluting industries and car-choked highways away from white neighborhoods and have turned communities of color – especially poor and working-class communities of color – into sacrifice zones where residents are forced to breathe dirty air and suffer the many health problems associated with it. In addition to the increased health risks that come from living in such places, members of these communities experience economic harm in the form of missed workdays, higher medical costs, and local underinvestment.

Environmental racism isn't limited to cities and industrial areas. Outdoor laborers, including the estimated three million migrant and seasonal farmworkers in the United States, are among the most vulnerable to air pollution – and also among the least equipped, politically, to pressure employers and lawmakers to affirm their right to breathe clean air.

Recently, cumulative impact mapping, which uses data on environmental conditions and demographics, has been able to show how some communities are overburdened with layers of issues, like high levels of poverty, unemployment, and pollution. Tools like the Environmental Justice Screening Method and the EPA's EJSCREEN provide evidence of what many environmental justice communities have been explaining for decades: that we need land-use and public health reforms to ensure that vulnerable areas are not overburdened and that the people who need resources most are receiving them.

### **Controlling Air Pollution**

In the United States, the Clean Air Act has been a crucial tool for reducing air pollution since its passage in 1970, although fossil-fuel interests aided by industry-friendly lawmakers have frequently attempted to weaken its many protections. Ensuring that this bedrock environmental law remains intact and properly enforced will always be key to maintaining and improving our air quality.

But the best, most effective way to control air pollution is to speed up our transition to cleaner fuels and industrial processes. By switching over to renewable energy sources (such as wind and solar power), maximizing fuel efficiency in our vehicles, and replacing more and more of our gasoline-powered cars and trucks with electric versions, we'll be limiting air pollution at its source while also curbing the global warming that heightens so many of its worst health impacts.

And what about the economic costs of controlling air pollution? According to a report on the Clean Air Act commissioned by NRDC, the annual benefits of cleaner air are up to 32 times greater than the cost of clean-air regulations. Those benefits include up to 370,000 avoided premature deaths, 189,000 fewer hospital admissions for cardiac and respiratory illnesses, and net economic benefits of up to \$3.8 trillion for the U.S. economy every year.

### **How to Help Reduce Air Pollution**

“The less gasoline we burn, the better we're doing to reduce air pollution and harmful effects of climate change,” Walke says. “Make good choices about transportation. When you can, walk, ride a bike, or take public transportation. For driving, choose a car that gets better miles per gallon of gas, or choose an electric

car.” You can also investigate your power provider options – you may be able to request that your electricity be supplied by wind or solar. Buying your food locally cuts down on the fossil fuels burned in trucking or flying food in from across the country. And most important, “Support leaders who push for clean air and water and responsible steps on climate change,” Walke says.

### **How to Protect Your Health**

- “When you see in the news or hear on the weather report that pollution levels are high, it may be useful to limit the time when children go outside or you go for a jog,” Walke says. Generally, ozone levels tend to be lower in the morning.
- If you exercise outside, stay as far as you can from heavily trafficked roads. Then shower and wash your clothes to remove fine particles.
- The air may look clear, but that doesn’t mean it’s pollution free. Utilize tools like the EPA’s air pollution monitor, AirNow, to get the latest conditions. If the air quality is bad, stay inside with windows closed.
- If you live or work in an area prone to wildfires, stay away from the harmful smoke as much as you’re able. Consider keeping a small stock of masks to wear when conditions are poor.
- Wear sunscreen. When ultraviolet radiation comes through the weakened ozone layer, it can cause skin damage and skin cancer.

*This story was originally published on November 1, 2016, and has been updated with new information and links.*

*Read the article, translate it and discuss in groups:*

### **Water Pollution: Everything You Need to Know**

Our rivers, reservoirs, lakes, and seas are drowning in chemicals, waste, plastic, and other pollutants. Here’s why – and what you can do to help.

Melissa Denchak

<https://www.nrdc.org/stories/water-pollution-everything-you-need-know>

### **What Is Water Pollution?**

Water pollution occurs when harmful substances – often chemicals or microorganisms – contaminate a stream, river, lake, ocean, aquifer, or other body

of water, degrading water quality and rendering it toxic to humans or the environment.

This widespread problem of water pollution is jeopardizing our health. Unsafe water kills more people each year than war and all other forms of violence combined. Meanwhile, our drinkable water sources are finite: Less than 1 percent of the earth's freshwater is actually accessible to us. Without action, the challenges will only increase by 2050, when global demand for freshwater is expected to be one-third greater than it is now.

### **What Are the Causes of Water Pollution?**

Water is uniquely vulnerable to pollution. Known as a “universal solvent,” water is able to dissolve more substances than any other liquid on earth. It's the reason we have Kool-Aid and brilliant blue waterfalls. It's also why water is so easily polluted. Toxic substances from farms, towns, and factories readily dissolve into and mix with it, causing water pollution.

Here are some of the major sources of water pollution worldwide:

#### **Agricultural**

Not only is the agricultural sector the biggest consumer of global freshwater resources, with farming and livestock production using about 70 percent of the earth's surface water supplies, but it's also a serious water polluter. Around the world, agriculture is the leading cause of water degradation. In the United States, agricultural pollution is the top source of contamination in rivers and streams, the second-biggest source in wetlands, and the third main source in lakes. It's also a major contributor of contamination to estuaries and groundwater. Every time it rains, fertilizers, pesticides, and animal waste from farms and livestock operations wash nutrients and pathogens—such bacteria and viruses—into our waterways. Nutrient pollution, caused by excess nitrogen and phosphorus in water or air, is the number-one threat to water quality worldwide and can cause algal blooms, a toxic soup of blue-green algae that can be harmful to people and wildlife.

#### **Sewage and wastewater**

Used water is wastewater. It comes from our sinks, showers, and toilets (think sewage) and from commercial, industrial, and agricultural activities (think metals, solvents, and toxic sludge). The term also includes stormwater runoff, which occurs when rainfall carries road salts, oil, grease, chemicals, and debris from impermeable surfaces into our waterways

More than 80 percent of the world's wastewater flows back into the environment without being treated or reused, according to the United Nations; in some least-developed countries, the figure tops 95 percent. In the United States, wastewater treatment facilities process about 34 billion gallons of wastewater per day. These facilities reduce the amount of pollutants such as pathogens, phosphorus, and nitrogen in sewage, as well as heavy metals and toxic chemicals in industrial waste, before discharging the treated waters back into waterways. That's when all goes well. But according to EPA estimates, our nation's aging and easily overwhelmed sewage treatment systems also release more than 850 billion gallons of untreated wastewater each year.

### **Oil pollution**

Big spills may dominate headlines, but consumers account for the vast majority of oil pollution in our seas, including oil and gasoline that drips from millions of cars and trucks every day. Moreover, nearly half of the estimated 1 million tons of oil that makes its way into marine environments each year comes not from tanker spills but from land-based sources such as factories, farms, and cities. At sea, tanker spills account for about 10 percent of the oil in waters around the world, while regular operations of the shipping industry – through both legal and illegal discharges – contribute about one-third. Oil is also naturally released from under the ocean floor through fractures known as seeps.

### **Radioactive substances**

Radioactive waste is any pollution that emits radiation beyond what is naturally released by the environment. It's generated by uranium mining, nuclear power plants, and the production and testing of military weapons, as well as by universities and hospitals that use radioactive materials for research and medicine. Radioactive waste can persist in the environment for thousands of years, making disposal a major challenge. Consider the decommissioned Hanford nuclear weapons production site in Washington, where the cleanup of 56 million gallons of radioactive waste is expected to cost more than \$100 billion and last through 2060. Accidentally released or improperly disposed of contaminants threaten groundwater, surface water, and marine resources.

## **Categories of Water Pollution**

To address pollution and protect water we need to understand where the pollution is coming from (point source or nonpoint source) and the type of water body its impacting (groundwater, surface water, or ocean water).

## Where is the pollution coming from?

### *Point source pollution*

When contamination originates from a single source, it's called point source pollution. Examples include wastewater (also called effluent) discharged legally or illegally by a manufacturer, oil refinery, or wastewater treatment facility, as well as contamination from leaking septic systems, chemical and oil spills, and illegal dumping. The EPA regulates point source pollution by establishing limits on what can be discharged by a facility directly into a body of water. While point source pollution originates from a specific place, it can affect miles of waterways and ocean.

### *Nonpoint source*

Nonpoint source pollution is contamination derived from diffuse sources. These may include agricultural or stormwater runoff or debris blown into waterways from land. **Nonpoint source pollution** is the leading cause of water pollution in U.S. waters, but it's difficult to regulate, since there's no single, identifiable culprit.

### *Transboundary*

It goes without saying that water pollution can't be contained by a line on a map. Transboundary pollution is the result of contaminated water from one country spilling into the waters of another. Contamination can result from a disaster—like an oil spill—or the slow, downriver creep of industrial, agricultural, or municipal discharge.

## What type of water is being impacted?

### *Groundwater pollution*

When rain falls and seeps deep into the earth, filling the cracks, crevices, and porous spaces of an aquifer (basically an underground storehouse of water), it becomes groundwater – one of our least visible but most important natural resources. Nearly 40 percent of Americans rely on groundwater, pumped to the earth's surface, for drinking water. For some folks in rural areas, it's their only freshwater source. Groundwater gets polluted when contaminants – from pesticides and fertilizers to waste leached from landfills and septic systems – make their way into an aquifer, rendering it unsafe for human use. Ridding groundwater of contaminants can be difficult to impossible, as well as costly. Once polluted, an aquifer may be unusable for decades, or even thousands of years. Groundwater can

also spread contamination far from the original polluting source as it seeps into streams, lakes, and oceans.

### ***Surface water pollution***

Covering about 70 percent of the earth, surface water is what fills our oceans, lakes, rivers, and all those other blue bits on the world map. Surface water from freshwater sources (that is, from sources other than the ocean) accounts for more than 60 percent of the water delivered to American homes. But a significant pool of that water is in peril. According to the most recent surveys on national water quality from the U.S. Environmental Protection Agency, nearly half of our rivers and streams and more than one-third of our lakes are polluted and unfit for swimming, fishing, and drinking. Nutrient pollution, which includes nitrates and phosphates, is the leading type of contamination in these freshwater sources. While plants and animals need these nutrients to grow, they have become a major pollutant due to farm waste and fertilizer runoff. Municipal and industrial waste discharges contribute their fair share of toxins as well. There's also all the random junk that industry and individuals dump directly into waterways.

### ***Ocean water pollution***

Eighty percent of ocean pollution (also called marine pollution) originates on land – whether along the coast or far inland. Contaminants such as chemicals, nutrients, and heavy metals are carried from farms, factories, and cities by streams and rivers into our bays and estuaries; from there they travel out to sea. Meanwhile, marine debris – particularly plastic – is blown in by the wind or washed in via storm drains and sewers. Our seas are also sometimes spoiled by oil spills and leaks – big and small – and are consistently soaking up carbon pollution from the air. The ocean absorbs as much as a quarter of man-made carbon emissions.

## **What Are the Effects of Water Pollution?**

### **On human health**

To put it bluntly: Water pollution kills. In fact, it caused 1.8 million deaths in 2015, according to a study published in *The Lancet*. Contaminated water can also make you ill. Every year, unsafe water sickens about 1 billion people. And low-income communities are disproportionately at risk because their homes are often closest to the most polluting industries.

Waterborne pathogens, in the form of disease-causing bacteria and viruses from human and animal waste, are a major cause of illness from contaminated

drinking water. Diseases spread by unsafe water include cholera, giardia, and typhoid. Even in wealthy nations, accidental or illegal releases from sewage treatment facilities, as well as runoff from farms and urban areas, contribute harmful pathogens to waterways. Thousands of people across the United States are sickened every year by Legionnaires' disease (a severe form of pneumonia contracted from water sources like cooling towers and piped water), with cases cropping up from California's Disneyland to Manhattan's Upper East Side.

Meanwhile, the plight of residents in Flint, Michigan – where cost-cutting measures and aging water infrastructure created a lead contamination crisis – offers a stark look at how dangerous chemical and other industrial pollutants in our water can be. The problem goes far beyond Flint and involves much more than lead, as a wide range of chemical pollutants – from heavy metals such as arsenic and mercury to pesticides and nitrate fertilizers – are getting into our water supplies. Once they're ingested, these toxins can cause a host of health issues, from cancer to hormone disruption to altered brain function. Children and pregnant women are particularly at risk.

Even swimming can pose a risk. Every year, 3.5 million Americans contract health issues such as skin rashes, pinkeye, respiratory infections, and hepatitis from sewage-laden coastal waters, according to EPA estimates.

### **On the environment**

In order to thrive, healthy ecosystems rely on a complex web of animals, plants, bacteria, and fungi—all of which interact, directly or indirectly, with each other. Harm to any of these organisms can create a chain effect, imperiling entire aquatic environments.

When water pollution causes an algal bloom in a lake or marine environment, the proliferation of newly introduced nutrients stimulates plant and algae growth, which in turn reduces oxygen levels in the water. This dearth of oxygen, known as eutrophication, suffocates plants and animals and can create "dead zones," where waters are essentially devoid of life. In certain cases, these harmful algal blooms can also produce neurotoxins that affect wildlife, from whales to sea turtles.

Chemicals and heavy metals from industrial and municipal wastewater contaminate waterways as well. These contaminants are toxic to aquatic life – most often reducing an organism's life span and ability to reproduce – and make their way up the food chain as predator eats prey. That's how tuna and other big fish accumulate high quantities of toxins, such as mercury.

Marine ecosystems are also threatened by marine debris, which can strangle, suffocate, and starve animals. Much of this solid debris, such as plastic bags and

soda cans, gets swept into sewers and storm drains and eventually out to sea, turning our oceans into trash soup and sometimes consolidating to form floating garbage patches. Discarded fishing gear and other types of debris are responsible for harming more than 200 different species of marine life.

Meanwhile, ocean acidification is making it tougher for shellfish and coral to survive. Though they absorb about a quarter of the carbon pollution created each year by burning fossil fuels, oceans are becoming more acidic. This process makes it harder for shellfish and other species to build shells and may impact the nervous systems of sharks, clownfish, and other marine life.

## **What Can You Do to Prevent Water Pollution?**

### **With your actions**

We're all accountable to some degree for today's water pollution problem. Fortunately, there are some simple ways you can prevent water contamination or at least limit your contribution to it:

- Learn about the unique qualities of water where you live. Where does your water come from? Is the wastewater from your home treated? Where does stormwater flow to? Is your area in a drought? Start building a picture of the situation so you can discover where your actions will have the most impact – and see if your neighbors would be interested in joining in!
- Reduce your plastic consumption and reuse or recycle plastic when you can.
- Properly dispose of chemical cleaners, oils, and nonbiodegradable items to keep them from going down the drain.
- Maintain your car so it doesn't leak oil, antifreeze, or coolant.
- If you have a yard, consider landscaping that reduces runoff and avoid applying pesticides and herbicides.
- Don't flush your old medications! Dispose of them in the trash to prevent them from entering local waterways.
- Be mindful of anything you pour into storm sewers, since that waste often won't be treated before being released into local waterways. If you notice a storm sewer blocked by litter, clean it up to keep that trash out of the water. (You'll also help prevent troublesome street floods in a heavy storm.)
- If you have a pup, be sure to pick up its poop.

### **With your voice**

One of the most effective ways to stand up for our waters is to speak out in support of the Clean Water Act, which has helped hold polluters accountable for five decades—despite attempts by destructive industries to gut its authority. But

we also need regulations that keep pace with modern-day challenges, including microplastics, PFAS, pharmaceuticals, and other contaminants our wastewater treatment plants weren't built to handle, not to mention polluted water that's dumped untreated.

Tell the federal government, the U.S. Army Corps of Engineers, and your local elected officials that you support water protections and investments in infrastructure, like wastewater treatment, lead-pipe removal programs, and stormwater-abating green infrastructure. Also, learn how you and those around you can get involved in the policymaking process. Our public waterways serve every one of us. We should all have a say in how they're protected.

*This story was originally published on May 14, 2018, and has been updated with new information and links.*

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