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SOME ASPECTS OF ECOLOGICAL PROBLEMS

Учебное пособие
по профессиональному английскому языку

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Пособие составлено на основе текстов аутентичной американской и английской учебной и научной литературы по глобальным и региональным проблемам взаимодействия человека и природы.

Предназначено для студентов старших курсов, изучающих экологию как самостоятельный учебный предмет, владеющих английским языком на уровне Intermediate, а так же для магистров и аспирантов и иностранных студентов, обучающихся по программам экологической направленности.

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INTRODUCTION

В процессе преподавания профессионального английского языка студентам специальности 0…. «Геоэкология», возникает необходимость в поиске специальной литературы экологической направленности по широкому спектру вопросов, что вызывает определенные трудности. Авторы, создавая это пособие, постарались собрать воедино информацию, отражающую современные проблемы экологии глобального и регионального характера.

Первая часть пособия основана исключительно на аутентичных текстах, содержащих информацию о современных глобальных экологических проблемах. Занятия построены таким образом, чтобы после ознакомления с текстом студенты могли отработать основную терминологию, закрепить навыки чтения, развивать умение говорить.

Вторая часть отражает проблемы и методы изучения состояния окружающей среды на региональном уровне.

В третьей части студентам предлагаются лабораторные работы, выполнение которых закрепляет теоретические аспекты, изложенные в первых двух частях.

Пособие рассчитано на студентов, обучающихся на специальностях экологической направленности, а так же может быть полезно преподавателям иностранного языка и специалистам, читающим лекции и ведущим занятия по профессиональному английскому.

PART I. GLOBAL ASPECTS OF ECOLOGICAL PROBLEMS

UNIT 1. BIOSPHERE AND ECOLOGY

Key words:

emerge	появляться
layer	слой
composition	состав
cycling	круговорот
fragile	хрупкий
desert	пустыня
fauna	фауна
flora	флора
biota	биота, флора и фауна
interaction	взаимодействие
environment	окружающая среда
population	популяция, население
community	сообщество
cause	быть причиной, вызывать
affect	воздействовать
damage	повреждать, причинять ущерб
airborne	переносимый по воздуху
to envelop	окутывать
soil	почва
rock	скала, горная порода
sediments	осадочные породы
intact	нетронутый, неповрежденный

Read and translate the Words:

biosphere	ecology	lithosphere
structure	biology	atmosphere
nature	geology	hydrosphere
human	energy	ecosystem
physics	abiotic	chemistry
concept	biologic	discipline
cycle	energetics	modify
component	biochemical	organization

Read the text and do the tasks.

The idea of biosphere appeared more than a century ago, but at first it found a little application, until it was developed by the Russian scientist V.I. Vernadsky. It is his concept of the biosphere that we accept today.

The first living cells emerged between 4 billion and 3.8 billion years ago. At present biosphere includes vast numbers of plants, animals, and other life-forms of our planet, many of them are yet to be discovered. Biosphere is a relatively thin life-supporting layer around the Earth containing living organisms, which is strongly influenced in its composition, structure and energetics by the living organisms. The part of the biosphere containing the highest concentration of living matter – the Earth's thin and fragile "film of life" – varies from a few meters in deserts and tundra to a hundred meters in a tropical forest regions and oceans.

The biosphere is a complex system of energy use and material cycling. This system functions on energy flowing from the Sun and it gives off energy (primarily as heat) to space. We can divide the biosphere into two parts, living and nonliving, or biotic and abiotic. The biotic part of the biosphere consisting of fauna and flora is known to be called biota. We can further divide the abiotic portion into three parts: the solid Earth or lithosphere, liquid water or hydrosphere, and the atmosphere.

Ecology is a branch of science which deals with the world of nature - including its human component – at certain levels of biological organization. It is the study of the living organisms interactions with each other and with their environment. Particular concern of the ecologists is with the "higher" levels of life organization: from populations to biosphere. The functional unit in ecology is the ecosystem because it comprises all of the interactions of communities with both their living (biotic) and their nonliving (abiotic) environments.

Ecology is a multidisciplinary science. Facts about ecological systems are drawn from biology, geology, chemistry, physics, and other sciences. Originally ecology was considered to be, environmental biology. Modern ecology has to deal with environmental problems caused by human activities. People have always affected the natural environment. But the population growth along with the industrial world economy during the last two centuries has increased the magnitude, complexity and rate of these modifications. Today environment is not just modified by human action: it is radically transformed. Global satellite observations of the Earth have revealed that about 60 percent of land surface is to some extent damaged by industrial, agricultural, and other human activities, whereas no more than 40 percent of land remains intact.

Humankind is entering a new era in its evolution characterized by a

new relationship with nature. Understanding of how biosphere works, and how it reacts to the global environmental change is of fundamental importance.

I. Answer the Following Questions:

1. How would you define the biosphere?
2. What is the biota?
3. When did the first living cells appear on our planet?
4. What are the limits of the "film of life"?
5. What levels of biological organization in nature are of particular interest for ecology?
6. What major factor has increased the intensity and scale of the biosphere transformations over the past two centuries?
7. Do you think the present day biosphere transformations caused by human activities are reversible?

II. Translate the following word groups:

Global satellite observations, industrial world economy, tropical forest regions, living organism interactions, life organization, life organization levels, atmosphere layers, nature balance, population growth.

III. Find the synonyms to the following words in the text:

To influence, to include, large, to emerge, to change, mankind, to release, field of science, to be concerned with.

IV. What are the subjects of the following sciences?

Physics	... deals with ...	The molecular transformation Chemical reactions
Ecology	... treats ...	The interactions of subatomic particles
Chemistry	... is concerned with ...	The structure and functioning of the biosphere

V. There are some definitions in the text. What are they? Complete the sentences:

1. ... is the layer around the Earth in which all living organisms exist.
2. ... is the total sum of all liquid and frozen water on or near the Earth's surface.
3. ... is a region of gases, airborn particles, and water vapour enveloping the Earth.

4. ... is the solid Earth with the rocks, soils and sediments on its crust.

VI. Suggest as many word combinations as possible and translate:

(a) Layer (thick, of water, around the Earth, of gas, outer, thin, containing, living matter);
(b) Environment (clear, physical, part of, modified, healthy, biotic, damaged, intact);
(c) Interactions (between, humankind, nature, stable, communities, global, constant, living organisms, environment).

VII. Transform the sentences using emphatic construction "It is ... that...

Example: The activities of living organisms influence the biosphere.
It is the activities of living organisms that influence the biosphere.

1. The activities of living matter determine the structure, composition, and energetics of the biosphere.
2. Vernadsky's concept of the biosphere is accepted today.
3. The functional unit in ecology is the ecosystem.
4. The industrial world economy has caused the present-day transformations of the environment.

VIII. Say it in English

a) Современная концепция биосферы была разработана русским ученым В.И. Вернадским более 50 лет назад (present-day, develop).
Биосфера - это слой вокруг Земли, который содержит все живое вещество на нашей планете (contain).
Биосфера - слой вокруг земли, который преобразован живыми организмами (transform).
Жизнь на земле возникла около 3,8 миллиарда лет назад (emerge).

b) Биосфера - это слоистая система преобразования энергии и круговорота веществ (cycling).
Биосфера функционирует на энергии, поступающей в нее от Солнца (function, flow into).
Толщина слоя биосферы, содержащего наивысшую концентрацию живого вещества (пленка жизни) варьируется от нескольких метров до сотен метров (thickness, film of life, vary from ... to).

c) Экология - многодисциплинарная наука, основанная на биологии, физике, химии и многих других науках (multidisciplinary). Взаимодействие человека с природой имеет глобальный и постоянный характер (interaction).
Человек воздействует на окружающую среду и изменяет ее (affect the environment).

Биосфера реагирует на эти воздействия (react).

d) Сегодня окружающая среда коренным образом преобразована в результате деятельности человека (radically, as a result of). Около 60% природных экосистем суши в той или иной степени разрушено в результате сельскохозяйственной, промышленной и других видов деятельности человека (to some extent, damage). Не более 40% суши еще осталось нетронутой (intact).

IX. Read the text and tell about the importance of atmosphere for
- the Earth
- the organisms living

The air surrounding the Earth is called the atmosphere. It rises upward for hundreds of miles. This air can be heavy or light, calm or stormy, hot or cold.

Without air nothing on Earth could live. There could be no colour, no weather, no fire, no sound. Without air the Earth would be burning in the daytime and freezing at night.

Air is a mixture of gases. About 78 per cent of it is nitrogen, almost 21 per cent is oxygen, and the other 1 per cent is water vapor, argon, carbon dioxide and rarer gases.

We live at the bottom of an air ocean which rests on the Earth's surface. Air has weight. Anything that takes space has weight and exerts pressure by pushing.

The outer atmosphere begins at the top of the ionosphere, but nobody knows how many thousands of miles it extends. There is no oxygen in the outer atmosphere. Hydrogen is the main element.

Mankind has learnt much of this remote part of the atmosphere because of the many experiments with space satellites.

UNIT 2. POPULATIONS AND ECOSYSTEMS

Key words:

individual	особь, индивидуум
species	биологический вид, виды
density	плотность
age structure	возрастная структура
birth-rate	рождаемость
gene pool	генетический фонд
competition	конкуренция, отбор
maintain	поддерживать, сохранять

livestock	домашний скот
interconnect	связывать
habitat	место обитания
behavior	поведение
overlap	перекрываться, накладываться друг на друга
coincide	совпадать
niche	(экологическая) ниша
organic whole	единое целое
disruption	распад, разрушение
property	свойство
severe	резкий, сильный
irreparable	непоправимый, невосстановимый
slight	незначительный, слабый
carbon dioxide	углекислый газ, двуокись углерода
minute	мельчайший
lichen	лишайник
fungi	грибы
algae	водоросли
generation	поколение

Read "ch" as [k] in the words of Greek origin:

chrome	mechanism
chemical	technical
character	technology

Read the text and do the tasks.

A population is a group of individuals of the same species occupying a given area. Populations are characterized by density, age structure, birth and death rate. Each individual carries a certain combination of genes (total sum of an individual's genes is called genotype). The sum of all genetic information stored in genes of individuals of a given species is called a gene pool of the species. The population is also an evolutionary unit. Evolution suggests changes in the gene information.

Lifetime of any species is very long and can reach a million years. It exceeds the lifetime of an individual (a member of population) by many orders. Thus, the stability of a population as a system is achieved through continuous renewal of its elements.. In the reproduction process there appear many individuals whose properties differ from normal. As a rule, such weaker (noncompetitive) individuals will be forced out of reproduction by the competition process. These two processes - reproduction and competition – are vitally important for maintaining stable existence of any species in nature. Normally, the genotype of any species cor-

responds to the maximum competitiveness, which is a set of properties that provides species capability to fulfill its most important function – to sustain the ecosystem stability and, eventually, to keep matter cycles in the biosphere closed. Notice, that stability of natural ecosystem does not concern any domestic species such as agricultural plants, livestock, etc. as well as pigeons, sparrows, rats, and other "companions" of men.

A group of interconnected population of all species that occupies a habitat composes a community. Each habitat has a characteristic range of physical and chemical conditions, such as amount of light, typical temperature, pH of water, and so on. And each species is adapted to those conditions in terms of its morphology, physiology, and behavior. A full range of abiotic and biotic conditions under which a particular species can live and reproduce is called its ecological niche. Each niche may overlap with many others, which belong to neighboring species, but it coincides with none.

As a rule, the more complex the system is, the more successfully it can resist the outer stress. An ecosystem is a natural organic whole of a biologic community and its nonliving environment. Constant interactions between living organisms, say, plants, bacteria, and animals and their physical environment in any ecosystem are the ways by which matter and energy are distributed. Moreover, these interactions unite the living and nonliving components together into a stable system. Many contrast forces act within the ecosystem which may result in imbalances or disruptions but normally the ecosystem is stabilized due to its self – compensating properties. The state of a balance in any ecosystem is self-sustainable so that even slight imbalances are corrected before they become severe and irreparable.

Any stable natural ecosystem consists of a great number of various species, from minute living things like viruses or bacteria to giants like whales or sequoias, each playing a unique role in reaction in the whole system. The biological diversity is the key to the maintenance of the world as we know it and keeps the world steady.

I. a) Give the synonyms of the following words:

to keep, to reach, inner, characteristic, owing to, various, total, to perform, opposing, to cause, continuous, certain

b) Give the antonyms for the following words:

living, minute, balance, slight, strong, simple.

II. Read, translate, mark suffixes and prefixes:

environment - environmental;
stable - stability;

compete - competition - competitiveness - competitive;
evolution - evolutionary;
act - interact - interaction;
maintain - maintenance;
balance - imbalance.
Can you find any more examples of words with the same root in the text?

III. Translate the following word groups:

Matter cycles, reproduction process, competition process, balance state, gene pool, sea level, ozone layer, stress resistance.

IV. Answer the questions:

1. What are the main characteristics of any population?
2. Does the term "gene pool" refer to one individual or to a whole species?
3. What interaction between an individual in the population provides the stability of the species?
4. What is the difference between a population and a community?
5. What is an ecosystem?
6. Which systems are, as a rule, more stress resistant: complex or simple?
7. What is a characteristic property of any stable ecosystem?

V. Join the parts of the definitions:

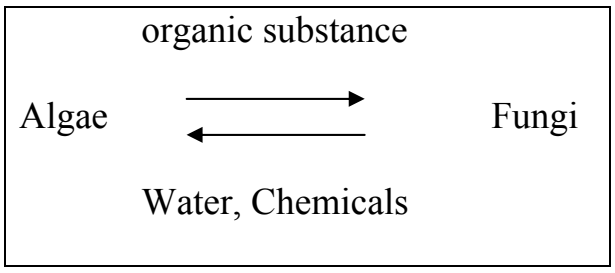
a)

1) Hydrosphere	a) all air surrounding the Earth
2) Lithosphere	b) all water on the globe
3) Atmosphere	c) all solid matter on the Earth

b)

1) abiotic	d) a disruptive force from outside
2) self – regulating means	e) nonliving
3) outer stress	f) able to control itself.

VI. Look at the figure and answer the questions below:



Consider lichen as the simplest ecosystem containing only two kinds of living organisms (algae and fungi). Answer the questions:

1. Where do fungi obtain organic matter from?
2. Where do algae get water and chemical elements from?
3. Are the material cycles of this ecosystem open?
4. Is this system closed from the standpoint of energetics?

VII. Translate into English:

Играть уникальную роль, постоянное обновление, соседние виды, невосстановимый дисбаланс, проблемы окружающей среды, биологическое разнообразие, смертность и рождаемость, частично совпадать с другой нишей, набор свойств, действовать внутри экосистемы, постоянные взаимодействия.

VIII. Are the following statements true or false? If false, say why.

1. Biologic population is a group of non – interacting individuals.
2. Simple systems are as a rule more resistant to outer stress than complex ones.
3. There exist different species whose ecological niches completely coincide.
4. Most of the energy originally fixed by an ecosystem is eventually lost to the environment as metabolically generated heat.
5. Any ecosystem consists of organisms of one and the same species.

UNIT 3. PROBLEMS OF THE CONTEMPORARY ENVIRONMENT

Key words:

conservation	сохранение
degradation	разрушение, деградация, гниение
desertification	опустынивание
destruction	разрушение, деструкция
disposal	размещение, удаление
environment	окружающая среда
environmental	экологический (зд. природоохранный)
impede	препятствовать, задерживать
management	управление, бережное использование
pollutant	загрязнитель

pollution	загрязнение
resources	ресурсы, запасы
natural resources	природные богатства
soil erosion	эрозия почвы

I. Look through the text and say:

What problems are discussed in the text?
Why are they of great importance now?
What environmental problems are mentioned here?
How can the environmental problems be solved?

The environmental question is one of the key issues of our era, and as such is directly and indirectly linked with other important international problems, namely overgrowth of population, hunger, poverty, peace and disarmament, the need for a harmonious economic and social development. It has been repeatedly stated that the protection of our environment is a matter of survival of mankind of Earth; as such, it can only be tackled as an international - global issue. Furthermore, it is clear that in order to effectively protect the environment more and better focused research is needed, as well as better and more efficient management of the environment and all natural resources.

Environmental degradation of large areas of our globe affects wide groups of population and is clearly international. Borders cannot impede air pollution, river or marine pollution, destruction of forests, desertification or soil erosion. National borders are often unable to higher the expansion of environmental problems of a different nature, such as the case with the use of well - known dangerous substances, the transport and in some cases uncontrolled disposal of toxic or radioactive products, health problems directly connected with water use or food supply, etc. It is thus evident that environmental policy becomes more complex at national and international levels. At least on paper, nearly all governments recognize the relation between protection of the environment, conservation of natural resources and development, and have taken level and administrative measures towards this end.

The experience of the past decade has shown that environmental problems can be, and in some cases are, solved, whenever sound international cooperation is obtained. There is a need for sound supportive structures of national police, national legislation and efficient administration, national research, training and information, together with globally oriented environmental education at all levels.

II. Arrange the following into pairs of synonyms.

Solve a problem, the key issue, protect, soil erosion, be linked with, impede be connected with, hinder, tackle a problem, the main problem, desertification, safeguard.

II. Translate the following paying attention to italicized grammar constructions.

l. The questions are linked with the results of our experiment. 2. Health problems are also connected with water use. 3. These ideas are supported by crystallographic data. 4. The environmental problems can be, and in some cases are, solved 5. Forests have also been affected by... 6. More efficient management of the environment is needed. 7. It has been repeatedly stated that... 8. The experience of the past decade has shown that... 9. The results will be discussed in more detail elsewhere. 10. An example will be considered from the field of corrosion control. 11. The transformation is followed by the appearance of new properties in the gelatin.

UNIT 4. THE ECOSYSTEM OF RAINFOREST

Key words:

rainforests	тропические леса
mouth of a river	устье реки
cloud	облако
extinction	вымирание
destroy	разрушать
contaminate	загрязнять
disappear	исчезать
rhinoceros	носорог
mercury	ртуть
conservation	заповедник, сохранение
habitat	место обитания
release	выделять, высвобождать
vapour	пар

Read the text and do the tasks.

Rainforests are perhaps the most important places on Earth. The weather in rainforests is hot all the year round - usually between 20 degrees Celsius and 28 degrees Celsius every day. The weather is always

wet and most rainforests have more than 200 mm of rain in a month.

The rainforests are situated in different parts of the world in South America, West Africa and Madagascar, Indonesia and Australia. They are of different kinds: some are high in the mountains and others are near the sea, often at the mouths of great rivers.

In 1950, rainforests covered 15 per cent of the Earth's land. Forty years later people have destroyed half of these. But rainforests are home to about 50 mln. people and millions of species of animals, plants and insects. In 10000 square metres of rainforests there can be more than 8000 different species of plants. (In all Great Britain there are only 1.443 different species of plants.)

The leaves of rainforest trees make one - third of the Earth's oxygen. Besides, the peoples there have always used plants to produce medicines. Today, all over the world, people use medicines made from rainforest plants for different diseases (for malaria, leukaemia and so on). Rainforest trees are used to make things which we use every day (food, rubber etc).

They are also important because they control some of the Earth's weather. Through their large leaves, they release water vapour which makes heavy clouds. The clouds then move to other parts of the Earth and give rain. The clouds also protect the Earth from the sun.

Many rainforest plants are in danger because people catch them from the forest to sell in the shops of the rich countries of the north. Many animals are in danger of extinction because people are destroying the rainforests which are their habitat. For example rhinoceros, mountain gorillas and so on. But some animals are in danger because people want them as pets.

Today, there are many conservations in the rainforests of the world. Animals need large parks because some species have to travel many kilometers to find food. So, why are we destroying the rainforests? There is a short answer to that question: money. The trees are cut down to sell the wood to export it to other countries. When people look for metal, they destroy the forest. When people look for gold in the Amazon forest, they use mercury to wash the gold. This mercury contaminates the rivers and kills fish and other animals. Many countries cut down rainforests to plant coffee and sugar for export to other countries.

Actually, when we destroy forests, forest people lose their homes, and thousand of species of animals and plants disappear - and once they have disappeared we will never see them again.

I. Review questions:

1. What is the weather like in a rainforest?
2. Where are the rainforests situated?

3. Why are the rainforests so important? (Enumerate the reasons).
4. What are the reasons of rainforest animal extinction?
5. Why do animals need large parks in the forests?
6. Why are the rainforests quickly destroyed?
7. What could the other results of rainforest destroying be besides those mentioned in the text?

II. Complete if-sentences (several variants are possible):

If we destroy the forests, we...
If there are no more rainforests...
If we begin to study and protect rainforests...
If there is much conservation in the forests...
If people cut down the trees in the forests…

III. Say in what context these numbers were used:

1950, 10000, 8000, 28, 1.443, 15, 200

IV. Tasks for investigation:

1. When you visit a pet shop, ask about animals there. Did somebody catch any of them in the rainforests?
2. When you visit a flower shop near you, ask about plants there. Did someone take any plants from the rainforest?
3. Does your country cut down the forest? Can you say the exact figures? What wood is the furniture at your home made of ?
4. Is there any forest in your region (ecosystem)? What role does it play for your country and city? Are the problems similar to those of rainforests? Discuss them in group.

V. Fill in the correct word from the list below

1. When the last animal of a certain species dies, that species becomes... (no longer m existence).
2. Many animals find it more and more difficult to survive as their natural... is destroyed (home).
3. A new group has been... to protect rare rainforest animals (set up).
4.... groups try to protect animals and the places where they live (environmental protection).
5. Animals for zoos have to be ... by experts as they must not be injured in any way (caught).
6. It is hoped that educational programs will ... an understanding of the earth's environmental problems, (produce)
7. Several environmental groups are working to ... the world rainforests from

being destroyed (stop).
8. The earth's areas are in danger of disappearing completely (tree covered).

habitat	conservation	create
prevent	forested	organized
extinct	captured	

VI. Some more interesting facts about rainforest:

Do you know that...
the rafflesia grows in the forest on the island of Borneo. It is the largest flower in the world. It catches and eats insects;
some trees grow as tall as seventy meters - and some animals live all their lives in the top of these trees;
hummingbirds drink nectar from flowers. While a hummingbird is drinking nectar, its wings move up and down about fifty - five times every second;
rainforest trees grow very slowly, and they live for hundreds of years.

VII. Fill in the correct idioms from the list below:

work like a dog
kill two birds with one stone
fight like cat and dog
a memory like an elephant
straight from the horse's mouth
l. If you're going to Manchester on business, you might as well visit cousin May - that way you can...
2. Paul never forgets anything - he is got...
3. Since Dina started her own business, she s had to ... she never has any tree time.
4. Of course it's true that Sally quit her job - I heard it...
5. Tim and Ann used to ... but now they get on very well.

VIII. Read this abstract, then listen to the tape and underline the correct word.

Only 600 mountain gorillas remain in the wild. People view gorillas as fierce, 1) vicious/savage animals. However, if you look into a gorilla's 2) face/eyes, you see gentleness and 3) intelligence/strength. Gorillas spend their lives peacefully in forests eating thistles and bamboo 4) shoots/leaves. Yet, gorillas have suffered greatly. In the first part of this century, more than 5) 50/15 gorillas were killed in Virunga. In 1925, Belgium established Africa's first national 6) zoo/park. When Civil War

broke out, hunters were free to 7) hunt/trap the gorillas. The animals' heads and hands were sold to 8) tourists/explorers as souvenirs. Fortunately, a wildlife conservation 9) society/association in New York began "gorilla tourism". As a result, tourists paid a lot of money to see the mountain gorillas and Rwand became a model of conservation. People and gorillas need each other. The Rwandans need money and gorillas desperately need 10) protection/food.

IX. Listen to the two people discussing animals in zoos and animals in the wild and decide whether the statements are True (T) or False (F). Talk about animals in zoos and animals in the wild, and then write a paragraph. You may me the following expressions:

Also, too, however, as well, furthermore, whereas, in addition, on the other hand, on the contrary etc.

1. Animals don't have food in zoos.
2. Animals are free in zoos.
3. Animals get medical care in zoos.
4. Animals live very happy lives in zoos.
5. Animals are protected from hunters in zoos.
6. Animals are in their natural habitat in zoos.
7. Animals are not protected from extinction in zoos.
8. Animals are lonely in zoos.

Model of talking: A: Animals in zoos have got plenty of food and water.
B: I agree. However, they are not free, etc.

UNIT 5. AIR POLLUTION AND ACID RAINS

Key words:

sulphur dioxide	двуокись серы
airborne	воздушный
lead pollution	загрязнение свинцом
car exhaust	выхлопные газы
combustion	сгорание
fossil fuel	ископаемое топливо
contaminant	загрязняющее вещество
(pollutant)	
nitrogen oxide	окись азота
particles	частички
mortality rate	смертность

acid rain	кислотный дождь
decline of forests	гибель лесов
long-range	крупномасштабный
vehicle	средство передвижения, автомобиль
emission	выброс загрязняющих веществ в
	атмосферу
fine suspended particulate matter	мельчайшие взвешенные в воздухе час-
	частички
major pollution events	случаи сильного загрязнения воздуха
soot	сажа
contamination	загрязнение, заражение
ubiquitous	повсеместный

Read the text and answer the questions:
What damage does air pollution cause?
What does the term "acid rain" mean?

Air Pollution and Acid Rains

Without air there can be no life. Without air of good quality there cannot be a healthy life. Air pollution is an old problem, which has in this century assumed wide economic and social significance.

An average person requires over thirty pounds of air a day or about six pints every minute. Daily an individual draws 26000 breaths, between 18 and 22 each minute, many of which are of filthy air. The lungs of town inhabitants are usually greyish in colour, those of country people are normally pale pink.

The air is being polluted by acid gases, dust, petrol and diesel fumes and poisonous chemicals. These come from cars, factories and power plants.

Of all the pollutants, that taint the air, fine suspended particulate matter, sulphur-dioxide and ozone pose the most, wide-spread and acute risks. However, airborne lead pollution* coming from car exhausts, is a critical concern in many cities as well.

Particulate Pollution

Suspended particulate matter is nearly ubiquitous urban pollutant. It is a complex mixture of small and large particles of varying origin and chemical composition. Larger particles ranging from 25 microns to 100 microns in diameter usually comprise smoke and dust from industrial processes, agriculture, construction and road traffic, as well as plant pollen and other natural sources.

Smaller particles - those less than 25 microns in diameter generally come from combustion of fossil fuels. These particles include soot from vehicle exhaust, which is often coated with various chemical contaminants or metals.

The health effects of particles are strongly linked to their size. Small particles, such as those from fossil fuel combustion, are most dangerous, because they can be inhaled deeply into the lungs, setting in areas, where the body's natural clearance mechanisms can't remove them. The constituents in small particles are more chemically active and may be acidic as well and therefore more damaging.

Particulate pollution causes acute changes in lung function, respiratory illnesses, heart disease and aggravation of asthma and bronchitis.

Acid Rains

Other very dangerous pollutants are sulphur and nitrogen oxides. These gases are released by factories and power plants when fossil fuels are burned and by cars. These oxides reach high into the atmosphere and mix with water and other chemicals to form rain that can be as acid as vinegar. Acid rains are responsible for the decline of many forests. Tiny droplets of acid attack plant leaves, disrupting the production of chlorophyll. It also weakens the tree by altering the chemistry of the soil that surrounds its roots. Acid rains affect everything it falls on. Rivers, lakes, forests are at risk throughout Europe and North America. This kills fish and drives out fish-eating wildlife.

Forests are particularly badly affected by acid rains and in many places previously green, luxuriant trees show bare branches at the top, stripped of foliage.

Acid rain emerged as a concern in the 1960s with observations of dying lakes and forests damage in Northern Europe, the United States and Canada. It was one of the first environmental issues to demonstrate how the chief pollutants-oxides o sulphur and nitrogen - can be carried hundreds of miles by winds before being washed out of the atmosphere in rain, snow and fog.

Meanwhile urban air pollution has worsened in most large cities in the developing world, a situation driven by population growth, industrialization and increased vehicle use.

In some parts of Asia such as Southeast China, Northeast India, Thailand and the Republic of Korea, and in the Pacific region acid rain is now emerging as a major problem.

Many countries in the world are trying to solve the problem of air pollution in various ways, either by trying to burn fossil fuels more cleanly or by fitting catalytic converters to their cars, so fewer poisonous gases

are produced. In some countries, like Sweden for example, new power plants use a method called fluidized bed combustion, which cuts emission down by 80 per cent. Developing technologies may raise the price of electricity a little, but will save millions of trees, plants and animals and human health.

I. Review the questions:

1. Can people be healthy without air of good quality?
2. Why are the lungs of town inhabitants greyish in colour?
3. What pollutants pose the most wide-spread and acute risks?
4. What does suspended particulate matter?
5. What are the sources of large particles? small particles?
6. Which particles are the most dangerous and why?
7. What are the effects of particulate pollution?
8. Which gases cause acid rain?
9. What are the sources of these gases?
10. How does acid rain form?
11. How does acid rain affect plants, lakes and soil?
12. What is the main problem with air pollution?
13. How do people try to curb air pollution?
14. In what parts of the world is acid rain emerging now as a major problem?

II. Join the parts of definitions

pollution	is	- a mixture of oxides of sulphur and nitrogen with water
lungs		- a fossil fuel
fuel		- dirt in the air
disease		- organs for breathing
gas		- anything burned to produce heat or power such as coal, oil or wood
dust		- illness, poor health
suspended particular matter		- substance not solid, liquid or having form
oil		- fine, dry earth
acid rains		- a complex mixture of small and large particles of varying origin and chemical composition

III. Complete the following sentences:

1. The problem of (загрязнение воздуха) in big cities is very acute now. The air is polluted by (выхлопные газы) from cars and by harmful substances from the chemical industry, etc.

2. The earth we live on and its rivers are becoming (загрязненными) with ever more dangerous materials.

3. Moscow's drinking water sources are kept (свободными от загрязнения) by the work of some purifying stations.

4. The protection of (окружающая среда) is the constitutional duty of every Russian citizen.

5. The Russian Government spends many million rubles every year on (защита окружающей среды).

6. (Экология) is the science of relations between organisms and the resources of their environment.

7. Cars are the main (источники загрязнение).

8. Prof. Pavlov (руководит) of a small research team. This research team is busy with the problems of (шумовое загрязнение).

9. The Russian Government takes a lot of (меры по защите окружающей среды). Among them is the constant control of (чистота) of the air in big cities by special control stations.

IV. Translate the following paying attention to italicized grammar constructions.

I. The air is being polluted by acid gases, dust, petrol and diesel fumes and poisonous chemicals. 2. These gases are released by factories and power plants when fossil fuels are burned and by cars. 3. Forests are particularly badly affected by acid rain and in many places previous by green, luxuriant trees show bare branches at the top, stripped of foliage. 4. Buildings "die" too. Some of the most beautiful historical buildings in the world are being eaten away by the dilute acid, rained on them. 5. In most parts of the world the motor car is seen as a sign of progress and development. 6. Gasoline and diesel fuel are distilled at huge refineries which produce both toxic waste and toxic air emission. 7. In places where roads are built, the topsoil is pushed aside, the vegetation is stripped away and animal habitats are destroyed. 8. Seas and rivers are being filled with rubbish. 9. The air is being poisoned with chemicals and smoke. 10. CFCs are released into the air when a product containing them is destroyed.

UNIT 6. PROBLEMS OF ENERGY PRODUCTION

Key words:

fossil fuel	ископаемое (добываемое топливо)
despite (in spite of)	не смотря на
forecast	прогноз

reserves	ресурсы, запасы
overall	всеобщий
per capita	на душу населения
outlay	издержки, расходы
according to	согласно, на основании
develop	развивать, разрабатывать
rate	скорость
obtain	получать
raw material	неотработанный материал, ископаемые
recognize	признавать
release	высвобождать, испускать
imply	предполагать, подразумевать
utilize	использовать
avoid	избегать
result in	приводить к
to be under way	быть в процессе изучения (разработки)
to some extent	в некоторой степени
rural area	сельская местность
on a large scale	в больших масштабах
accompany	сопровождать
occur	случаться, встречаться
consumption	потребление
increase	увеличивать
decrease	уменьшать
shortage	недостаток
ultimate	в конечном счете, в конце концов
core	сердце, сердечник
spew	извергать
intact	нетронутый
to be dizzy	чувствовать головокружение

Guess the meaning of the words:

energy	battery
pessimistic	radiation progress metallurgical
investor	battery
to limit	radiation progress metallurgical
hydro-resources	to concentrate
production	thermo power station
irrational	transmission

Read the text and do the tasks.

The production of energy is growing rapidly, both per capita and in total. About 90 percent of the energy we use today comes from fossil fuel - oil, coal and gas, just a few percent from nuclear fuel and about five percent from hydro - resources, all of which in the final analysis, are a transmuted kind of solar energy. Despite the intensive utilization of oil, gas and coal, and the pessimistic forecasts, their reserves are increasing both overall and per capita. The huge reserves of coal in the United States are almost untouched because this would require high outlays, according to investors of that country.

Nevertheless, the reserves of oil and other types of fossil fuel are limited. They are being developed, used at a much more rapid rate than other sources of energy.

Uranium and thorium are used for obtaining nuclear energy, and are most unlimited reserves of raw materials for producing thermonuclear energy. But it should be recognized that both fossil and nuclear energy release some additional heat to the Earth, implying a fundamental "thermal pollution" limit to the use of either form.

Technological progress in exploration and utilization of outer space has stimulated the development of solar batteries and other means of using direct solar radiation. Only the use of solar energy, directly or indirectly, or tidal energy helps to avoid the above - mentioned problems. But in this field there are some restrictions. The amount of energy reaching the Earth from the sun is great when considered as a whole, but per unit surface the quantity is small. This results in the serious difficulty of concentrating the heat gathered from a large surface and using it as a source of energy. The research on this difficulty is under way, and progress has been made on the problem of the use of solar energy directly as heat; for example, solar radiation is being used to heat homes, to produce high temperatures for metallurgical operations (solar furnaces), and to concentrate water solutions by evaporation.

The energy of air movement has been used to some extent for the production of work, especially in rural areas (wind mills). But the necessity for large - sized equipment and variations of wind directions prevent from using this energy on a large scale.

So far all the methods of energy production have been rather inefficient. Thus the generation of electric power at thermopower stations is accompanied by a loss of at least 70 percent of the chemical energy contained in the fuel. Further losses occur when transmitting and utilizing electric power.

In spite of all those facts, energy consumption per unit of industrial production is going down as the result of increasing efficiency in the production and transformation of energy in various stages. The application of superconductivity has reduced the loss of energy in generation and transmission. There are some other ways of decreasing the waste and irrational use of energy.

At the same time, the energy problem may still create serious difficulties and may even set limits to the development of mankind. It's not a shortage of energy but its excessive consumption that might lead to such a situation. Besides, the electric power, used for any purposes, is ultimately converted into heat. The release of additional heat and the discharge of combustion products can result in dangerous environmental changes.

I. Find in the text the words with the similar meanings:

Application, in spite of, generation, power, to be in process, to reduce, to transform, resource, quantity, to get.

II. Form the words with the opposite meaning by adding the prefixes:

Direct, touched, limited, efficient, balance, possible.

III. Review the questions:

1. What is the most common source of energy at present?
2. Are the fossil fuel reserves increasing?
3. What are the drawbacks of fossil and nuclear energy?
4. What are the alternative sources of energy?
5. Why isn't solar energy used commonly?
6. Where is solar energy utilized?
7. What is the drawback of using wind energy?
8. Why is energy production at thermopower stations inefficient?
9. What are the ways of increasing efficiency in the production and transformation of energy?
10. What can result in dangerous environmental problems? Why?

IV. Transform the sentences like in the model:

Model: The huge reserves of coal remain untouched because they require high outlays. - The huge reserves of coal remain untouched requiring high outlays.

1. Both fossil and nuclear energy release some heat to the Earth and imply a fundamental "thermal pollution" limit to the use of these forms.

2. The electric power is converted into heat and release the additional heat as well as discharge of combustion products into the

atmosphere.

3. The efficiency in the production of energy increases and reduces the consumption of energy.

4. Ecology is a branch of natural science. It deals with interactions within the biosphere.

5. In case of nuclear accident huge areas should be evacuated. Because remains contaminated with radioactivity for years.

6. Radioactivity causes cancer. It affects future generations.

7. We should do research on solar energy, wind and tidal power because they are promising sources of energy and that energy lasts for ever.

V. Read the examples, join the sentences in every possible way

Example № 1: They tried hard to clean up the lake, but/yet it remain polluted.

Example № 2: They tried hard to clean up the lake; however/nevertheless, it remains polluted.

Example № 3: Although/Even though/Though they tried hard to clean up the lake, it remains polluted.

Example № 4: In spite of/Despite their trying hard to clean up the lake, it remains polluted.

1. Technological progress has stimulated the development of solar batteries. The use of them reveals some serious problems in gathering the heat from the sun.

2. The fossil fuel is rapidly running out. Some huge reserves remain untouched.

3. There are some difficulties in using solar energy. This energy is used directly as heat to produce high temperature for metallurgical operations.

4. The air in our region is much polluted. Toxic gases are still being damped into it.

5. The efficiency in the production and transformation of energy increases. The energy problem remains.

6. The wind power has been used in rural areas from ancient times. The necessity for large – sized equipment and variations of wind direction make it impossible to use this power on a large scale.

VI. Join the sentences using the words in brackets. In what other ways can they be joined?

1. Nuclear energy is an unlimited source for producing thermonuclear

energy. It presents some danger for environment (however).

2. The energy station was fined. It is still releasing toxic gases into the air (In spite of).

3. Wind power is ecologically friendly with the environment. It lasts for ever (Moreover).

4. The production of nuclear energy is connected with the danger of accidents. It introduces the problems of burning nuclear waste (not only ... but also).

5. The generation of electric power is accompanied by a great loss of energy. Some losses take place when transmitting and using it (besides).

VII. Listen to the discussion about energy crisis. You will hear the following words:

To run out, to fail, inevitable, to contaminate, public outcry, to cause cancer, for disposal, to ransom, evil, nuclear waste, in the short – term.

If you don't know any of these words, find them in the dictionary.

After listening answer the questions:

1. Why do we need some energy sources besides fossil fuel?
2. What are the alternative sources of energy?
3. What are the disadvantages of nuclear power?
4. What are the advantages of nuclear power?
5. Who do you agree with? Are you an optimist?

VIII. Read the article and answer the questions below:

The Truth about Chernobyl

... A series of explosions shook the plant. About 700 tons of graphite and 70 tons of uranium fuel from the core of the reactor, all lethally radioactive, spewed onto the tarmac and the roof of the turbine hall. Another 50 tons of fuel evaporated, releasing 10 times as much radioactivity into the atmosphere as was released at Hiroshima.

Yet so sure of themselves were they, that for 17 hours after the blast, the power station management insisted that the reactor remained intact and that it was only an emergency water tank that had exploded.

It should have been a simple matter to check, but the dosimeters for measuring radioactivity were locked in a safe and the panel in the control room was dead. The managers refused to believe the word of a physicist who inspected the plant, and who was to die of radiation sickness a few days later. Instead, they relied on machines which had a maximum reading of one five-thousandth of the dose some were actually receiving ...

Some workers received lethal doses because the rest of the site was not evacuated. Night fishermen fished at the outflow to the power station until morning, by which time they were dizzy, vomiting constantly, and their skin had acquired a nut - brown nuclear tun.

There was no evacuation from the company town of Pripyat, where 50 000 people lived, for 36 hours. A man in Pripyat sunbathed on his balcony throughout the next day. Later that evening he was taken to hospital, vomiting uncontrollably.

1. Why didn't the managers stop the reactor?
2. What were the consequences of the blast at the station?
3. What were the consequences of the explosion for the company town?

UNIT 7. CARS: TOO MUCH OF A GOOD THING

Key words:

cancer rate	заболеваемость раком
catalytic converter	каталитический преобразователь
incinerator	завод, сжигающий мусор
leach	просачиваться
lead exposure	воздействие свинца на организм, отравление
power plant	электростанция
raw materials	сырье
refinery	нефтеперерабатывающий завод
waste	отходы
arable land	пахотная земля

I. Look through the text and say:

a) What problems are discussed in the text?
b) Why are they of great importance?

The widespread use of cars has real environmental and economic costs. Vehicles are major sources of urban air pollution and greenhouse gases emissions. They make our towns and cities dirtier, noisier and more dangerous places to live.

The motor car industry requires a vast quantity of raw materials. It uses 20% of all world's steel, 10 % of aluminum, 7 % of copper, 50% of lead and 60% of natural rubber. Besides this, the transport sector consumes about one half of the world's oil production, the bulk of it as

motor fuel. Car engines use only 10 to 20% of energy in the fuel - the rest is lost as noise, heat and pollution.

Car exhausts contain nitrogen oxide, which contributes to acid rain, carbon dioxide, which contributes to global warming, and lead, which damages human brain and kidney. Lead is particularly toxic to the brain, kidney, reproductive system and cardiovascular system. It is very dangerous because it can accumulate in the body. Lead is a special hazard for young children. Lead exposures can significantly reduce the IQ (intelligence quotient) of school-aged children; they also cause aggressive behavior, delinquency and attention disorders.

Many countries introduced catalytic converters into their cars, which require unleaded gasoline. But despite widely recognized damage to the health, most countries still use leaded fuel.

Gasoline and diesel fuel are distilled at huge refineries, which produce both toxic waste and toxic air emissions. The refineries are located in towns that have the highest cancer rates and are populated by workers with the highest occupational disease rates.

Road building withdraws large areas of land from agricultural use, requires tremendous amounts of resources and causes great changes in the environment. In the USA 60 thousand square miles (10% of the country's arable land have been paved).

Asphalt is made from toxic tar that remains from coal and oil processing. To that is added aggregate, which often comes from incinerators and power plants and is laden with dangerous heavy metals like cadmium and mercury. These materials slowly leach their contents into the soil and water.

From the 1960 onwards more and more people protested against the motor car. Some pressure groups and local councils opposed traffic in towns, the building of new roads, and the closure of railways and the loss of bus services. Some councils restricted the use of cars, improved public transport and created better facilities for pedestrians and cyclists.

Now car manufactures are trying to make more environmentally friendly cars which use fuel more efficiently and cause less pollution.

In the future cars may run on solar power, alcohol from plants or fuel cells using methanol or hydrogen. They will be much lighter with aerodynamic design and advanced electronics.

II. Are the following statements true or false? If false, say why

l. The widespread use of cars does not produce any environmental problems.

2. The motor car industry requires a vast quantity of raw materials.

3. Car engines use 80% of energy in fuel.

4. Car exhausts do not contain any harmful substances.

5. There is no use to run your car on unleaded gasoline, because lead is absolutely harmless.

6. Towns with oil refineries have the highest cancer rates.

7. Roads use up large areas of arable land.

8. People do not protest against the expanded use of cars.

III. Working in pairs, discuss the advantages and disadvantages of cars. One person speaks for cars and another against them.

IV. Practice with someone asking and answering:

Put some more questions for discussion:

l. The car of the future... what standards should it meet? Should it be petroleum powered?

2. Why is it necessary to have air pollution standards?

3. What cities are air pollution champions? Give some facts about the environmental situation in these cities.

4. Are fumes from automobiles harmful only to health?

5. How is the purity of the air controlled in many cities?

V. Complete the missing part of the story:

There was once a town in the heart of America where all life seemed to live in harmony with surroundings.. The streams flowed clear. The countryside was famous for the abundance and variety of its bird life ... Then everything began to change...

UNIT 8

WATER POLLUTION

Key words:

stream	поток, ручей
lungs	легкие
enormous	огромный, громадный
huge	огромный, гигантский
immutable	неизменный, непреложный
tide	прилив (отлив)
dump	сваливать, выбрасывать
pour	лить
spill	разливать, проливать
damage	вред, повреждение, ущерб
disturb	нарушать, беспокоить

discharge	выбрасывать
mining	добыча ископаемых, разработка
creature	существо, создание
alga	морская водоросль
flood	наводнение
root	иметь корни, корениться
welfare	благосостояние
to be of particular concern	дело особой важности
short-term	краткосрочный
long-term	длительный, долгосрочный
sound	здоровый
penetrate	проникать
consumption	потребление
match	подходить
prevent from	мешать, предотвращать
reduce	уменьшать
spawn	икра
get rid of	избавляться

I. Read the words, remember the pronunciation

[ʌ] flood, blood, us, done, consumption
[ju:] suitable, produce, huge, immutable, sewage
[i:] heat, creature,
[e] dead, head, health, death, heavy
[a:] discharge, everlasting, grass, plant
[o:] pore, pouring, enormous, deformity, source, store, cause
[ai] vital, might, provide, society, die

Read the text and do the tasks.

Everything that finds its way into stream finds its way sooner or later into rivers. Everything found in river water ultimately reaches the ocean, which is the lungs of our planet, its unique heat regulator, an enormous factory for producing food for man, as well as a huge transport artery. About 75 per cent of the surface of Planet Earth is covered by the oceans and their seas so, "Planet Ocean" might well be seen as a name more suitable for our part of the solar system. Therefore, the marine environment is considered by most of people as everlasting and immutable. But it is not the fact. The oceans and seas remain within well - defined limits.

From their waters we collect food and extract salt, from their beds exploit minerals, gas and oil, on their tides and waves produce power. Into their waters we dump rubbish, pour polluted water spilling poisons

into the depth and oil onto the surface. With complete indifference to the damage done, perhaps because it can not be seen, we disturb the sea with our mining activities and discharge of the materials too dangerous for us to keep on land.

There are already some danger signs that all is not well: creatures with deformities, sea birds dead or dying, coasts full of alga, fish nets empty, flood and vast areas of water without life.

Though the ocean still appears to tolerate us, it can no longer serve mankind as a damping ground. Here are the words of the scientist whose name is for many synonymous with that of the ocean world: "The health of the global water system rooted in the ocean is vital of the future welfare of our planet, and is of particular concern to me as an ocean explorer. The future needs of society will be well served, however, only if we change our short-term mentality and often arrogant indifference to the results of our actions and focus on long-term considerations and a sound attitude in the use of all our resources."(Coustean. 1981).

Life exists in the ocean, particularly in the waters over the continental shelf, at depths to which sunlight penetrates. Vegetable and animal plankton provides food for larger marine creatures. As grass is to land so phytoplankton is to water. Both lie at die bottom of the food chain; marine life depends on the consumption of the vegetable plankton by the small creatures of the zooplankton. When the marin system is in balance the production of the phytoplankton is matched by the consumption of the zooplankton. Limit the vegetable matter and the zooplankton will be limited too; consequently fish and higher forms of life will be affected too. But there are some waste products of man's activity, which influence the balance of the ocean. These include oil. The oil "carpet" extending over thousands of square kilometres prevent the ocean from absorbing carbon dioxide, it changes the process of evaporation from the ocean surface, it poisons the plankton and reduces the productivity of phytoplankton. The presence in a litre of water of only 0.01 millilitre of oil already brings death to the spawn and many species of fish. And although the surface film is not long - lasting, the ocean does not easily "get rid" of it. How quickly this takes place depends on the physical properties of the oil itself. Whether the oil is "light" or "heavy" is of great importance in the solution of the problem.

II. Translate from Russian into English:

В конце концов, морская среда, вечный и постоянный, полное равнодушие, беспокоить море, больше не, проникать, морские существа, пищевая цепь, кислотные дожди, сточные воды, выливать ядовитые отходы, забивать реку, икра, избавляться от чего-либо, виды

рыб.

III. Pay attention to the following words:

leak spill
leakage spillage

E.g. Unintentional or unauthorized releases of chemicals, gases, or oil are leaks, leakages, spills, or spillages.

IV. Translate the sentences

1. When Union Carbide's pesticide plant sprang a leak and released a toxic cloud of methyl isocynate over Bhopal, some 2,500 people died and hundreds of thousand were injured.
2. The Exon Valdez, the tanker that ran around in Prince William Sound in Alaska in 1989, causing the biggest oil spillage in American history.
3. Ever Ready claims that the safety features in the batteries prevent leakages of lithium.
4. Four people were treated in hospital after chemical spill in Ponlottyn, south Wales.
5. The worsening weather conditions provoked more fears of spill from the vessel, which has already lost 1 000 tons of crude oil.

V. Fill in the prepositions

1. How long-lasting film on the ocean surface depend … the physical properties of the oil.
2. Every stream on the Earth flows … the Ocean.
3. We live on the planet with complete indifference … the results of our actions.
4. The oceans and seas remain … certain limits.
5. The health of the global water system rooted … the ocean is vital.
6. Life exists in the ocean even … depth where sunlight cannot penetrate.
7. Many towns still pore their sewage straight … rivers with little treatment beforehand.

VI. Change the sentences using Passive Voice

1. We cannot se the damage done to the Ocean.
2. The mankind will serve the future needs only with the help of the Ocean.
3. The nature matches the production of the phytoplankton to the consumption of zooplankton.
4. The ocean covers the most of the Earth surface.

5. Most people consider the Ocean as everlasting and immutable.

6. The limit of phytoplankton affects the zooplankton which in its turn influences the higher forms of ocean life.

VII. Say if the sentences are true or false

1. Our mining activity does not affect the balance of the marine system.

2. There is life in the Ocean at depth to which sunlight does not penetrate.

3. Phytoplankton plays the same role in the life of the Ocean that grass plays in that of land.

4. How long the oil film remains on the ocean surface depends on the physical properties of the oil.

5. The ocean is an everlasting and immutable part of the nature.

6. A very little amount of oil in a liter of water can reduce the quantity of spawn and fish significantly.

VIII. Translate from Russian into English

1. Любой ручеек рано или поздно впадает в реку, а река в океан, который является громадными легкими нашей планеты (sooner or later, to reach, lungs).

2. Так как 75 % поверхности нашей планеты занято водой, то более подходящим для нее названием может быть планета Океан (more suitable, to be covered).

3. Хотя кажется, что океан все еще терпит нас, он больше не может служить нам ямой для отходов (to appear, no longer, damping ground).

4. Здоровье Океана жизненно важно для будущего благосостояния нашей планеты и представляет особую тревогу для ученых (vital, welfare, to be of particular concern).

5. Морская жизнь зависит от потребления фитопланктона малыми существами зоопланктона, которые потребляются более крупными морскими животными (depend on, consumption, creatures).

6. Удобрения, которые фермеры употребляют для выращивания урожая, иногда вызывают загрязнение, когда дождь вымывает их в реку (fertilisers, to make crops grow, to wash into).

IX. Review the questions:

1. What role does the ocean play in the life of mankind? What does it give to us? (Name at least 5 items).

2. What harm do we do to the ocean?

3. What are the sings of the ocean disturbance?

4. How should we change our attitude to the ocean in Coustean's opinion?

5. What is the role of phytoplankton for the ocean?

6. How does disbalance in the production of phytoplankton influence the marine system?

7. How do oil spills affect the balance of the ocean?

8. What does the time of lasting of oil film on the ocean surface depend on?

UNIT 9. OZONE GROUND-LEVEL AND HIGH-LEVEL OZONE

Key Words:

makeup	составлять
breathe	дышать
split up	расщеплять
destroy	разрушать, разбивать
promote	способствовать, содействовать
immense	огромный
absorb	всасывать, поглощать
poisonous	ядовитый, вредный
damage	повреждение, вред, повреждать
cause	быть причиной, заставлять
irritation	раздражение
weaken	ослаблять
harden	укреплять, делать твердым
bleach	отбеливать
treat	обрабатывать
yarn	пряжа, нитки

I. Read the text without using a dictionary. Speak on the properties and practical applications of ozone

There has been considerable interest in ozone and the greenhouse effect recently. Most of free oxygen molecules in the earth's atmosphere

contain two oxygen atoms. This is known as diatomic oxygen and it makes up 20.95% of our atmosphere. It is this type of oxygen that we need to breathe. However, the two atoms can be split up by solar radiation and when each of these then joins diatomic oxygen, the result is a three-atom molecule of oxygen. The triatomic form of oxygen is called ozone.

Without oxygen there is no life. On the other hand, ozone in large concentrations kills all living things. On combining with organic substances ozone immediately destroys them. It is two-faced! A murder of all living things, ozone also promotes life on the Earth in many ways.

This paradox is easy to explain. Solar radiations are not uniform. They contain what are known as ultraviolet rays. If all these reached the Earth's surface, life on Earth would be impossible because these rays carry an immense amount of energy and are fatal to living organisms. Fortunately, only a very small fraction of the Sun's ultraviolet rays reaches the Earth's surface. Most of them lose their force in the atmosphere at an altitude of 20 - 30 kilometers.

At this level of the air blanket enveloping our planet, there is a great deal of ozone. And it absorbs the ultraviolet rays. By the way, one of the present - day theories of the origin of life on Earth relates the appearance of the first organisms to the time of formation of the ozone layer in the atmosphere. The presence of ozone can be a good or a bad thing ... it depends on where it is.

Ozone is poisonous and can damage people's health. Even at low concentration it can cause irritation of eyes, nose, throat and chest - this makes ground-level ozone a problem. Ozone can be an important link in the built up of acid air pollution - a huge problem around the world. It can also weaken textiles and cause paints and pigments to fade. Rubber is particularly prone to ozone damage which causes it to harden and crack. Many car tyres and insulating materials are now treated with chemicals to prevent attack by ozone.

But people need ozone on the Earth too, and in large quantities. The chemical industry would gladly make use of the astounding oxidizing power of ozone. Drinking water treated with ozone is absolutely free from pathogenic bacteria and has no unpleasant taste. Ozone is used to disinfect air. Ozone can renew old automobile types and bleach fabrics, cellulose, and yarn. That is what ozone is! O_3 is no less important than O_2.

II. Answer the following questions

1. What is the difference between ozone and oxygen?
2. What is the most powerful oxidizing agent?
3. Why is ozone called "two-faced?"
4. At what level of the atmosphere is there a great deal of ozone?

5. What theory of the origin of life is mentioned in the text? Do you find it convincing or not?

III. Some of the statements are not true to fact, correct them

1. Ozone and oxygen are entirely different substances.
2. On combining with organic substances ozone does not destroy them.
3. If all the ultraviolet rays reached the Earth's surface, life on Earth would be impossible.
4. Drinking water treated with ozone has an unpleasant taste.
5. Ozone in large concentration kills all living things.
6. Ozone is a powerful oxidizer.

IV. Look through the text again and find sentences:

a) stating the two faces of ozone affect;
b) explaining the important role of ozone in protecting life on our planet;
c) describing the uses of ozone.

V. Say what grammar the following sentences illustrate:

1. It does make a very big difference: ozone and oxygen are entirely different substances.
2. It is this gas that makes the air seem cleaner.
3. If all ultraviolet rays reached the Earth's surface, life on Earth would be impossible.
4. The chemical industry would gladly make use of the astounding oxidizing power of ozone.
5. When attacked by ozone, all the metals change into their oxides.
6. It is this type of oxygen that we need to breathe.
7. Drinking water treated with ozone has a more pleasant taste than that of chlorinated one.

VI. Is it right that:

- ozone is a colourless and odourless gas?
- ozone is formed in processes associated with the liberation of atomic oxygen?
- ozone is heavier than oxygen and considerably more soluble in water?
- ozone removes harmful ultraviolet radiation from sunlight?
- the ozone belt protects life on Earth?
- ozone is a powerful oxidizing agent?

UNIT 10. SOIL POLLUTION

Key words:

victim	жертва
fertilizer	удобрение
crop	урожай
irrigation	орошение
consequence	последствие
degradation	ухудшение, деградация
composition	состав
salinisation	засоление
capability	возможность
attempt	попытка
lime	известь
deposition	отложение, осаждение
damage	повреждение
emission	сброс, выброс

Read the text and do the tasks.

Let us turn our attention to the foundation of human life - the land and the soil. Loss and destruction of the soil are of more than just economic importance. The damage which be caused to the soil eco-system by pollution would appear to be even - more significant. Agriculture is not the only polluter here and indeed it is often the victim (e.g. acid rain). Nevertheless, it plays an important part through its methods of fertilizing and pest control.

Farming changes the natural ecology of an area: it requires the removal of natural vegetation, and the cultivation of a limited number of crop plants and keeping a limited number of animals, rather than a great variety of species which occur naturally. Land clearance and crop cultivation remove plant nutrients, and, when bare, the soil is exposed to higher wind speeds, greater temperatures and higher intensity of rainfall. Furthermore, many farming techniques, such as irrigation and the use of chemical fertilizers seemed to have unexpected adverse consequences.

The term land degradation has been used to describe physical and chemical changes which reduce the long - term productivity of the soil. But this is difficult to measure: removal of top soil by wind in the American Great Plains in the 1930s was obvious, as is gullying in parts of Nigeria now, but slow changes in the chemical composition of soils are less easy to monitor. However, some ten years ago, the Food and Agriculture

Organization of the United Nations estimated that one quarter of the world's arable land was subjected to degradation, through salinisation, soil erosion and desertification.

However, agriculture is known to make a positive contribution to the conservation and strengthening of the ecosystem's capabilities. This can be seen in the way that agriculture attempts to counteract the negative effects of non - agricultural pollution by using fertilizers containing lime.

The sources of pollution are the indiscriminate dumping of materials on land, fall - out of materials from the atmosphere and the deposition of materials from floodwater. One indication of the extent of soil damage caused by emission from non-agricultural sources is the rapidly increasing scale of forest damage. According to the most recent survey of forest damage carried out in 1986, 54 per cent of the woodland area of the Federal Republic of Germany is damaged, one third of it (19 per cent of the total) seriously or very seriously. The main cause is considered to be air pollution, in particular sulphur dioxide and nitrogen oxide.

Improvement of land management is a matter of the optimal coordination of the different forms of land use also involving the consideration of long - term precautionary aspects as well as a matter of protecting the soil ecosystem, especially against pollution by reducing it as its source. Both these management tasks require a regionally differentiated approach.

I. Review the questions

1. What are the main sources of soil pollution?
2. What is the influence of agriculture on soil ecosystem?
3. Does agriculture influence soil ecosystem only negatively?
4. What are the methods of changing the natural ecology of an area by farming?
5. What happens to soil if nutrients are removed?
6. What are the consequences of the use of chemical fertilizers? Of irrigation?
7. What does the term land degradation mean?
8. How does agriculture counteract the negative effects of soil pollution?
9. What sources of non - agricultural pollution do you know?
10. How is soil pollution connected with air pollution?
11. Are there any ways of solution of this problem?

II. Find in the text and translate the words with the same meaning

To remove, clear, desert, to act, to improve, to pollute, to irrigate, agriculture, to consider, precaution.

III. a) Find in the text all sentences containing the subjective Infinitive Construction;

b) Remember what other verbs can be used with this construction as predicates.

c) Translate the following sentences

1. Оказывается, сельское хозяйство не только загрязняет почву, но и оказывает положительное воздействие на нее.
2. Известно, что растительность защищает почву от эрозии.
3. Считается, что эрозия является основной проблемой современных фермеров.
4. Предполагается, что проблема загрязнения почвы несельскохозяйственными источниками может быть решена в будущем.
5. Говорят, что американские фермеры применяют удобрения и химикаты в больших количествах.

IV. Read and translate the sentences paying attention to words and phrases denoting time

1. Until recent centuries, the equilibrium between the carbon in the word's forests and in the atmosphere remained constant
2. Trees currently cover more than a third of the Earth's land surface.
3. The Global Agricultural Revolution which began in the middle of the 17th century perhaps gave rise to the population explosion.
4. About 9 million square kilometers have turned into deserts over the past fifty years due to deforestation, soil erosion, and unsuitable irrigation.
5. Nowadays people are becoming aware of the possible consequences of a global change.
6. So much has been said and written about the adverse effects of pollution on health that little more can be added here.
7. In recent times the destruction of the environment assumed such proportions that it has greatly affected the quality of life in many parts of the world.
8. Researchers estimate that the Earth's mean temperature could rise 1.5°C to 4.5°C by the middle of the next century.

V. Match the definitions of the terms mentioned in the text:

1. land management	a) the increase of salt content in soil
2. irrigation	b) as the result of which appears
3. salinisation	c) a process of changing physical and chemical properties of soil reducing its productivity

4. desertification	d) a method of water supply of some region for increasing crop productivity
5. land degradation	e) a set of actions for improvement of soil quality and for balance of ecosystem of soil

VI. Translate the phrases:

Неконтролируемый сброс химикатов, повреждение почвы, пахотная земля, повышение потенциальных возможностей экосистемы, противодействовать отрицательному влиянию, очистка земли, рассмотрение профилактических мер, нежелательные последствия, образование оврагов, подвергаться воздействию ветра, методы удобрения, недавние исследования.

VII. Read a letter to the editor of the Irish Times newspaper:

Sir over the past few months I have traveled regularly on the motorway between Kildare Town and Dublin Airport. Am I alone in noticing the appalling amount of plastic materials in all form which adorn not just the sides of our roads but the trees and bushes as well? There are cans, bottles, refuse sacs and all manner of litter to be seen every few yards. Could I please ask the relevant country councils if there is a plan to clean up this mess-or, indeed, if there is a regular cleaning scheme?

Our government tells us that tourism is vital to our economy and boasts of ever increasing numbers. If first impressions are lasting, then those who enter through Dublin and travel our highways will be less than impressed.

In any event, we owe it to ourselves to live in a clean environment. The litter laws are obviously just a dirty joke!

J.A.Ryan
Lakelands, Naas

Write a similar letter to a newspaper or a magazine stressing ecological problems that worry you.

VIII. Questions for investigation:

1. Is agriculture developed in your region?
2. What branches of agriculture are there in your region?
3. What methods of farming are used in your region?
4. What non-agricultural sources of soil pollution are there in your region?
5. What actions are done by the local authorities in your town (region) to prevent further soil pollution?

UNIT 11. GREENHOUSE EFFECT. DEPLETION OF OZONE

Key words:

depletion	нарушение, истощение
greenhouse	теплица, парник
greenhouse effect	парниковый эффект
lifetime	время жизни
overall	суммарный, общий, полный
shielding	экранирование, защита
albedo	альбедо (физ.), отражающая способность
visible band	видимый диапазон
transparent	прозрачный
incoming radia-	поступающее излучение
reradiate	переизлучать
vitally important	жизненно важный
sophisticated	сложный
harmful	вредный
lethal	смертельный, смертоносный
conservation	сохранение
affect	воздействовать

I. Look through the text and express the main idea of it. Divide the text into logical parts and entitle them.

Two global pollution problems are connected with air pollution: the greenhouse warming and the depletion of stratospheric ozone. Human activities release increasing quantities of carbon dioxide and other gases into the atmosphere, that are thought to contribute to global warming. These gases (ozone, methane, chlorofluorocarbons and nitrous oxides) showing a steady increase of their concentrations in the troposphere, accelerate the rate of global warming arising from the greenhouse effect due to CO_2.

Some of these are naturally occurring gases, but the sophisticated technology used by humans is increasing the amounts of these gases in the atmosphere. The natural balance of the planet is being affected and the earth is beginning to heat up.

It is difficult to predict what will happen if greenhouse gases continue to build up. However, most scientists agree that the temperature of the atmosphere will rise by between 1.5 degree C and 2.5 degree C. This will affect the world's climate, sea level and agriculture.

Climate changes and sea level rises due to greenhouse are closely linked with acid deposition and threats to the Earth's ozone shield, mostly

due to changes in the composition of the atmosphere by human activity. Reduction of coal and oil use and energy conservation undertaken to reduce acid deposition will also lower concentration of greenhouse gases.

The near - ultraviolet radiation from the Sun produces the ozone (O_3) layer, which in turn shields the Earth from such radiation. Almost all ultraviolet radiation is absorbed by the ozone layer and oxygen. This is vitally important for living things because ultra-violet is extremely harmful and potentially lethal to most forms of life.

The atmosphere is almost perfectly transparent to incoming radiation of the visible band. The Earth reradiates this energy as infrared (heat) waves. Water vapor, carbon dioxide (CO_2), nitrous oxide (N_2O), ozone (O_3), and some other gases absorb infrared wavelengths, much of which get reradiated back toward the Earth. The atmosphere therefore behaves like glass in a greenhouse, allowing passage of light rather than heat. This phenomenon is termed the "greenhouse effect". If the Earth had no atmosphere (but the same reflectivity to solar radiation, or albedo, as it has now), its average surface temperature would be - 18° C instead of comfortable + 15°C found today. Thus, the result of greenhouse effect is a net warming of the earth - atmosphere system and of the Earth surface temperature.

The concentrations and specific distribution of ozone at various atmospheric strata are also critical for the meteorological processes that determine climate: heating rates, air movements, water vapour concentrations etc. The concentrations and vertical distribution of ozone are affected by complex catalytic reactions between various forms of oxygen, nitrogen, chlorine and hydrogen oxides. Small amounts of catalytic oxides and free radicals are able to control the ozone concentrations. Human activities are changing the amounts of these catalysts and this is expected to affect the amount of ozone.

Particular concern has been expressed for a group of chemical compounds known as chlorofluorocarbons. These stable compounds have an atmospheric lifetime of approximately 100 years. If their emissions remained at current levels, they would reduce the total amount of ozone by 3 % to 5 % in the same period. This small change in the overall ozone column is the result of depletion up to 60 % of the ozone layer above 40 km, much smaller reduction at 30 km and an offsetting increase at lower altitudes. Greater depletion is expected at high latitudes and different seasons, leading to major changes in air movements and to greater increase in UV radiation.

The depletion of the ozone layer has become a global problem. A thinning ozone layer will allow more ultraviolet radiation to reach the earth's surface, which can have a direct effect on our health. It can dam-

age our immune systems, make us prone to infectious diseases, cause skin cancers and damage our eyes.

II. Read the text and answer the questions

1. What factors do climate changes and sea level rises depend on?
2. Why does the global mean temperature steadily increase?
3. What factors affect ozone concentrations in the atmosphere?
4. Does the stratospheric ozone shield the Earth's surface against ultraviolet radiation?
5. What would the average Earth's surface temperature be if there were no greenhouse effect?

III. Look at the sentences below. Match the definitions to words from the box

Ozone layer, chlorofluorocarbon (CFC), pollutants, greenhouse effect, global wanning, acid rain, environment.

1. These gases act as a blanket and allow less heat to escape from the earth, causing its temperature to rise.
2 .The air, water, and land around us.
3. It contains dangerous chemicals, this is caused by smoke from factories.
4. A layer of gases which stops harmful radiation from the sun reaching the earth.
5. A chemical which can damage the ozone layer.
6. An increase in world temperature caused by an increase in carbon dioxide.
7. Substances, especially, man-made chemicals and waste products that negatively affect, or pollute the environment.

III. Explain the meaning of italicized grammar constructions and translate the sentences

1. These factors *are thought to contribute* to global warming
2. The global mean temperature *is predicted to rise.*
3. The emissions of cars *are known to damage* plants and to affect human health,
4. Human activities *are expected to affect* the amount of ozone.
5. Other gases are also *likely to affect* it.
6. CFCs, gases used in aerosols and refrigeration fluids, *are thought to be* a major cause of damage to the ozone layer.
7. The world's trees *are known to contain* between 400 and 800 billion tons of carbon.
8. Global warming *is expected to rise* much more rapidly in the polar

regions than in the rest of the world.

9. If the pollution affects the level of carbon dioxide in the atmosphere, the results *are likely to be serious.*

UNIT 12. CARBON DIOXIDE AND GLOBAL WARMING

Key Words:

maintain	поддерживать, сохранять
absorb	всасывать, поглощать, впитывать
prevent	предотвращать, предохранять, препятство-
remain	оставаться, сохраняться
increase	увеличивать
interfere	мешать, быть помехой
remove	уничтожать, удалять, устранять
excess	избыток, излишек
carbohydrate	углевод
respiration	дыхание
release	освобождать
tissue	ткань
limestone	известняк
wear away	изнашивать
climate equilibrium	климатическое равновесие
natural variability	изменение климата, вызванное естественными причинами
geographic roug	ареал, распространение животного или растения
pattern	характер, распределение
fertile lands	плодородные почвы
flood	наводнение
drought	засуха
hurricane	ураган

I. Read the text and choose the most suitable title:

a) The function of carbon dioxide in the atmosphere
b) The future of man
c) Possible effects of technology on the environment
d) The control of temperature in the environment

Carbon dioxide constitutes only a small part of the atmosphere. But it has an important function in maintaining the balance between radiation from the sun entering the atmosphere and radiation leaving the Earth. Some of the radiation is absorbed by the Earth and some is radiated back into the atmosphere. The carbon dioxide in the atmosphere prevents some of the radiation from leaving the atmosphere. Thus the heat remains in the atmosphere and carbon dioxide helps to prevent the temperature of the Earth from falling.

If the proportion of carbon dioxide in the atmosphere is increased as a result of air pollution, the temperature of the atmosphere may rise. This might eventually cause the ice in the north and the south poles to melt. If this happened, the sea level would rise and parts of the Earth would be flooded. The likelihood of this happening is remote, but the possibility exists.

There is also a fairly strong possibility that the dust level in the atmosphere will rise as a result of industrial pollution. This dust pollution will reflect sunlight back into space. If this happens, less sunlight will reach the Earth and the temperature will fall.

People are not only putting huge amounts of carbon dioxide into the atmosphere, they are also interfering with the normal way it is removed from it. Trees and other plants remove this gas from the air and replace it with oxygen, transforming carbon into wood. By rapidly destroying the forests, people are damaging the earth's ability to remove excess carbon dioxide.

The carbon cycle

All plants and animals need carbon for growth. Plants take in carbon from the air during photosynthesis. In this process, plants use energy from the sun together with carbon dioxide from the air. They then make sugars and other carbohydrates. The carbohydrates are needed for the growth of roots, stems and leaves.

The leaves may subsequently be eaten by animals, which digest the carbohydrates. The carbon is then used for building muscles and bones. Some of the carbon, however, is returned to the atmosphere after respiration, when carbon dioxide is released from the body.

When an animal eventually dies, decomposition of the body tissue takes place. Through the action of bacteria and other organisms, the chemicals are broken down, or decomposed, and carbon dioxide is released. Some dead plants are buried under earth. Over millions of years, the pressure of the earth turns them into coal. When coal is burned to produce heat, carbon dioxide is released.

Many tiny animals living in the sea have carbon in their shells, in the

form of calcium carbonate. When these animals die, their shells form layers of calcium carbonate at the bottom of the sea. These eventually turn into a rock, called limestone. After movements of the earth, the limestone may reach the surface. The wind and rain then wear away the limestone, and some of its carbon is once more released into the atmosphere.

II. Review questions

l. How do animals take in carbon?
2. How is limestone formed?
3. What is the carbon cycle?
4. How do plants take in carbon?
5. How do animals give up carbon?
6. How is coal formed?
7. What is the function of carbon dioxide in the atmosphere?
8. What factors do climate changes depend on?
9. What would happen if the proportion of carbon dioxide in the atmosphere is increased as a result of air pollution?
10. Why does the global mean temperature steadily increase?

III. Make ten true sentences from the tables below

a).

As a result of	eating plants, photosynthesis, combustion of coal, decomposition of dead plants	carbon dioxide is given off. carbohydrates are produced by plants. animals absorb carbon.

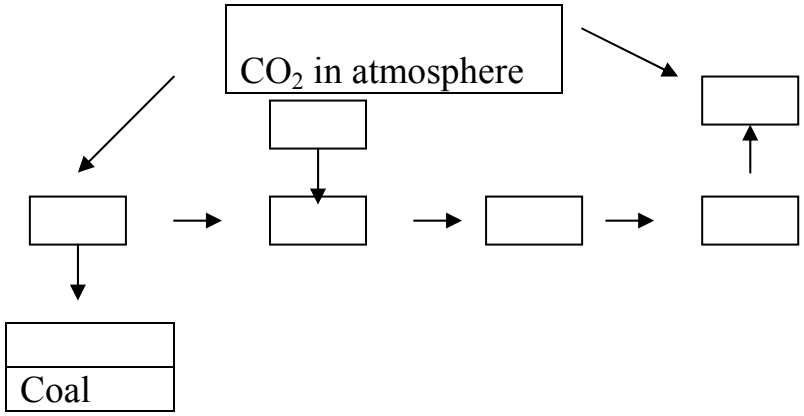
b).

Decomposition of plants	results in	respiration.
under pressure		photosynthesis
Release of CO_2		the formation of teeth
into the atmosphere		and bones in animals.
Decomposition of		the formation of rocks.
dead animals		the formation of coal.
Formation of	results from	CO_2 in the atmosphere
hard water		
Absorption of		the formation of shells.
CO_2 by the sea		the combination of

		rain and
Production of		the release of CO_2 into the atmosphere
carbohydrates	leads to	
Formation of		
carbonic acid		
Formation of shells		

IV. Put these labels into the flow-chart

CO_2 in atmosphere
photosynthesis in plants
animals eat plants
animals die
tissue decomposes
animals breathe out CO_2
plants are buried coal



Now make your own flow - chart of the formation of limestone.

V. Quote the text to prove that there are means of lowering the greenhouse gases concentration.

Global Warming

The increase of concentrations of carbon dioxide and other green-house gases posed a threat to the earth's ability to regulate the amount of heat retained in the atmosphere. This increase of heat seriously threatens the global climate equilibrium that determines the patterns of winds, rain-falls, surface temperatures, ocean currents and sea level.

Over the past century the planet has warmed 0.3 to 0.6 degree C. Most of the scientists think this wanning was caused by human activities, but there are some skeptics who believe it to reflect the natural variability of the global climate.

Global warming is expected to rise much more rapidly in the polar regions than in the rest of the world. As the polar air warms, the ice here

will thin, and since the polar cap plays a crusial role in the world's weather system, the consequences could be disastrous. And this process has already begun. The thick ice that has for ages covered the Arctic Ocean at the Pole has turned to water. In August 2000 an ice-free patch of ocean about a mile wide was opened at the very top of the world. The Russian icebreaker "Yamal" with tourists aboard reached the North Pole for the first time in human history.

In many land areas norlh of the Arctic Circle the spring snowmelt now comes earlier every year and deeper in the tundra below, the temperature is steadily rising. If the frozen tundra thaws, enormous quantities of methane are expected to be produced and released into the atmosphere. Since each methane molecule is twenty times more effective in trapping heat than each molecule of carbon dioxide, there will be a great increase in the overall concentrations of greenhouse gases and global warming will be accelerated.

Not only the plants reacted to surface warming. Field studies of small American butterfly, known as Edith's checkerspot butterfly, have shown the first convincing evidence that the geographic range of an animal species has shifted in response to climate change. Scientists have long ago predicted, that as global temperatures get warmer, the geographic ranges of plants and animals will shift toward the poles or to higher elevations to maintain their preferred temperature conditions. This is precisely what happens to the checkerspot. Over a number of decades, butterfly colonies on the southern limit of the range died, while new colonies formed on the northern limit of the range and also at higher elevations.

Global warming will dramatically change the face of the Earth. If the polar ice cap melt, the sea level will rise and low-lying territories with very dense populations will disappear. This will cause massive migrations of people.

Global warming is expected to change wind and ocean current patterns. As a result vast territories of rich fertile lands will turn into deserts.

Such disasters as tornados, floods, droughts and hurricanes may become more frequent, and occur in such places where they never (or seldom) happened before.

Computer models predict that global warming will expand the incidence and distribution of many illnesses, such as malaria, yellow fever, cholera and several kinds of encephalitis.

The greenhouse effect is recognized as a serious crisis and much research is devoted to it. It will take world action to deal with the greenhouse effect, but there are many basic things every single person can do to help reduce it.

What can we do?

Avoid CFC in aerosols, packaging and refrigerators. Buy aerosols marked "ozone friendly" or "environmentally friendly" – it means that they are CFCs – free and try to avoid those blown-foam trays used in supermarkets for meat and fruit. Instead, buy unpackaged food when you can. Encourage your families to use fewer paint sprays, deicers, hairsprays and air fresheners.

Use bicycles and public transport instead of private cars. Public transport is less polluting than cars. Save paper, which also helps save the forests, and use recycled paper as often as possible. Eat less meat, particularly red meat from methane-producing cattle. Save energy-make sure that the heat, created in power stations, doesn't just get lost. Even switching off lights helps. Help save forests. Support or join campaigns to save the forests, plant trees yourselves.

Remember, the ozone crisis and the greenhouse effect aren't somebody else's problem they are affecting you right now!

VI. Review the questions:

1. What are the major environmental problems confronting humanity today?
2. What factors are slowly changing the global climate?
3. What are the consequences of damaging the environment?
4. Why are people concerned about protecting environment from pollution and from destruction of natural resources?
5. What would happen if we don' temperature learn to use the environment carefully.
6. What should people do if they want to live on the Earth?

VII. If we want to look after the environment, there are certain things we should and shouldn't do. Complete these two lists in suitable ways.

We should:

…paper, bottles and clothes
…more trees
…water and energy
…using aerosols
…public transport

We shouldn't:

…paper, bottles and clothes
…the ozone layer
…water and energy
…blown foam trays for meat and fruit
…forests

VIII. Read the following dialogue. Be ready to act out the dialogue in class.

Practice the dialogue with your friend.

- Did you have a nice weekend?

- Yes, I did. Boris and I decided to go to Novosibirsk University to take part in the discussion on environmental problems.

- Oh, really. How unusual. That must have been interesting.

- Yes, it was. There was a lot of people, scientists and politicians.

- Are you specializing in the field of ecology?

- Yes, I am. I think ecology is a very important science as far as the future of our planet is concerned.

- Are you going to be an environmentalist?

- Yes, I would like to ileal professionally with such problems as water, air and noise pollution. The air we breathe, the earth we live on and its rivers and seas that used to be so beautiful and full of fish are becoming contaminated with ever more dangerous materials – the by-products of Man's activities. Many scientists say that our world is going through a global crisis which means the gradual destruction of the human race.

- Don't be so pessimistic! The fears of ecologists about the ecological crisis are exaggerated. Whenever I go into the country I find a lot of beauty in nature to enjoy. In fact I am fed up with all the talk about environmental problems. The problem of man and his interaction with the environment has now become the focal point for many scientists because it is fashionable.

- You are wrong. Sometimes pollution is unseen and invisible but we can't ignore the fact that the environment is getting worse. Man's intervention in nature is steadily increasing which is a growing threat to the environment. What we see at present are signs of ecological imbalance, which may cause a crisis if due measures are not taken.

- Actually, a lot of you are speaking makes sense. People ought to take measurements. But let's stop looking on the black side of things. Have you noticed what, wonderful weather we've having! What would you say to an outing.

- A perfect day for an outing somewhere in the forest.

IX. Role Play

In this role play you are going to take part in a meeting to decide what to do about a local pollution problem. First, read about the situation.

Techtronics is a large multinational company, which produces chemical products. One of its factories is in Blackthorpe, a small town in the north of England. The factory is the biggest employer in the town and has

over 1,200 workers. Recently, there have been a number of complaints because the amount of dirt coming from the factory chimneys seems to have gone up. Mr/Mrs Dobson, the mayor of Blackthorpe, has called a meeting of interested parties to find out more about the problem. Four other people are there. They are: Mike Smith, the manager of the factory; Marion Green, the leader of a local environmental group called *Spearhead:* Arthur McCarthy, trade union boss at the factory, and Jennifer Hunter, a local housewife. Their task is to try and find a solution to the problem.

You are Mr/Mrs Dobson, the mayor of Blackthorpe. You are in charge of the meeting and must make sure that everybody has the chance to speak. There is going to be another election soon and you want to solve the problem caused by the factory. You have met the American president of *Techtronics* and know that he will close the factory down if there is too much criticism. You think that the company should try and improve its image locally.

You are Marion Green from *Spearhead.* You are more worried about damage to the environment than the loss of jobs. Your scientists believe that the dirt is dangerous. You want the factory to fit new filters to its chimneys. You are worried about new reports of toxic fumes coming from pipes near a field where children play. You would like to organize a demonstration.

You are Mike Smith, the factory manager. You think the chimneys are dirty rather than dangerous. New filters would cost $3 million. The American company would close the factory down rather than spend that kind of money. Your boss says you can spend $3000,000 on improving the company's image. You know there are fumes coming from pipes near a playing field. You are trying to get them fixed now.

You are Arthur McCarthy, the trade union boss at the factory. You aren't very worried about dirt from the chimneys. You think that jobs are more important. Blackthorpe is in an area of high unemployment. However, you think that *Techtronics* could do more for the town. The local amateur football team is looking for a sponsor and a new community center is needed for old people.

You are Jennifer Hunter, a local housewife. You have written to Mike Smith but haven't had a reply yet. Your children, who play in a field near the factory, have been ill recently. Last week your washing was made dirty by the chimneys. Your husband is a worker at the factory.

UNIT 13. RECYCLING IN THE USA

Key Words:

recycling	переработка
waste	трата, потеря
instead of	вместо
treat	обрабатывать
headlight	фара
attitude	отношение
advertise	рекламировать
car part	запасная часть
scrap	лом
eventually	в конечном счете, со временем
pave	мостить
huge	огромный
throw away	выбрасывать
make an effort	делать усилие
mine	добывать
sterilize	стерилизовать

Read the text and do the task.

Recycling is a very important subject, and one that is becoming more so all the time. As we all know, it reduces waste and is good for environment. But what do recycling centers do with the things we throw away?

Recycling paper has been the biggest success. In 1990, in the USA, more than 20 million tons of paper were recycled and turned into birthday cards, cereal boxes, and hundreds of other things. Paper is the earliest material to recycle and, as David Dougherty of Clean Washington said, "You can use it six times over, than burn what's left to create energy".

Wisconsin cow farmer George Plenty had the most interesting use for recycled paper: he uses it instead of straw in his barn. "It is cheaper than straw", he said, "but even if the price were the same, I wouldn't go back".

Plastic is the hardest material to recycle, because there are so many different kinds, all of which need to be treated differently. At the moment, only two per cent of the plastic used in the US is recycled. But it does have its uses: one company uses plastic from recycled car headlights to make windows. In some ways they are better than normal windows, because they are much harder to break. Another company, Image Carpets, uses plastic to make carpets and rags. A comment made by the manager showed us how attitudes towards recycling have changed. "We worried that people might refuse to buy the carpets if they knew they were recy-

cled, said the sales Manager. Now we advertise the fact as a marketing strategy."

Metal is another important material. It is easier to recycle an aluminium can than to make a new one. It is also 20 per cent cheaper, and uses only 5 per cent of the energy than making a new can would use. So many of the things we use are made of metal, and can all be reused after they stop working. Recycling car parts, for example, is a big business. There is also very little waste involved in recycling metal. Steel is 100 per cent recyclable, and can be recycled hundreds of times. Recycling steel is cheaper than mining it. A lot of America's scrap metal is taken by the Japanese, recycled, and eventually sold back to America as new cars.

20 per cent of America's glass is recycled, and used for a number of things. For example, it can be mixed with asphalt or cement and used to pave streets. It can also be melted down and used to make new bottles. However, unlike the other materials, glass can also be reused commercially in its original form; many types of bottles are returned to bottling plants, sterilized and refilled. Recycling and reusing glass is actually a huge worldwide business, with bottle banks appearing everywhere.

So remember, think before you throw things away – they may still be useful. If we all make an effort to recycle, we can make the planet a cleaner place to live.

I. Review the questions:

l. What materials can be recycled?

2. How many times can paper be recycled?

3. What is the most interesting way of recycling paper?

4. What is the difficulty with recycling plastic?

5. Where is recycled plastic used?

6. What are the advantages of recycling metal in comparison to making new one?

7. How many times can be recycled?

8. Where can recycled glass be used?

9. What is the difference between glass and other materials in recycling?

II. You have read the article about recycling. For answering the questions choose

From the materials (A-D). There is an example at the beginning (0).

A. Paper

B. Plastic

C. Metal

D. Glass

According to the text, which material is stronger than glass?
the least difficult to recycle?
costs less to recycle than to replace?
can be used to make roads?
can be recycled a great number of times?
can be used in farming?
is sent to another country and bought back?
has been made into a product which attracts people because it is recycled?
is the most difficult to recycle?
does not have to be changed to be used again?
can eventually be used to produce power?

III. Are the following statements true or false:

a) Recycled car headlighits can be used to make windows.
b) Carpets can be made from recycled plastic.
c) There is a lot of waste produced in recycling metal.
d) The Japanese use American scrap metal to make cars.

IV. Choose the correct word:

1) The driver switched on the ... as it was getting dark.
a) aerial b) bumper c) headlights d) windscreen wipers.
2) The path by the river is ... with concrete.
a) made b) paved c) produced d) done
3) Wood and concrete are just two of the ... used in the construction industry.
a) fabric b) matters c) ingredients d) materials
4) The ... metal dealer went around the houses collecting broken machines that people didn't want any more.
a) remnant b) leftover c) scrapd) waste
5) We took all the empty bottles to the recycling ... after the party.
a) shop b) centre c)industry d) market.

V. Explain the following words from the text:

to treat, rug, attitude, marketing strategy, mining, sterilise, bottle bank.

VI. Task for investigation

1) How many bottle banks are there in your city? Do they accept all kinds of bottle? Is there recycling industry in your city?
2) What else can we do to protect the environment?
3)

VII. Read the table, then in pares discuss the problems, their effects and solutions as in the example

e.g. A. Dropping litter can result in dirty streets.

B. That's true. I think we should use litter bins instead of dropping litter carelessly etc.

C. Think of the other ecological problems as well as their effects and solutions.

problems	effects	solutions
litter/rubbish	dirty streets, spread of diseases	encourage recycling use litter bins
air pollution	breathin problems cancer risk	unleaded petrol filters in factories ban cars from city centers
water pollution	fish die stomack illnesses	limit use of chemicals in industry, fine factories which pollute seas or rivers.

VIII. Answer the following questionnaire, and add up your score to find out how environmentally aware you are. Then, suggest ways in which people with low scores in this quiz could become more environmentally aware. Use expressions like:

They should / ought to

They'd better

The best thing would be ..., etc.

1. What does you family do with empty bottles?

a) take them to a recycling bin

b) return them to the supermarket

c) throw them in the rubbish bin

2. When you buy one or two items at the supermarket, you

a) take a plastic carrier bag

b) reuse an old plastic carrier bag

c) use your own bag

3. How often do you choose products which contain recycled materials?

a) always

b) never

c) sometimes

4. If you were asked to contribute to a Save the Animals project, you would

a) give generously

b) give a small amount

c) refuse to give anything

5. A local beach has been polluted with oil. You

a) donate money for the clean-up project

b) do nothing

c) volunteer to help with the clean-up project

6. You eat a chocolate bar in the street. What do you do with the wrapper?

a) drop it on the pavement

b) put it in a litter bin

c) save it for recycling

7. When you buy paper products, you

a) buy whatever the cheapest

b) try to purchase recycled paper

c) purchase recycled paper as long as it doesn't cost more

8. When you clean your teeth, you

a) turn the tap on only when you need water

b) leave the tap running until you have finished

c) only use one glass of water

1. A3	B2	C0
2. A0	B2	C3
3. A3	B0	C2
4. A3	B2	C0
4. A2	B0	C3
6. A0	B2	C3
7. A0	B3	C2
8. A2	B0	C3

18-24 Keep up the good work !
You are doing your part to protect the environment.

13-17 There's some room for improvement.
Change your habits and you'll soon be green.

0-12 You are part of the problem.
You should try to become part of the solution.

IX. You will hear a radio interview with Join Burgess, a member of the Forest Protection Society. Read the following sentences, then listen to the tape and fill in the missing parts.

1. Paper is used in many different forms-from... to milk cartons.
2. We need more paper than we can...
3. One way of increasing paper production is to grow...
4. Trees grow much faster in ... areas.
5. A tree planted in Brazil can be harvested within ... years.
6. Most plantations are in ...
7. The trees in these plantations are used only for ...
8. Which means that to natural forests need to be ...
9. What we should be trying to do is to restore and preserve ... and
10. To use less ...

UNIT 14. GREENING LIVING

Rub your eyes and look around,
Litter lying on the ground,
Bottles, cans and polythene –
Take the tip and change to green!
Forests going up in smoke,
Cities fit to make you choke,
Now here left to be that's clean –
Take a breath and change to green!
Animals and plants have died,
People starve to feed our pride,
For the life that might have been
Take a stand and change to green!
There's so much that isn't right,
It could get you well uptight,
So make a start and change the scene –
The lights are flashing-change to green!

Key Words:

endangered species	вид, которому угрожает вымирание
ozone-friendly aerosols	аэрозоли, не разрушающие озоновый слой
recycling	переработка использованного продукта

recycled paper	бумага, изготовленная из макулатуры
rubbish	мусор, сор, хлам
extinction	вымирание, исчезновение
substitute	заменять, использовать вместо
fertilizer	удобрение
packaging	упаковка

I. Read the text and express your attitude to the problems mentioned in it. What should be done to improve the environment?

Green Living

Every day we hear about the disasters that face us on this planet. Animals and plants are dying, becoming extinct at the rate of one species a day. Seas and rivers are being filled with rubbish. The air is being poisoned with chemicals and smoke. And these are only a few examples of the way we have lived until now-damaging our world.

But lifestyles are already beginning to change as people become aware of what is going on and make choices to live in a way that is less damaging to the planet. Group campaigns are saving seas, rainforests, countryside. Governments and world leaders claim they have the environment at the top of their lists. Many people call themselves "green" and their lifestyles "green living". "Green" is becoming a household world. It is exciting time to be green and every person's help is crucial. The word "green" means different things to different people. Generally it is based on four principles.

1) Conservation means keeping the world in a state where it is fit for us and the generations after us to live. By preserving forests we can stop animals, plants and birds from extinction, help to keep the earth's water balance stable and prevent soil erosion. By recycling we cut down our needs and save resources. Every time we reuse a plastic bag we are putting conservation into practice.

2) Finding alternatives means trying to supply our needs in a way that is less damaging to the planet.

We can substitute fruit for sweets, bicycles for cars, recycled paper for ordinary paper or ecologically friendly washing up liquid for the old kind. There are many substitution projects going on at the moment. Solar power, energy from the sun which won't run out, can be used to heat houses instead of energy from coal and oil. Food can be grown with fewer fertilizers, which means that the soil will be healthier.

3) Choosing means being aware of the power you have as a consumer and what you can do. If you spend your money on goods that will last and that you can use again and again, you will be doing more to help the pla-

net that if you buy things you can use only once and then throw away. The more people who put their money and time behind things that don't damage the planet, are the more green massage will spread.

4) Caring means having respect for anything that shares out planet with us. It means looking after plants and animals as well as other human being and trying to make sure that our lives don't damage theirs.

Putting these principles into practice means taking some kind of action. You can make a personal choice about your food you can eat, the products you buy and the books and newspapers you read. Here are some examples of personal actions.

Ride a bike whenever you can and use public transport instead of cars.

Build a pond or grow a wild flower garden, creating places where insects and birds can live.

Try to avoid overpackaged goods when shopping. One layer of packaging-like a bag-should be ample. Choose paper bags over plastic ones.

Refuse plastic carrier bags. Take your own shopping bag or basket instead.

Try to recycle bottles and cans-this saves money, too. Buy reliable containers when you can.

II. Quiz: How Green Are You?

Here is a quiz to see how green you are and how well informed you are about the environment.

Score one point for every "yes" answer.

1. Do you read the list of ingredients on the food you buy?
2. Do you take a shower instead of bath?
3. Have you planted at least one tree?
4. Do you feed birds or squirrels in winter?
5. Do you insulate your house in winter to save heat?
6. Do you switch off lights if nobody needs them on?
7. Does your home use recycled paper?
8. If you have ever organized campaigns on environmental issues, score 5.
9. For short journeys, do you regularly walk, if you can?
10. For long journeys, do you regularly use a bike or public transport?
11. If your family has a car, does it run on unleaded petrol?
12. If your family doesn't have a car, score 2
13. Do you buy ozone-friendly aerosols?
14. If you don't buy aerosols at all, score 5
15. Do you buy cruelty-free products? (those not tested on animals)

16. If you have ever written to a manufacturer to complain about their products, score 5

17. Do you belong to any environmental organization?

18. Can you name one endangered species?

19. Do you take bottles to the bottle bank?

20. Do you collect aluminum cans for recycling?

21. Do you collect paper for recycling?

22. If you are non-smoker, score 3

23. Coning back from the forests or from the beach, do you always take your litter with you?

III. How do you score?

Add your scores to discover if you are; Very pale green – scores under 5 Light green – scores 6-16 Mid-green – scores 17-27 Dark green – scores 28-38

Very pale green

Scores under 5

There is a whole green world awaiting for you. Read on, read on.

Light green

Scores between 6 and 16.

If you are light green you've already begun to notice that some parts of your lifestyle aren't very environment friendly. You wouldn't think twice about throwing away paper, cans and bottles. You realize that it is a good move to be green and you should definitely read on and go greener.

Mid-green

Scores between 17-27

You are mid-green you are really thinking about the way the planet operates and you know that everything you do -good or bad – will rebound on us sooner or later. You have made some changes to you lifestyle already. You are aware of the most common environmental problems and you feel strongly about some endangered species. You often watch environmental programmes on television.

You may be thinking about joining an environmental group.

Dark green.

Scores between 28 and 38.

If you are dark green you take environmental issues very seriously and try to live in a way that does not damage the environment. You like to plant trees and take care of birds. You don't pick wild flowers and never kill wild animals. You might be a member of an environmental organization and you have already taken part in some action.

IV. Translate the supplementary text without using a dictionary.

Reproduce the text in English.

Converting Garbage to Gold

Recycling saves and expensive raw materials, protects the environment and cuts waste disposal costs. Aluminium plays an important role in any industrial society, so its efficient production and use are essential. Many aspects of modern civilization such as air travel are impossible without aluminium.

Using aluminium instead of heavy steel in automobiles saves gasoline. Using it instead of glass or steel packaging saves energy in transportation and many allow more efficient recycling, Yet extracting AI from ore requires 20 times as much electricity as recycling the metal, Environmental degradation results from strip-mining the ore and from damming rivers to generate hydroelectric power for smelting. Recycling help to solve these problems. It reduces air emissions associated with aluminium production by 99%. By doubling worldwide aluminium recovery rates, more than и million ton of air pollutants, including toxic fluorides, can be eliminated. The world is far from achieving the technical potential for this recycling.

V. Join The Green Party!

Once you received a letter...

There was nothing unusual about it, but the envelope was quite peculiar. It had a text on the other side. Here it is:

Help Make A Green Future – Now!

The Earth is all we have - a world of finite resources. We depend on our planet and those resources for our very survival. We are part of a fragile interdependent network of Life. If our planet dies, we die. The way we live now is Killing our planet; we pollute the air we breathe, the water we drink, the soil we need to grow food. The way we live now is wasteful: we consume those irreplaceable resources: we produce goods which wear out quickly, cannot be recycled and which we don't really need. The way we live now is unjust: one quarter of the World's population consumes three quarters of the World's wealth. The way we live now cannot go on forever. We must change, or face extinction. It is political change which we need above all else: measures which attack the ROOT CAUSE of our society's ills rather than just the ends results. We've come a long way. But now we need YOUR help if our society is to survive.

Write to: The Green Party, Freepost, London SW 12999.

There is so much feeling in the letter isn't there? Would you write back? Of course, you can express your attitude to the problems men-

tioned, but it would be nice if you also describe some facts you know concerning the situation in your country or somewhere else.

The Green Party are sure to appreciate your reply!

PART II. REGIONAL ASPECTS OF ECOLOGICAL PROBLEMS

UNIT 1. CONTAMINATION MONITORING OF SNOW COVER

Key Words:

ecological-geochemical assessment	эколого-геохимическая оценка
contamination	загрязнение
monitoring	мониторинг
snow cover	снежный покров
sampling	отбор проб
sample preparation	пробоподготовка
pit method	метод шурфа
snow solid residue	твердый осадок снега
snow-up	снегостав
dust burden (dust load)	пылевая нагрузка
background	фон
total pollution factor	суммарный показатель загряз-
geochemical noosphere clarke	геохимический кларк ноосферы
concentration factor	коэффициент концентрации
element concentration	концентрация элемента
substantial composition	вещественный состав
anthropogenic components	антропогенные компоненты
natural components	природные компоненты
soot	сажа
slag	шлак
coal particles	угольные частицы
fly ash	зола уноса
combustion spherules	сферы сгорания
metallic micro spherules	металлические микросферулы

General characteristic

Atmogeochemical investigating method has been intended for study of background dust burden and peculiarities in substantial composition of

regional dust-aerosol fall-outs (Weiss, Herron, 1978; Drake, Moote, 1980).

Recently natural environments accumulating aerosols have been widely used in the environmental monitoring. In this case snow yields a real value of dry and moist atmospheric fallouts during cold season. During the cold season of year in the location of continuous snow cover, substantial and chemical composition of snow solid residue becomes a function of atmospheric fallouts when soil particles transfer to its surface is absent (Василенко и др., 1985). Possibility of using snow cover as an indirect indicator of atmospheric state in the conditions of large-size urban zone with a number of contamination sources has been proved by experiments carried out by Institute of mineralogy, geochemistry and crystal chemistry of rare elements in cooperation with Institute of petrography on the territory of a large city (Методические …., 1982). In addition, from the experience of working in Siberian region it is known that dust-aerosol fallouts are mostly analyzed by snow sampling (Язиков, Рихванов, 1996; Шатилов, 2001; Язиков, 2001 и др.).

Snow sampling operations are usually made at the end of winter on the profiles located in the direction of wind rose as well as transversely to its location. Samples are selected in terms of relief elements and their exposition with respect to the direction of wind-dust transportation (at watersheds, slopes, terraces, flood plains), as well as on the sites of anthropogenic gas-dust releases where the network of sampling is thicker.

Study of snow cover allows for determination of dust burden as well as revealing the source of contamination and zone of industrial effect in terms of substantial composition of aerosol fallouts.

Sampling and sample preparation

Snow sampling is carried out by pit method for the whole thickness of snow cover, except for 5 sm layer over soil, measuring sides and depth of the pit (Методические …, 1982).

When sampling snow cover of its entire thickness the results appear to be more representative, since they exclude any varieties (fluctuations in wind direction, variability of discharges) and yield weighed mean value of contamination, averaged in a natural way over the long time period – from snow-up to sampling (Экология Северного …, 1994).

The time is registered (in twenty-four hours) from the moment of snow-up day (the day when snow falls out and does not melt). The sample weight is 10-15 kg., which permits to have 8-10 l of water after melting. Snow sampling includes separate analyses of snow water and solid fallout consisting of dust precipitated on the snow cover surface (Fig. 1). Insoluble phase is isolated by means of ash-free filter; dried out, riddled for re-

moving admixtures, and weighed.

Further operations are performed in terms of recommendations from В.Н. Василенко (Василенко и др., 1995), И.М. Назарова (Назаров и др., 1978) works, Методические рекомендации (1982) and instructions on atmospheric pollution control (РД 52.04.186 – 89).

It is desirable to combine the spots of sampling with the main points of observation. In case when snow sampling is difficult due to weather conditions, dust-aerosol sampling is made by the plane table. Table fitting and material collection requires definite methods connected with covering the table with fastening materials such as vaseline or gauze.

Sample preparation starts with snow melting, and then includes the following actions: filtration, drying, dressing, weighing, and abrasion.

Snow sample preparation involves separate analysis of snow melting water obtained by melting, and solid residue consisting of atmospheric dust settled on the snow cover.

Melting water is filtered, in the process of which the solid precipitate on ash-free filter and melting water are produced.

Sample drying is made at the room temperature or in special drying box. Dried samples are dressed through the bolt with the size of mesh 1 mm to remove the impurities and are weighed. The difference in the filter mass before and after filtration shows the dust mass in samples.

Methods of result treatment

The methods of result treatment are taken from references (Методические …, 1982; Геохимия …, 1990).

The following factors are calculated by the snow sampling results.

Weight of dust in snow sample allows for determination of **dust burden** (P_n) in terms of mg/m^2 per day or kg/km^2 per day which correlates with each other. Dust burden is a quantity of solid particles which are settled in a unit of time on a unit of square. Dust burden is calculated by the formula (1):

$$P_n = P_o \ / S \times t \qquad (1)$$

where:

P_n – dust burden, mg/m^2 per day (kg/km^2 per day);

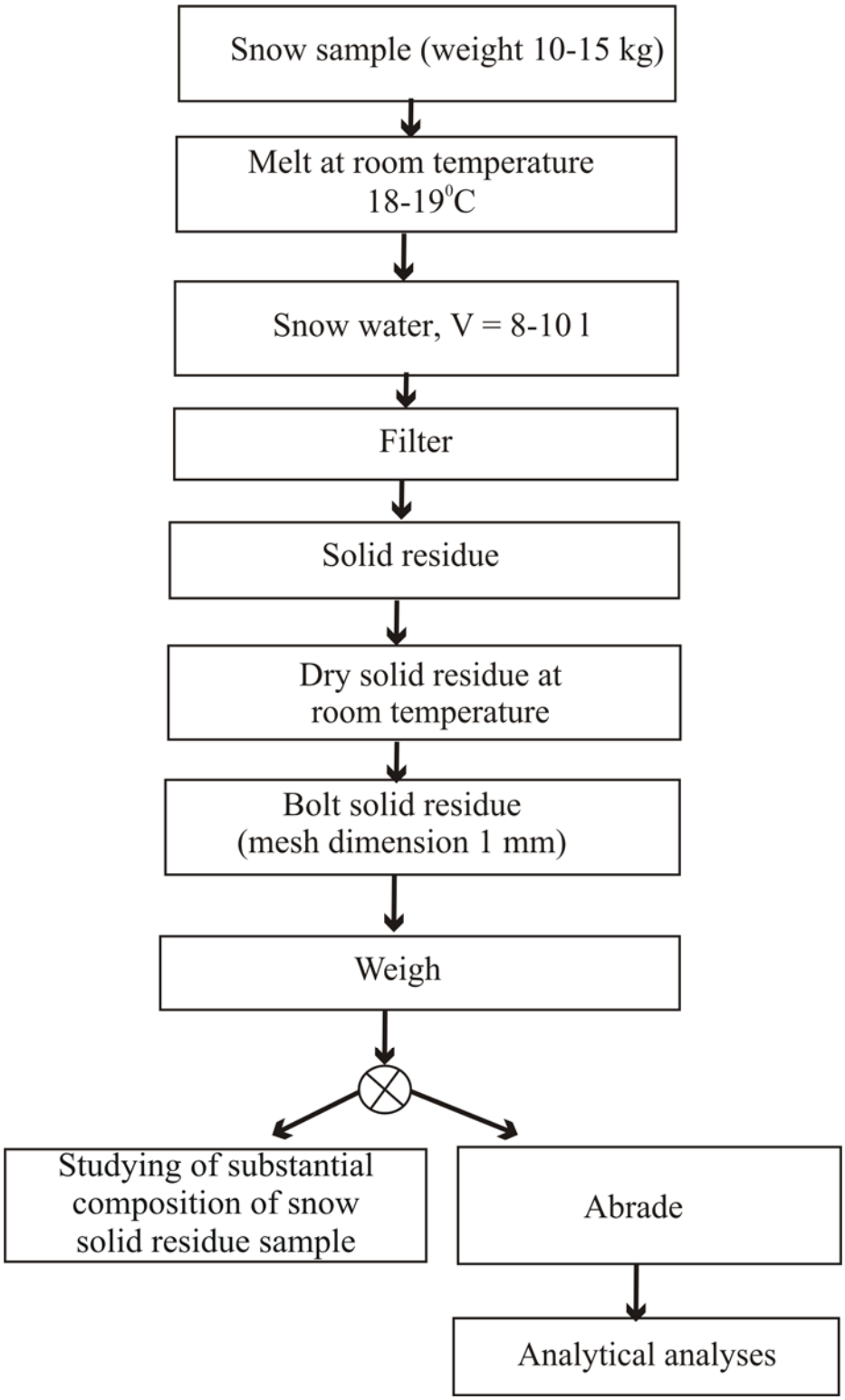


Fig. 1. The scheme of preparation and study of snow samples

P_o – weight of the snow solid residue, mg (kg);

S – square of the pit, m^2 (km^2);

t – number of days from snow-up day (the day when snow falls out and does not melt) to sampling day.

Dust burden is characterized by the following contamination level and morbidity level:

less than 250 mg/m^2 per day – low contamination level; safety morbidity level;

250-450 mg/m^2 per day – middle contamination level; mildly unsafe morbidity level; increase in bronchial asthma and conjunctivitis;

450-850 mg/m^2 per day – high contamination level; unsafe morbidity level; increase in respiratory and sense organs morbidity;

more than 850 mg/m^2 per day – very high contamination level; immensely unsafe morbidity level; increase in morbidity more than 2 times.

Concentration factor is shown the anomalous of element concentration relatively the background value. It is calculated by the formula (2):

$$KK = C / C_b \quad (2)$$

where:

KK – concentration factor;

C – element concentration, mg/kg;

C_b – background value of element concentration or geochemical the noosphere clarke, mg/kg.

According to concentration factor the geochemical row of element association from the highest value to the lowest value are constructed.

Factor of pollutant (element) load on the environment is calculated by the snow sampling results. The factor is defined as a pollutant mass falling on a unit of square in a unit of time. Total pollutant mass (P_n, dust burden) and element concentrations (C) in the snow solid residue are used to calculate the factor. Based on that the following factors are calculated.

1. Total load producing by the chemical element emissions in the environment (or average daily fallout of metals on the city territory) is calculated by the formula (3):

$$P_{total} = C \times P_n, \text{ mg/km}^2 \text{ per day} \quad (3)$$

2. Factor of relative increase in total elements load is calculated by the formula (4):

$$K_p = P_{total} / P_b \quad (4)$$

where:

P_b – background value of total element load. It is calculated by the formula (5):

$$P_b = C_b \times P_{nb} \quad (5)$$

P_{nb} – background value of dust burden, it is 10 kg/km^2 per day for the non chernozem zone of Russia.

As the anthropogenic abnormalities usually comprise many elements, total pollution factor (Z_c) and factor of total element load (Z_p) are calculated. It characterizes the impact of the group of elements. The factors are calculated by the formula (6-7):

$$Z_c = \sum KK - (n-1) \quad (6)$$

$$Z_p = \sum K_p - (n-1) \quad (7)$$

where: n – a number of elements having KK and K_p values more than 1.

There is the following gradation for values of total pollution factor:

less than 64 – low contamination level; safety morbidity level; lower change of children's health;

64-128 – middle contamination level; mildly unsafe morbidity level; increase in total morbidity;

128-256 – high contamination level; unsafe morbidity level; increase in total morbidity and number of illness children;

more than 256 – very high contamination level; immensely unsafe morbidity level; very high level of morbidity, there are many children with chronic diseases and abnormalities in physical abilities.

Substantial composition of snow solid residue sample

The study of substantial composition of snow cover solid residue is made on the basis of invention patent № 2229737 on October, 17, 2002. (Язиков Е.Г., Шатилов А.Ю., Таловская А.В. Способ определения загрязненности снегового покрова техногенными компонентами).

Microscopic examination of samples is carries out by the binocular stereoscopic microscope (MBS-9). Detailed study of microparticles makes possible to characterize particles with determination of color, luster, hardness, transparency, form, and size of particles, characteristic of surface, degree of roundness and oxidization.

In the samples of snow solid residue there can be natural and anthropogenic formations.

Natural constituent includes mineral formations and biogenic particles. In general, the sources of natural particles are soils, plants, surface of seas and oceans, volcanoes, cosmic dust, forest fires (Аэрозоли …, 2006). In urban regions the sources of natural minerals are erosion of banks, building industry emissions, ice-slick protection as well as long-range transport of air mass, e.g. from Central Asia.

Natural components are mostly presented by different types of quartz, feldspar, mica and iron oxides in the studied samples. More de-

tailed characteristic of the components is given below.

1. Quartz – transparent, colorless, with acute edges. Size ranges from 28 μm to 1 mm (Fig. 2).

2. Quartz – translucent, partly gravel, yellow. Size ranges from 28 μm to 1 mm.

3. Quartz covered by iron oxides – translucent, partly gravel. Size ranges from 28 μm to 1 mm.

Particles of quartz described above should be related to one type of quartz. But its different morphologic features are the evidence of its different sources and residence time in the denudation period.

4. Carbonate – semi-gravel, white (Fig. 3). Size ranges from 30 μm to 550 μm. Carbonates have high intensity of grow and light-yellow color under electron jet impact.

Fig. 2. Transparent colorless non-gravel particles (quartz), mag. 50^x

Fig. 3. Particles of white color half-gravel (carbonate), mag. 50^x

5. Particles contain iron oxides and hydroxides are presented by brown, small, shapeless particles. Size ranges from 28 μm to 1 mm.

6. Mica – transparent, different colors (colorless, golden, green). Size ranges from 50 μm to 750 μm.

7. No gravel yellow particles. Size ranges from 100 μm to 300 μm.

8. Feldspar – small, right-angled, pink. Size ranges from 28 μm to 500 μm.

9. Organic particles – remains of plants, seed. Size ranges from 140 μm to 1 mm.

The main sources of anthropogenic atmospheric pollution connected with human activity are power engineering (27 %), non-ferrous (22,5 %) and ferrous metallurgy (15,8 %), oil production (9 %) and oil refining (5,1 %) oil extraction and processing (15,5%), transport (13,1 %), coal and gas industry, machine-building industry as well as building industry (Эколо-гические …, 2002).

The following types of **anthropogenic particles** were found in the samples:

1. Micro spherules having light-grey and white colors, with glass luster and hollow (Fig. 4). The synonyms are Al-Si fly ash and combustion spherules. Size ranges from 14 μm to 280 μm.

There are 2 hypotheses for the origin of alumosilicate hollow spherules (AHS) – natural and cosmic. Natural hypothesis was proved by the example of regions of dust-coal combustion (Кизильштейн, 1987; Кизильштейн, 2002). These alumosilicate hollow spherules are one of the components of ash loss from thermal power stations operating on coal. As a result of investigation it has been stated that AHS consist of mullite and sillimanite. The results of chemical analysis show that they are enriched with mostly Al_2O_3 and a little Fe_2O_3, CaO, SO_3. Cosmic hypothesis of origin was considered by the example of Low Permian salt sediments. In the washed fragment of rock salt from the surface of salt deposit of Loe Permian age some amount of spherical melted formations of silicate and mixed composition has been found (Иванов, 1968). Research on sow solid residue of Tomsk region, Tomsk oblast has shown that these spherules of white color consist of mullite (Язиков, 2006).

According to the data of laser microspectral analysis the main elements in them are presented by Al and Si. The particles possess poor electromagnetic properties.

Distribution of the given particles in snow solid residue points out to the fact that they are from emissions of thermal boilers and power stations operation on coal.

2. Metallic micro spherules – black spherules with metallic luster (Fig. 5). Size ranges from 14 μm to 420 μm.

On the one hand, metallic spherules can be of natural origin – black magnetic balls are the only known fraction of fine-grained cosmic matter having internal features of cosmogeneous nature. Therefore, a number of works are devoted to determination of their intensity in falling to the Earth (Иванов, 1970 et al). On the other hand, some authors prove their anthropogenic origin. Microballs containing magnetite, maghemite, and hematite were found in the ash of dust-coal combustion loss at Thermal power stations (Кизильштейн и др., 1991; Природа, химический …., 2001). Thorough investigations of single metallic spherules isolated from snow solid residue samples of machine-building and metal-working areas with cast houses were performed. They showed that the spherules are wasted from those industries and presented by magnesioferrite (Язиков и др., 2003; Язиков, 2006).

Investigating metallic spherules by laser microspectral analysis it was stated that they contain Fe, Mg, Ti, Mn in prevailing amount. These

particles possess magnetic properties.

The abundance of metallic spherules in samples of snow solid residue proves their anthropogenic origin.

Fig. 4. Spherules of mullite of alumosilicate composition, mag. 50^x

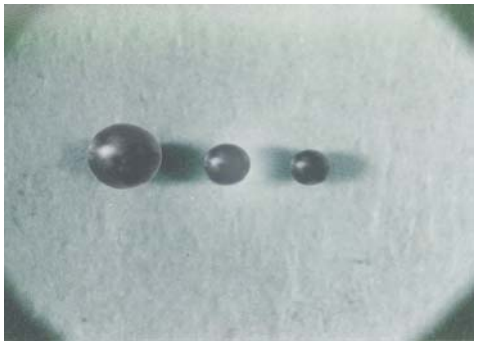


Fig. 5. Metallic spherule, mag. 50^x

3. Coal particles and soot – opaque, flat, black particles (Fig. 6). Size ranges from 4 μm to 40 μm. Coal particles and soot are emitted by coal-powered thermoelectric stations and waste incineration. The particles contain mostly carbon.

4. Slag – shapeless, black or brown particles with semi-metallic luster. Size ranges from one hundredth μm to 720 μm. According to the results of formless particles of brown color by means of laser microspectral analysis it was stated that they contain mostly Fe, Ti, Cu, Al. These particles were slag containing mostly oxides of Fe. Particles of slag come to the environment with emissions of thermal boilers and power stations using coal.

5. Coal dust is black flat particles (Fig. 7). It looks like a shell. Size ranges from 28 μm to 1 mm. The particles are mostly found in the samples from areas where coal-mining industry is located. The particles are released from both coal open-casts and concentration plants. Investigating coal dust by laser microspectral analysis it was stated that they contain C, Fe, Ca in prevailing amount. These particles possess electromagnetic properties.

6. Particles of broken bricks. Size ranges from 0,2 μm to 0,6 μm.

7. Fibrous particles. Size ranges from 1 mm to 2 mm.

8. Particles look like sugar, covered with white thin coating. Size ranges from 50 μm to 100 μm.

9. Brown micro spherules with glass luster. Size ranges from one hundredth μm to tenth μm.

10. Angular orange particles present in orenoplast Э2-330, which is used for plastic producing. Size ranges from 14 μm to 280 μm. These particles possess poor magnetic properties.

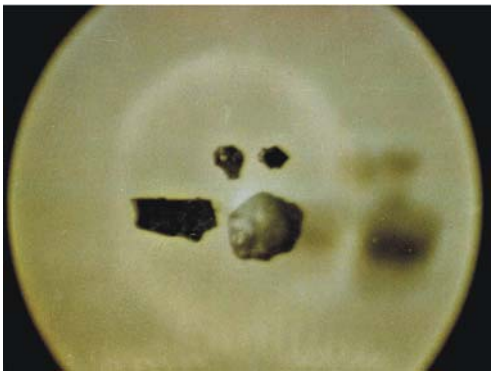


Fig. 6. Particles of soot and slag, mag. 50^x

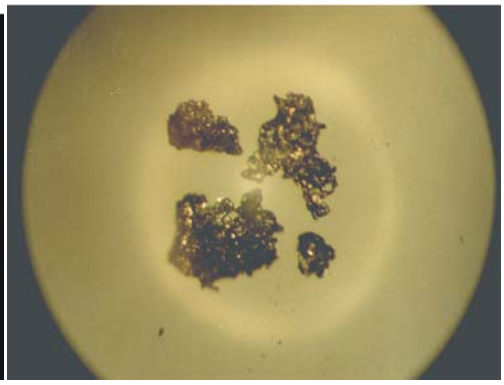


Fig. 7. Black shell-like particles (coal dust), mag. 50^x

11. Semi-angular grey silicate spherules. Size ranges from 14 μm to 520 μm. These particles possess poor electromagnetic properties. Investigating these particles by laser microspectral analysis it was stated that they contain Si, Fe, Mn, Mg, Al, Ca, Cd in prevailing amount. These particles are typical for wastes of cast iron industries.

12. Sawdust is released from carpentry. Size ranges from 140 μm to 1 mm.

13. Cement kiln dust – grey microcrystal particles. Size ranges from one hundredth μm to 1 mm.

In the samples one determines the percentage of all types of natural mineral, biogenic particles and anthropogenic particles by the method of comparison with standard circles of S.A. Vakhromeev template (Вахромеев, 1956) in such a way that content of all particles would make 100 %. When compared it is not difficult to find the closest in composition standard and in this way state the percentage of each type of particles in the sample.

Presented materials are part of geoecological monitoring and can be apply for any branch of industries.

Questions:

1. What method is used to collect snow samples?
2. How sample preparation is performed?
3. How is dust burden calculated?
4. What are contamination levels determined according to dust burden value?

5. What does concentration factor show?

6. How is concentration factor calculated?

7. What are contamination levels determined according to total pollution factor value?

8. What types of natural components does snow solid residue consist of?

9. What types of anthropogenic components does snow solid residue consist of?

UNIT 2. REGIONAL RADIOECOLOGICAL PROBLEMS

Key words

nuclear reactor	ядерный реактор
military	военная (продукция)
enrichment	обогащать
separation	разделение
radioactive waste	радиоактивные отходы
international agreement	международное соглашение
estimate	оценивать, подсчитывать
borehole	скважина
accident	несчастный случай
explosion	взрыв
weapons	оружие
ratio	отношение

Read the text and do the tasks

The region of Tomsk-7 (or Seversk) is known for it Siberian Chemical Combine (SCC), which consists of five nuclear reactors originally designed for military production: a chemical separation plant, a reprocessing facility for uranium and plutonium, an uranium enrichment plant and storage facilities for radioactive waste. Together with Mayak, Seversk was a major former Soviet Union weapon production and fuel reprocessing facilities site. Since the international agreement on reducing strategic armaments was reached, activities on the site have gradually been shifted away from military towards civil applications. At Seversk, releases of radionuclides in the environment are due to accidents and to waste handling practices (Alexakhin et al., 2004). Most of the radioactive wastes at Seversk are in liquid form (Liquid Radioactive Waste, LRW). Until 1982, LRW was disposed into at least two surface reservoirs that contain an estimated total inventory of 4.7×10^{18} Bq. These reservoirs have been now

covered. However, since 1963, LRW has been disposed of by borehole injection into Cretaceous strata at a depth of 280 - 400 m at a distance of about 10 - 20 km east of the Tom River.

Around 4×10^{19} Bq of long - lived nuclides is reported to have been disposed of by these means (Lgotin and Makushin, 1998) and a total volume of disposed wastes may reach 8 of millions of cubic meters (Bradley et al., 1996).

The inventory of accidents with atmospheric releases is difficult to set out at Seversk, which is still a closed city.

However, from local information sources it is usually accepted that since the time nuclear activities started in 1952 - 1955, at least 23 accidents occurred resulting in release of radioactivity to the environment.

The main accident that has been documented occurred on April 6, 1993. An explosion happened at the U - Pu extraction line unit in a vessel containing 4 m^3 of nitric acid solution with Pu, Np and U. The total α-activity (mainly Pu: 79% and U: 20%) of the solution was about 7.4×10^{11} Bq and total b-activity was about 1.85×10^{13} Bq (Tcherkezian et al., 1995). Part of this solution has been ejected to the atmosphere during the explosion. Tcherkezian et al. (1995) reported that Pu contamination in soil due to the 1993 accident ranges between 10 and 13 Bq kg^{-1} with maximum up to 17 Bq kg^{-1} and that the accumulation in topsoil layer was up to 1100 Bq m^{-2} by that time. The $^{238}Pu/^{239+240}Pu$ ratio in soil of 0.35 ± 0.07 suggests that it corresponds to partially burn nuclear fuel. This accidental release involves also gamma emitters such as ^{95}Zr, ^{95}Nb, ^{106}Ru, ^{125}Sb and ^{137}Cs (Tcherkezian et al., 1995; IAEA, 1998). However, neither ^{134}Cs nor ^{241}Am was reported as radionuclides related to this accident.

Bradley et al. (1996) suggest that the largest release of radioactive waste into the Russian environment has occurred as a result of inadequate management of radioactive waste resulting from the reprocessing of spent fuel. Most of the areas showing major radioactive contaminations due to military activities in Russia are located in Siberia and Urals. In this region, Seversk and Mayak are considered as the two major sources of radioactive contaminants affecting the Ob River and its estuary (Paluszkiewicz et al., 1997; Cochran et al., 2000). The total amount of radioactivity released from these sources into the Ob aquifer has been estimated to be 4.63×10^{19} Bq (Bradley et al., 1996).

I. Look through the text and say:

1. What problems are discussed in the text?
2. Why are they of great importance now?
3. What environmental problems are mentioned here?
4. How can the environmental problems be solved?

II. Say in what context these structures were used:

$\times 10^{18}$ Bq, 1993, 4 m^3, ^{95}Zr, ^{95}Nb, ^{106}Ru, ^{125}Sb and ^{137}Cs.

III. Some more interesting facts:

1. Half - life of ^{239}Np and ^{131}I is 2,35 and 8,0 d, respectively
2. An alfa particle is a helium nucleus and consist of two protons and two neutrons.
3. Plutonium - 239 can be used to generate electrical power or to make nuclear weapons.
4. Isotopic ratio for plutonium global fallout is constant (^{240}Pu / ^{239}Pu = 0,19 and ^{241}Pu / ^{239}Pu = 0,003).
5. Canada was the ferst country to mine and refine uranium on a large scale, and it has been the worlds largest exporter of uranium throughout most of the history of uranium production.
6. The heavily industrialized Chelyabinsk region is one of most polluted in Russia. The city of Chelyabinsk contains over 130 factories, including the largest zinc - processing plant and the second largest iron and steel complex in the Urals.
7. In the Chelyabinsk - 65 sites worst accident, a high - level liquid - waste storage tank exploded on 29 September 1957.

PART III. LABORATORY WORKS

LABORATORY WORK № 1

Determining quantity of anthropogenic contamination from city transport

Aim: *To study the express-method of determining the degree of air contamination with toxic substances from exhaust gases of city transport.*

Equipment: a clock, pens, note-books, a calculator.

Theoretical introduction

Internal combustion engines of cars are the principal source of atmospheric contamination in the urban areas. In particular, on the territory of the country the part of transport in the total emissions of pollutants in the atmosphere from all sources amounts 45%, in greenhouse gas emissions – approximately 10%, in harmful sewage discharges – nearly 3%.

The main harmful impurities contained in the exhausted gases are: carbon oxide, nitric oxides, various hydrocarbons including carcinogenic 3,4-benzopyrene, aldehides, sulphur dioxide. Besides, gasoline engines exhausts contain lead, chlorine, bromine, and sometimes phosphorus, whereas diesel ones – significant amount of smoke and soot particulates of ultramicroscopic size. Every gasoline vehicle passing 15 000 km, uses 4350 kg of oxygen and exhaust 530 kg of CO, 93 kg of hydrocarbons, 27 kg of nitrogen oxide. 75% of lead contained in high-antiknock fuel, comes to the atmosphere, i.e. every vehicle exhausts up to 1 kg of lead into air annually. In total, the exhausted gases of internal combustion engines contain more than 200 harmful substances.

Practical part

Choose different route sections of approximately 100 m long. Determine the number of transport units passing on the chosen section within 30 or 60 min. In this case take into account the number of vehicles of a definite type (cars, lorries, buses, diesel lorries) passing on the chosen section. If the observation takes 30 min., the result obtained should be multiplied by 2.

Calculate the average number of registered vehicles for each type of transport depending on the quantity of chosen route sections, complete Table 1.

Table 1

Average number of registered transport

Transport type	Within 30 min in total	Within 1 hour in total
Cars		
Lorries		
Buses		
Diesel lorries		

The amount of transport exhausts in the atmosphere can be determined by the calculated method. The initial data for the calculation of exhaust amount are:

– the number of vehicle units passing on the selected route section per unit of time;

– standards for transport fuel rate.

The average standards of fuel rate for urban areas are presented in Table 2.

Table 2

Average standards of fuel rate

Type of transport	Average fuel rate (l per 100 km)	Specific fuel rate Y_a (l per 1 km)
Cars	11-13	0,11-0,13
Lorries	29-33	0,29-0,33
Buses	41-44	0,41-0,44
Diesel lorries	31-34	0,31-0,34

The values of empirical coefficients (K) determining the transport exhausts in terms of fuel kind are shown in Table 3.

The coefficient K is numerically equal to the amount of emissions for corresponding compound while burnt the fuel in vehicle engine, equal to the specific fuel rate (l/km).

Table 3

Values of empirical coefficients

Kind of fuel	Coefficient value (K)		
	Carbon monoxide	Hydrocarbons	Nitrogen oxide
Gasoline	0,6	0,1	0,04
Diesel fuel	0,1	0,03	0,04

The result processing

Calculate the whole length of section covered by the stated number of each type vehicle per 1 hour (L_a, km) according to the formula (1):

$$L_a = N_a \times L \quad (1)$$

where:

N_a is the number of each type vehicle;

L is the section length, km; a is the type of vehicle.

Find the amount of fuel of different kind (Q_a), burnt by the engines at this time by the formula (2):

$$Q_a = Y_a \times L_a \quad (2)$$

where:

Y is the specific fuel rate (l/km);

L is the length of the route section, km;

a is the type of vehicle.

Determine the total amount of burnt fuel for each type of transport and complete Table 4.

Table 4

Total amount of burnt fuel

Type of transport	Q_a	
	Gasoline	Diesel fuel
Cars		
Lorries		
Buses		
Diesel lorries		
Total amount (ΣQ)		

Calculate the volume of exhausted pollutants in litres per every kind of fuel multiplying the corresponding values of ΣQ and the empirical coefficients K. Complete table 5 with your results.

Table 5

The volume of exhausted pollutants

Kind of fuel	The amount of pollutants, l		
	Carbon monoxide	Hydrocarbons	Nitrogen oxide
Gasoline			
Diesel fuel			
Total amount (V)			

Calculate the mass of exhausts (m, g) according to the formula (3):

$$m = V \times M / 22{,}4 \quad (3)$$

where:

M is the molecular mass (for CO – 28, for NO_2 – 46, the average molecular mass for hydrocarbons – 43).

Determine the average daily concentration of harmful substances (C_{ad}, mg/m^3) in the atmosphere of the region taking into account that the volume of the air near the road section of 100 m length is approximately 20 000 m^3. One should also take into consideration high traffic intensity during the day.

Compare the results obtained with MPC_{CC} (maximum permissible

concentration) for each of the harmful substance and make a conclusion about the degree of atmospheric anthropogenic contamination of the region involved.

Questions

1. What substances are considered air pollutants?
2. What is the contribution of city transport to environmental pollution in cities?
3. Compare pollutants emitted by gasoline and diesel engines. Which type of fuel gives more essential environmental impact?
4. What direct criteria of atmosphere estimation do you know?
5. What is MPCcc? Name the values of MPCcc for the main pollutants of the atmosphere.

LABORATORY WORK № 2

Investigation of physiological characteristics of organism adaptation to low temperature

Aim: *To study the influence of low environmental temperature on physiological processes in an organism and reveal its adaptation capabilities.*

Equipment: Plastic basin with cold water**,** blood-pressure meter, clock, pen, ruler, note-book.

Theoretical introduction

Capacity for adaptation is one of the main properties of living matter on our planet. Any organism is able to live in a definite temperature range. Warm-blooded animals' outer body layers form a more or less distinct "film", the temperature of which changes in the wide range. Stable temperature defines only the region of vitally important organs and processes. But superficial tissues can withstand its more marked fluctuations. When decreasing the temperature of medium the metabolism of warm-blooded organisms intensifies, at the same time the compression of the surface blood vessels and expansion of deep ones takes place as an adaptive reaction, which results in conservation of body.

Practical part

Physiologic adaptation characteristics to low temperature can be studied by means of a simple action – to drop hands into the ice water. This experiment allows us to study the adaptation reaction of the organ-

ism to the intensive cold stimulation.

To make this research it is necessary to select 3-4 students from the group born and grown in different climatic conditions. Then, measure the first student's systolic and diastolic pressure, then let him drop his hand into the ice water. In 3 minutes measure his pressure one more time, and let him drop the hand into ice again. In 3 minutes more the tested student should remove his hand from the cold water. It is necessary to measure his pressure one more time. Measure the pressure every 3 minutes until the determined parameters reverts to the original state. Write down all registered data in the course of study. Carry out similar research for the other tested students.

Plot the graphs according to the results obtained, the abscissa being the data of systolic pressure (in mm of mercury), whereas the ordinate is the time in three-minute interval. Compare the graphs obtained, make a conclusion on the research.

According to the theory the students' systolic pressure can increase by 20-40 mm mercury at cold simulation. In this case people getting used to cold climate the reaction is less distinct in general, but thee arterial pressure values are normalized faster.

Questions

1. What groups are all living organisms divided into according to their temperature adaptation?
2. Give the examples of reversible hypothermia. What does its biological essence consist of?
3. How are anatomico-morphological characteristics of warm-blooded animals defined under the action of low temperature (the Allen's rule, 1877)?
4. Give 1-2 examples of the Bergmann's climatic rule (1847).
5. Why are medical instruments sterilized not by freezing them, but either by boiling or heating in autoclave under high pressure?

LABORATORY WORK № 3

Study of calculation method of depletion time for non-renewable resources

Aim: *To study the calculation method of time depletion of natural resources.*

Equipment: a calculator, a pen, a note-book.

Theoretical introduction

The resources can be classified into everlasting, renewable and non-renewable.

Everlasting resources such as solar energy are really inexhaustible from the point of view of human history.

Renewable resources are restored under normal conditions as a result of natural processes. Forests, wild animals, fresh waters of surface streams and lakes, arable soil etc. may serve as examples.

Non-renewable or exhaustible resources occur in limited amount (reserves) in different parts of the Earth's crust. The examples are oil, coal, copper, aluminium, etc. They can be depleted because they are not restored in natural processes (e.g. copper, aluminium) as well as because their reserves are restored slower than they are consumed (oil, coal). Non-renewable resources are considered economically depleted when 80 % of their estimated reserves are explored. On reaching this limit the cost for exploration, recovery and refining of the remained reserves become higher than their market price.

Practical part

Estimate the time of natural resource exhaustion, if the level of recovery in the current year is known, whereas consumption of the resource will grow at the specified rate of annual consumption increment. The initial data for the work are presented in Table 1.

To calculate it you can apply the formula of the sum of geometric progression members:

$$Q = \frac{\left((1 + TP/100)^t - 1\right) \times q}{\text{----------}},$$

where: Q is the resource reserve; q is the annual resource extraction;

TP is the growth in the resource consumption; t is the number of years.

Taking the logarithm of Q expression gives the following formula to calculate the time of resource depletion:

$$t = \frac{\ln\left((Q \times TP)/(q \times 100) + 1\right)}{\text{----------}}$$

$$\ln(1 + TP/100)$$

Calculate the depletion time of the resources presented in the Table, fill them in as an additional line in the Table. Make a conclusion on the sequence of stopping resource mining.

Questions

1. Characterise the natural resources in general.

2. What role does the fossil fuel reserves play in the civilization development?

3. Why is exhaustion of natural resources so dangerous?

4. What are the ways of decreasing mineral losses at mining, enrichment, processing, and transporting? Give an example.

5. Study the map of your region. Say, what minerals are mined in it, what measures of their protection are taken.

Table 1

The data for calculation of the resource depletion time

Initial data	Kinds of resources									
	1	2	3	4	5	6	7	8	9	10
Re-sources	Coal	Natural gas	Oil	Fe	P	Cu	Zn	Pb	Al	U
Resource reserve, Q, bill.t.	6800	280	250	12000	40	0,6	0,24	0,15	12	300
Resource extrac-tion,q, bill.t./year	3,9	1,7	3,5	0,79	0,023	0,008	0,006	0,004	0,016	0,2
Growth in volume of resource consump-tion, TP, % per year	2	1,5	2	2,5	1,8	1,7	1,3	2,2	1,6	2

LABORATORY WORK № 4

Ecological-geochemical assessment of the territory by snow survey

The laboratory work was compelled on basis of the methodical aid (Язиков, Шатилов, 2000).

The purpose of the work is to improve theoretical knowledge introduced in the lecture course "Geochemical monitoring of the environment", to consider some issues concerned with ecological-geochemical assessment of the territory as well as to interpret the results obtained. The task of the research includes application of geochemical methods to prognose the disease incidence for city dwellers.

The variant of the problem is chosen for the day-time students by number in the list of group, but for correspondence students – by the number of credit-test book (Table 1).

The information on the Ecological-geochemical assessment of the region territory in the city is suggested in the form of a real data obtained in the course of research project on the territory of Mezhdurechinsk and Strezhevoy on the instructions of city ecological committees. To solve the complex problem the territories of the cities were divided into microregions in different variants, which unite 9-10 snow samples (see Appendix 1, 2, 3, 4).

Table 1

The test number for students of day-time and correspondence departments

Number of task	Description of task	Number of task	Description of task
	Mezhdurechinsk	12	Variant III-I
1	Variant I-I	13	Variant III-II
2	Variant I-II	14	Variant III-III
3	Variant I-III	15	Variant III-IV
4	Variant I-IV	16	Variant III-V
5	Variant I-V	Strezhevoy	
6	Variant I-VI	17	Variant I-I
7	Variant II-I	18	Variant I-II
8	Variant II-II	16	Variant I-III
9	Variant II-III	20	Variant I-IV
10	Variant II-IV	21	Variant I-V
11	Variant II-V		

To calculate the dust burden the data from Tables 2, 3 are used. The concentration of microelements is chosen from the database according to the number of sample (Table 4, 5).

The Order of Work

In the course of the lab work the consequent treatment of the material is performed with the subsequent drawing a conclusion. The work consists of three stages of investigation.

I stage:

1). Determination of general dust level and construction a scheme.

2). Selection of contaminators according to the hazard classes, calculation of statistic parameters in general for the given territory.

3). Construction of monoelement schemes of heavy metal content in solid snow residue.

4). Construction of polyelement scheme of heavy metal content in solid snow residue.

5). Calculation of concentration factor, total pollution factor, and plotting the additive diagram of pollution.

6). Construction of geochemical row of element association with concentration factors in descending order.

7). Calculation of average daily fallout of metals on the city territory.

II stage:

1). Plotting the diagram of prognosis for disease incidence in terms of dust burden.

2). Plotting the diagram of prognosis for children's disease incidence in terms of total pollution factor.

III stage:

1). Construction of the scheme for nature-conservative measures on the city territory.

At the first stage according to the data of snow sampling (date of sampling, beginning of snow-up, weight of snow solid residue, parameters of pit square) dust burden is calculated in every point. The material is presented in the form of table, the final values in terms of mg/m^2 per day or kg/km^2 per day which correlates with each other.

Dust burden is calculated by the formula (1):

$$P_n = P_o \ / S \times t \qquad (1)$$

where:

P_n – dust burden, mg/m^2 per day (kg/km^2 per day);

P_o – weight of the snow solid residue, mg (kg);

S – square of the pit, m^2 (km^2);

t – number of days from snow-up day (the day when snow falls out and does not melt) to sampling day.

According to operating instructions for the geochemical estimation of the area chemical elements contamination (Методические …, 1982) the background value of dust burden is 20 mg/m^2 per day, whereas dust burden is 1 mg/m^2 per day in Antarctica, dust burden rages from 0,006 to 0,06 mg/m^2 per day in Arctic.

The obtained dust burden values are mapped on the scheme and isolines are drawn in terms of the contamination levels:

less than 250 mg/m^2 per day – low contamination level;

250-450 mg/m^2 per day – middle one;

450-850 mg/m^2 per day – high one;

more than 850 mg/m^2 per day – very high one.

The contamination levels are taken from reference (Методические…, 1982).

If the isolines could not be drawn on the scale, the background value of dust burden is used (20-60-100 mg/m^2 per day) to determined the dangerous zones in the area.

The next step includes the choice of contaminated elements according to the State Standard 17.4.1.02-83:

1st hazard class – As, Cd, Hg, Se, Pb, Zn, F;

2nd hazard class – B, Co, Ni, Mo, Cu, Sb, Cr;

3^{d} hazard class – Ba, V, W, Mn, Sr.

United system of measurements is used for the calculations. It means that the element concentration is measured in n*10^{-4} % or mg/kg.

The sampling of the concentration elements is used to calculate the main distribution characteristics of the elements: mean (C), standard deviation (S), variance (V), which is presented the heterogeneity of the sampling. The obtained results are presented in the form of tables.

Monoelement schemes of heavy metals distribution in the snow solid residue are constructed according to the total area sampling. Geochemical clarke of the noosphere is used as gradation to draw the isolines. Geochemical noosphere clarke is taken from reference (Глазовский Н.Ф., Глазовская М.А., 1988). Though, it would be better to use the background values of element concentration as gradation for drawing isolines.

Total pollution factor is calculated by the formula (2):

$$Z_c = \sum KK - (n-1) \qquad (2)$$

where:

Z_c – total pollution factor;

KK – factor of element concentration calculating by the formula (3):

$$KK = C / C_b \qquad (3)$$

where:

C – element concentration, mg/kg;

C_b – background value of element concentration or geochemical the noosphere clarke, mg/kg.

n – a number of elements having the KK values more than 1.

The total pollution factor is characterized by the following contamination levels (Геохимия …, 1990):

less than 64 – low contamination level;

64-128 – middle one;

128-256 – high one;

more than 256 – very high one.

According to concentration factor the geochemical row of element association from the highest value to the lowest value are constructed. Example: $Pb_{25} – Zn_{10} – Cu_3 – Ni_2$. That makes it possible to determine the type of pollution sources (Геохимия …, 1990).

Factor of pollutant (element) load on the environment is calculated by the snow sampling results. The factor is defined as a pollutant mass falling on a unit of square in a unit of time. Total pollutant mass (P_n, dust burden) and element concentrations (C) in the snow solid residue are used to calculate the factor. Based on that the following factors are calculated.

1. Total load producing by the chemical element emissions in the environment (or average daily fallout of metals on the city territory) is calculated by the formula (4):

$$P_{total} = C \times P_n, \text{ mg/km}^2 \text{ per day} \quad (4)$$

2. Factor of relative increase in total elements load is calculated by the formula (5):

$$K_p = P_{total} / P_b \quad (5)$$

where:

P_b – background value of total element load. It is calculated by the formula (6):

$$P_b = C_b \times P_{nb} \quad (6)$$

P_{nb} – background value of dust burden, it is 10 kg/km^2 per day for the non chernozem zone of Russia.

As the anthropogenic abnormalities usually comprise many elements, factor of total element load (Z_p) are calculated. It characterizes the impact of the group of elements. The factor is calculated by the formula (7):

$$Z_p = \sum K_p - (n-1) \quad (7)$$

where: n – a number of elements having K_p values more than 1.

All factors are calculated both for each given sample and total investigated area.

At the second stage it is necessary to obtain the prognosis schemes

of children's disease incidence according to the data on dust burden and total pollution factor. There is the following gradation for values of dust burden in terms of the recommendations from Сает и др. work (Геохимия …, 1990):

less than 250 mg/m^2 per day – safety morbidity level;

250-450 mg/m^2 per day – mildly unsafe one; increase in bronchial asthma and conjunctivitis;

450-850 mg/m^2 per day – unsafe one; increase in respiratory and sense organs morbidity;

more than 850 mg/m^2 per day – immensely unsafe one; increase in morbidity more than 2 times.

There is the following gradation for values of total pollution factor:

less than 64 – safety morbidity level; lower change of children's health;

64-128 – mildly unsafe one; increase in total morbidity;

128-256 – unsafe one; increase in total morbidity and number of illness children;

more than 256 – immensely unsafe one; very high level of morbidity, there are many children with chronic diseases and abnormalities in physical abilities.

Third stage includes working out of nature-conservative measures project for studying territory, analyzing the facts, and using references.

Report content and preparation

Having done the laboratory work there should be prepared a report. Penscript is presented on standard (297x210 mm) or nonstandard pages. The text volume is 10-12 pages.

The work includes the following parts:

Introduction.

1. Characteristic of sampling region.
2. Research methods.
3. Characteristic of dust burden.
4. Heavy metals concentration in snow solid residue.
5. Prognosis for children's disease incidence.
6. The scheme for nature-conservative measures on the city territory.

Conclusion.

References.

In the Introduction one should point out the purpose of work, initial material, and the main tasks of research.

In the first paragraph one should analyze general ecological situation in the city as well as in the respect of the site involved.

The second paragraph comprises description of research methods and types of analyses.

The third paragraph includes calculation of dust burden, analysis of obtained results, and scheme of territory dust level.

The fourth paragraph consists of literature review on heavy metals that gives the possibility to analyze the obtained material and estimate the effect of the given elements on human health.

Monoelement, polyelement, and additive schemes are to be constructed, associative geochemical row is to be given, calculation of statistic parameters are to be made here.

In the fifth paragraph on the basis of snow survey and geochemical indicators there should be presented the prognosis for children's disease incidence. In particular, it should be pointed out the impact of definite elements exceeding the standard indexes.

The final sixth paragraph should be presented nature conservative measures enabling the improvement of ecological situation in the city.

Conclusion includes summary of the work and measures of environmental monitoring in the city territory using the other types of investigation. At the end of the work there should be reference.

Table 2

Results of snow sampling within Mezhdurechinsk

Snow-up day: 13.11.1990; Sampling day: 17.03.1991

Number of sample	Square of the pit, sm^2	Weight of the snow solid residue, g	Number of sample	Square of the pit, sm^2	Weight of the snow solid residue, g
1	25*25	1.52	29	35*35	17,45
2	25*25	4,00	30	25*25	8,45
3	35*35	9,95	31	30*30	4,77
4	25*25	10,54	32	25*25	5,15
5	40*40	4,47	33	25*25	1,55
6	30*30	0,95	34	25*25	2,90
7	30*30	1,20	35	25*25	1,85
8	25*25	1,77	36	25*25	2,25
9	30*30	1,95	37	30*30	3,10
10	30*30	7,45	38	35*35	2,05
11	25*25	2,45	39	30*30	2,10
12	35*35	2,45	40	25*25	1,60
13	30*30	3,25	41	25*25	1,25
14	30*30	1,70	42	25*25	2,05
15	30*30	1,30	43	25*25	1,95
16	25*25	2,05	44	25*25	1,45
17	25*25	1,25	45	35*35	1,45
18	25*25	3,86	46	25*25	1,90
19	25*25	2,05	47	25*25	1,65
20	30*30	3,20	48	30*30	1,35
21	25*25	2,45	49	30*30	0,80
22	35*35	2,70	50	25*25	1,30
23	30*30	3,45	51	25*25	3,10
24	30*30	1,60	52	35*35	3,25
25	35*35	3,55	53	30*30	3,30
26	25*25	4,25	54	30*30	15,60
27	30*30	3,65	55	35*35	3,55
28	25*25	11,95			

Table 3

Results of snow sampling within Strezhevoy

Snow-up day: 20.10.1991; Sampling day: 3.04.1992

Number of sample	Square of the pit, sm^2	Weight of the snow solid residue, g	Number of sample	Square of the pit, sm^2	Weight of the snow solid residue, g
1	40*30	2,228	26	30*20	0,174
2	27*34	1,322	27	30*35	0,756
3	36*33	2,187	28	36*30	1,821
4	32*35	0,737	29	30*30	0.562
5	40*35	0,337	30	35*35	0,361
6	50*35	0,908	31	40*40	0,306
7	40*35	0,6	32	35*35	0,06
8	35*30	1,304	33	30*30	0,35
9	38*36	1,094	34	40*35	0,18
10	30*40	0,431	35	40*40	0,166
11	30*40	0,871	36	30*30	0,317
12	30*43	0,376	37	30*35	0,57
13	40*40	2,39	38	30*30	1,272
14	32*30	0,61	39	40*35	1,05
15	42*40	1,576	40	40*35	3,905
16	40*33	1,248	41	35*35	1,953
17	42*30	3,706	42	30*35	0,114
18	35*25	0,86	43	35*30	0,98
19	34*30	5,008	44	45*35	1,082
20	30*40	0,207	45	45*45	1.49
21	46*36	1,092	46	30*40	0,35
22	35*30	0,124	47	40*40	0,305
23	25*25	0,33	48	30*40	3,476
24	37*33	1,005	49	35*30	0,587
25	25*32	3,283	50	35*50	2,228

Table 4

Element composition of snow solid residue within Mezhdurechinsk, mg/kg

NPR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	!5	16	17	18
Pb	50	50	20	30	40	80	60	80	60	80	50	60	80	100	100	100	100	20
Zn	40	40	40	60	60	60	60	80	20	60	60	40	80	150	100	100	100	60
Hg	0,6	0,5	0,2	0,3	0,4	0,2	0,2	0,2	0,1	0,3	0,1	0,07	0,2	0,09	0,05	0,2	0,1	0,1
Ni	6	20	6	10	10	15	10	20	10	20	10	15	20	30	20	15	20	20
Co	1	2	1	2	2	2	1	3	1	3	2	2	6	8	10	4	8	3
Cu	30	30	20	30	40	30	30	40	30	30	30	40	50	50	50	40	40	30
Cr	10	10	6	8	6	6	6	10	6	8	6	8	8	30	20	20	20	6
Mo	1	1	1	1	1	1	1	2	1	1	1	1	1	2	1	1	3	1
V	10	20	6	10	10	10	6	20	6	10	6	6	10	20	10	10	20	6
Mn	200	200	200	200	200	200	200	300	200	200	100	200	200	200	200	300	300	200
Ba	200	300	200	200	300	300	200	300	200	300	200	300	400	600	400	300	500	200
Sr	200	300	200	200	300	300	200	300	300	300	300	300	400	400	400	300	500	300

Continuation of table 4

NPR	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
Pb	40	60	80	100	40	80	80	30	40	20	30	40	30	60	80	40	60	80
Zn	40	40	30	20	60	100	60	20	40	20	20	20	100	60	100	40	40	40
Hg	0,07	0,06	0,1	0,1	0,07	0,06	0,08	0,1	0,08	0,05	0,05	0,3	0,3	0,3	0,2	0,2	0,1	0,08
Ni	20	20	30	30	20	20	30	20	10	10	10	20	10	15	20	to	30	30
Co	1	4	4	6	2	2	6	2	1	1	1	1	1	1	3	1	1	4
Cu	30	40	40	40	30	30	40	40	30	30	30	30	30	40	40	40	60	50
Cr	6	10	6	20	10	10	10	10	20	10	6	10	6	10	10	10	30	30
Mo	1	1	1	2	1	1	2	I	1	1	2	2	1	2	4	1	1	3
V	6	10	6	30	10	10	10	8	10	10	6	10	6	10	10	6	20	20
Mn	100	200	200	200	200	200	200	200	300	200	200	200	100	200	100	100	200	200
Ba	200	400	400	600	200	200	400	200	200	200	200	300	200	300	300	300	400	400
Sr	300	300	400	400	200	200	300	200	300	200	200	200	300	300	300	300	400	400

End of table 4

NPR	37	38	39	40	41	42	44	45	46	47	48	49	50	51	52	53	54	55
Pb	150	80	60	100	100	60	60	80	40	40	50	60	60	30	40	80	20	30
Zn	1500	60	40	60	100	40	60	100	60	40	60	60	80	40	40	60	40	60
Hg	0,05	0,06	0,1	0,1	0,06	0,1	0,06	0,06	0,05	0,03	0,03	0,04	0,05	0,1	0,1	0,1	0,1	0,06
Ni	40	10	10	20	30	20	20	30	10	20	10	10	20	20	10	20	10	10
Co	4	6	4	10	10	3	10	30	10	20	2	3	3	1	2	*2*	1	3
Cu	80	40	40	60	80	60	60	60	30	30	40	40	60	20	60	60	20	30
Cr	40	10	6	20	20	30	20	30	10	6	10	10	20	6	10	20	6	6
Mo	1	1	1	2	1	2	2	3	2	1	2	1	2	1	2	3	2	1
V	30	20	*6*	20	20	30	10	30	10	60	8	10	10	6	10	10	6	6
Mn	300	100	100	200	200	200	200	200	100	100	300	300	300	200	300	300	200	300
Ba	600	300	200	300	300	400	300	500	300	300	200	300	300	200	300	300	300	200
Sr	400	300	200	400	400	400	300	300	300	300	300	300	300	200	300	300	200	200

Table 5

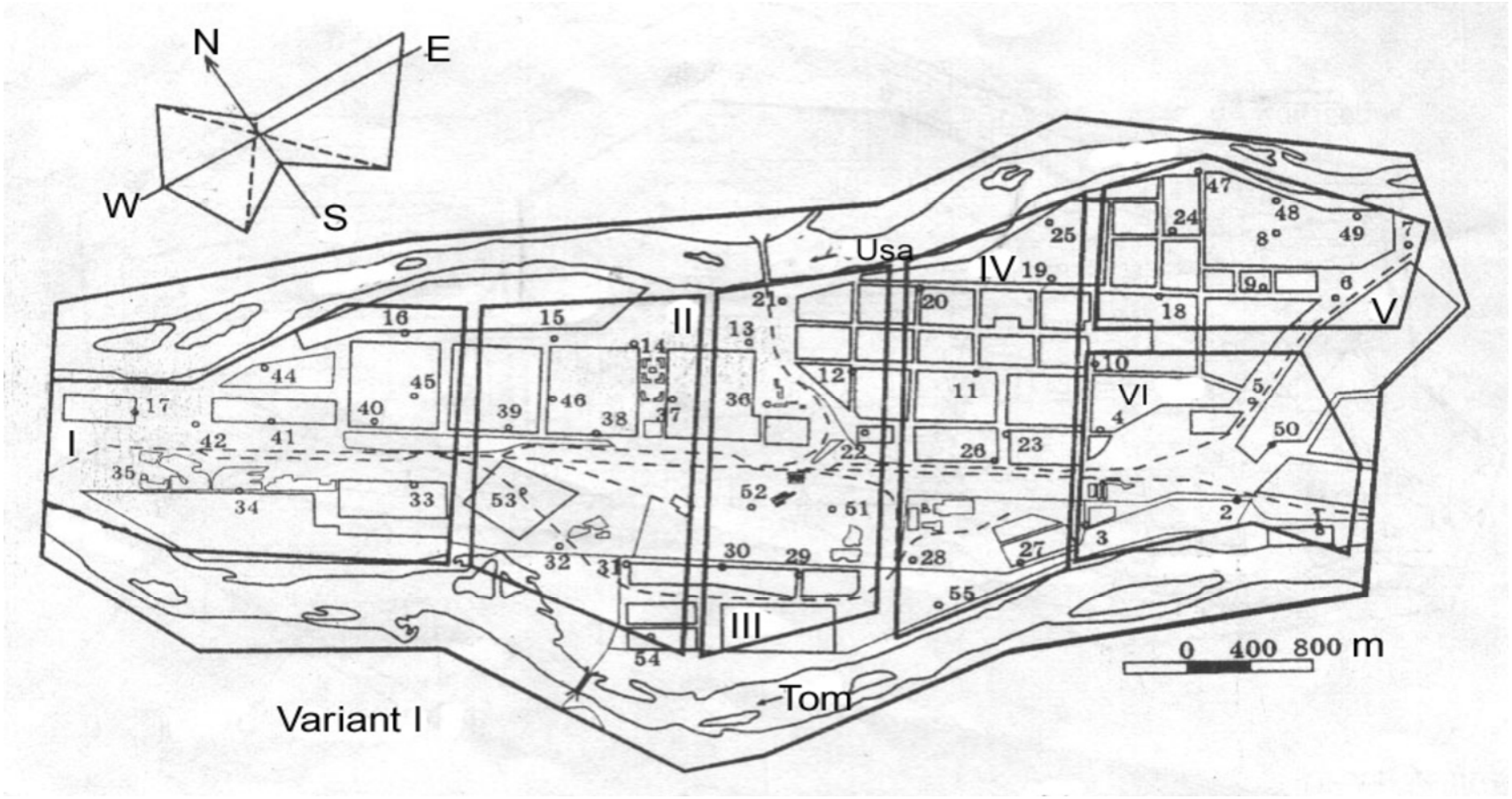
Element composition of snow solid residue within Strezhevoy, mg/kg

NPR	Pb	Zn	Hg	Cr	Ni	Co	Cu	Mo	Mn	Ba	Sr	V
1	100	40	0,1	40	8	4	20	3	100	400	300	15
2	100	40	0,1	60	10	6	15	4	100	300	300	10
3	40	60	0,08	40	8	6	10	2	200	300	300	10
4	80	600	0,1	60	10	3	150	3	300	300	200	10
5	100	150	0,03	80	40	8	100	3	600	400	300	30
6	100	100	0,2	80	30	8	150	6	400	600	300	60
7	40	150	0,2	60	30	4	15	4	300	300	200	15
8	40	40	0,2	40	6	2	10	2	150	200	200	8
9	80	1500	0,1	150	30	6	150	6	600	300	200	15
10	200	150	0,2	60	40	8	60	4	400	800	300	80
11	100	60	0,1	80	20	4	40	3	300	400	300	40
12	100	80	0,1	80	10	3	20	3	300	300	200	60
13	30	40	0,09	80	10	4	15	3	300	400	300	40
14	150	60	0,2	60	10	3	15	4	300	300	200	30
15	40	40	0,2	40	15	3	15	2	300	300	200	30
16	60	80	0,2	40	8	2	10	3	200	200	200	10
17	200	150	0,1	60	15	6	20	3	300	400	200	30
18	200	100	0,2	30	15	4	20	2	300	300	200	30
19	20	60	0,09	30	20	2	10	2	100	300	200	10
20	40	300	0,07	40	20	4	20	4	200	200	200	20
21	80	150	0,06	60	20	6	30	2	300	400	400	20
22	30	150	0,1	60	10	3	20	6	300	200	300	15
23	1000	60	0,2	200	8	2	20	30	100	200	200	6
24	40	30	0,03	30	20	3	8	2	200	300	200	10
25	40	200	0,07	60	20	6	20	2	400	400	300	6
26	30	80	0,07	40	10	2	10	3	300	200	300	8
27	80	150	0,2	80	30	6	60	4	800	400	300	40
28	200	200	0,2	60	30	8	60	3	600	600	300	60
29	40	40	0,09	30	8	2	10	3	100	200	200	8
30	30	80	0,1	40	20	4	20	3	600	300	200	8
31	150	60	0,1	40	10	6	30	3	300	300	200	30
32	20	30	0,03	40	6	3	10	2	100	200	200	6
33	30	60	0,07	40	10	6	30	2	400	300	200	15
34	100	60	0,2	200	80	4	30	3	200	300	200	15
35	60	40	0,3	150	40	6	20	3	300	300	200	20

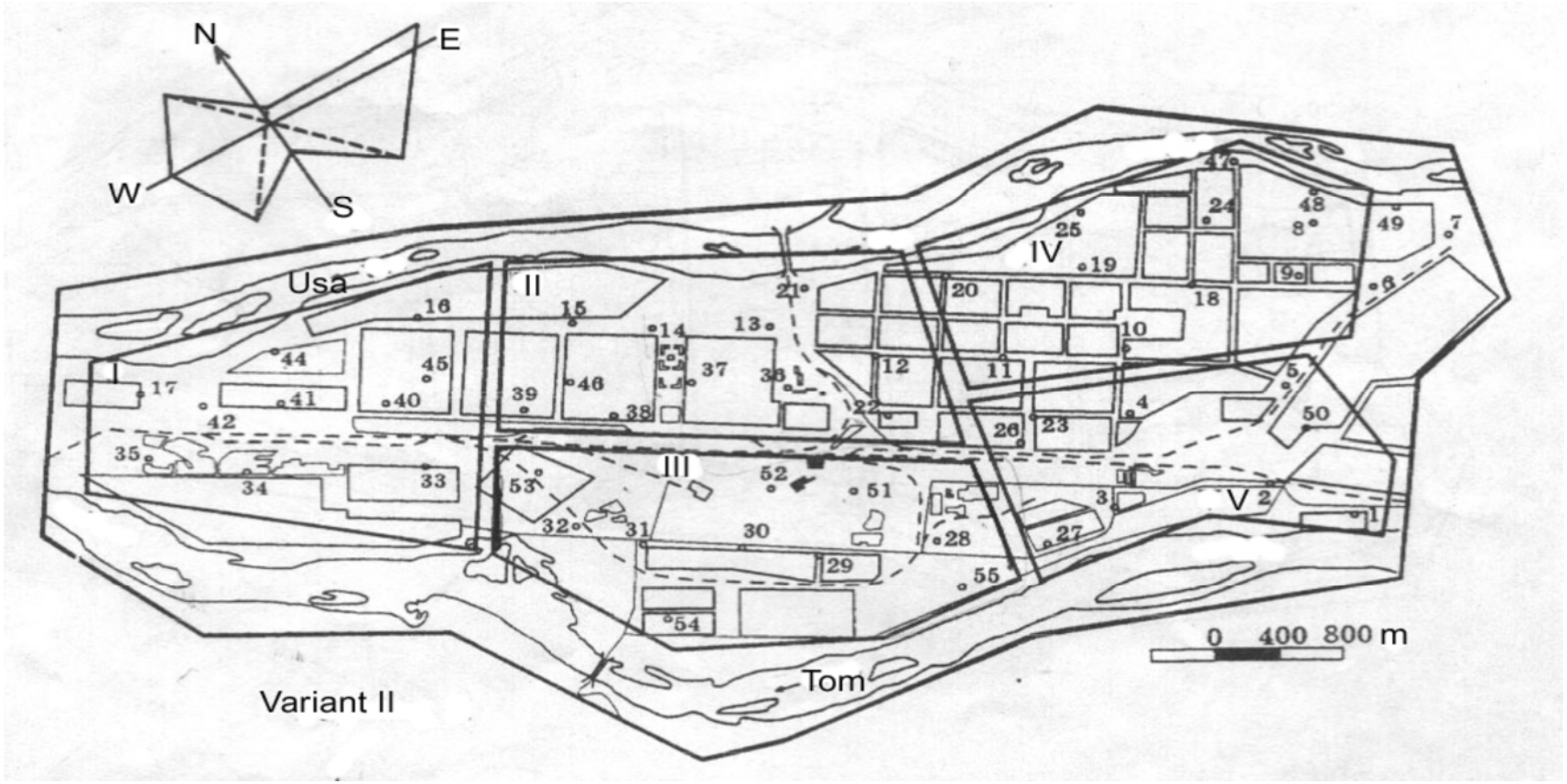
Continuation of table 5

NPR	Pb	Zn	Hg	Cr	Ni	Co	Cu	Mo	Mn	Ba	Sr	V
36	20	60	0,07	40	10	6	10	4	300	300	200	15
37	100	100	0,2	60	30	10	40	3	600	600	300	40
38	150	200	0,180	60	30	8	100	4	300	300	200	30
39	150	200	0,170	40	20	6	30	2	600	300	300	15
40	80	80	0,140	40	10	6	10	2	300	300	200	15
41	80	150	0,140	40	30	6	30	6	600	400	400	40
42	40	150	0,145	60	30	8	40	2	200	300	300	10
43	30	30	0,1	30	6	3	8	2	80	200	200	6
44	100	200	0,1	40	30	8	30	3	400	400	200	20
45	30	200	0,2	60	30	6	20	3	1000	400	300	20
46	30	40	0,03	40	30	6	20	3	200	300	200	20
47	80	100	0,4	60	60	6	60	4	600	600	300	40
48	10	30	0,05	40	10	3	6	4	100	200	200	6
49	40	60	0,09	60	20	8	20	3	300	600	400	40
50	150	30	0,1	30	10	6	8	3	200	400	400	20

Appendix 1

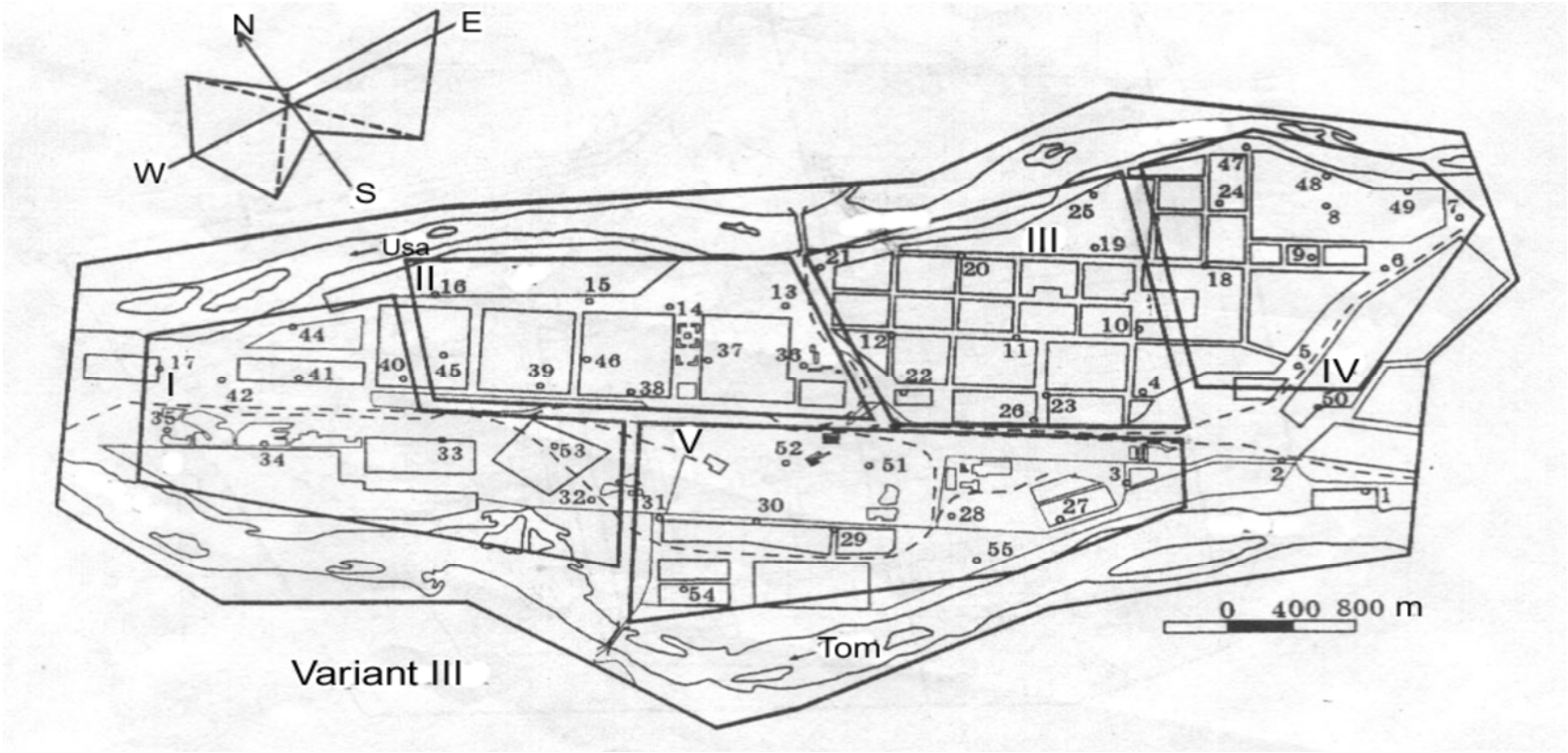


Map of snow survey within Mezhdurechinsk



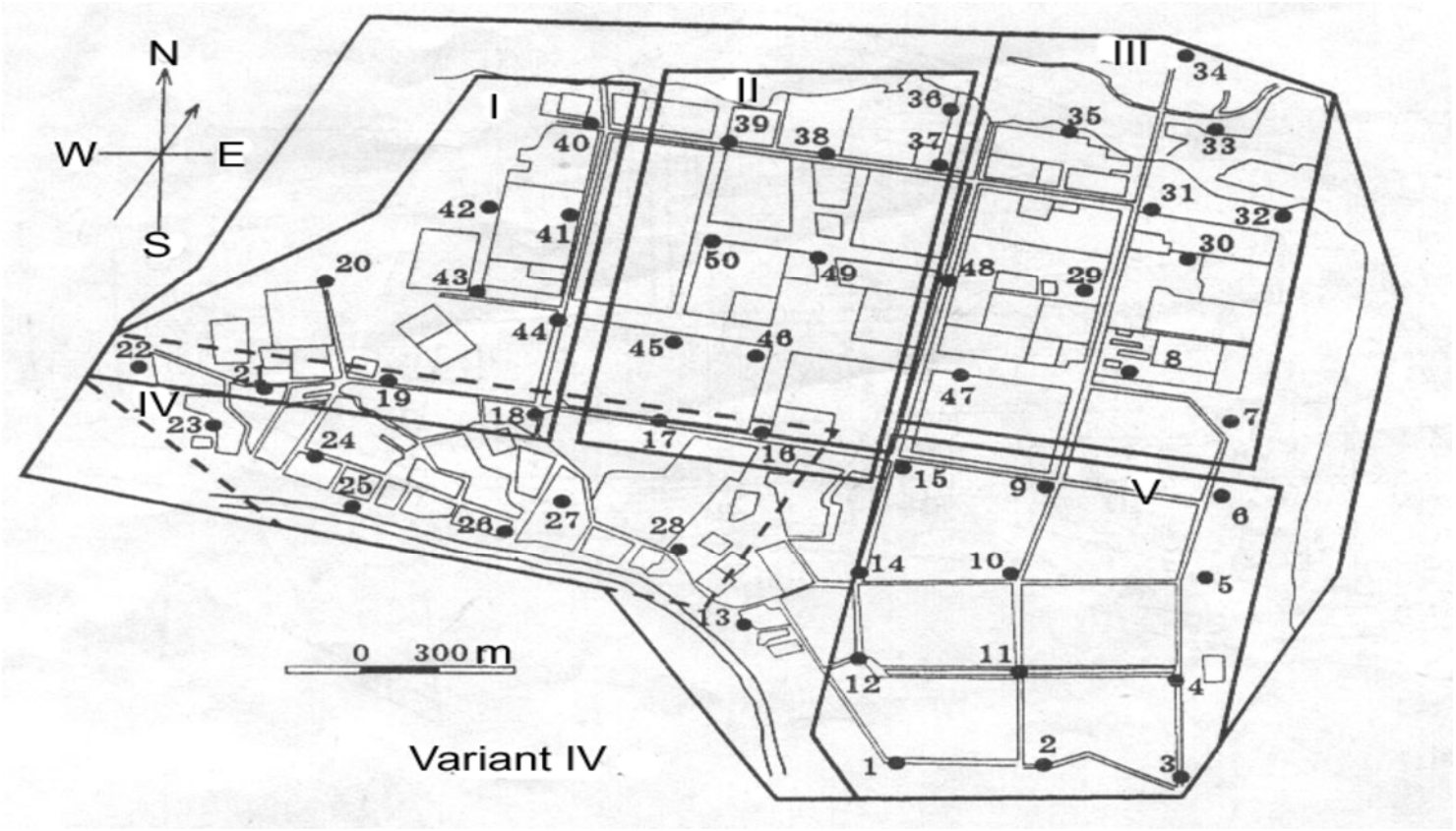
Map of snow survey within Mezhdurechinsk

Appendix 3



Map of snow survey within Mezhdurechinsk

Appendix 4



Map of snow survey within Strezhevoy

LABORATORY WORK № 5

Substantial composition of snow solid residue sample

Purpose and tasks.

The purpose of the work is to improve theoretical knowledge obtained in the course of «Mineralogy of anthropogenic formations» and develop practical skills in determination of anthropogenic and natural mineral formations in samples of snow solid residue.

The tasks of research include examination of theoretical material; snow sampling; investigation of substantial composition of snow residue samples; division of samples into magnetic and electromagnetic fractions.

The investigation material is real samples selected in different urban regions in the course of research work on the given territories. Besides, the material can serve concrete samples selected by the students.

The variant of the problem is chosen by the student's number in the group list for the students of full-time department, but for correspondence students – by the number of credit-book (Table 1).

The scheme of sample study

I stage

1. Snow sampling.
2. Preparation of snow samples for analysis.
3. Magnetic and electromagnetic separation of snow solid residue samples.

II stage

1. Calculation of dust burden.
2. Microscopic examination of snow solid residue samples.
3. Determination of percentage for natural mineral particles, biogenic constituents and anthropogenic formations in the bulk sample of snow solid residue.
4. Determination of percentage for anthropogenic formations in the magnetic and electromagnetic fractions.

At the first stage one should take samples on the territory of a definite object and prepare it for analysis or use the material suggested by a lecturer.

At the second stage the dust burden is calculated (in mg/m^2*daily) and substantial composition of snow solid residue samples is investigated.

Dust burden is calculated by the formula (1):

$$P_n = P_o \ / S \times t \qquad (1)$$

where:

P_n – dust burden, mg/m^2 per day (kg/km^2 per day);

P_o – weight of the snow solid residue, mg (kg);

S – square of the pit, m^2 (km^2);

t – number of days from snow-up day (the day when snow falls out and does not melt) to sampling day.

Table 1

The sample number for students of day-time and correspondence departments

Sample number	Sample characteristics	Sample number	Sample characteristics
1	Soviet region of Tomsk city	11	Moryakovka village
2	Oktyabrskiy region of Tomsk city	12	Luchanovo village
3	Kirov region of Tomsk city	13	Chernyshovka village
4	Linin region of Tomsk city	14	Naumovka village
5	Lagerny Garden	15	Samus village
6	Region of the 17 th building of TPU	16	Kireevsk village (conditional background)
7	Sanitary-protective zone of Power Station-2	17	Seversk town
8	Akademgorogok	18	Mezhdurechinsk town
9	Timiryazevo village	19	Pavlodar city (Kazakh Republic)
10	Dzherzhinskiy village	20	Teya deposit (Khakasia)

The obtained dust burden values are mapped on the scheme and isolines are drawn in terms of the contamination levels:

less than 250 mg/m^2 per day – low contamination level;

250-450 mg/m^2 per day – middle one;

450-850 mg/m^2 per day – high one;

more than 850 mg/m^2 per day – very high one.

The contamination levels are taken from reference (Методические…, 1982).

To calculate the dust burden the data from Table 2 are used.

Then the microscopic examination of snow solid residue samples is performed in details. The study of substantial composition of snow cover

solid residue is made on the basis of invention patent № 2229737 on October, 17, 2002. (Язиков Е.Г., Шатилов А.Ю., Таловская А.В. Способ определения загрязненности снегового покрова техногенными компонентами).

Table 2

Data on snow formation

Number of samples	Snow-up day	Sampling day	Size of pit, cm	Weight of solid residue, g
1	21.11.2006	24.03.2007	40*45	1,09
2	21.11.2006	25.03.2007	30*32	1,08
3	21.11.2006	24.03.2007	35*30	0,79
4	21.11.2006	24.03.2007	35*40	1,39
5	21.11.2006	24.03.2007	30*30	0,72
6	01.11.2005	01.03.2006	50*50	0,7
7	05.11.2004	17.03.2005	80*80	2,03
8	21.11.2006	28.03.2007	30*30	0,28
9	01.11.2005	01.03.2006	50*50	1,31
10	29.11.1997	14.03.1998	30*30	0,3
11	20.10.1991	10.04.1999	50*50	0,7
12	10.11.1998	3.04.1992	40*40	0,3
13	01.11.2005	02.04.2006	70*60	0,76
14	01.11.2005	03.04.2006	50*45	2,1
15	01.11.2005	03.04.2006	60*60	1,7
16	08.11.2007	25.03.2008	75*50	0,2
17	20.10.1991	5.04.1992	30*25	2,1
18	13.11.1990	17.03.1991	25*25	1,52
19	28.11.2005	03.02.2006	1*1,5 m^2	1,7
20	25.11.2005	25.01.2006	1*1 m^2	2,2

Microscopic examination of samples is carries out by the binocular stereoscopic microscope (MBS-9). Detailed study of microparticles makes possible to characterize particles with determination of color, luster, hardness, transparency, form, and size of particles, characteristic of surface, degree of roundness and oxidization.

Then magnetic and electromagnetic separation of snow solid residue samples takes place. Magnetic separation of snow solid residue samples is made by means of multipolar magnet of A.Ya. Sochnev's system. After magnetic fraction separation some particles having slight magnetic prop-

erties are left in samples. They can be isolated from the sample by electromagnetic separation which is carried out by the DC electromagnet. The content of anthropogenic formations in the magnetic and electromagnetic fractions is to be studied.

In the samples of snow solid residue there can be natural (quartz, feldspar, mica, carbonate, organic particles) and anthropogenic (soot, coal particles, slag, metallic spherules etc.) formations.

In the samples one determines the percentage of all types of natural mineral, biogenic particles and anthropogenic particles by the method of comparison with standard circles of S.A. Vakhromeev template (Вахромеев, 1956) in such a way that content of all particles would make 100 % (Fig. 1).

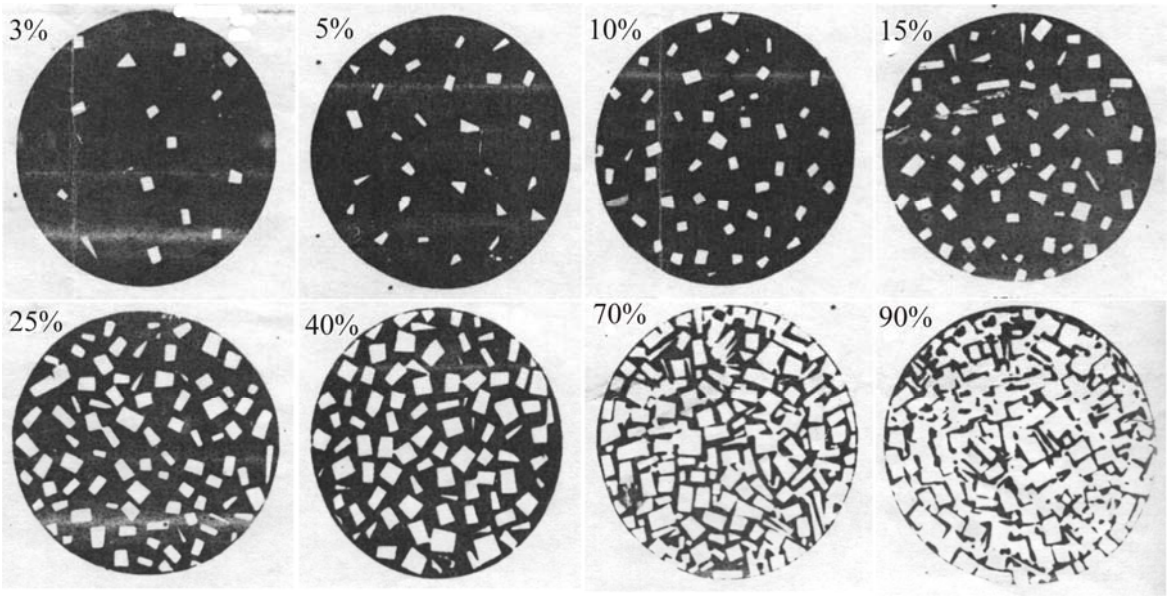


Fig. 1. Comparative method of determination (from S.A. Vakhromeev)

The essence of this method consists in comparison of amount of particles in the sample observed under microscope in some field of view with standard circles, on the black background of which there is a number of white figures. When compared it is not difficult to find the closest in composition standard and in this way state the percentage of each type of particles in the sample.

On the basis of the data one can determine the content and relationship of natural minerals, biogenic particles, and anthropogenic formations.

The data on substantial composition of studied samples are summarized in the Table (Tables 3, 4).

Table 3

Substantial composition of snow solid residue samples on the investigated region

Type of particles	Content, %
Natural mineral and biogenic particles:	
Quartz etc.	
Anthropogenic particles:	
Particles of soot and coal etc.	

Table 4

Substantial composition of magnetic and electromagnetic fractions of snow solid residue sample (content, %)

Type of particles	Magnetic fraction	Electromagnetic fraction
Metallic spherules		
Black formless particles etc.		

Report content and preparatio.

Having done the laboratory work there should be prepared a report. Penscript is presented on standard (297x210 mm) or nonstandard pages. The text volume is 5-10 pages.

The work includes the following parts:

Introduction.

7. Characteristic of sampling region.
8. Research methods.
9. Results of research in substantial composition.

Conclusion

References.

In the introduction one should state the purpose of work, initial material, and main research tasks.

The second part contains short characteristic of the researched region**.**

The third part includes characteristics of the research methods.

The fourth part presents the results of dust burden calculation with determination of contamination degree for the researched site. The main types of natural mineral and biogenic particles and those of anthropogenic

particles with their characteristic (color, transparency, size, roundness, source etc.) are enumerated. Photos or pictures of all types of particles are given. Relationship of natural mineral, biogenic formations as well as results of research in magnetic and electromagnetic fractions is introduced. Sources of natural mineral and anthropogenic formations on the researched sites are pointed out. The results of research in substantial composition are presented in the form of tables.

In the final part there should be conclusion and references.

REFERENCES

1. Аэрозоли Сибири / [И.С. Андреева и др.]; отв. ред. К.П. Куценогий; Рос. акад. наук, Сиб. отд-ние, Ин-т химической кинетики и горения [и др.]. – Новосибирск: Изд-во СО РАН, 2006. – 548 с. – (Интеграционные проекты СО РАН; вып. 9).

2. Василенко В.Н. Мониторинг загрязнения снежного покрова / В.Н. Василенко, И.М. Назаров, Ш.Д. Фридман. – Л.: Гидрометеоиздат, 1985. – 185 с.

3. Геохимия окружающей среды / Ю.Е. Сает, Б.А. Ревич, Е.П. Янин [и др.]. – М.: Недра, 1990. – 335 с.

4. Глазовский Н.Ф. Техногенные потоки вещества в биосфере / В кн.: Добыча полезных ископаемых и геохимия природных экосистем. – М.: Наука, 1982. – С. 7–28.

5. Иванов А.В. Интенсивность выпадения мелкодисперсного космического вещества на Землю / А.В. Иванов, К.П. Флоренский // Геохимия. – 1970. – № 11. – С. 1365–1372.

6. Кизильштейн Л.Я. Алюмосиликатные микросферы золы пылеугольного сжигания углей / Л.Я. Кизильштейн, А.Л. Шпицглуз, В.Г. Рылов // Химия твердого топлива. – 1987. – № 6. – С. 122–126.

7. Кизильштейн Л.Я. Магнетитовые микрошарики из золы-уноса пыле-угольного сжигания углей на ТЭС / Л.Я. Кизильштейн, А.С. Калашников // Химия твердого топлива. – 1991. – № 6. – С. 128–134.

8. Кизильштейн Л.Я. Экогеохимия элементов-примесей в углях. – Ростов н/Д: Изд-во СКНЦ ВШ, 2002. – 296 с.

9. Методические рекомендации по геохимической оценке загрязнения территорий городов химическими элементами. – М.: ИМГРЭ, 1982. – 111 с.

10. Пат. 2229737 Россия, МПК[7] G 01 V 9/00. Способ определения загрязненности снегового покрова техногенными компонентами / Язиков Е.Г., Шатилов А.Ю., Таловская А.В.; заявитель и патентообладатель. Томский политехн. ун-т. – № 2002127851; заявл. 17.10.2002; опубл. 27.05.2004.

11. Положинцев Б.И. Introduction to Ecology. СПб., 1999.

12. Шатилов А.Ю. Вещественный состав и геохимическая характеристика атмосферных выпадений на территории Обского бассейна: Автореф. дис. … канд. геол.-мин. наук. – Томск, 2001. – 24 с.

13. Шилов И.А. Экология: Учеб. для биол. и мед. спец. вузов/И.А. Шилов – 4-е изд., стер. – М.: Высш. шк., 2003.-512с.

14.Язиков Е.Г. Экогеохимия урбанизированных территорий юга Западной Сибири: дис. … докт. геолого-минерал. наук: 25.00.36 / Егор Григорьевич Язиков; Том. политехн. ун-т. - Томск, 2006. - 423 с.

15.Язиков Е.Г., Рихванов Л.П. Содержание радиоактивных и редкоземельных элементов в аэрозольных выпадениях снегового покрова различных территорий Западной Сибири // Радиоактивность и радиоактивные элементы в среде обитания человека: Материалы Международ. конф., 22-24 мая 1996 г., Томск. – Томск: Изд-во ТПУ, 1996. – С. 312–316.

16.Язиков Е.Г., Шатилов А.Ю. Эколого-геохимическая оценка территории района города по данным снеговой съемки / Метод. указ. По выполнению лаб. раб. № 1 по дисциплине «Геохимический мониторинг окружающей среды» для студентов очного и заочного обучения специальности 020804 «Геоэкология». – Томск: Изд-во ТПУ, 2000. – 20 с.

17.Язиков Е.Г., Шатилов А.Ю. Геоэкологический мониторинг: Учебное пособие. – Томск: Изд-во ТПУ, 2004. – 276 с.

18.Akinyemi R. Rainforests. Oxford Bookworms Fact Files. Oxford: Oxford University press, 1997.

Alexakhin, R.M., Budalkov, L.A., Gubanov, V.A., Drozhko, Ye.G., Ilyin, L.A., Kryshev, I.I., Linge, I.I., Romanov, G.N., Savkin, M.N., Saurov, M.M., Tkhomirov, F.A., Kholina Yu, B., 2004. In: IIyin, L.A., Gubanov, V.A. (Eds.), Large Radiation Accidents: Consequences and Protective Countermeasures. IzdAT Publisher House, Moscow, Russia, ISBN 5-86656-164-6, 555 pp.

19.Ailsa Alaby and Michael Allaby. Dictionary of Earth Sciences – Oxford University Press, 2003 – 619p.

20.Baarschers W.H. Eco-facts and Eco - fiction: Understanding the Environmental Debate. – London; New-York: Routledge, 1996.

21.Bradley, D.J., Frank, C.W., Mikerin, Y., 1996. Nuclear contamination from weapons complexes in the former Soviet Union and the United States. Physics Today 49, 40 - 45 (American Institute of Physics).

22.Cochran, J.K., Moran, S.B., Fisher, N.S., Beasley, T.M., Kelley, J.M., 2000. Sources and transport of anthropogenic radionuclides in the Ob River system, Siberia. Earth and Planetary Science Letters 179, 125 - 137.

23.Drake T.T. Moote T. R. Snow pH and dust loading at Scheffer-ville Quebec // Canadian Geographer. – 1980. – V. 24. – № 3. – P. 286–291.

24.Earth Systems: processes and issues / Edited by W.G. Ernst – Cambridge University Press, 1999. – 566p.

25.Environment, Population and Development./ Ed. by Ph. Sarre and J. Blunder. - London, 1996.

26.Environmental in Question. Ethics and Global Issues. / Ed. by D. E. Cooper and J.A. Palmer. - London and New-York, 1995.

27.Evans V., Dooley J. Enterprise 4. Express Publishing, 1998.

28.Fedorov E. Man and Nature: The Ecological Crisis and Social Progress. - Moscow, 1980.

29.Gauthier-Lafaye F., Pourcelot L., Eikenberg J., Beer H., Le Roux G., Rhikvanov L.P., Stille P., Renaud Ph., Mezhibor A. Radioisotope contaminations from releases of the Tomsk-Seversk nuclear facility (Siberia, Russia) //Journal of Environmental Radioactivity, 2007. - т.Volume 98 - № 1. - с. 301-314

30.International Atomic Energy Agency (IAEA), 1998. The Radiological Accident in the Reprocessing Plant at Tomsk. IAEA, Vienna, ISBN 92-0-103798-8, 77 pp.

31.Laptev I. The World of Man in the World of Nature. - Moscow, 1979.

32.Lgotin, V., Makushin, Y., 1998. Groundwater monitoring to assess the influence of injection of liquid radioactive waste on the Tomsk public groundwater supply, Western Siberia, Russia. In: Mather, J., Banks, D., Dumpleton, S., Fermor, M. (Eds.), Groundwater Contaminants and Their Migration, vol. 128. Geological Society, London, pp. 255 - 264 (special publication).

33.Mascull B. Key Words in Science and Technology. The University of Birmingham. Collins Cobuild, 1997.

34.Nuclear Wastelands: a global guide to nuclear weapons production and its health and environmental effects / Edited by Arjun Makhijani, Howard Hu, and Katherine Yih – the MIT Press, Cambridge, Massachusetts, London, England, 1995. – 666p.

35.Paluszkiewicz, T., Hibler, L.F., Becker, P., Mandych, A., Richmond, M.C., Thomas, S., 1997. An assessment of the flux of 90Sr contamination through the Ob' river and estuary to the Kara Sea. Science of the Total Environment 202, 43 - 56.

36.Tcherkezian, V., Galushkin, B., Goryachenkova, T., Kasharov, L., Liul, A., Roshina, I., Rumiantsev, O., 1995. Forms of contamination of the environment by radionuclides after the Tomsk accident (Russia, 1993). Journal of Environmental Radioactivity 27, 133 - 139.

37.Weiss H.V., Herron M.M. Langway C.C. Natural environment of element in snow. - Nature, 1978, V. 274, № 5669. - P. 352-353.

38.Francois Ramade Elements D'Ecologie. Ecologie fondamentale-Dunod, Paris, 2003. - 690p.

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