МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ
ОДЕСЬКИЙ ДЕРЖАВНИЙ ЕКОЛОГІЧНИЙ УНІВЕРСИТЕТ

# МЕТОДИЧНІ ВКАЗІВКИ
для СРС та учбовий матеріал
з англійської мови
для студентів II курсу
очної форми навчання
Напрям підготовки – гідрометеорологія

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Методичні вказівки для СРС та учбовий матеріал з англійської мови для студентів ІІ курсу очної форми навчання. Напрям підготовки: гідрометеорологія.

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## Передмова

Дані методичні вказівки призначені для студентів-метеорологів IIк, (III, IVсем.). Вони розраховані на 68 годин аудиторної роботи та приблизно на таку ж кількість годин самостійної роботи студентів. Мета роботи - розвинути навички читання, аналізу та перекладу текстів, усної мови на матеріалі наукової літератури, близької за тематикою до профілю. Методичні вказівки складаються з 8 уроків. Текстовий матеріал уроків призначений для опанування заходів ознайомлюючого та навчального читання, відпрацювання вміння аналізувати різні елементи тексту, розвитку навичок перекладу. Тексти відібрані з оригінальної науково-популярної та наукової літератури. Тексти А призначені для читання, усного перекладу, аналізу елементів тексту, анотування та переказу; тексти В, тематично пов'язані з текстами А, - для письмового перекладу з подальшою перевіркою на занятті, уточненням значень окремих лексичних одиниць, переказом за планом. Лексично-граматичний матеріал уроків закріплюється під час виконання відповідних післятекстових вправ. Лексичні вправи призначенні для вивчення та закріплення лексичного матеріалу кожного уроку та охоплюють лексику основних текстів. Вони можуть бути використані також для контролю (самоконтролю) засвоєння лексичного матеріалу уроку. Під час виконання лексичних вправ рекомендується не тільки підбирати українські або англійські еквіваленти наведених слів та словосполучень, але й знаходити у тексті або складати самостійно речення з зазначеними словами, звертаючи увагу на багатозначність слів, залежність їх значень від можливості їх сполучення та контексту. Слід також приділити увагу аналізу похідних слів, супроводжуючи його відповідними правилами словоутворення. Граматичні вправи спрямовані на аналіз найскладніших граматичних явищ тексту, розвиток навичок орієнтування у граматичній структурі англійського речення, які сприятимуть вірній інтерпретації тексту. Кожний урок завершується виконанням вправ оглядового характеру. Після закінчення цього курсу студенти повинні знати: лексично-граматичний матеріал, наданий у методичних вказівках за фахом, вміти: користуватися на практиці набутими навичками.

## LESSON 1

### Text A THE AIR AROUND US

Like a fish in the ocean, man is confined to a very shallow layer of atmosphere; his physical and psychological state - indeed, his very life depends on his atmospheric environment. Aside from the use of its constituents in biological processes, the atmosphere controls life in many ways. It acts as an umbrella or shield, filtering various types of electromagnetic radiation and high- energy particles from the sun and space. Most meteorites are burned up before they can penetrate to the earth's surface. Winds transport heat and moisture and. in the process, mix the air and create more uniform conditions on the earth than would otherwise exist. The same winds drive the ocean currents, produce waves. erode the soil, and transport pollen and insects, Weather destroys mans structures and systems of communication and transportation. The sounds which a man hears, the scents he smells, and the sights he sees are all affected by the state of the atmosphere.

Meteorology attempts to establish the physical laws or relationships that describe the state of the atmosphere. From these, three practical advantages can be envisioned: 1) prediction of future weather to guide the planning of man's activities, 2) adaptation of man's activities to the atmospheric environment, and 3) modification of weather.

### Text B EXPECTED DEVELOPMENTS IN METEOROLOGY

Our atmosphere communicates with the sun in two ways: first there is the direct communication through short-wave and corpuscular radiation via the uppermost part of the atmosphere. Second, there is the conversion of solar radiation into sensible heat and the resulting exchanges of heat and water vapour at the earth-atmosphere interface. Both of these complexes of process are important, for to some extent they influence the whole gaseous envelope of the earth. While satellite observations suffice for establishing the energy budget for entire-atmosphere system, observations at the lower interface are needed to determine the amount of heat available to the atmosphere alone. Such observations are essential also for

research on the circulation of water vapour. Polar regions as well as the large deserts are sparsely covered with international networks of observatory stations. Less known to meteorology is the fact that observations to describe the processes at interface between the earth and the atmosphere are almost universally absent. As a result, our knowledge of the heat and cold sources associated with the earth's surface is exceedingly meagre, and so is our knowledge of the supply of water vapour to the atmosphere. The lack of observations the lower interface is a severe of the processes surrounding to obstacle practical in the problems. way of progress in the science of meteorology and its application the moon, In the the nearest sun future a variety of satellites, not only of the earth but also of operation and the near planets (e.g. Mars, and Venus) will have been in result to be for obtained at least one half sunspot cycle. The most important meteorological time variation from a solar satellite would be the chance to observe the of the solar electromagnetic period covering and corpuscular radiation over a that the at least one half solar cycle, say five years or more. It is known radiation varies visible radiation undergoes only small variations but short wave the total greatly as does the corpuscular radiation. A quantitative study of yield essential solar energy input into the earth's atmosphere and its time variation will knowledge of the ultimate cause of the atmospheric changes in the upper atmosphere. Our ability to understand and predict the behaviour of hurricanes has been limited, mainly because of lack of observations from the ocean areas. Observations from earth satellites, combined with balloons and radar soundings, will greatly enrich the observational data. Though standard observations from the polar regions, large deserts and certain ocean areas will remain sparse for some considerable time, satellite observations of cloud systems and supplemental observations from reconnaissance systems will provide data to fill in the gaps. We expect within the coming ten-year period considerable improvement in accuracy of general weather forecasts, greatly improved accuracy in disaster warnings (hurricanes, tornadoes, etc.), some extension of the time period for which useful forecasts can be provided, and new possibility in the forecasting of the conditions of the uppermost atmosphere.

## Exercises

**Exercise 1.**

**(a) Find Ukrainian equivalents to the following:**

Environment, shallow layer, shield, physical and psychological state, to exist, high-energy particles, constituent, to create, to erode the soil, pollen and insects, prediction, to guide, adaptation, to envision, relationship.

**(b) Find English equivalents to the following in the Text A:**

Залежати від, використовувати, проникати, однорідні умови, океанічна течія, руйнувати, системи зв'язку та транспортування, закон, намагатися, перевага, бути під впливом, встановлювати.

**Exercise 2. Read Text A and answer the following questions:**

1. Man's life depends on his atmospheric environment, doesn't it?
2. In what ways does the atmosphere control man's life?
3. What's the role of winds in the atmosphere?
4. What damage may be caused by the weather?
5. Does the meteorology attempt to establish some physical laws relationships to describe the state of the atmosphere?
6. What main practical advantages can be envisioned from these laws?

**Exercise 3. or (a) Find synonyms to the following words and word combinations in the text:**

Surrounding, in fact, to apply, various, to break, to foresee, to carry, protection, to be influenced, to be limited, to try, to carry, protection, to be influenced, to be limited, to try. (b) Find antonyms to the following words in the Text:

Deep, to create, different, disadvantage, unlimited, cold

**Exercise 4. Translate paying attention to the underlined words and expressions:**

1. Automatic interplanetary stations will continue to act as the principal means of studying cosmic space.

2. The level of air pollution is greatly affected by the state of the atmosphere.

3. The weather officer began to analyse the data as he did not want to depend on the forecaster who had not come in time to the weather bureau.

4. They had to settie the question of transmitting weather data to the new stations.

5. The telescopes allow to see very small stars which otherwise would be impossible to observe.

**Exercise 5. Translate and explain the following:**

1. The explorers could not find their way in the snow.

2. This scientist always tries to solve any problem in his own way.

3. In many ways this method was different from the ones used before.

4. You should find a way out of the difficulty.

5. Old methods of weather analyses had to make way for new ones.

6. The turbine turned out by the metal plant is on its way to the construction site.

7. In such a way all requirements are met.

8. There exist various ways of observing the atmosphere.

9. Full-scale construction will start next year, preparations, however, are under way.

**Exercise 6. Translate sentences in which the infinitives are:**

(a) subject: discontinuity To investigate is the nature of the our flow in the vicinity of these sources of very important. (b) part of a predicate: Our task is to obtain a new mixture with new proportions. (c) object: and With to the earth satellite it is possible to measure the net balance of the earth map its variation over the surface. (d) adverbial modifier: To obtain synoptic data needed for definition and movement of cyclones, the national meteorological services were established. This

method is accurate enough to give reliable results. (e) attribute: Kites and balloons were instrumented to discover and define the lapse rate.

**Exercise 7. Find the infinitives in the following sentences and define their functions. Translate the sentences:**

1. The thermometer is to be protected from the direct and reflected rays of the sun.

2. Orographic clouds have a strong tendency to become supercooled.

3. To reduce surface temperatures to sea level when estimating the intensity of a front is of great importance.

4. For a cloud to form, the air must first become saturated with respect to water.

5. The ordinary method to be used for observation of wind at heights is that of sending us pilot balloons.

6. Winds tend to blow from areas of high pressure to regions of low pressure.

7. To determine the state of the atmosphere at any given point, there quantities are to be measured, viz., pressure, temperature and humidity.

8. In order to understand radiation processes it is necessary to know some of the so-called "classic radiation laws".

9. Results of these observations will tend to verify the choice of a particular model of atmosphere in a given region.

10.Our ability to understand and predict the behaviour of hurricanes has been limited mainly because of lack of observations from the ocean arcas.

**Exercise 8. Define Objective Infinitive Constructions and translate the sentences:**

1. The meteorologists considered the data of temperature to be representative for the given area.

2. The ancients already knew weather and temperature changes to dependent upon advection.

3. Near the equator the heating causes the atmosphere to expand vertically.

4. We know this scientist to have been working at this problem for some years.

5. We suppose the prediction of hurricanes to be limited mainly because of lack of observation from the ocean areas.

6. Scientists know high temperature, strong wind, low humidity and low pressure to aid evaporation and vice versa.

7. Meteorologists found the equations for cyclonic and anticyclonic winds to express the wind speed in terms of pressure distribution.

**Exercise 9. Define Subjective Infinitive Constructions and translate sentences:**

1. The air is said to be saturated if it contains all the water vapour that it can hold at the existing temperature and pressure.

2. The average vertical temperature gradient is found to be about 3.5°F per 1000ft.

3. Orographic clouds are believed to cause heavy and continuous rain.

4. Meteorologists are required to report observed weather changes regularly.

5. Heavy icing conditions can be expected to occur in freezing rain.

6. The Beaufort Scale of Wind Force is considered to be rather old for being used in meteorology.

7. The cold waves reaching Australia seem to originate from latitudes lower than 60°S.

8. The vertical distribution of ozone is likely to be valuable in the study of stratospheric circulation using ozone as a tracer.

**Exercise 10. Translate the following sentences paying attention to the predicates in the passive voice:**

1. There is nothing in our present knowledge to indicate that the general circulation of the atmosphere and the distribution of climates can influenced by man.

2. Laboratory experiments were followed by field experiments at different places.

3. The climate of Japan is greatly affected by its position off the east coast of the large land mass of Asia.

4. especially This coast when should the not be approached during north-easterly winds, visibility is low.

5. In this case the barometer must continuously be watched and its readings must be regularly recorded.

6. The main body of the Kuro Shiwo is joined by the north-easterly drift from the China Sea.

7. On the 28th, in the afternoon, weather ship got amongst a great number of ice bergs which were watched by some members of our crew with great

8. The result of the new experiment were reported by the Odessa observatory.

**Exercise 11. Translate Text B. Discuss it.**

## LESSON 2

### Text A OBSERVATION OF THE ATMOSPHERE

Weather observations have been made by man since earliest times, but systematic measurements of the weather elements did not begin until the invention of meteorological instruments during the seventeenth and eighteenth centuries. Up to the twentieth century, meteorological measurements were confined to the air close to the ground. Systematic measurements of most of the earth's atmosphere are scanty even today.

Measurement of the state of the atmosphere is quite difficult. In addition to the usual requirement that an instrument measures accurately the meteorological instrument must be rugged enough to withstand the weather elements - the force of buffeting winds, the corrosive action of high humidity and flying dust, the extremes of heat and cold. Another difficulty is the inaccessibility of much of the atmosphere, so that the instruments must be built to transmit their measurements to distant ground points. They must be rugged and light enough to be carried aloft by balloons and rockets and cheap enough sos that they can be used in the large quantities necessary

to observe the atmosphere. Finally, meteorological measurements must be representative. To take the depth of water in a single 8-inch diameter rain gauge as representative of the average rainfall over an area many square miles is somewhat like to assume that the height of a single student taken at random is equal to the average of the entire school.

## Text B THE AIR TEMPERATURE

In order to distinguish between the temperature of the free air and the temperature observed close to the surface of the earth, we shall call the latter the "surface-air temperature". The temperature observed near the surface of the earth is often neither representative nor conservative. It is not representative because of many local or orographical influences, and it is not conservative on account of the preponderance of non-adiabatic irreversible processes in the air close to the earth's surface. Of such influences we mention insolation, outgoing evaporation nocturnal radiation, and condensation, conduction etc. of heat from and to the surface of the earth, The diurnal maximum temperature over land on sunny days is fairly representative, for it depends largely on the temperature conditions in the air above the ground layer. As the sun rises, the surface layer of air is heated rapidly because the heat gained is distributed in a shallow layer of air. After some hours of sunshine, the surface layer is heated to such an extent that the inversion is dissipated, the lapse-rate under the inversion point having become dry-adiabatic. From now on, the heat transferred to the air from the surface of the earth is spread in a deep layer of air, and the temperature near the surface of the earth will not rise appreciably. The rate of decrease in temperature along the vertical is called the lapserate. From the observed distribution of temperature and humidity along the vertical, important conclusions may be drawn with regard to the development of clouds and hydrometers. Conversely, from cloud and hydrometer observations and also from the general life history of the air mass, conclusions may be drawn with regard to the lapse-rate and its variations. The dew point is conservative with respect to isobaric temperature variations. However, when the underlying surface is heated, the vapour-pressure

gradient between the surface and the air increases with the result that evaporation is accelerated, and the dew-point temperature rises. The temperature recorded by a well-ventilated wet-bulb thermometer is called the wet-bulb temperature of the air. The wet-bulb temperature may be defined more precisely as the lowest temperature to which the air can be cooled at constant pressure by evaporating water into the air. When the ventilation has continued for some time, the wet-bulb thermometer assumes a constant temperature indicating that there is no net gain or loss of heat. The heat gained from the air is then expended in evaporating water from the wet bulb.

***Exercises***

**Exercise 1**

**(a) Find Ukrainian equivalents to the following:**

Weather observation. (to be) close to, scanty, in addition to, to be designed, rugged, buffeting winds, the extremes of heat and cold. inaccessibility, distant ground points, finally, 8-inch diameter rain-gauge, representative, at random, entire.

**(b) Find English equivalents to the following in the Text:**

протистояти, Винахід, сила вітру, систематичні метеорологічні спостереження; пил, передавати, вітру, вимірювати точно, зонд, висока вологість, середня кількість опадів; характерний, бути рівним чомусь.

**Exercise 2.**

**(a) Arrange the following words in the pairs of synonyms:**

maximum, Ground, entire, general, assume, device, earth, precisely, finally, whole, at last, extreme. usual, instrument, rainfall, suppose, accurately, precipitation,

**(b) Arrange the following words in the pairs of antonyms:**

distant, Systematic, expensive, close to, single, light, to withstand, low, a lot of, cheap, to give in, heavy, high, scanty.

**Exercise 3. Answer the following questions and then retell Text A:**

1. When did systematic measurements of the weather elements begin?

2. Systematic measurements of most of the earth's atmosphere are carried out today, aren't they?

3. What principle requirements are given to meteorological instruments?

4. By means of what are meteorological devices carried aloft?

5. Can we assume that the readings of a single rain gauge are representative of the average rainfall over a large area?

6. What meteorological measurements may be considered as representative of the average conditions?

**Exercise 4. (a) Translate paying attention to the underlined words and expressions:**

***to send*** *- sending - який посилає, посилаючи*

*sent - посланий*

*being sent - який посилається*

*having sent - пославши*

*having been sent - будучи посланим*

To make, to measure, to build, to carry, to use, to register, to take, to collect, to drive.

**(b) Give infinitives of the given verb-forms and translate them into Russian:**

Being observed, having been recorded, moving, having passed, done, attached, having made, shielding, having been taken, kept, having absorbed, ascended.

**Exercise 5. Translate the sentences into Russian where the participle is (A)- an attribute:**

1. The atmosphere is the mass of gases surrounding the earth.

2. The weather map being shown to the meteorologists was a detailed one.

3. The meteorologists working in the Arctic communicate the data of

observations to the continent.

4. Meteorologists collect data of warm air penetrating from the Pacific Ocean to the high latitudes.

5. The word "atmosphere" is used to denote the gaseous sphere surrounding the earth.

6. Diurnal changes every are those occurring regularly every day, with two maxima and minima every 24 hr.

7. The highest amounts of atmospheric electricity observed occur at temperature not far below freezing.

8. The data sent by the sputnik will be compared with the data collected by ground observers.

9. The work done by Soviet expedition helped to understand many secrets of nature in the polar regions.

10.Gold anticyclones are wandering pressure structure seen on most winter weather map.

11. Land and sea breezes are winds caused by the local hcating of land and water surfaces.

12.The vertical temperature gradient, generally called the lapse rate is the change in temperature with altitude.

13. The instrument most commonly used to measure the temperature of the atmosphere is the mercury-in-glass thermometer.

14. The wind is simply air in motion, usually measured only in its horizontal component.

15. Dust consists of particles of all kinds of matter distributed be the wind.

16. Heated air increases in volume.

**(B) an adverbial modifier:**

1. Sending out balloons, meteorologists obtain data about temperature, pressure, etc.

2. Being equipped with all the necessary instruments, the observers could start this work.

3. Having communicated the weather report, the meteorologists continued to take observations.

4. Having been given all the necessary information the meteorologists began to analyse the data.

5. Being equipped with all the necessary instruments, the satellite can give information about the conditions in the higher atmospheric layers.

6. While observing the temperature of air and the speed of wind, scientists have obtained new data concerning heat exchange between the ocean.

7. Having aviation and been made more accurate, weather forecasts are of great help to navigation.

8. Having in its orbit, the satellite is periodically affected by changing thermal conditions.

9. Many airplanes is are struck by lightnings when flying at a level where the temperature is near freezing.

10.When analysed, the data may be used for weather reports.

**(C) a part of the predicate:**

1. Snow is falling now and a change of temperature may be expected.

2. Soviet engineers and scientists are creating more and more powerful rockets and jet engines.

3. The expedition was moving to the remotest part of the region.

**Exercise 6. Translate the following sentences, paying attention to the meanings of "that", "that of", "those" and "those of":**

1. There is a remarkable difference in atmospheric pressure over Europe as contrasted with over the region of the Great Lakes in North America.

2. The spectral distribution of solar radiation closely approximates that of a black body.

3. This air mass has characteristics and properties quite different from those of such air mass in winter.

4. The trade-winds of the Pacific are somewhat less strong and more variable

in direction than those of the Atlantic.

5. The process of condensation is similar to that described in connection with the formation of fog, where it is stated that the presence of hydroscopic nuclei is necessary.

6. The continental cyclones may be divided into those which are most frequent in winter and spring and least in summer, and which originate in North China and Siberia.

7. The forms and codes in general use are those adopted by the International Meteorological Conference held at Copenhagen in September 1929.

8. Depressions fall into two main classes, those of temperate and high latitudes, and those of tropical seas.

**Exercise 7. Translate Text B using the dictionary.**

## LESSON 3

### Text A PRESSURE

Pressure is defined as the force per unit area exerted on any surface (in a fluid). The orientation of the surface will not affect the pressure. In the case of the atmosphere, which has no outer walls to confine its volume, the pressure exerted at any level is due almost entirely to the weight of the air pressing down from above; i.e. the force results from gravitational attraction. in the The pressure changes more rapidly vertical. In the lowest few kilometers of the atmosphere the pressure decrease amounts to about 1 millibar per 10 meters. Because of compressibility of air, the rate at which the pressure decreases with height become slower at great heights. Variations of pressure in the horizontal are much smaller than they are in the vertical. Near sea level, the change of pressure with distance rarely exceeds 3 millibars per 10 kilometers and is usually much less than half this rate. Although the horizontal variations in pressure are small, they are responsible for the winds we observe. Pressure also changes with time at a single place. Some of those changes are of irregular nature, caused by occasional invasions of air having a different mean

density. But there is also a quite regular diurnal oscillation of the pressure that causes, on the average, two peaks (at about 10a.m. and 10p.m.) and two minima (at about 4a.m. and 4p.m.). The difference between maxima and minima is the greatest near the equator (up to 3 millibars), decreasing to practically zero in the polar regions. These regular fluactions in the pressure are analogous to the tidal motions in the ocean. In the atmosphere the daily heating and cooling cycle appears to be the dominant cause of the pressure variations.

## Text B ABOUT THE THEORY OF CONVECTION

The word convection is used in meteorological literature to denote vertical currents in the atmosphere which result from static instability. The theory of convection and the study of convective weather phenomena are, closely related to the study of the criteria of stability and instability. The conditions of static stability of the atmosphere and the convective weather phenomena have been studied from various points of view. The results thus obtained are applied with ease in the daily forecasting practice when the data derived from aerological ascents are plotted on a thermodynamical diagram. The stability (or instability) conditions of the atmosphere are then found by letting a small parcel of air move adiabatically upwards or downwards, and considering its density (or temperature) relative to its environment. Similarly, the amount of available energy is found by measuring the area on the diagram which is enclosed by the ascent curve (the environment curve) and the curve which the parcel in question would follow on the diagram during its adiabatic, or pseudo-adiabatic, movement. When using this method, it is assumed that a parcel of air can ascend or descend without causing any motion in the environment. This, again, implies that the density of the environment of the moving parcel does not change. It is approximate to remark here that from the circumstance that the parcel method is inaccurate, it does not follow that it is not a valuable means for predicting convective phenomena.

## Exercises

**Exercise 1.**

**(a) Give Ukrainian equivalents to the following:**

Orientation of, volume, of the surface, fluid, the force exerted on any surface, in the to be due to, i.e., to result from, compressibility, the vertical, to change in irregular at great height, to be responsible for, diurnal oscillation, to be of heating nature, the equator, to be analogous to, tidal motion, variation, and cooling cycle, to be defined as.

**(b) Give English equivalents to the following in the Text:**

Гравітаційне тяжіння, повністю, сила на одиницю площі, швидкість зміни по горизонталі, зменшуватись, рівень моря, перевищувати, середня густина, випадкове вторгнення повітря, бути основною причиною чогось, різниця, райони полюсу, регулярні коливання тиску, різко мінятися з відстанню, у середньому.

**Exercise 2. Paraphrase the following underlined parts of sentences, using words and word combinations from the text:**

1. Different factors influence the weather.
2. Temperature changes are registered by different types of thermometers.
3. The volume increases, the pressure gets less.
4. The pressure at any level depends on the weight of the air pressing down from above.
5. The speed of temperature decrease isn't more than 1°C daily.
6. The pressure changes are the cause of the different cyclones.
7. Diurnal changes are those occurring regularly every day, with two maxima and minima every 24hr.
8. The wind is simply air in movement, measured in its horizontal component.
9. What is the average temperature of this month?
10. Some laws governing the movements of water are like those governing the motion of air masses.

11.The temperature registered is 50 degrees below zero.

**Exercise 3. Retell Text A using the following questions as a plan:**

1. How is pressure defined?
2. Why does the pressure change more rapidly in the vertical?
3. What are the horizontal variations in pressure responsible for?
4. What is the cause of pressure changes with time?
5. What is the dominant cause of the pressure variations in the atmosphere?

**Exercise 4. Change the Participle constructions into Subordinate Clauses:**

Model: A fog consisting of ice crystals is called ice fog. A fog which consists of ice crystals is called ice fog.

1. The scientists working at the polar stations have investigated the whole polar basin.
2. An artificial satellite moving in a circular orbit at a given altitude must have a definite speed.
3. The moon, being a satellite of the earth, moves at a speed of one kilometer per second.
4. Beginning some experiment one should be very careful and attentive.
5. While heating a substance we cause a more rapid motion of its molecules.

**Exercise 5. Define the functions of the present participles and translate into Ukrainian:**

1. Considering the atmosphere, we find that unstable conditions occur every day and every hour.
2. In South Africa cumulus clouds are quite often seen to form at the top of smoke column originating from a fire, and cases are on record of copious rain falling from such clouds.

3. Observed data may be plotted on cross-section paper and a smooth curve may be drawn connecting the observed points.
4. However, from the surface up to the 2,000 feet level, the wind veers and increases in speed to a greater or lesser degree, depending upon the turbulence.
5. Towards the western sides of the anticyclones the winds turn polewards, becoming south-easterly in the northern and north-easterly in the southern hemisphere, at the same time becoming less steady in speed and direction.
6. Being of a transitory nature, the land and sea breezes do not adjust themselves readily to the pressure gradient and consequently blow more or less directly from sea to land and vice versa.
7. If the slope is covered with snow or ice the descending air is strongly cooled and may attain a considerable speed.
8. These clouds exist at very different levels, but when viewed from above they have a very similar structure, the upper surface having the characteristic rippled aspect.
9. When coming into contact with the stable layer, the vertical currents spread out their products of condensation below this layer and the result is a more or less thick strato-cumulus or flattened isolated cumulus called trade-wind cumulus.

**Exercise 6. Translate the following sentences paying attention to the absolute constructions:**

1. The accuracy pressure may be predicted from the surrounding pressure field with an length of depending upon a number of factors, the principal one being the the forecast period.

2. A great number of thunderstorms occurred at inland stations, three being observed in the vicinity of our station and no less than eight were observed by some other stations.

3. The relationship between ozone deviations and frontal systems have been studied and it was shown that the low ozone values appeared in the warm sector and in the region covered by the warm front surface, the fall in ozone content often extending several hundred kilometres ahead of the surface warm front.

4. The diurnal variation of relative humidity is determined by absolute humidity and temperature, the latter being the controlling factor.

5. The weight of the air column depends upon its height, its temperature and its pressure, the last two factors affecting density.

6. The simplest form of wind rose is the wind rose in which the number or proportion of winds blowing from each of the principal eight points of the compass is represented by lines converging towards a small circle, the proportion of winds from each direction being represented by varying length of the lines.

7. In valleys into which the cold air blows, the surface winds often bear no relation to the pressure gradient, the upper wind gliding over the cold air without disturbing it.

8. In both cases the speed of the surface wind is less than that of the upper wind, and its direction is backed from that of the upper wind, the reproduction in speed and the amount of the backing being greater for the lower degree of turbulence.

9. In the high levels of the atmosphere the trade winds undergo complete reversal, the upper currents being known as the antitrades. the Strait of Dover and Thames

10.The narrow water, such as estuary, are especially liable to be thus affected by radiation fog, the drift of which taking place from both shores.

**Exercise 7. Translate Text B using the dictionary.**

## LESSON 4

### Text A HUMIDITY

The concentration of gaseous water in the atmosphere varies from practically zero to as much as 4 per cent (4 grams of water in every 100 grams of air). The extreme variability in the amount of water vapour in both space and time is due to water's unique ability to exist in all three states - gas, liquid and solid - at the temperature normally found on earth. Water vapour is continuously extracted from

the atmosphere through condensation (vapour to liquid) and sublimation (vapour to ice); some of this may fall to the earth through precipitation. Water is continuously being added to the atmosphere through evaporation (liquid to vapour) from oceans, lakes, soil, plants and raindrops, and also sublimation (ice to vapour) from snowflakes, glaciers, etc. The exact amount of water vapour that exists at any place and time is important to the meteorologist because of the role water plays in weather processes. First, it is significant because condensation is an important aspect of "weather". Second, water vapour is the most important radiation absorber in the air and thus affects the energy balance of the atmosphere. Third, the release of the latent heat of condensation is an important source of energy for the maintenance of atmospheric flow. or For a substance such as water to change its phase from solid to liquid liquid to gas, the forces that bind the molecules together must be broken down. Work must be done in overcoming these intermolecular forces, so the molecules must expend part of their internal energy. The molecules acquire energy from their environment. The energy required to effect a "phase", or state, change such as occurs in evaporation is called latent heat. Changes directly between ice and vapour involve a latent heat of sublimation which is the sum of the latent heats of fusion and vaporization.

**Text B HUMIDITY (continued)**

We refer to the gaseous state of water as vapour because it is so easily condensed. The quantity of water vapour is the air can be expressed in a variety of ways. One is the density of water vapour, usually referred to as the absolute volume. humidity and expressed as the number of grams of water vapour in a given The partial pressure of water vapour (i.e., the contribution made by water to the total atmospheric pressure) is another measure that can be used. It is usually expressed in millibars or inches of mercury. The amount of water vapour that can be added to a volume at any given atmospheric pressure and temperature is limited. When a volume has reached its 17 capacity for water vapour, it is said to be saturated and the volume will accept vapour no more gascous water. The saturation vapour

pressure, as this maximum a pressure is called, is a function of temperature. The temperature to which "saturated" sample of air must be cooled (at constant atmospheric pressure) to make it water vapour is called the dew point. The dew point is a direct measure of the is a measure pressure; the difference between the temperature and the dew point of the degree of saturation of the air. The relative humidity is the ratio of the actual vapour pressure, i.e., relative humidity humidity = actual vapour pressure/saturation vapour pressure. The relative is very sensitive to temperature changes. These is normally a large air diurnal is constant. change Study of relative humidity, even when the quantity of moisture in the under field conditions. of the atmosphere requires almost instantaneous sampling None of the many techniques used to measure atmospheric humidity are completely satisfactory; here we will mention just a few of the most commonly used instruments. The hair hygrometer is probably the oldest and most widely used instrument for measuring moisture. The hair hygrometer merely consists of one or more hairs whose changes in length are made to move a point or, in the case of hygrograph, a pen. The psychrometer consists of a pair of ordinary liquid-in-glass thermometers, one of which has a piece of tight-fitting muslin cloth wrapped around its bulb. The cloth-covered bulb, called the wet-bulb, is wetted with pure water, and both thermometers are then ventilated. The dry bulb will indicate the air temperature, while the wet bulb will be cooled below the dry-bulb temperature by evaporation. If the surroundings are saturated, there will be no evaporation, and the wet and the dry-bulbs will read the same. The difference between the dry and wet-bulbs, called the depression of the wet bulb, is measure of the degree of saturation of the air. a An electrical hygrometer is used in the radiosonde. It consists of an electrical conductor that is coated with lithium chloride, which is hydroscopic. The amount of moisture absorbed by the conductor depends on the relative humidity of the air, and the electrical resistance of the conductor is a function of its dampness.

## Exercises

**Exercise 1.**

**(a) Give Ukrainian equivalents to the following:**

Amount of water vapour, unique, to exist, gas, liquid and solid, thus, continuously, to extract from, sublimation, precipitation, glacier, to be added to, evaporation, snowflake, to be important to, because of, exact, to play a role, radiation absorber, release, maintenance, to overcome intermolecular forces, to blind, to occur, directly, fusion.

**(b) Give English equivalents to the following in the Text:**

Концентрація, пара, здібність, існувати, краплина, конденсація, падати на землю, джерело, по-перше, прихована теплота конденсації, внутрішня енергія, речовина, руйнувати, називатися, випарювання, придбати, включати.

**Exercise 2. Give synonyms to the following words and word combinations using your active vocabulary:**

To vary, extreme, amount, ability, to exist, important, to effect, sum, fow. to break down, to acquire, precipitation, humidity.

**Exercise 3. Insert the correct word from the list below:**

1. The earth satellite gave information on the.. of cosmic rays on a living organism.

2. The... of the atmosphere depends on the amount of water vapour it contains.

3. The ... of precipitation is condensation of water vapour in the atmosphere.

4. Ice formation is... sublimation.

5. Particles of ... are also suspended in the air.

6.... temperature... pressure are important meteorological elements.

7.... we had to study the temperature distribution.

***both... and, source, humidity, first, effect, liquid, due to***

**Exercise 4. Read Text A and answer the following questions:**

1. What is the concentration of gaseous water in the atmosphere?

2. What is water vapour extracted from the atmosphere through?

3. What are the ways of water addition to the atmosphere?

4. Why is the exact amount of water vapour at any place and time important to the meteorologists?

5. What is necessary for the molecules of water to change its place from solid to liquid or liquid to gas?

6. What is called a latent heat of sublimation?

**Exercise 5. State the form and function of the Gerund:**

1. Plotting a chart requires much practice.

2. The new meteorologist was given the task of observing the winds.

3. The sun governs the weather changes by heating the atmosphere.

4. Most of the solar radiation passes through the atmosphere without being absorbed.

5. Before analysing the data of pressure the forecaster must reduce them to sea level.

6. In determing chief the future weather meteorologist must consider the position of the chief pressure system.

7. The observers succeeded in getting new data by means of balloon ascents.

8. For many centuries people have dreamt of flying to the moon and other planets.

9. An instrument for determining the density of liquids is called a hydrometer.

10. The snow storm prevented the travellers from going out. 11.Sublimation is the process of changing water vapour droplets into ice.

**Exercise 6. Translate Text B using the dictionary:**

a) Name all measures that are used to define the quantity of water vapour in

the air (the absolute humidity).

b) Name all instruments used for measuring atmospheric humidity.

## LESSON 5

### Text A THE ATMOSPHERE'S ENERGY

A convenient way to examine the workings of the atmosphere is through the energy budget. The law of conservation of energy requires that we account for all of the energy received by the earth, so by looking at all forms of energy and transformations we have a guide to atmospheric phenomena.

Practically all (99.98%) of the energy that reaches the earth comes from the sun. Intercepted first by the atmosphere a small part is directly absorbed, particularly by certain gases such as ozone and water vapour. Some of the energy is reflected back to space by the atmosphere, its clouds and the earth's surface. Some of the sun's radiant energy is absorbed by the earth's surface. Transfers of energy between the earth's surface and the atmosphere occur in a variety of ways, such as conduction, evaporation and convection. Kinetic energy (air in motion or wind) results from difference in temperature within the atmosphere. And, finally, friction is constantly bleeding off some of the energy of motion, converting it to heat. The combination of these many processes produce the complex phenomena called weather.

Heat energy can be transmitted from one place to another by conduction, convection and radiation.

*Conduction* is the process by which heat energy is transmitted through a substance by point-to-point contact of neighbouring molecules. Solid substances, especially metals, are usually good conductors. Heat conduction in air is so slow that it is of little importance in transmitting heat within the air itself; however, it is significant in the exchange of heat between the earth’s surface and the air in contact with it.

*Convection* transmits heat by transporting groups of molecules from place to place within a substance. Thus, convection occurs in substances in which the molecules are free to move, i.e. in fluids. The convective motions that carry heat

from one point to another within a fluid arise because the warmer portions of the fluid are less dense than the surroundings and therefore rise. A circulation of fluid, i.e. a closed circuit of fluid motion is thus established between the warm and cool regions.

*Radiation* is the transfer of heat energy without the involvement of physical substance in the transmission. Heat may therefore be transmitted through a vacuum and if the radiation takes place through a completely fransparent medium, the medium itself is not heated or affected. The transfer of heat energy from the sun to the earth is by means of the radiative process. Earth also loses its heat energy to outer space in the same way: by radiative transfer.

**Text B**

The sun is not an unusual star, either in brilliance or in size. A slowly rotating body of hot (several million degrees Celsius), very dense gas, with a diameter of about 1,400,000 kilometers, it is surrounded by a very tenuous atmosphere that extends several solar diameters from the surface. It generates a tremendous amount of heat, but the earth intercepts very little. Measurements made on the earth indicate that the rate at which energy impinges on a surface perpendicular to the sun's rays at the mean solar-earth distance is about 2.00cal/cm² min. This value is known as the solar constant.

**Exercises**

**Exercise 1. Arrange the words to form a sentence. Translate the sentences into Ukrainian:**

1. varies, lapse, considerably, in time and space;
2. clouds, with, instability, are associated, Cumuliforms;
3. turbulent, strong, flow, rapid, causes;
4. the role, in the atmosphere, is great, of moisture;
5. rotates, an axis, the earth, about;
6. around, the earth, moves, the sun;
7. and varies, the in both hemispheres, the total daily energy received, little,

the poles equator, between, in summer.

**Exercise 2. Answer the following questions:**

1. What does the law of conservation of energy require?

2. What is reflected back to space by the atmosphere, its clouds and the earth's surface?

3. How do transfers of energy between the earth's surface and the atmosphere occur?

4. By means of what physical processes can heat energy be transmitted from one place to another?

5. What do you understand by the term "conduction"?

6. What is meant by the term "convection"?

7. Please explain the term "radiation".

**Exercise 3. Explain the meaning of “as” in the following sentences and translate them:**

1. The movement of water as it relates to the earth is called "the hydrological cycle"

2. The science of meteorology encompasses the behaviour of the weather elements as they occur in the atmosphere and on the surface of the earth and other planets.

3. As rain continues, the earth's surface becomes covered with a film of water.

4. Snow as it falls varies greatly in its water content.

5. There is also some question as to whether the ocean regulates the concentration of carbon dioxide by absorbing any excess.

6. The difficulty with such a fact as an explanation of climatic changes is that different areas would be affected at different times.

7. There was a marked lag between the melting of snow and the appearance of the resulting water as runoff in the streams.

**Exercise 4. Fill in the blanks with appropriate words from the list below and translate the sentences into Ukrainian:**

CLOUDS.... are to be considered as the result of the condensation of ... in the atmosphere. They are known to consist of minute ... particles, or crystals at temperatures well enough below freezing. The principal methods of production have to be classified according to the following...: 1) the direct ascent of ... caused by convection or topography, 2) the gradual ascent of air over a large ..., as in front of the warm sector or a cyclone, 3) the mixing of two unsaturated ... of different temperatures.

***water, ice, clouds, air, cooling processes, area, water vapour, cloud***

**Exercise 5. Give English equivalents for the following:**

Закон збереження енергії, атмосферний тиск зручний спосіб, потік енергії, поглинати; досягати землі, назад у простір, проводимість випарювання, конвекція; тертя; енергія руху, точковий контакт, тепловий обмін, конвективний рух, замкнений ланцюг, прозоре середовище: радіаційний процес, зовнішній простір.

**Exercise 6. Suggest a suitable title for the passage. Express the main idea in Ukrainian:**

The ocean changes extremely little in temperature between day and night as compared with land. Here are five reasons for this:

1) A large amount, about 40% of insolation, which is reflected from the surface and thus lost without heating the water.

2) The remaining 60% of the insolation, which is absorbed, is transmitted to a considerable depth. Thus, it is not a thin surface layer, but a layer of a considerable depth and great mass that is heated.

3) A considerable amount of evaporation takes place from the surface of the ocean.

4) A large amount of heat is required for raising the temperature of a given

quantity of water than of other known substance.

5) The water of the ocean is in continual motion. Thus, again it is not a small surface layer that is heated but considerable amount of water. Therefore the temperature of the ocean rises very little during the day and falls little during the night.

**Exercise 7. Instead of saying: "By weighing the material which is absorbed before and after the measurement, the mass of water vapour in the sample can be determined" We can say: "By weighing the material absorbed before and after the measurement, the mass of water vapour..."**

1. Water vapour, which is normally most abundant near the ground is carried up and diffused.

2. Collection of reports which are needed for a complete analysis requires extensive communication facilities.

3. Winds as flying levels are determined by means of small balloons which are released to float freely in the air.

4. The signals which are sent out by the transmitters are used to track the satellites orbit.

**Exercise 8. Translate into Ukrainian paying attention to the modal verbs:**

1. One cannot doubt the importance of meteorology to the national economy.

2. Further tests are to be made to determine the possibility of using the new method. 3. You should follow all the scientific researches in your field of knowledge.

4. He has to analyse many weather forecasts compiled by students.

5. The laboratory was to make an important experiment in a very short time.

6. Clouds are to be considered as a result of water vapourt in the atmosphere.

7. You might use all the new equipment for your experiment.

8. The importance of climate in the affairs of man cannot be doubted.

9. A whirl or eddy may be as large as a continent (macroscale), the size of a few thunderstorms (mesoscale), or smaller than a city (microscale).

10. In micrometeorology, the scale of interest is limited to a few square kilometers, and the Corioles force can usually be neglected.

11. On cloudless days solar radiation can pass through the atmosphere with little reduction in strength.

12. It is to be noted that the strongest horizontal temperature gradient are in the middle latitudes, corresponding to the region of greatest scope of the tropopause.

13. Clouds consisting of large-sized water drops or ice particles can be viewed by radar to obtain direction and speed motion.

14. The rate of heat loss must exactly balance over a long period of time the amount of heat received from the sun.

15. In the cosmic sense, radiation is the only means of maintaining a complete heat balance, because it is only by radiation that the energy can be transferred through space.

16. Not only must there be a balance between the earth's surface and the incoming radiation, but also a balance must exist that includes the atmosphere.

17. Slight though the absorption of solar radiation might be, it is nevertheless important.

**Exercise 9. Translate Text B in writing:**

## LESSON 6

### Text A SOLAR ENERGY

The radiant energy transmitted by the sun covers a broad range of the electromagnetic spectrum.

What happens to the enormous amount of energy impinging upon the earth in the form of electromagnetic waves? When rays encounter the earth's atmosphere some pass through undisturbed, some are absorbed by the atmosphere, and the rest are turned back.

*Absorption.* Oxygen, ozone, water vapour, carbon dioxide and dust particles are the most significant absorbers of the "short-wave" radiation from the hot sun and

the "long-wave" from the cool earth. The gases are selective absorbers, meaning that they absorb strongly in some wavelength, weakly in others, and hardly at all in still others. The very short ultraviolet radiation of the sun (less than 0.20mm) is absorbed as it encounters and splits molecular oxygen into two atoms in the upper levels of the atmosphere. Ozone formed by the combination of O and O2 effectively absorbs ultraviolet light of longer wavelengths - those between 0.22 and 0.29mm. Absorptivity is the fractional part of incident radiation that is absorbed. Water vapour is significant absorber of radiation. Although not effective in the wavelengths below 0.8m. where most of the solar radiation exists, it absorbs wavelengths at which the cool earth and its atmosphere emit much of their energy. The atmosphere is essentially transparent between 0.3 and 0.8mm. where most of the solar (short-wave) radiation occurs. But between 0.8 and 20mm, where much of terrestrial (long-wave) radiation is emitted, there are several bands of moderate absorptivity by water vapour.

*Scattering.* The atmosphere is composed of many discrete particles space between particles is actually greater than the volume occupied by the particles. Fach particle acts as an obstacle in the pass of radiant energy (e.g. light waves) travelling through the atmosphere. The wave fronts are deformed by these obstacles in a pattern that makes it appear that the rays emanate from the расТОСТ obstacles. Thus, radiant energy propagating in a single direction is dispersed in all directions as it encounters each particle on its path. This dispersion of the energy is called scattering.

*Reflection.* Radiant energy from the sun encounters still another obstacle before it reaches the earth - clouds. Most clouds are very good reflectors but poor absorbers of radiant energy. The reflection by clouds depends primarily on their thickness, but also to some extent on the nature of the cloud particles (i.e. whether ice or water) and the size of these particles. The reflectivity of clouds varies from less than 25 percent to more than 80 percent, depending on the cloud thickness. Clouds absorb very little radiation that strikes them. In general, the earth is a poor reflector of solar radiation.

## Text B SOLAR ENERGY ABSORBED BY EARTH

Although normally 50 percent of the earth's surface is covered by clouds, they are generally poor absorbers of shortwave radiation. Approximately 19 percent is absorbed by the gases and dust of the atmosphere, principally by water vapour. This means that a total of 22 percent is absorbed as the rays traverse the atmosphere.

The earth's surface absorbs about 46 percent of solar radiation; some of it (19 percent) comes directly from the sun, some (22 percent) after reflection by clouds, and the rest (5 percent) after being scattered by the air. The reflectivity of the surface varies, of course. Some fresh snow fields and water surface (when the sun is close to the horizon) reflect 90 percent or more of the incident rays. But percent. a forest may reflect less than 10 percent and green grass fields only 10-15 Thus, of the total energy arriving from the sun approximately absorbed by the earth's surface 68 percent is to space, having and the atmosphere. The rest, 32 percent is lost the particles in been reflected by clouds and the earth's surface or scattered by earth is said, the air. The average reflectivity, "whiteness", or albedo of the therefore, to be 0.32, since that is the fractional part of the incident radiation that is bounced off the earth. The moon's albedo is only about percent, that means it is not nearly as bright as the earth.

### Exercises

**Exercise 1. Give Ukrainian equivalents of the following words and word combinations. Use them in short English sentences of your own:**

Solar energy, to impinge upon the earth, electromagnetic waves, to encounter, absorption, short-wave radiation, selective absorbers, to split into, oxygen, wavelength, moderate absorptivity, incident radiation, water vapour, effective, to be transparent, bands, scattering, to be dispersed, discrete particles, wave front, to propagate, reflection, thickness of clouds, reflectivity.

**Exercise 2. Arrange in pairs of synonyms:**

Enormous, encounter, to pass through, transmit, wide, solar, modei, terrestrial

radiation, shortwave radiation, scatter, absorb, pattern, to take in, disperse, solar radiation, long-wave radiation, radiant, broad, to carry, to travel through, impinge in, huge.

**Exercise 3. Translate the following derivatives into Ukrainian:**

disturb -disturbance - undisturbed

absorb - absorption - absorber - absorptivity - absorbed

disperse - dispersion - dispersed - dispersive

reflection - reflector - reflectivity - reflex

effect - effective – effectively

scatter - scattered – scattering

**Exercise 4. Answer the following questions:**

1. What happens to the radiant energy impinging the earth in the form of electromagnetic waves?

2. What are the most significant absorbers of radiation?

3. What is absorptivity?

4. What is "short-wave" and "long-wave" radiation?

5. What is called scattering?

6. How do discrete particles of the atmosphere act in the pass of radiant energy?

7. What obstacles does radiant energy from the sun encounter before it reaches the earth?

8. Most clouds are good absorbers of radiant energy, aren't they?

9. What does the reflection by clouds depend on?

10.How does the reflectivity of clouds vary?

11.Is the earth a good reflector of solar energy?

**Exercise 5. Fill in the blanks with appropriate words from the list below. Translate the text:**

Insolation, or the sun's... is responsible for the heat of earth's atmosphere. of insolation, which is received by the earth varies about 7... during the year. About 37% of the insolation ... by clouds and earth's surface. Most of the remaining 63% is transmitted by the atmosphere directly to the... A small amount is absorbed by... and.... The extent of... depends upon the amount of water vapour in the atmosphere and varies from time to time at various... Much of the insolation reaching the earth's surface is there absorbed and re- radiated as ... radiation or ... into the atmosphere.

***water vapour, radiant energy, absorption, is reflected, percent, ozone, long-wave radiation, terrestrial, levels, surface, the amount***

**Exercise 6. Translate the sentences into Ukrainian, paying attention to the forms of Subjunctive Mood:**

**A**. 1. He looks as if he were very tired.

2. It is necessary that the type of the reaction be determined.

3. He would come to see us if he had time.

4. I should give you a lot of examples.

5. It is unlikely that they should come in time.

6. It is better to take the bus lest you should be late.

7. However far this place might be, you could get there by bus in an hour.

8. They propose that he should work at their office.

9. There would be no life without water.

10. It is apparent that moisture and temperature distributions that would cause a layer to gain heat are also possible.

11. Slight though the absorption of solar radiation might be, it is nevertheless important.

12. Many insects use the surface of water as if it were a solid surface, moving around on it.

**B.**

1. The absolute zero is the temperature at which an ideal gas would have

zero volume at any finite pressure.

2. It is necessary that atomic energy should be used for industrial purposes.

3. No fuel would burn in an atmosphere deprived of its oxygen.

4. It seems necessary that reliable knowledge of mountain wind patterns be obtained soon.

5. Whether the air motion be upward or downward precipitation elements will always fall with respect to the air and the smaller cloud elements.

6. It is necessary that these processes should take place at the surface of the earth.

7. Frictional drag would be expected to cause some reduction in velocity.

8. The downward flux of moisture would continue until the relative humidity has been lowered to the limited value.

9. It's probably true that clear ice would be encountered only in precipitating clouds or in rain at freezing temperatures.

10. In order to maintain saturation, the advection of warmer air would have to be strong to overcompensate the loss of moisture toward the snow.

**Exercise 7. Translate into Ukrainian without a dictionary. Suggest a suitable title for the passage and express the main idea of the text in Ukrainian:**

The ground receives radiation from the atmosphere and, in daytime, from the sun. The amount of radiation received in daytime is generally larger, than the amount lost. At night when the shortwave radiation from the sun and the scattered sky radiation are absent, the radiation emitted by the ground is as a rule greater than the radiation received from the atmosphere. The difference between the radiation from the ground upward and the radiation received from the atmosphere at the ground is called the net outgoing or nocturnal radiation. The problem of the nocturnal radiation is important for the forecast of minimum temperatures. Nocturnal radiation being strong, the cooling of the ground and the adjacent layers of the air is also considerable. However, nocturnal cooling depends on a number of other factors. The

radiation determined by the cloudiness and the water vapour content of the atmosphere is only one of these factors.

**Exercise 8. Translate into Ukrainian without a dictionary:**

Radiation is the only means by which heat can be transferred through space without the aid of a material medium. In the interplanetary space between the sun and the earth where a relatively minute quantity of matter exists,. radiation appears to be the only important form of heat transfer. A material medium through which the radiation can pass is said to be transparent to the radiation.

## LESSON 7

### TEXT A THE EARTH HEAT BALANCE

Studies indicate that over moderately long periods of time (between hundreds and thousands of years) the mean temperature of the earth is constant. This would indicate that there exists a long-term heat balance between earth and space. It follows then that since 68 percent of solar energy striking the earth is absorbed, an equal amount be reradiated to space. Keep in mind that although there is a heat balance for the planet as a whole, all parts of the earth and its atmosphere are not in radiative balance. In fact, it is the imbalance between incoming and outgoing energy over the earth that leads to the creation of winds systems that act to alleviate the surplus and deficits of heat that would other result. Of special interest in the long-wave energy transfers is that fact that the amount emitted by the earth and the air actually exceed the total solar energy amount retained by the earth (68 per cent). This can be explained in the terms of "blanketing effect" of the atmosphere, which keeps the earth's surface and lower layers of the atmosphere a good deal warmer than they would be without the atmosphere. The gases-water vapour and carbon dioxide play the most important role in keeping the earth warm. Except for the "windows" between about 8x10 and 13x10, these gases block the direct escape of the infrared energy emitted by the earth's surface. Only when the earth's temperature is fairly high does the radiational loss through the transparent bands and from the top of the

atmosphere equal the amount absorbed from the sun. The heat-retaining behaviours of the atmosphere is somewhat analogous to what happens in a greenhouse. In a greenhouse the glass (or more recently, plastic) roof and sides permit the sun's energy to enter and be absorbed by plants and earth, but they prevent much of the interior heat from escaping by blocking mixing of the inside air with that of the outside. The role of moisture in the atmosphere, allowing solar energy to pass through while absorbing much of the earth's long-wave radiation, has thus come to be known as the greenhouse effect.

**Text B 1. DISTRIBUTION OF THE EARTH'S ENERGY**

Although they are the overall income and outgo of radiant energy are essentially in not in balance, they are not in balance everywhere on the earth. This is mainly because the amount if incoming energy varies greatly from place to place. It is also caused to a lesser extent by variations in the intensity of outgoing radiation. The amount of energy emitted by the earth and the atmosphere to space is controlled largely by the amount of moisture in the air, the distribution of solar energy absorbed by the earth's surface is controlled mostly by the earth's movements, the distribution of physical properties of the surface and cloudiness.

The latitudial variations of absorbed solar energy can be easily understood if one bears in mind three facts: 1) the earth is essentially a sphere, 2) the sun is so far away that its rays of light are approximately parallel, and 3) the earth is rotating. Only one half of the sphere can be illuminated at one time, and the angle that the sun's rays make with the sphere's surface will decrease from 90 degrees at the exact centre of the lit hemosphere to 0 degrees at the edges (where the shadow begins).

**2. DISTRIBUTION OF THE EARTH'S ENERGY**

The times of high and low temperature do not coincide with the times of maximum and minimum solar radiation, either on annual or daily basis. The months of January and February are the coldest of the year, while July and August are generally the hottest yet the greatest intensity of radiation occur in June and the

lowest in December. On a daily basis, the highest temperature normally occurs at 2 or 3 p.m., yet the greatest intensity of insolation each day occurs near noon. The earth loses heat continuously through radiation. During some months of the year and some house of the day, the incoming energy exceeds the outgoing energy of the earth. While this is occurring the temperature will be increasing, since the earth's heat content will be rising. The maximum temperature will occur at the time when the incoming energy ceases to exceed the outgoing. When the outgoing energy is greater than the incoming, the temperature will fall until the two are again in balance. At the point where a "surplus" of energy begins to appear, the lowest temperature will have occurred.

## Exercises

**Exercise 1. Study the following words and word combinations. Give their Ukrainian equivalents:**

Heat balance, mean temperature, long-term heat balance, incoming energy. outgoing energy, wind system, to alleviate, surpluses and deficits of heat, longwave energy transfer, total solar energy amount, to exceed, "windows" of water vapour, direct escape of energy, plastic roof, radiational loss, transparent bands, heat retaining behaviour, to be analogous to, "greenhouse effect", interior heat. outside air.

**Exercise 2. Arrange in pairs of antonyms:**

Surplus, inside, low, interior, long-term, to cool, balance, minor, high, incoming energy, deficits, to block, exterior, to heat, outside, imbalance, to diminish, short-term, outcoming energy, to give away, to exceed, total.

**Exercise 3. Give other words of the same root and state what parts of speech they are:**

Global dense, gradually, to measure, to move, equal effect, to radiate, to classify, to define, experimental, various, to use, deep, mainly, to relate, to evaporate, actual, to symbolise, to direct, to mix.

**Exercise 4. Read Text A carefully and answer the following questions:**

1. Does there exist a short-term heat balance between earth and space?

2. What processes lead to the creation of wind system?

3. What do wind systems alleviate?

4. What is the essence of "blanketing" effect in the atmosphere?

5. What do water vapour and carbon dioxide in keeping the earth warm?

6. What are the "windows" of water vapour and carbon dioxide?

7. When does the radiational loss through the transparent bands of the atmosphere equal the amount absorbed from the sun?

8. Why to the heat-retaining behaviour of the atmosphere said to be analogous to what happens in a greenhouse?

9. What is known as the "greenhouse effect"?

**Exercise 5. Read you have and translate found in it: the text without a dictionary.**

Say what new information The "greenhouse effect" is quite noticeable when one compares the rapid temperature fall at night in the desert, where the air is dry, with the slower decrease in temperature in coastal regions, where the air is moist. On a global basis, the effectiveness of the atmospheric "greenhouse" is illustrated by the fact that the mean air temperature is only about -20°. Venus's greenhouse effect is even more dramatic. Its radiative temperature is about 30°, but its surface temperature is estimated to be more than 450°C.

**Exercise 6. Translate the sentences into Ukrainian, paying attention to the meaning of "but", "for", "since", "as":**

1. Since radio-waves are of the same nature as solar radiation, they spread out in straight lines from their source.

2. A record was made at the depth of snow fall since the observation. 3. We had watched our barometer falling gradually for several days.

4. The study of clouds is one of the most popular phases of meteorology, for it is a subject in which everyone is more or less interested.

5. Heat is defined as the total energy of molecular motion within a body.

6. Paradoxical as it may seem, it is not the sun that heats the air, but the earth.

7. The barometer falls as a cyclone approaches.

8. On account of the small variation of temperature between winter and summer in the West Indies, the seasons are known as dry and wet, not hot and cold.

9. New York Harbour is not only the important seaport of the United States, but also one of the greatest commercial centers of the world. 10.Day after day we could hear nothing but the wind and noise of the water.

**Exercise 7. Translate the different types of conditional sentences. Pay attention to the conjunctions, introducing English conditional clauses:**

**A**. 1. I shall not go out tomorrow, if the weather is bad.

2. I could do this work in case I got the necessary tools.

3. They would have stayed in town, unless the weather had been warm.

4. He will come to see you, provided he knows your address.

5. Had they seen you yesterday, they would have certainly told you about our plans.

6. Were it not for your help, he would not finish the work.

7. But for your advice, I should have acted differently.

**B**. 1. If the dew point passed, condensation would begin.

2. Were it not for the protective ozone layers, life upon the earth might have been impossible.

3. Were the vapour cooled below its dew point, some of it would become liquid.

4. Had the air contained only very small dust particles, condensation would have been delayed.

5. If the vertical extent of the clouds is rather limited, very little activity may

be expected.

6. If the air is not saturated, its wet-bulb temperature will be lower than the air temperature.

7. Invisible water vapour may become visible provided it is transformed into clouds, rain, hail, snow, sleet, dew or frost.

8. The vertical movements of the atmosphere usually pass unnoticed by most people, unless those movements are specially vigorous.

**Exercise 8. Make up sentences according to the following table:**

| | | |
|---|---|---|
| | - the bad weather | we could have gone to Warsaw by air |
| ***But for*** | - his visit | they would not have been delayed |
| | - His beign so angry | I should have done this work in time |
| | - The rush-hour | he would not have behaved so awfully |

**Exercise 9. Translate without a dictionary:**

1. If the outgoing terrestrial radiation were greater than the incoming solar radiation, the earth would become progressively colder.

2. If the atmosphere were totally transparent to the terrestrial radiation, the heat would go directly out into space, uninfluenced by the presence of the atmosphere.

3. The hair hygrometer or hygrograph is far from being a satisfactory instrument because it is reliable only if calibrated frequently and carefully.

4. If covered with a piece of tight-fitting muslin-cloth, an ordinary liquid-in-glass thermometer bulb becomes a wetbulb thermometer; for, if the cloth-covered bulb is wetted with pure water and the thermometer is properly ventilated, the temperature reading will decrease to a certain point at which it remain until all the water is evaporated.

**Exercise 10. Read and translate Text B in writing. Say the main idea of each paragraph and write an abstract.**

## LESSON 8

### TEXT A SCALES OF MOTION

Temperature the differences produce the basic force that drives the winds. frictional drag picture of the air flow is made complex by the earth's rotation, character of and turbulence, mountain obstacles and the extremely variable the earth's surface and incessant changes of the state of water in the within air. To simplify eddies" the analysis of the enormously complex patterns of "the eddies that exist in the atmosphere, it is convenient to categorize circulation systems according to size. Almost every size is represented in the atmosphere - everything from small whirls that kick up the dust on a road to enormous oscillation, that have horizontal dimensions of several thousand kilometers. All of these different sizes or scales of motion, as they are called are interdependent. - Actually, most routine meteorological measurements a are made in such way that very small eddies are eliminated. Most anemometers do not react to small, high-frequency changes. Observations are so widely spaced in time and area that most must be considered average over horizontal distance of tens of kilometers and vertical distances of tens of meters. The scales of atmospheric motions can be classified as follows:

| Typical Horizontal Dimensions | Description |
|---|---|
| A few centimeters to a few kilometers (microscale) | Small high-frequency eddies, often referred to as turbulence, that are strongly influenced by local conditions such as terrain roughness and temperature. Their lifespan is usually less than a few minutes. Very significant as diffusers of pollutants in the air. Coriolis force is generally not important. |

| | |
|---|---|
| 1 – 100 km (mesoscale) | Small convective cells that persist for many minutes or hours, such as the land-sea breeze, mountain-valley breeze, tornadoes, thunderstorms. Coriolis force is generally not important. |
| Hundreds to several thousands of kilometers (macroscale) | The cyclones and anticyclones that are largely responsible for the day-to-day weather changes. Such systems persist for days or even weeks. Coriolis force is very significant. |
| Few thousand to 10,000 km (large macroscale) | Features of the atmospheric circulation that persist for weeks or months. Long waves that exist in this flow move very slowly or not at all across the earth. These play an important role in the characteristics of weather over periods of a month or more. Coriolis force is very important. |

## Text B THE GENERAL CIRCULATION

The general circulation of the atmosphere is the average flow of air over the entire globe. It is determined by averaging wind observations over long periods of time - usually twenty years or more. In order to isolate the seasonal variation of the general circulation induced by the earth's revolution about the sun, the averaging is sometimes done separately for each season of the year. The picture of the general circulation can be simplified somewhat by averaging the observed winds along each latitude, thus eliminating the longitudial variations. The horizontal flow of the earth's surface is shown in the center of the diagram; the net meridional circulation at the

surface and aloft is depicted around the periphery. Within the equatorial region are the doldrums, a belt of weak horizontal pressure gradient and consequent light and variable winds. Here, also, is the region of maximum solar heating, and the surface air rises and flows both northward and southward toward the poles. This poleward flow at high levels is acted upon by the Carioles force, turning the right in the Norther Hemisphere and to the left in the Southern Hemisphere. Thus, in both hemispheres, the poleward flowing air becomes a west wind and at an average latitude at about 30 degrees, reaches a maximum speed which may exceed 100 mi/hr. These are the jet streams.

At about 30 degrees north and south latitudes, some of the air descends again toward the surface. This is the region of the *horse latitudes*.

Between the doldrums and the horse latitudes are wide belts where a portion of the previously equatorial air returns again to the tropics. These are the remarkably persistent *trade winds*.

From the horse latitudes, some of the descending air moves poleward as flow is deflected by the Coriolis force and the winds have a westerly component. These are the *prevailing westerlies*.

Poleward of the polar front are the *polar easterlies*. These winds bring the cold and antarctic air from the polar regions towards the polar front, where they are warmed by their equatorial movement.

From this description of the general circulation of the atmosphere, we see that there are two primary zones of rising air — in the tropics and in the region of the polar front. It is here that the principal areas of precipitation are found.

## Exercises

**Exercise 1. Study the following words and word combinations. Give their Ukrainian equivalents:**

Temperature differences, air flow, earth's rotation, frictional drag, turbulence, mountain obstacles, incessant changes, eddy, to be represented, circulation systems, small whirls, enormous oscillations, dimension, scales of motion, to be

interdependent, to eliminate, high-frequency changes, to be spaced in time and area, terrain roughness, pollutants, Carioles force, connective cells. land sea breeze, mountain-valley breeze.

**Exercise 2. Translate the words and their derivatives:**

Sun - sunny day - solar system

water - watery dish - aqueous vapour

moon - moonlight-lunar halo

sea–seawater-maritimeair

earth - earthly colour - terrestrial globe

year - yearly income - annual variations of temperature

sky - sky-blue - celestial map

day - daily newspaper - diurnal variations of humidity

star - starry eyes - interstellar space

**Exercise 3. Find the equivalents in the text to the following:**

Temperature variations, model, air system, eddies, unceased changes, in fact, to neglect, day-to-day observations, to be influenced by, impurities, to cause, ground, to last for, huge.

**Exercise 4. Read Text A carefully and answer the following questions:**

1. What do temperature differences produce?
2. What makes the picture of the air flow complex?
3. What is done to simplify the analysis of the enormously complex patterns of circulation systems?
4. Are all scales of motion interdependent?
5. What kind of eddies may be eliminated in most routine meteorological observations?
6. How can the scales of atmospheric motion be classified?
7. What is a microscale?

8. What atmospheric phenomena may be referred to as a mesoscale?
9. What are the most characteristic features of cyclones and anticyclones?
10. What is characteristic of a large macroscale?

**Exercise 5. Translate the sentences. Explain the meaning and function of the underlined words:**

1. Tsiolkovsky **provided** a scientific basis for interplanetary travel.
2. The meteorologist **provided** the crew with necessary information.
3. **Provided** there is time enough, we shall radio the news.
4. Thick snow covered the surface of the ground.
5. **Surface** winds may be observed without any instruments.
6. **Rainfall** is the result of condensation. Sublimation results in ice formation.
7. Condensation nuclei such as dust particles in the air result from air being **polluted** by local industrial sources of pollution.
8. **As a result** of observation and exchange of data many a gap on the weather map has been filled.
9. There are definite weather **patterns** recognised by meteorologists.
10. Artists **pattern** cloth.

**Exercise 6. Read and translate the passage into Ukrainian without a dictionary. Express the main idea of the text:**

**Large, essentially horizontal eddies** are important in producing an exchange of air between the polar regions and the tropics. These large whirls are most active in the middle latitudes, where they are the chief weather producers. Periodically, these wave cyclones develop along the boundary between warm and cool streams of air, later sucking streams of air toward their centres. The prognosis of the formation and development of these cyclones is one of the principal tasks of the short range

forecast in the polar and temperature regions of the earth. Two concepts are important in the explanation of these enormous storms: air masses and fronts. An air mass is a huge body of air, extending over thousands of kilometers, within which the temperature and humidity change gradually in the horizontal. Air masses are classified according to their source region — polar or tropical, maritime or continental.

**Exercise 7. Translate the sentences. Pay attention to the function of "would" and "should":**

**A.**

1. We decided that we should make our experiments out of doors.
2. This probably should be classified as advection-radiation fog.
3. The student should be careful to distinguish between the words "weather" and "climate".
4. In order to obtain the true temperature of the air it is necessary that reliable thermometers should be employed and that they should be properly and read.
5. Ice formation should be observed mainly in ascending air.
6. The weather officer has demanded that all the instruments should be inspected regularly.
7. Wind measurements should not be taken close to mountains or valleys.

**B.**

1. The weather bureau reported that it would rain next day.
2. No forecaster would be accurate without the correct observation and interpretation of cloud forms.
3. If the rain stopped, they would continue their observations.
4. I would like to say that the scientific work of the expedition was successful.
5. The world-wide system of winds would not exist without the transfer of heat.
6. If you had made more experiments, you would have obtained all the

necessary data.

7. Any decrease of wind velocity in the evening would cause rapid decrease of turbulence.

**Exercise 8. Translate the sentences:**

1. The view was wonderful. If I'd had a camera I would have taken some photographs.
2. If we'd had more time, we would have prepared a more interesting report.
3. If he had been looking where he was going, he wouldn't have walked into a wall.
4. The students wouldn't have got bad marks in geography if they had revised.
5. If she hadn't failed one of her final exams she wouldn't have had to spend part of the summer in college.
6. The first motorways would never have been built if more people had been concerned about pollution in the 1960s.
7. If people had realized that smoking was dangerous when they were young they wouldn't be having serious health problem now.
8. The seeds wouldn't have died if the schoolchildren had remembered to water them.
9. Many unique plants and animals wouldn't have become extinct, if people hadn't cut down rainforests.
10. I would be able to concentrate if I had gone to bed earlier.

**Exercise 9. Translate the sentences with "I wish":**

1. I wish I had a camera. The view was spectacular!
2. The weather was cold while we were away. I wish it had been warmer.
3. I wish I had studied science instead of languages.
4. I feel sick. I wish I hadn't eaten so much cake.
5. I have failed the exam. I wish I hadn't watched TV too much before the

exam.

6. I was late for classes again. I wish I hadn't been so slow in the morning.
7. I wish I hadn't painted the door red. It doesn't look very nice.
8. I wish I hadn't sold my car. I could give it my son.
9. It was a difficult question. I wish I had known the answer.
10. We didn't have time to see all around in London last year. I wish we'd had more time.

**Exercise 10. Translate Text B in writing.**

## ІНОЗЕМНІ ЗАПОЗИЧЕННЯ

Деякі іменники, запозичені з латинської та грецької мов, зберігають свої форми множини.

**is [ ] → es [ ]**

| | | | |
|---|---|---|---|
| analysis | analyses | аналіз | аналізи |
| axis | axes | вісь | вісі |
| basis | bases | основа | основи |
| crisis | crises | криза | кризи |
| phasis | Phases | фаза | Фази |

**us [] → i [ ]**
**us []→ a [ ]**

| | | | |
|---|---|---|---|
| locus | loci | місцезнаходження | місцезнаходження |
| focus | foci | фокус, центр | фокуси, центри |
| radius | radii | радіус | радіуси |
| nucleus | nuclei | ядро | ядра |
| stimulus | stimuli | вплив, стимул | впливи, стимули |
| genus | genera | рід, сорт | роди, сорти |

**on,um → a [ ]**

| | | | |
|---|---|---|---|
| phenomenon | phenomena | явище | явища |
| criterion | criteria | критерій | критерії |

| | | | |
|---|---|---|---|
| datum | data | дані величина | дані величини |
| stratum | strata | шар | шари |
| maximum | maxima | максимум | максимуми |
| minimum | minima | мінімум | мінімуми |
| equilibrium | equilibria | рівновага | рівноваги |

**a → [ ]**

| | | | |
|---|---|---|---|
| formula | formulae | формула | формули |
| nebula | nebulae | туманність | туманності |
| corona | coronae | корона | корони |

Іменники, які мають одну форму однини та множини

| | | | |
|---|---|---|---|
| species | species | вид | види |
| series | series | серія, ряд | серії, ряди |
| facies | facies | фасція | фасції |
| means | means | засіб, спосіб | засоби, способи |

**Література**

1. Antonov V. Short Course of General Meteorology. Чернівці, „Рута”, 2004, - 335 с.
2. Voronov H., Protsenko H. Fundamentals of Meteorology. P.I. – ВПЦ „Київський університет”, 2002, - 160 с.
3. Voronov H., Palamarchuk L., Protsenko H. Fundamentals of Meteorology. P.II. – ВПЦ „Київський університет”, 2004, - 143 с.
4. PAarne Vesisind, J.Jeffrey Peirce, Ruth F.Weiner. Environmental engineering. Butterworth-Heinemann. Boston, London, Oxford, Sydney, 1994