LIFEPAC®

SCIENCE

STUDENT BOOK

7th Grade | Unit 5

Alpha Omega
PUBLICATIONS

SCIENCE 705

The Atmosphere

LIFEPAC Test is located in the center of the booklet. Please remove before starting the unit.

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The Atmosphere

Introduction

Genesis tells how God created the heavens and the earth. The Bible does not give a detailed description of Creation. God has allowed man to investigate His creation to gain a better understanding of it. Through this understanding, man should see the power and divine nature of God (Romans 1:20). We can not fully appreciate God's creation unless we see God as He really is.

For study, the earth can be divided into the *lithosphere*, the *hydrosphere*, and the *atmosphere*. The solid part of the earth is called the *lithosphere*. Covering a large part of the lithosphere are oceans which make up the *hydrosphere*. Above the earth is an ocean of air called the *atmosphere*. We live at the boundary between the atmosphere and the lithosphere.

In this LIFEPAC® you will study the structure of the atmosphere. You will also study the natural cycles which affect the composition of the atmosphere. Finally you will see how man's activities are upsetting the delicate balance of nature.

Objectives

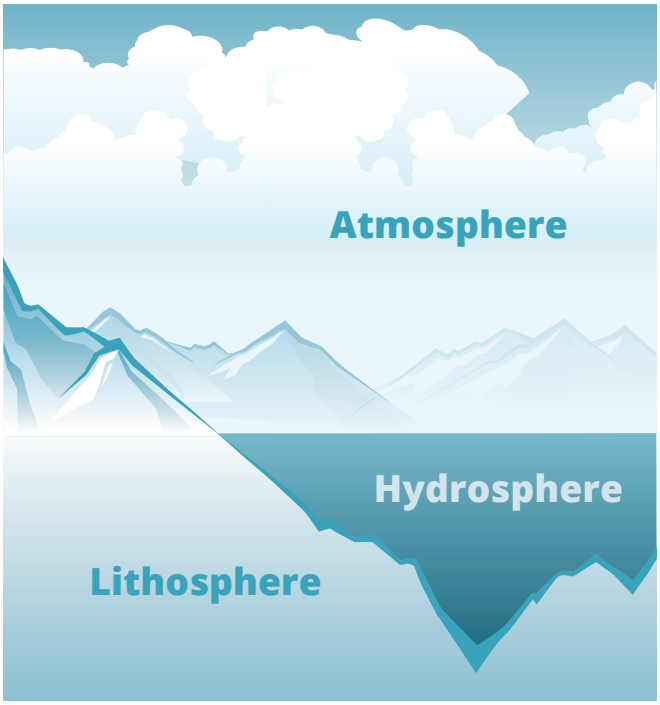
Read these objectives. The objectives tell you what you will be able to do when you have successfully completed this LIFEPAC. When you have finished this LIFEPAC, you should be able to:

1. Name the constant and variable gases and their percentages.
2. Name the layers of the atmosphere and some characteristics of each.
3. Describe the effects that the atmosphere has on solar radiation.
4. Tell how the atmosphere makes life possible.
5. Tell how the atmosphere has changed.
6. Describe the water cycle.
7. Describe the carbon-oxygen cycle.
8. Describe the nitrogen cycle.
9. Name the different air pollutants and their sources.
10. Describe some of the effects pollutants have on life.
11. State God's commands and explain how they should affect man's decisions about pollution.

Survey the LIFEPAC. Ask yourself some questions about this study and write your questions here.

1. STRUCTURE OF THE ATMOSPHERE

The atmosphere is important to every living thing. To understand why it is important, we must learn more about it. At first, all parts of the atmosphere appear to be the same. A closer look reveals that the atmosphere is a complex structure that has changed through time. Many inventions have been necessary to enable man to take this closer look. He had to build complicated instruments, airplanes, rockets, and satellites. The information he gathered slowly changed his view of the atmosphere. It no longer seemed the same from one part to another. As the data were put together, they revealed that the atmosphere was made up of many layers of different gases which affect the sunlight and life.



| Figure 1

SECTION OBJECTIVES

Review these objectives. When you have completed this section, you should be able to:

1. Name the constant and variable gases and their percentages.
2. Name the layers of the atmosphere and some characteristics of each.
3. Describe the effects that the atmosphere has on solar radiation.
4. Tell how the atmosphere makes life possible.
5. Tell how the atmosphere has changed.

VOCABULARY

Study these words to enhance your learning success in this section.

aurora (ô rôr´u). Streamers or bands of light appearing in the sky at night, especially in polar regions.

greenhouse effect (gren hous u fekt). Process by which the atmosphere traps heat given off by the earth after having been heated by the sun.

ion (ī´on). An electrically charged atom.

ionosphere (i on´u sfir). The layer of atmosphere containing ions; above the stratosphere.

mesosphere (mes´u sfir). The layer of the atmosphere just above the stratosphere.

meteorite (mē´ tē u rīt). Mass of stone or metal that has passed through the atmosphere and has struck the earth's surface.

meteoroid (mē´tē u roid). Mass of stone or metal traveling through space.

ozone (ō´zōn). A form of oxygen having three atoms of oxygen to a molecule.

ozonosphere (ō´zon u sfir). A region in the upper stratosphere where ozone is concentrated.

photosynthesis (fō tu sin´thu sis). The process by which green plants use chlorophyll and energy from sunlight to manufacture food from carbon dioxide.

pollution (pu lū´ shun). Waste substances added to the environment.

respiration (res pu rā´shun). The process by which oxygen combines with food to release energy and carbon dioxide.

scattering (skat´ur ing). The bending of light rays in all directions by gas molecules.

spectrum (spek´trum). A broad range of related waves.

stratosphere (strat´u sfir). The layer of the atmosphere just above the troposphere where the temperature remains fairly constant.

thermosphere (thėr´mu sfir). The layer of the atmosphere above the mesosphere where temperatures are the highest in the atmosphere.

troposphere (trō´pu sfir). The layer of the atmosphere nearest the earth in which most weather changes occur.

Note: *All vocabulary words in this LIFEPAC appear in* **boldface** *print the first time they are used. If you are not sure of the meaning when you are reading, study the definitions given.*

Pronunciation Key: h**a**t, **ā**ge, c**ă**re, f**ä**r; l**e**t, **ē**qual, t**ė**rm; **i**t, **ī**ce; h**o**t, **ō**pen, **ô**rder; **oi**l; **ou**t; c**u**p, p**u**t, r**ü**le; **ch**ild; lo**ng**; **th**in; /*ŦH*/ for **th**en; /*zh*/ for mea**s**ure; /*u*/ represents /*a*/ in **a**bout, /*e*/ in tak**e**n, /*i*/ in penc**i**l, /*o*/ in lem**o**n, and /*u*/ in circ**u**s.

GASES

The air of the earth's atmosphere is a mixture of many gases. These gases are held in place by the earth's gravity. The gases at the bottom of the atmosphere are compressed. Fifty percent of the total mass of the atmosphere lies within 5.6 kilometers of the earth's surface. The remaining half of the atmosphere extends up for hundreds of kilometers but gets increasingly thinner. The atmosphere has a constant composition of some gases. Other gases are present in varying amounts.

Constant gases. If a sample of dried air is analyzed, we would find two main gases. Nitrogen would make up 78 percent of the sample; oxygen would make up 21 percent. Most of the remaining 1 percent would be argon and carbon dioxide. Figure 2 lists other gases that are found in trace amounts.

Variable gases. Some gases not listed in Figure 2 are found in varying amounts. Water vapor is by far the most important variable gas in the atmosphere. Water vapor can account for as much as 3 percent of the total volume of very moist air. In very dry air, water vapor may take up as little as 0.1 percent.

Another variable gas is **ozone** (O_3). It is an uncommon form of oxygen (O_2), rarely found in the lower atmosphere. Between 30 and 60 km in the atmosphere, the percentage of ozone is relatively high; therefore, this region is called the **ozonosphere**. An ozone molecule has *three* oxygen atoms. An oxygen molecule consists

of only *two* atoms. Ultraviolet rays act upon oxygen molecules to form the ozone layer. The ozone layer then acts as a shield to protect the earth from most of the sun's ultraviolet rays.

GAS	SYMBOL OR FORMULA	PERCENT BY VOLUME
Nitrogen	N_2	78.084
Oxygen	O_2	20.946
Argon	Ar	0.934
Carbon dioxide	CO_2	0.033
Neon	Ne	0.00182
Helium	He	0.00053
Methane	CH_4	0.00015
Krypton	Kr	0.00012
Xenon	Xe	0.00009
Hydrogen	H_2	0.00005
Nitrous oxide	N_2O	0.00005

Figure 2 | Gases in Pure Dry Air

Answer these questions.

1.1 What percent of the atmosphere is above 5.6 kilometers? _____

1.2 What is the most abundant gas in the atmosphere? _____

1.3 What is the second most abundant gas in the atmosphere? _____

1.4 Which variable gas is most important? _____

1.5 What is the difference between oxygen and ozone? _____

_____

1.6 Where is most of the ozone found? _____

1.7 What is the ozonosphere? _____

LAYERS

The atmosphere is divided into layers. The significant difference between the layers is the *temperature.* Except for the upper layers, the mixture of gases is relatively uniform.

The five layers are:

- **troposphere**,
- **stratosphere**,
- **mesosphere**,
- **thermosphere**, and
- **ionosphere**.

Troposphere. The layer closest to the earth is the troposphere. It extends from the earth's surface to an average height of ten kilometers (7 miles). The upper boundary of the troposphere, the tropopause, is higher above the equator than it is above the poles. The temperature within the troposphere decreases with height to about -55°C (-70°F).

The troposphere is warmed by the warm surface of the earth. Air near the bottom is the warmest. As warm air rises, cooler air sinks to replace it. This tendency to overturn gives the lower layer the name *troposphere—sphere of overturning.* (*Tropo* is Greek for *turn*.) Almost all weather and clouds occur in this layer.

Stratosphere. The second layer, the stratosphere, extends from the tropopause to a height of 50 kilometers (30 miles). In the lower part of the stratosphere, temperatures remain constant. Temperatures rise steadily in the upper part to about 70°C (150°F). The air is warmed directly by absorption of radiation in the ozonosphere, which is the upper part of the stratosphere.

The stratosphere is a stable layer. Little vertical air movement is possible because cold, heavy air is on the bottom. This layer is characterized by strong, steady winds and few sudden changes in weather.

Mesosphere. Above the stratosphere is a layer called the mesosphere. The upper boundary is at about the 80-kilometer (50-mile) level. Temperatures decrease steadily until they are the lowest anywhere in the atmosphere, -90°C(-130°F). Like the troposphere, the mesosphere is heated from below. The ozone layer provides the heat.

Thermosphere. The atmosphere above the mesosphere differs from the lower layers in two main ways. *First,* the gas mixture is replaced by layers of single gases. Gravity separates the gases so that the heaviest are at the bottom and the lightest are on top. The lowest layer is nitrogen molecules; the next, oxygen atoms; the next, helium atoms; and finally, the lightest gas, hydrogen atoms. A *second* difference is temperature. Within the thermosphere, temperatures increase with height and may exceed 2,000°C (3,600°F). Air in this layer is heated by direct radiation from the sun but is so thin that temperature as we know it is meaningless. Objects passing through the thermosphere are only slightly warmed.

Ionosphere. Cutting across all of the thermosphere is another layer, the ionosphere. It is not a separate region as the other layers. Powerful radiation from the sun is absorbed by

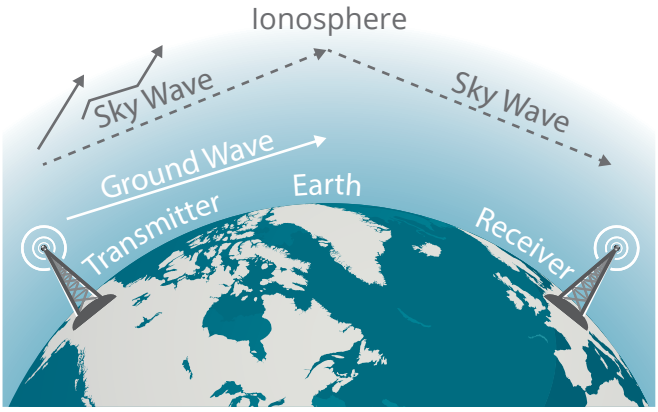


Figure 4 | Reflection of Radio Waves

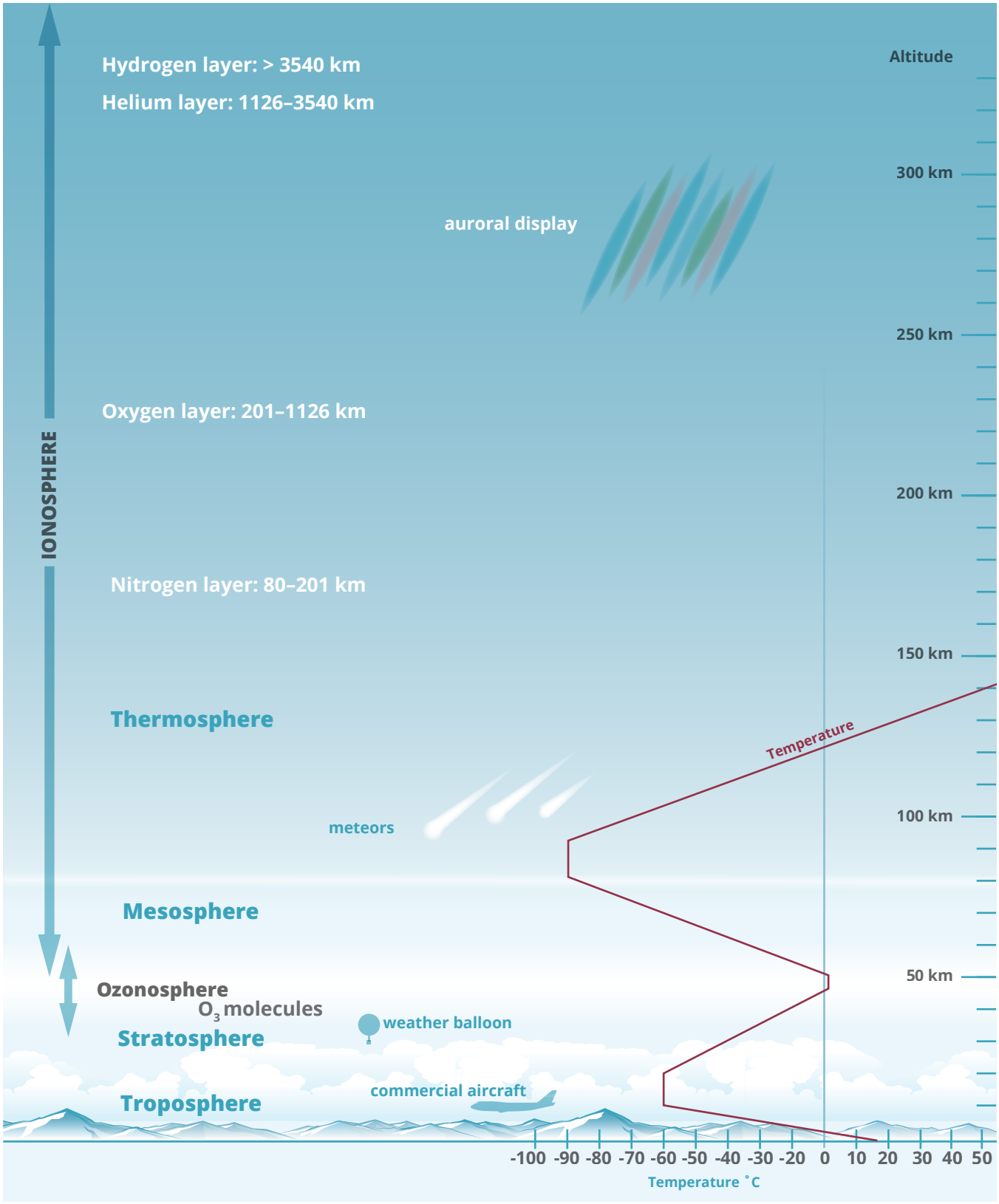


Figure 3 | The Atmosphere

nitrogen and oxygen. This action produces the high temperatures of the thermosphere and the **auroras** (northern and southern lights). In the process, electrons are given up by the molecules and atoms. Positively charged **ions** that are formed give this region an electrical charge.

This layer plays an important part in the transmission of radio waves. Radio waves traveling in straight lines would be lost to space if they were not reflected by the ionosphere. The curvature of the earth would limit reception from 80 to 100 kilometers.

Complete these activities.

1.8 The major factor that changes from one layer to another is _____ .

1.9 Most weather occurs in the _____ .

1.10 The ozonosphere is located in the upper part of the _____ .

1.11 The layer of the atmosphere that has the coldest temperatures is the _____ .

1.12 The hottest temperatures are found in the _____ .

1.13 The part of the atmosphere that includes all of the thermosphere is the _____ .

Match these items. Write the letter of the change that occurs in the temperature of each layer, from the bottom of the layer to the top.

1.14	_____	troposphere	a. increases
1.15	_____	lower stratosphere	b. decreases
1.16	_____	upper stratosphere	c. stays the same
1.17	_____	mesosphere	
1.18	_____	thermosphere	

Answer these questions.

1.19 What is the meaning of the word *troposphere*? _____

1.20 Which layer varies in thickness from the equator to the poles? _____

1.21 Why does air not move vertically in the stratosphere? _____

_____

1.22 How is the arrangement of gases in the lower layers (troposphere, stratosphere, and mesosphere) different from the arrangement in the thermosphere? _____

_____

_____

Match these items. Write the letter indicating the way each of the layers is warmed.

1.23 _____ troposphere
1.24 _____ stratosphere
1.25 _____ mesosphere
1.26 _____ thermosphere

a. by the earth
b. by the ozonosphere
c. by direct absorption of radiation

Answer these questions.

1.27 In what way is the troposphere and mesosphere the same? _____

_____

1.28 Why are the gases in the thermosphere arranged in particular order? _____

_____

1.29 Why is the extremely high temperature of the thermosphere meaningless? _____

_____

_____

1.30 a. How is the ionosphere formed? _____

_____

b. Why is it important? _____

_____

SOLAR EFFECTS

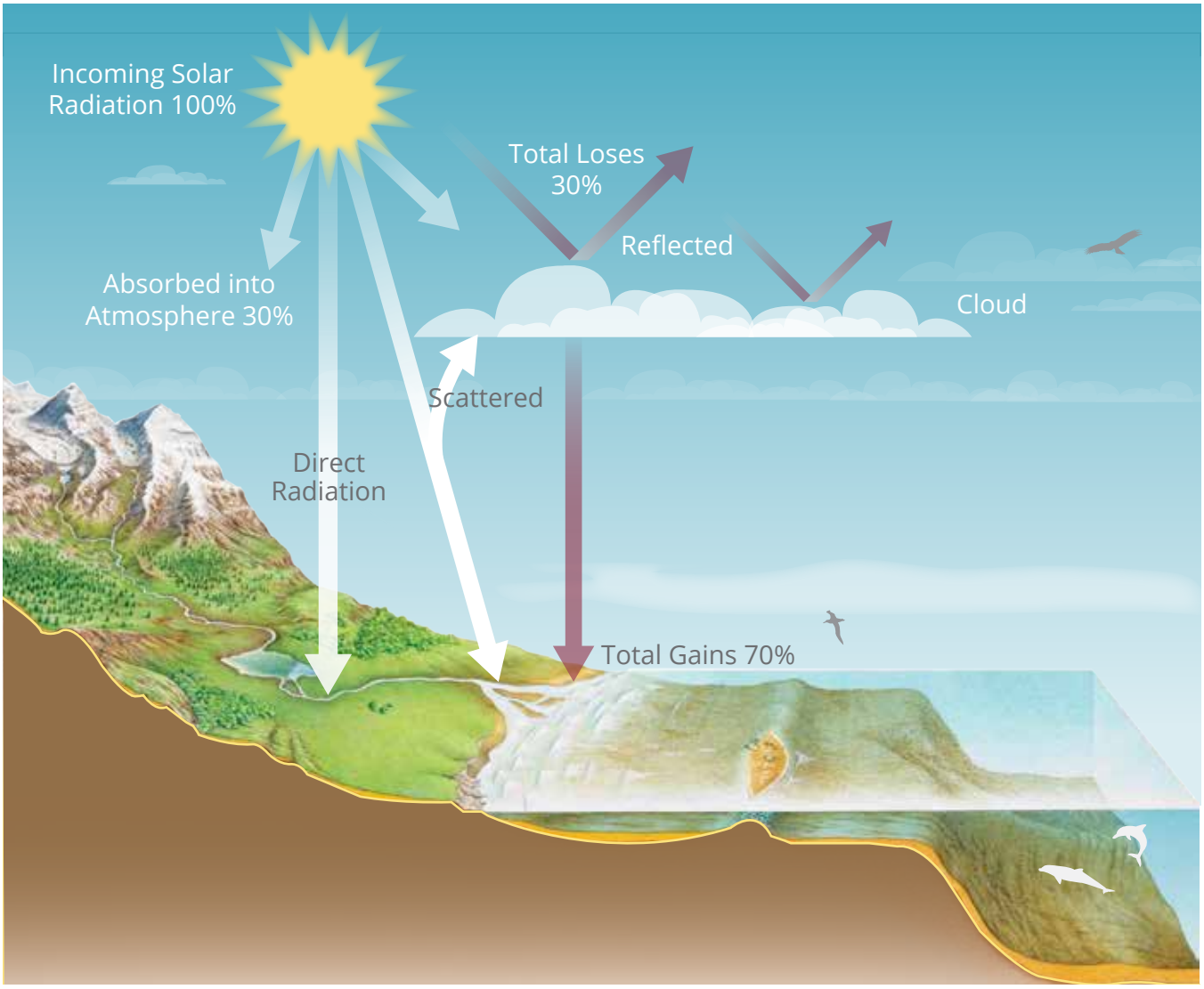
The sun is our most important source of heat. Only a small fraction of the energy released by the sun reaches the earth's atmosphere. The **spectrum** of solar radiation is shown in Figure 5. Visible light forms only a small part of the entire spectrum. Incoming solar radiation is selectively absorbed and reflected to warm the earth and atmosphere and to maintain a temperature friendly to life.

Figure 5 | Solar Spectrum

Incoming radiation. Our atmosphere and clouds reflect about 30 percent of the incoming solar radiation. The remaining 70 percent is responsible for warming the earth and atmosphere. About 30 percent of the total incoming radiation is absorbed directly by the atmosphere. The ozonosphere and ionosphere are responsible for most of this absorption of radiation. The remaining 40 percent of the total solar radiation reaches the surface of the earth. As the solar radiation penetrates the lower layers where air is more dense, some **scattering** occurs. Scattering is the bending of light rays in all directions by gas molecules. Some light rays are lost back to space. Since blue light is most affected by scattering, the sky appears blue.

Energy released by a very hot object like the sun is in the form of *short*-wave radiation. Land and water can absorb this form of radiation far better than can the atmosphere. As a result the earth's surface is warmed. Since the earth is a warm object it, too, re-leases energy. Ground radiation is of the *long*-wave form because the earth is cooler than the sun.

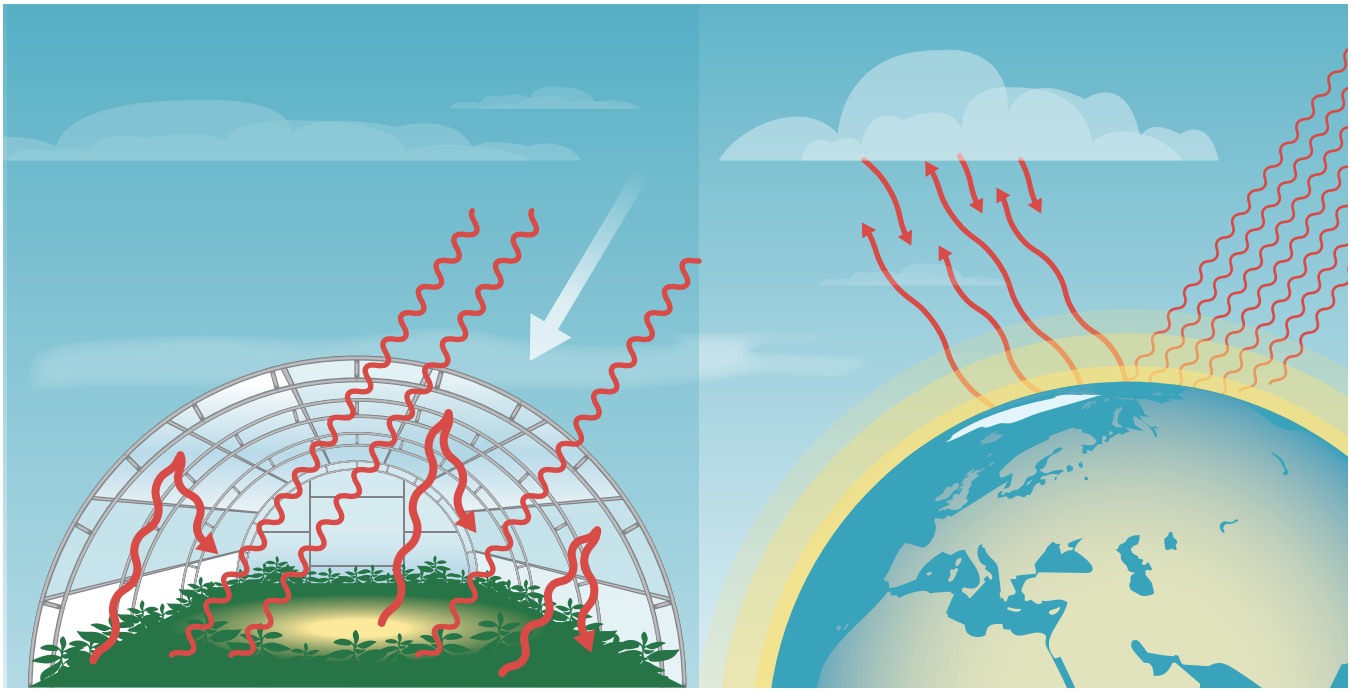
Greenhouse effect. Long-wave radiation given off by the warm earth is absorbed by water



| Figure 6

vapor and carbon dioxide in the atmosphere. The trapping of ground radiation (heat) by the earth's atmosphere is called the **greenhouse effect**. In a greenhouse, glass takes the place of the water vapor and carbon dioxide. The sun's short-wave rays pass through the glass roof, but the glass will not permit the long waves to escape. As an example of the atmosphere's greenhouse effect, the temperature does not drop as much on a cloudy night as it does on a clear night. A cloud has the same effect as glass.

Radiation balance. Scientists have made many measurements of the radiation reaching the earth's surface. The exact amount of heat absorbed by the atmosphere and the earth varies from place to place and from time to time. The data gathered over many years show that the earth as a whole is neither gaining nor losing heat. This means that the amount of radiation absorbed by the earth and the amount of heat lost to space are equal. Loss of heat energy is greater at night than during the day. At the equator, more energy is gained than lost. In contrast, at the poles, more energy is lost than gained.



| Figure 7

Complete these sentences.

1.31 Most of the heat energy received by the earth comes from the _____ .

1.32 The percent of incoming radiation that is reflected is a. _____ percent. The remaining energy warms the atmosphere and the earth's surface: b. _____ percent warms the atmosphere directly and c. _____ percent reaches the earth's surface.

1.33 Most of the incoming radiation absorbed by the atmosphere is absorbed by the a. _____ and b. _____ (layers).

1.34 The type of radiation absorbed by land and water is _____ .

1.35 Gases that absorb long-wave radiation are a. _____ and b. _____ .

1.36 Long-wave heat radiation is given off by the _____ when it absorbs short-wave radiation.

1.37 More energy is lost than is gained during the _____ (day, night).

1.38 More energy is gained than lost at the a. _____ while more energy is lost than gained at the b. _____ (poles, equator).

Answer these questions.

1.39 What is *scattering*? _____

_____

1.40 What causes the sky to be blue? _____

1.41 How is radiation from the sun different from that of the earth? _____

_____

1.42 What is the *greenhouse effect*? _____

_____

_____

1.43 What is *radiation balance*? _____

_____

Try this experiment to demonstrate the greenhouse effect.

These supplies are needed:

- two shoe boxes
- sheet of clear plastic *or* pane of glass
- two thermometers
- watch *or* stop watch

View 705 The Greenhouse Effect, from the Grade 7 SCIENCE EXPERIMENTS Video.

Follow these directions and answer the questions. Put a check in the box when each step is completed.

- ☐ 1. Place a thermometer in the bottom of each shoe box.
- ☐ 2. Tightly cover one of the boxes with clear plastic or glass. Leave the other box open.
- ☐ 3. Place the boxes in direct sunlight so the bottom of the box is filled with light. Record the temperature in the boxes once each minute for fifteen minutes.
- ☐ 4. Remove the boxes from the direct sunlight and continue to record the temperature for another fifteen minutes.

	Direct Sunlight			Shade	
Time	Closed Box	Open Box	Time	Closed Box	Open Box
0			16		
1			17		
2			18		
3			19		
4			20		
5			21		
6			22		
7			23		
8			24		
9			25		
10			26		
11			27		
12			28		
13			29		
14			30		
15					

Greenhouse Effect Experiment

1.44 In which box did the temperature rise faster? _____

_____

1.45 In which box did the temperature rise higher? _____

_____

1.46 In which box did the temperature drop faster after it was removed from the sunlight?

_____

1.47 How does this experiment demonstrate the greenhouse effect? _____

_____

_____

_____

After you have completed the experiment and answered the questions, compare your results with another student.

INFLUENCES ON LIFE

God created an atmosphere exactly suited for many forms of life. Our atmosphere is necessary to sustain life. The qualities of our atmosphere cannot be appreciated until changes take place that threaten life. The atmosphere plays a vital role in the processes of **respiration** and **photosynthesis**, in regulating temperature, and in protecting us from radiation and **meteorites**.

Respiration. All living things need energy to stay alive. Energy is obtained from food when it is combined chemically with oxygen. The oxygen necessary for this process is readily available in the atmosphere. A process in which living things obtain energy from food is called *respiration*. The waste products that result are carbon dioxide and water. Respiration can be represented by the following word equation:

food + oxygen $\longrightarrow$ carbon dioxide + energy

Photosynthesis. Although carbon dioxide is a waste product of respiration, plants use it to make food. Plants take in carbon dioxide through their leaves and water through their roots. With the help of a green substance (chlorophyll) and sunlight, plants convert carbon dioxide and water into food. This process by which plants make food is called photosynthesis. A by-product of photosynthesis is oxygen. Photosynthesis can be represented in this way:

energy from sun + carbon dioxide +

water $\xrightarrow{\text{chlorophyll}}$ oxygen + food

Animal life is dependent upon plants for oxygen. Plants, in turn, need the carbon dioxide given off by animal life to produce food and oxygen. Both carbon dioxide and oxygen are available in the atmosphere.

Radiation. The atmosphere plays an important role in protecting the earth from harmful radiation. Ultraviolet rays that penetrate the atmosphere cause the skin to be tanned. Exposure to ultraviolet rays for too long can cause skin cancer. People who must work in the sun often have thin, wrinkled skin. The ozonosphere absorbs ultraviolet radiation. This protective shield is another evidence that God designed and created our universe—it was not produced by chance.

X-rays are more dangerous than ultra-violet rays. The amount of damage to the body is determined by the amount of exposure. Bone marrow, sex organs, digestive system, and blood vessels are some of the body parts affected most by radiation. Babies may be born with deformities if the mother is expos-ed to radiation. People who work with radiation might develop cancer. Very powerful forms of radiation or overexposure can ultimately cause death. The ionosphere absorbs all but a small amount of gamma radiation and X-ray radiation.

However small the amount of radiation, living things are affected in some way. Humans are usually exposed to only small amounts of radiation over their lifetime. This small amount may be responsible for shortening life.

Temperature. The amount of atmosphere a planet possesses has a great effect on temperature range. The moon has no detectable atmosphere. Temperatures on the moon measure from just above the boiling point of water on the side facing the sun. Mars, however, has a thin atmosphere. Temperatures near its equator range from 27°C (80°F) during the day to -70°C (-100°F) during the night. Although Mars receives less than half the energy that the moon receives, the temperatures on Mars are far less extreme. Any amount of atmosphere around a planet will moderate the temperature.

Meteorites. Meteoroids are solid objects moving through space at very high speeds. These objects are made of metal or stone. Most are about the size of grains of sand, though some are as large as giant boulders.

Meteoroids that collide with the atmosphere are called **meteors**. They are heated by friction with air molecules. Usually at about 60 miles above the earth (the lower thermo-sphere) they become white hot and burn up.

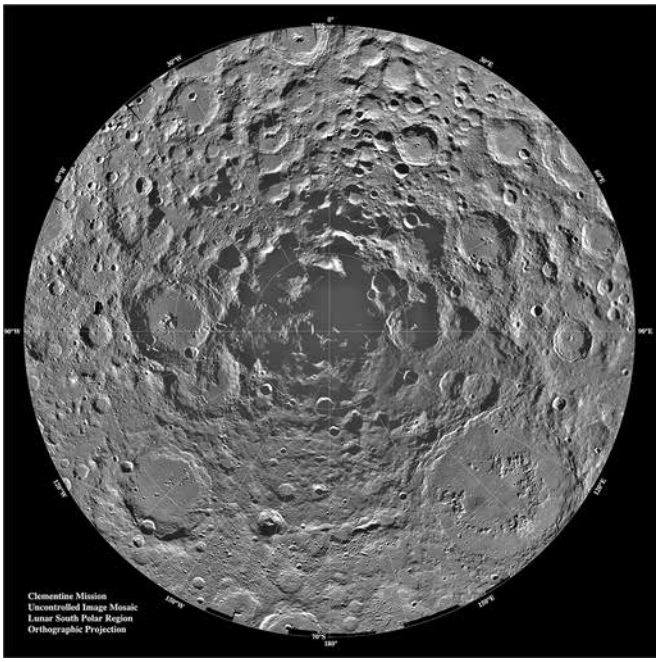


Figure 8 | Surface of the Moon

Large meteoroids that do not completely burn up may collide with the earth. The part that reaches the earth's surface is called a **meteorite**. One meteorite that fell in a Kansas cornfield is estimated to weigh over one ton. At a few places on earth giant meteorites have blasted out large craters. Some craters are as large as several miles across. Meteorite craters have been found on nearly every continent.

Other than the occasional observance of meteoroids or "falling stars," we are unaware of the protection our atmosphere gives. Scientists have estimated that over 25 million meteoroids enter the earth's atmosphere *every day*. Planets with little or no atmosphere give us a clue. Mars, Mercury, and the moon show the effects of continual bombardment by meteorites. The surfaces of these planets are pitted with craters. Although most meteorites are very small, the power they possess is many times that of a bullet fired from a rifle. Safety is possible only with a thick, protective atmosphere.

Complete these sentences.

1.48 The gas that is necessary for respiration is _____ .

1.49 The waste products of respiration are a. _____ and b. _____ .

1.50 All living things need _____ to stay alive.

1.51 The products of photosynthesis that are essential for life are a. _____ and b. _____ .

1.52 X-rays and gamma rays are absorbed in the _____ (layer).

1.53 Ultraviolet rays are absorbed in the _____ (layer).

1.54 Overexposure to powerful radiation can cause _____ .

1.55 Most meteoroids burn up in the _____ (layer).

1.56 Meteorites crashing into the earth form _____ .

1.57 Meteorite craters are common on the moon because the moon has no _____ .

1.58 Meteoroids are made of a. _____ or b. _____ .

Write true or false.

1.59 _____ Radiation can cause cancer or death.

1.60 _____ Very small amounts of radiation have no effects on life.

Answer these questions.

1.61 What is *respiration*? _____

_____

1.62 What is *photosynthesis*? _____

_____

1.63 What ingredients are needed for photosynthesis to occur? _____

_____

1.64 What happens to skin exposed to radiation? _____

_____

1.65 What effect does radiation have on the life span? _____

_____

1.66 What parts of the body are most affected by radiation? _____

_____

_____

1.67 What effect does an atmosphere have on the temperature of a planet? _____

_____

_____

1.68 What are m*eteoroids*? _____

_____

1.69 Why do meteoroids burn up? _____

_____

1.70 What size are most meteoroids? _____

_____

1.71 What is a *meteorite*? _____

_____

1.72 How are we protected from falling meteoroids? _____

_____

CHANGES

Man's knowledge of the atmosphere is continually growing. Many changes occurring in the atmosphere go unnoticed with single measurements. Information gathered over many years reveals that small changes are taking place. The total amount of carbon dioxide in the atmosphere is estimated to have *increased* by 10 to 15 percent since 1900. This is probably caused by the increased burning of fossil fuels such as coal, petroleum, and natural gas. Another source of additional carbon dioxide is volcanoes and hot springs. Volcanoes and hot springs also produce large quantities of water vapor.

Activities of man seem to be causing some harm to our atmosphere. Pollution is very much a concern today. The full extent of the effect to the atmosphere is still unknown. Larger amounts of carbon dioxide in the atmosphere could cause a warming trend. Air pollution reflects radiation and could cause a cooling trend.

Complete these sentences.

1.73 Increases in carbon dioxide in our atmosphere could cause a _____

_____

1.74 More air pollution could cause the earth's temperature to _____ .

Write true or false.

1.75 _____ The carbon dioxide level in the atmosphere has been increasing since 1900.

Answer these questions.

1.76 How does more carbon dioxide in the atmosphere affect the temperature? _____

_____

1.77 What is the probable cause of the increase in the carbon dioxide level since 1900? _____

_____

_____

1.78 What gases do volcanoes and hot springs add to the atmosphere? _____

_____

1.79 Thought question: What are some of the effects that more atmospheric carbon dioxide could have on the level of the sea? _____

_____

_____

_____

Review the material in this section in preparation for the Self Test. The Self Test will check your mastery of this particular section. The items missed on this Self Test will indicate specific areas where restudy is needed for mastery.

SELF TEST 1

Match these items (each answer, 2 points). Some answers may be used more than once.

1.01	_____ 78%	a.	reflects radio waves
1.02	_____ 21%	b.	carbon dioxide
1.03	_____ ionosphere	c.	oxygen
1.04	_____ 30%	d.	amount of radiation reflected
1.05	_____ 70%	e.	nitrogen
1.06	_____ needed for respiration	f.	amount of solar radiation absorbed
1.07	_____ needed for photosynthesis	g.	absorbs ultraviolet rays
1.08	_____ ozonosphere		

Write the letter of the correct choice. (each answer, 2 points).

1.09 The major difference between oxygen and ozone is _____ .

a. the number of atoms in a molecule
b. the kind of atoms they are made of
c. the color of the gas
d. one is a gas and the other is a liquid

1.010 *Sphere of overturning* is the meaning of _____ .

a. thermosphere b. mesosphere c. troposphere d. ionosphere

1.011 The effect of the stratosphere being colder at the bottom than at the top is _____ .

a. sudden weather changes
b. no vertical air movement
c. better radio reception
d. the separation of gases into layers

1.012 The trapping of heat by carbon dioxide and water vapor is known as the _____ .

a. radiation balance
b. greenhouse effect
c. radiant spectrum
d. scattering

1.013 The waste products of respiration are water and _____ .

a. food b. carbon dioxide c. oxygen d. sugar

1.014 The process by which plants make food is called _____ .

a. photosynthesis b. respiration c. digestion d. transpiration

1.015 We are protected from falling meteors by the _____ .

a. ozonosphere b. ionosphere c. atmosphere d. thermosphere

1.016 The burning of fossil fuels has caused _____ .

a. more radiation to be reflected
b. the carbon dioxide level to increase
c. the climates to become cooler
d. increased plant growth

Write true or false (this answer, 1 point).

1.017 _____ Exposure to radiation helps man to live longer.

Complete these sentences (each answer, 3 points).

1.018 The layer that is warmed from below by the ozonosphere is the _____

_____

1.019 The hottest layer in the atmosphere is the _____ .

1.020 *Radiation balance* means that the amount of radiation gained by the atmosphere _____ the amount of heat lost to space.

Answer these questions (each answer, 5 points).

1.021 What main factor varies from one layer to the next in the atmosphere?

_____

1.022 Describe the arrangement of gases in the lower layers. _____

_____

1.023 How does the ozonosphere protect us? _____

_____

46/57 **SCORE** _____ **TEACHER** _____ _____
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