LIFEPAC®

SCIENCE

STUDENT BOOK

9th Grade | Unit 9

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PUBLICATIONS

SCIENCE 909

Science and Tomorrow

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Science and Tomorrow

Introduction

The future has always fascinated people. The technology we enjoy today was only a dream to our forefathers. Our own future contains both blessings and responsibilities. A happy future comes from wise planning today. God expects man to be a faithful steward over all that He has given him. In the very beginning God gave man the responsibility of caring for the earth. God's words were plain when He declared to man in Genesis 1:28, "...Be fruitful, and multiply, and replenish the earth, and subdue it: and have dominion over the fish of the sea, and over the fowl of the air, and over every living thing that moveth upon the earth." Therefore, the responsibility of caring for our natural resources passes on from man to man. God will one day hold man accountable for his faithfulness in meeting this responsibility. In fact, the apostle Paul reminds us in 1 Corinthians 4:2, "...it is required in stewards, that a man be found faithful." For this reason, the subject of "Science and Tomorrow" is such an important one. We are shaping tomorrow by the way we live today.

As we think about life on earth, we see people living on the land that God gave them. How are they caring for that land? Is man being a good steward of his natural resources? Do the oceans and dry land reflect care, or neglect? What can man do to be sure that he is using, not abusing, his natural resources?

Man must work in order to live on the land that God has given to him. God emphasized man's need of work when He declared in Genesis 3:19, "In the sweat of thy face shalt thou eat bread, till thou return unto the ground; for out of it wast thou taken: for dust thou art, and unto dust shalt thou return."In this LIFEPAC®, we shall investigate man's working world. We shall discuss man's energy sources, his industries, his methods of transportation, and his urbanization in the world of today and tomorrow.

Although much of the earth has already been explored, areas still remain to be pioneered. Man has just begun to scratch the surface in both outer and inner space exploration. As man flies above the heavens into the universe or as he dives below the surface of the oceans, he is still aware of God. The Creator of the beautiful world in which man lives walks beside him, able to calm his fears and to give him a perfect peace about the future. David exclaimed in Psalm 139:7 and 8, "Whither shall I go from thy spirit? or whither shall I flee from thy presence? If I ascend up into heaven, thou art there: if I make my bed in hell, behold, thou art there." The Christian can be optimistic about the future because he has given his life to the One who holds the future. "Science and Tomorrow" is an exciting subject because Jesus has promised in Matthew 28:20, "...lo, I am with you alway, even unto the end of the world. Amen."

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. List three ways man has used and abused the biosphere of the earth.
2. List three major concerns in agricultural growth.
3. Describe a way in which waste material can be made useful.
4. Describe the way in which mercury poisoning affects the body.
5. Name two sources of energy that are important to man.
6. State how driving to and from work increases air pollution.
7. List three benefits of a rapid-transit system.
8. State a reason for the exploration of outer space.
9. Contrast the percentage of the earth's surface that is covered by water with the percentage of dry land.
10. Describe why the Christian can be optimistic about the future.
11. List two limitations to the exploration of inner space.

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

1. PEOPLE AND THEIR LAND

Man's history has been one of both success and failure. He has made outstanding progress in technology. Sometimes, that progress has been at the expense of his environment. As man has used the air, land, and sea for his benefit, he has learned lessons of both use and abuse of the environment. Man's progress has resulted in polluted air, polluted land, and polluted seas. Conservation and recycling efforts are underway in many areas to prevent future abuse of man's environment.

One of the primary ways that man uses the land upon which he lives is by cultivating it. Certain areas of the world grow the majority of the world's food. One concern in the growth of the world's food is the occurrence of natural disasters such as droughts and insects. Other concerns are disasters caused by man such as the careless use of certain types of fertilizers.

As the world's population continues to grow, many people ask, "Will enough food be available to nourish all the peoples of the world?" Famines already occur in many areas of the world. Will more technology provide some of the answers for an increase in food production?

As the world population continues to grow, so do our waste materials. In this section we shall ask, "What shall we do with this ever-increasing accumulation of waste materials?" Hopefully, the answer lies in converting the refuse of society into a usable product that will benefit a "people and their land."

SECTION OBJECTIVES

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

1. List three ways man has used and abused the biosphere of the earth.
2. List three major concerns in agricultural growth.
3. Describe a way in which waste material can be made useful.
4. Describe the way in which mercury poisoning affects the body.

VOCABULARY

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

algae (al´ jē). Plant-like simple organism that contains chlorophyll and undergoes photosynthesis. They vary from single-celled forms to complex multicellular forms such as seaweeds and kelp.

antibiotic (an tē bī ot´ ik). An antibacterial substance produced by a living organism.

biosphere (bī´ u sfir). The volume of air, water, and soil surrounding the earth within which conditions support life.

blight (blīt). Any disease or injury of plants resulting in withering, cessation of growth, and death of parts, as leaves, without rotting.

cellulose (sel´ yu lōs). An inert substance, the chief component of the solid framework (cell walls) of plants.

cross-pollination (krôs pol u nā´ shun). The deposition of pollen from one flower on the stigma of another, as by wind or insects, or artificially, to produce new varieties.

desalination (dē sal u nā´ shun). The process of removing salts and other chemicals from sea water.

ecology (ē kol´ u jē). The science of the relationship of an organism and its environment.

extinction (eks tingk´ shun). The state of a species being no longer living.

horticulturist (hôr tu kul chur ist). One who has knowledge in the art of growing plants.

kwashiorkor (kwä´ shē ôr kôr). Severe malnutrition, characterized by anemia, edema, potbelly, depigmentation of the skin, and loss of hair or change in hair color (native word in Ghana).

marine (mu rēn´). Of or pertaining to the sea or the ocean.

organic (ôr gan´ ik). Pertaining to or derived from living organisms.

pollutants (pu lü´ tunts). Those things which pollute or contaminate air, soil, or water.

terrestrial (tu res´ trē ul). Of or consisting of land, in distinction from water.

troposphere (trō´ pu sfir). The lowest region of the earth's atmosphere.

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**ã**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.

ECOLOGY

Have you ever seen the smokestack of a large factory belching out fumes? Have you ever noticed the haze that hangs over a large metropolitan city? Have you ever seen an airplane spraying a field? If so, then you have seen man as he affects his environment. This relationship between man and his environment is the science of **ecology**.

Man's location in the biosphere. Man lives in the **biosphere**. The biosphere measures approximately ten miles. This area extends from the greatest depths of the oceans to thousands of feet above the surface of the earth. Man lives within this range.

The biosphere is divided into three parts: air, land, and water. The portion of the biosphere that makes up nearly 70 percent of the total air mass surrounding the earth is several miles high. This small portion of the earth's atmosphere is the **troposphere**. The troposphere contains the global and local wind systems. It is composed mainly of nitrogen (78 percent), oxygen (21 percent), and argon (1 percent). The air that you are breathing right now is made up mostly of nitrogen and oxygen.

Winds carry such things as pollen, dust, and soil. In fact, even a ten-mile-per-hour wind can carry a dust particle nearly three thousand miles before the particle settles back to earth. In 1934 the famous dust bowl storms in the United States carried almost 700 million tons of topsoil out to sea.

Water in the biosphere comes from a cycle of evaporation and precipitation. Water that evaporates eventually returns in some form of precipitation (for example, rain, snow, or hail). Precipitation results from a condensation of water vapor.

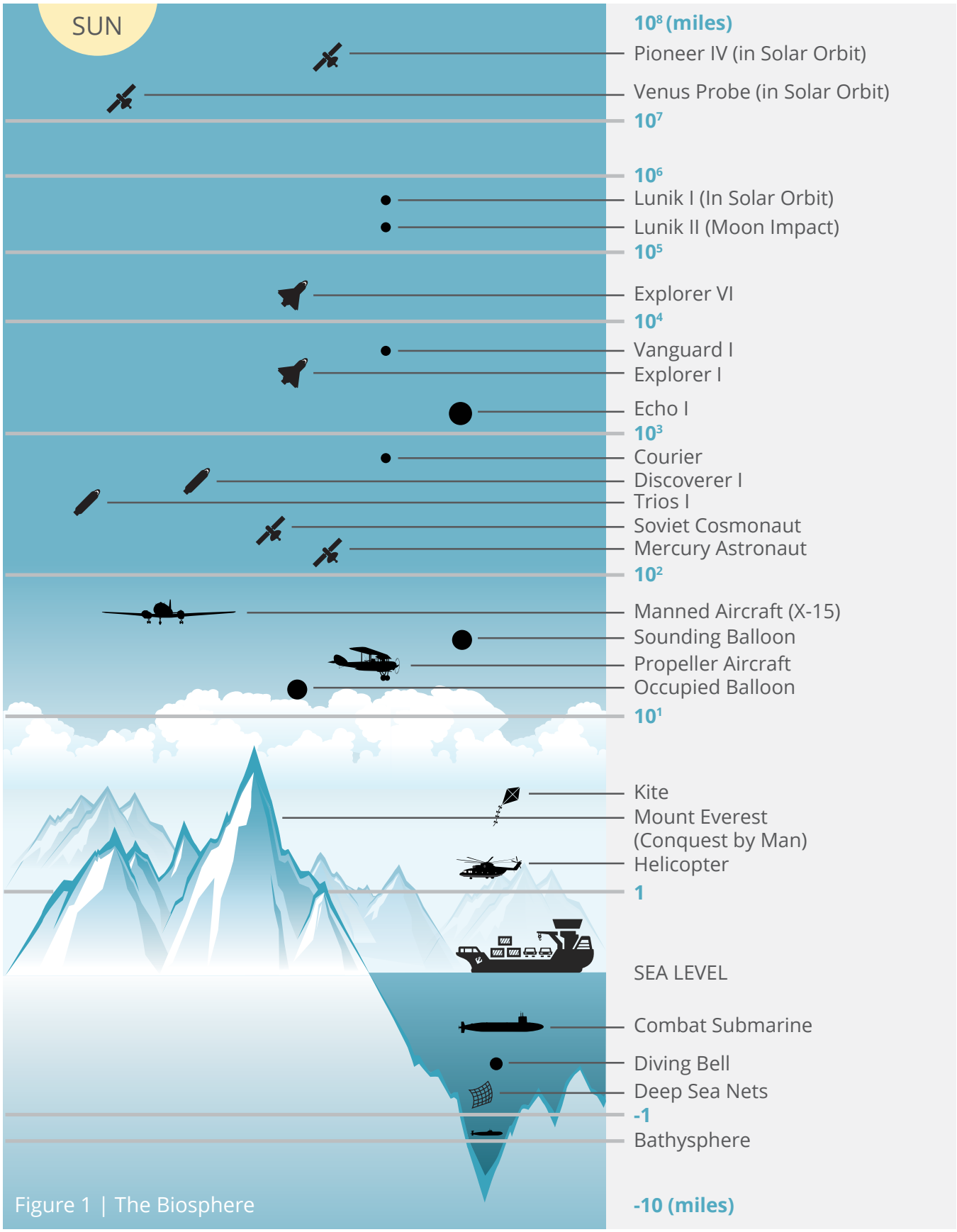

Figure 1 | The Biosphere

Try this activity to discover how precipitation results from the condensation of water vapor.

These supplies are needed:

- screw-top jar lid
- bird seed
- paper towels
- rubber band or wire tie
- plastic sandwich bag
- water

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

- ☐ 1. Cut several thicknesses of the paper towels to the size of the jar lid.
- ☐ 2. Place the paper towels in the jar lid.
- ☐ 3. Drop enough water on the paper towels to saturate it.
- ☐ 4. Sprinkle a small amount of the bird seed on the wet towels.
- ☐ 5. Place the jar lid in a plastic sandwich bag and tie the bag with a rubber band or wire tie.
- ☐ 6. Store your "garden" in an area shaded from direct sunlight.
- ☐ 7. Daily observe your "garden" noting any change regarding water droplet formation or anything else significant.

1.1 What kind of change do you notice regarding water formation within the bag after two days?

_____

1.2 Where does most of the water appear to be collecting? _____

_____

_____

Condensation of Water Vapor Experiment

Complete these activities.

1.3 List the two stages involved as water travels from earth to the atmosphere and back to earth again.

a. _____ b. _____

Write true or false.

1.4 _____ Water that evaporates from the earth returns to the earth again in a usable form.

1.5 _____ Precipitation can take many forms.

1.6 _____ Precipitation is the result of condensed water vapor.

Man lives primarily in the **terrestrial** portion of the biosphere. Because the earth has more water area than dry land area, man is limited in space for living and for agriculture. Man is able to use only 25 percent of earth's dry land. In this small area man lives, farms, and cares for large animal populations. The remainder of the dry land area lies in uninhabitable regions: deserts, jungles, ice caps, and mountain peaks.

Man can grow food on only a small portion of his land. Man is always looking for new ways and new places to grow his food. In the future, man hopes to develop new and better fertilizers. Someday, we may witness farming in locations we have only imagined. We may see farming in outer space, on the surface of other planets and asteroids in our solar system, and even in the earth's inner space (in the oceans and underground). Today, however, man must continue to use wisely his present farming lands. The land must be properly cared for and maintained. If not, it may become unproductive through neglect or abuse, and the area that man possesses for agriculture will be reduced even further.

The thin layer of topsoil is the life of farmland because it contains plant nutrients. In the past, man has misused this vital topsoil. The result of this misuse has been decreased agricultural

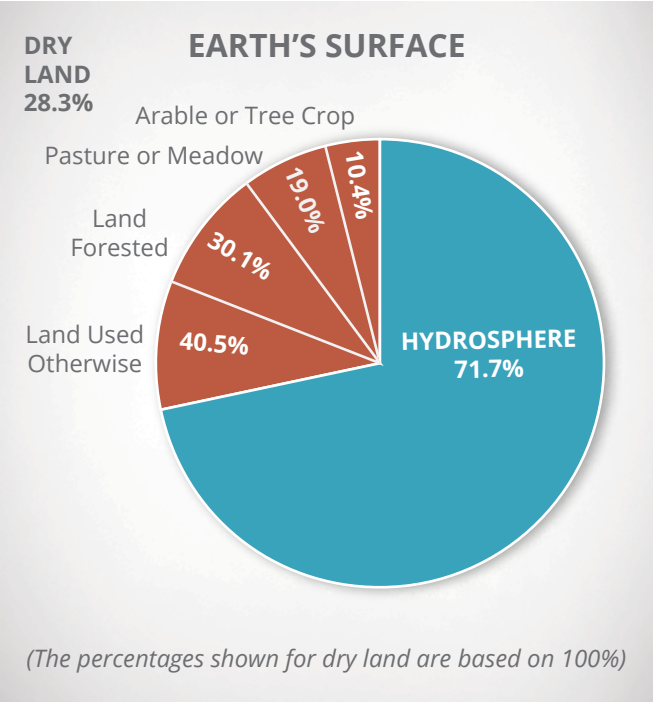

Figure 2 | Earth's Surface

production and a disfigured environment. This occurred in the Oklahoma dust bowl storms of the 1930s.

The oceans of the world cover more than 70 percent of the earth's surface. In that space lives four-fifths of all the animal life on earth, as well as most of the earth's vegetation. Inner space calls out to man for exploration. Barely

one percent of all sea organisms have been studied. Much work still remains to be accomplished by the scientists of tomorrow.

The oceans of the world hold many possible uses for man. Many nations depend largely upon a seafood diet. In the future, man may be forced to look to the oceans for his supply of food for several reasons. Ocean animals grow faster than land animals. If man were able to grow more ocean crops, he would have fewer weather problems. The oceans offer rich mineral resources that man has already begun to extract. The water of the oceans, after being filtered, could also provide man's irrigation needs in farming. In fact, after being **desalinated** the oceans could provide man with one of his basic needs of life—fresh water. In the past, desalination has seemed impractical to man. This process is possible today by combining nuclear-power and fresh-water generating plants. This method already produces over 50 million gallons of water per day.

In spite of their great potential, our oceans are being contaminated by man's dumping of sewage and industrial wastes. While man has been searching the ocean for mineral resources, accidents have occurred. Sometimes spills occur from oil-drilling platforms and transporting sea tankers. Certain ocean species have almost become extinct because of man's hunting and fishing of them.

If used wisely, the oceans could provide additional space in man's environment as well as important answers for many of the problems he faces. The oceans could yield an abundant supply of food, mineral resources, and water for agricultural needs. They also can provide recreation possibilities for man's enjoyment. We must remember that with benefits come responsibilities. God expects man to do all that is humanly possible to care for his environment, whether it be in the air, in the sea, or on the land.

Look at Figure 2 and answer these questions.

1.7 What percentage of the earth's surface is water? _____

1.8 How much of earth's dry land is pasture or meadow? _____

1.9 How much of earth's land is presently forests? _____

Write true or false.

1.10 _____ Man can live on most of the earth's surface.

1.11 _____ The combined percentages of forests and meadowland nearly equal that of land used otherwise.

1.12 _____ Almost three-fourths of the earth's surface is covered with water.

Complete these sentences.

1.13 The oceans of the world cover more than _____ percent of the earth's surface.

1.14 The fraction of all sea organisms studied is less than _____ percent.

1.15 Man has already begun to extract rich _____ resources from the oceans' depths.

1.16 To be used for agricultural purposes, sea water must first be _____ .

1.17 Excessive fishing and hunting have resulted in the near _____ of certain ocean species.

Answer this question.

1.18 What difficulties do you think might arise from a major oil spill just off a coastline? _____

_____

_____

_____

Man's use and abuse of the biosphere. Man must live in the biosphere and use the natural resources that surround him. Too often, man has been guilty of abusing the resources that supply his needs. Sometimes the abuse is through neglect or ignorance. Sometimes the abuse is intentional. Air pollution is an example of both intentional and thoughtless abuse.

Air pollution affects almost everything in our environment. It affects the clothes we wear, the buildings we live in, and our own bodies as well. Damage from air pollution is estimated to cost over $1 billion annually. Smog in the United States alone is blamed for a large amount of damage to vegetation. When the smog is combined with other fumes and pollutants, the problem is greatly increased. Livestock from our farms have been diagnosed as suffering from the effects of air pollution. Air pollution slows plant growth, withers plant leaves, and causes bleaching (loss of green color). To avoid an agricultural disaster, some **horticulturists** believe that scientific help must be provided to protect plants from the problem of air pollution.

Pesticides have been used greatly by man for the benefit of all, but they have also caused some problems. The chemicals used to protect our crops have also contaminated our soil, lakes, and rivers. A recent example of this problem occurred in the Gulf of Mexico when nearly 10 million fish were killed in the area of the Mississippi River Basin. The cause was traced to a pesticide runoff. Crops upstream had been sprayed with a powerful pesticide to protect them from insects. The rains had flushed the chemicals into the streams and rivers that flow toward the Gulf of Mexico. These chemicals then collected in the area where the Mississippi River flows into the Gulf. The concentration of the chemicals was so high that the fish in that area were killed.

Man's use of the environment has sometimes become abusive, and the seas also suffer from the effects of pollution. Wastes from our factories and homes flow daily into our seas, rivers, and lakes. Man has attempted to treat wastes chemically before allowing them to enter the world's water supplies. Such treatment is often not sufficient to protect the waters from

pollution. In fact, 10 to 40 percent of the polluting materials remains in the sewage and is not filtered out. The unfiltered materials are left to accumulate in the world's water supplies. Sewage has an unpleasant effect upon our waters and upon the creatures and plants that live in an aquatic environment. The problem caused by sewage, as serious as it is, cannot outrank that of industry. Industry adds three times more waste than sewage adds to the world's water supplies.

Several serious problems arise from water pollution. Bacteria are encouraged to grow and to produce an increase of disease. Chemicals collect in the water and poison aquatic life. **Algae** plants are stimulated to grow by **organic pollutants**. This growth results in the formation of slime. It also robs the water of its oxygen content because the overabundance of algae plants die and decompose.

The cost of treating all wastes effectively before they reach the oceans is very high. Water pollution is a complex problem that will require much thought and effort. Work is needed to develop a more effective means of reducing water pollution before the problem becomes worse.

Try this investigation to discover some of the causes of water pollution.

These supplies are needed:

- jar with a lid
- small amount of soil
- water

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

- ☐ 1. Fill the jar three-fourths full with water.
- ☐ 2. Pour a small amount of soil into the water.
- ☐ 3. Tighten the lid on the jar and shake the contents vigorously.
- ☐ 4. Place the jar on a table, allowing the contents to settle.
- ☐ 5. Record your observations of the water and of the dirt.

1.19 What happened to the soil after shaking? _____

_____

1.20 Why did all the soil not settle to the bottom immediately? _____

_____

1.21 How long did all the soil take to settle to the bottom? _____

_____

1.22 How did your shaking the jar affect the environment within the jar? __

_____

Water Pollution Experiment

Write true or false.

1.23 _____ The degree of cloudiness of the water would be affected by the amounts of water and soil in the jar.

1.24 _____ If more soil were added to the water, more time would be required for it to settle out.

Man's reuse of the biosphere. Rather than allow waste materials to accumulate in the air, on the land, and in the seas, man should recycle waste products and conserve natural resources. Advanced technology has made great strides in the areas of recycling and conservation. Much work still needs to be done. A recent development is a device that helps to conserve water. This device uses ultrasonic waves and only a small amount of water to cleanse the body.

Offensive animal and human waste products have been deodorized and changed into reusable materials. Giant ocean spills of oil from tankers and oil-drilling platforms are now being cleaned up with large recovery units similar to giant floating skimmers. Another method used is a dispersant, which can be thrown from a ship into the floating oil slick. As this material is scattered it gels the oil. The dispersant and oil are then easily absorbed into the environment. The idea of inserting magnetic dust into oil being transported by large ocean tankers has been considered. The dust could be used in tracing the offender when oil is discovered from a spill in the ocean. These advances and others represent an effort to clean up and save man's environment. How well man accepts and meets this challenge will determine the extent to which man will be able to use tomorrow's world.

Complete these sentences.

1.25 The logical use for waste material is _____ .

1.26 A device for personal hygiene uses small amounts of water and _____ waves.

1.27 A substance that combines with spilled oil to form a substance harmless to the environment is a(n) _____ .

SELF TEST 1

Match these items (each answer, 2 points).

1.01 _____ famine
1.02 _____ conservation
1.03 _____ recycle
1.04 _____ DDT
1.05 _____ ecology
1.06 _____ inner space
1.07 _____ desalinate
1.08 _____ precipitation
1.09 _____ methyl-mercury
1.010 _____ protein
1.011 _____ "glassphalt"
1.012 _____ extinction

a. the relation of living things to their environment
b. a pesticide affecting birds of prey
c. to remove salt from sea water
d. a pesticide causing death or extreme physical harm
e. the result of a lack of food
f. needed to help prevent kwashiorkor
g. the preserving of natural resources
h. the possible fate of birds of prey
i. the ocean depths
j. to use again
k. the result of condensation
l. a recycled product
m. a seaweed plant

Define these terms (each answer, 5 points).

1.013 water pollution _____
1.014 topsoil _____
1.015 condensation _____

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

1.016 _____ Proper disposing of wastes is a difficult problem.
1.017 _____ The biosphere measures nearly fifty miles.
1.018 _____ Air is composed mainly of oxygen.
1.019 _____ The surface of the earth is mainly water.
1.020 _____ The oceans contain large mineral deposits.
1.021 _____ Smog damages everything but plants.
1.022 _____ The use of pesticides can create other problems.

Complete these lists (each answer, 3 points).

1.023 List three possible solutions for the problem of waste.

a. _____

b. _____

c. _____

1.024 List three problems of rapid population growth.

a. _____

b. _____

c. _____

1.025 List five waste items that have been recycled effectively.

a. _____ b. _____

c. _____ d. _____

e. _____

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

1.026 The population of the world is _____ .

a. increasing b. decreasing c. stabilizing d. neutralizing

1.027 The best solution to the problem of waste is to _____ .

a. produce less b. throw away less

c. ignore it d. recycle more efficiently

1.028 Kwashiorkor results from a lack of _____ .

a. technology b. protein c. cellulose d. algae

1.029 Antibiotics added to livestock feed have been found to _____ .

a. disappear b. kill livestock

c. collect in muscles and tissue d. retard animal growth

1.030 Pesticides have been helpful in controlling _____ .

a. cross-pollination b. insect larvae c. bleaching d. precipitation

1.031 Horticulturists are primarily concerned with _____ .

a. animals b. oceans c. plants d. recycling

1.032 God gave man the responsibility of caring for the earth in _____ .

a. Genesis b. Numbers c. 1866 d. Acts

75/93 **SCORE** _____ **TEACHER** _____ _____

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