



SCIENCE

STUDENT BOOK

► **9th Grade | Unit 9**

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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 LIFE PAC®, 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 always, 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 LIFE PAC. When you have finished this LIFE PAC, 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.

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 (krōs 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 (hōr 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 LIFEPAK 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: hat, āge, cāre, fār; let, ēqual, tērm; it, īce; hot, ōpen, ôrder; oil; out; cup, pūt, rüle; child; long; thin; /ʒh/ for then; /zh/ for measure; /u/ represents /a/ in about, /e/ in taken, /i/ in pencil, /o/ in lemon, and /u/ in circus.

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**.

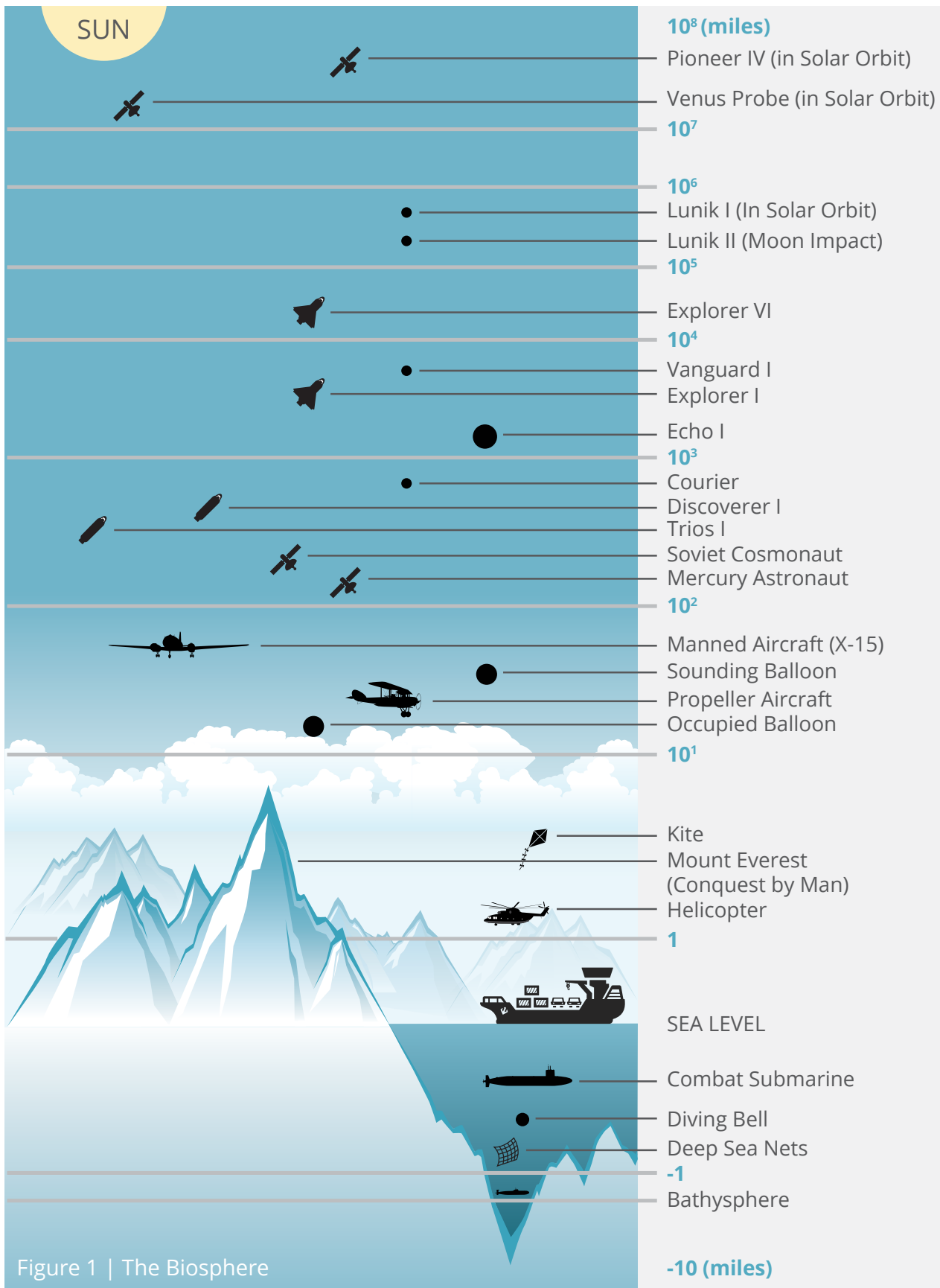
Man's location in the biosphere. Man lives in the **biosphere**. The biosphere measures approximately ten miles. This area extends from the greatest depths of the oceans to thousands of feet above the surface of the earth. Man lives within this range.

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.





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

These supplies are needed:

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

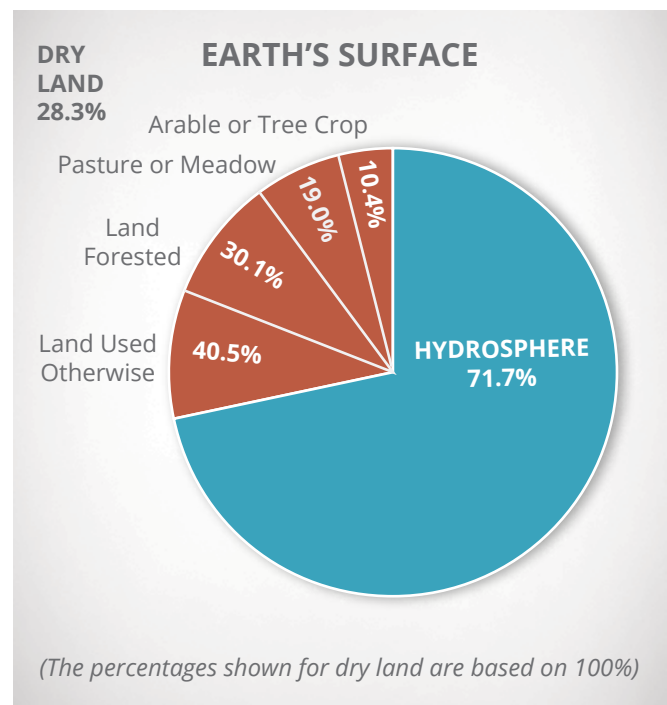


Figure 2 | Earth's Surface

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) _____ .

AGRICULTURE

Agriculture will play a major role in the world of tomorrow. No physical consideration is more important than that of food. Think about your own life and how hard it is to concentrate on a task when you feel hungry. Does your family have enough food to care for your needs and those of other family members? Does the world have enough food right now to feed all the families of the world? As our world population continues to grow, our food supply must also continue to grow.

Does increased scientific knowledge promise any help? What if we fail to provide enough food for our world? Famine is already a reality in some parts of the world. God desires that Christians not be fearful in the face of shortages, for He has promised in Hebrews 13:5 never to leave us nor forsake us. God does, however, want us to rely upon His wisdom to provide the answers for the pressing needs of our world.

Growth. The world's food is not grown uniformly throughout the earth. In fact, much of the world's food supply is grown in rural areas. Most of the world's food supply is produced on the North American continent, principally in the United States. The United States holds no more

than one-tenth of the world's population, and yet it produces a majority of the world's food.

Man has discovered and put to use certain farming practices that increase crop production. The use of irrigation to provide needed water and the use of natural fertilizers to promote crop growth are farming methods that have been practiced for centuries. More sophisticated irrigation techniques, various chemical pesticides, and modern chemical fertilizers were developed in the twentieth century. These products have solved some farming problems, but they have produced some environmental ones at the same time.

One method for irrigating crops is the canal. Man built concrete canals to transport large quantities of water. These canals carry water from areas of high-water concentration to areas of low-water concentration, such as from the mountains to the deserts. Not all canal water is used by agriculture; the water in canals is often used for industry and for private homes. A few ecologists believe that although the canal water is good, the canal itself affects the natural beauty of the environment. Some believe that the canal system may also affect the animal life surrounding it.



Try this activity to discover ways in which canals flow.

These supplies are needed:

- flat cake pan
- soil (or sand)
- assorted small rocks
- water

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

- ☐ 1. Fill the flat cake pan with soil until it is three-fourths full.
- ☐ 2. Place the small rocks in various locations within the soil. Pack firmly.
- ☐ 3. Make a depression in the soil at one end of the pan and design a series of canals leading to the other end of the pan.
- ☐ 4. Slightly elevate the end of the pan containing the “water reservoir” after the addition of water to the “reservoir.”
- ☐ 5. Record all observations regarding the water flow (for example, time of flow and major obstacles encountered).

1.28 How does a canal help in transporting water from an area of high concentration (such as the “reservoir”) to an area of low concentration (such as the end of the canal system)?

1.29 How was the “natural landscape” of the cake pan three-fourths full of soil disturbed in order to create the canal system? _____



1.30 Do the benefits of such a canal system outweigh any ecological damages? _____

Water Flow Experiment



Follow these directions.

1.31 List two reasons why the water flowed from the “reservoir” to the end of the canal system.

a. _____

b. _____

Write true or false.

1.32 _____ Water always flows from an area of high concentration to an area of low concentration regardless of other circumstances.

1.33 _____ The degree of elevation affects the rate of flow of water through a canal system.

Plants need protection from such problems as an insect **blight**. Insects are a major enemy to the crops of the world when they compete with man for food. Not all insects are harmful. In fact, such insects as the bee are beneficial to the plant kingdom. They provide important functions such as **cross-pollination**. Other insects destroy other crops. Destruction can begin when an adult insect lays her eggs on a plant leaf. The eggs hatch as larvae that must eat constantly to survive. A few larvae can soon destroy an entire plant.

Man has tried to combat harmful insects through the use of pesticides. He has entered a difficult battle. In killing the offending insect population, man has created new problems. The pesticide he uses affects other living things that man does not want to harm.

DDT (standing for the insect-killing chemical, dichloro-diphenyl-trichloro-ethane) was a popular pesticide for many years. Environmentalist groups questioned the use of DDT because of its harmful effects on the environment. DDT washes from the plants to the rivers and oceans through rain runoffs. Because DDT decomposes slowly and is readily absorbed by animal tissue, this chemical collects in high concentrations in **marine** life. Birds of prey, such as pelicans, ospreys, and bald eagles, then feed on the marine life. This high concentration

of DDT causes birds to lay eggs so deformed and fragile that they break before hatching. In fact, one nest was found to contain an egg with no shell at all! The effects of DDT, which has proved helpful by controlling harmful insect populations, were causing many birds of prey to face **extinction**. Although man needs to control harmful insects, he must not destroy other life in the process. Therefore, in 1972, the United States banned almost all uses of DDT; however, it is still used in other parts of the world. Man is responsible for proper stewardship of his environment.

Not only do plants need water and protection from insects, they also need important nutrients to thrive and to provide food for an expanding world population. Chemical fertilizers can provide major elements and trace elements needed by plants. Improper or excessive use of these chemicals may result in crop damage and in the excessive growth of algae in various waterways that receive the runoff from the fields. The nitrates and phosphates used in these fertilizers can contaminate nearby wells and reservoirs.

Other chemicals have been added to livestock feed in an effort to produce healthier, meatier animals. **Antibiotics** are used in feed to prevent disease; and hormones such as DES are used to speed growth in these animals. Scientists discovered, however, that the chemicals

added to livestock feed were gradually collecting in the animals' muscles, tissue, and fat. These antibiotics and hormones are passed on to the consumer of the animal products. (DES was banned by the Food and Drug Administration in 1979.)

Carelessness with chemicals can be tragic. Seed is frequently treated with chemicals that make it unsafe for consumption by animals. In 1970 a farm family fed some chemically treated grain to their hogs. The grain had been treated with a methyl-mercury compound and had been

marked dangerous to health. Since methyl-mercury was not always considered dangerous, the farmer thought the label was exaggerating the situation. The family later ate the pork from the contaminated hogs. The result was terrible. Most of the family members either lost their sight, hearing, speech, or coordination, or suffered brain damage from mercury poisoning. Later, reports were received from Japan that people were dying from mercury poisoning. The seafood that the Japanese were eating had been contaminated by this deadly chemical.



View 909 Diffusion, from the Grade 9 SCIENCE EXPERIMENTS Video



Try this investigation to determine how quickly and in what manner substances can spread throughout an environment.

These supplies are needed:

- | | | |
|---|-----------------|--------------------------|
| ■ 3 clear glass containers of various sizes | ■ food coloring | ■ medicine dropper |
| | ■ water | ■ watch with second hand |

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

- ☐ 1. Fill each container almost full with water.
- ☐ 2. Using the medicine dropper, add one drop of food coloring to each container.
- ☐ 3. Observe what happens in each container and record your observations.
- ☐ 4. Measure the amount of time required for the drop of food coloring to spread uniformly throughout the container.
- ☐ 5. Repeat the procedure using two drops of the coloring.
- ☐ 6. Repeat the procedure using three drops of the coloring.
- ☐ 7. Record your information on a bar graph, labeling your vertical axis "Time Elapsed (seconds)" and your horizontal axis "Number of Drops of Food Coloring." Each line on the graph will represent a different container.



Diffusion Experiment

- 1.34** In which container did the single drop of food coloring spread the fastest?

- 1.35** Did the drops of food coloring eventually spread uniformly throughout all the containers?

- 1.36** In which container was the color the most intense? _____
- 1.37** Using your graph, what was the time difference between the spreading rate of two drops in the intermediate-size container and the spreading rate of two drops in the largest-size container? _____



- 1.38** Once the color has spread throughout the container, how could you make the color less intense? _____

Diffusion Experiment



Write true or false.

- 1.39** _____ The size of the container makes no difference relative to how soon the color is spread throughout the container.
- 1.40** _____ The rate at which the color spreads throughout the containers cannot be controlled.
- 1.41** _____ When each drop of coloring is added to the water, the solution intensifies in color content.

Research and report.

- 1.42** Select a bird of prey to research and describe in report form. Use any library sources such as books, magazines, or filmstrips to gather information. Develop detailed answers to these questions:

What is the habitat of the bird?

What are the nesting habits of the bird?

Is the population of this species increasing, remaining the same, or declining?

How are the uses of pesticides affecting this species?

What steps could be taken to benefit this species?

TEACHER CHECK

initials

date

Distribution. Because of better methods used to grow our crops, man is enjoying more food now than at any other time in history. Families can choose what type of protein source they prefer for dinner: pork, beef, lamb, fish, poultry, or some other alternative. Some schools are providing their students with a balanced breakfast, as well as a balanced lunch. The number of restaurants in any large city continues to increase. Yet, the blessings of plenty are not enjoyed by all. In fact, much of the world's population does not have enough to eat daily. Nearly one-third of the world's children die before the age of five because they do not get enough to eat.

What if man does not use his agricultural resources wisely? Famine will result from unwise stewardship of the land. Many parts of the world are already experiencing famine. Poor agricultural methods and wrong decisions could make the problem worse. The world's food is not distributed evenly among

the world's population. Africa and India have suffered widespread famine in the past. Many places face the same bleak prospect of famine for the future. Crop failures, natural disasters, and an expanding world population could result in the death of billions instead of millions of people.

Over half of the world's population of nearly 5 billion suffers from a lack of food. Death by starvation claims millions each year. God expects His children to help others in need. During 1966 and 1967 the United States performed the largest relief operation in history. The United States shipped 8 million tons of grain to famine-stricken India. This action resulted in the diminishing of the United States' grain surplus by only one-fifth.

Although agricultural methods have improved, a giant problem still exists. A rapidly growing world population cannot exist on a limited and less rapidly growing supply of food.



Complete these statements.

- 1.43 Although better methods to grow crops are enabling man to produce more food than at any other time in history, much of the world's _____ does not have enough to eat daily.
- 1.44 Nearly one-third of the world's children die before the age of _____ because they do not have enough to eat.
- 1.45 Over half of the world's population of nearly _____ billion suffer from lack of food.
- 1.46 If man does not use his agricultural resources wisely, _____ will result.
- 1.47 God expects His children to a. _____ others in b. _____.
- 1.48 During 1966 and 1967 the United States performed the largest a. _____ operation in history by shipping 8 million tons of b. _____ to c. _____.

Technology. Future scientific advances may help to increase the supply of the world's food. Science hopes to produce quick-ripening fruits and vegetables, thus reducing the growing season. Research is being performed to make crops fertile the whole year. Synthetic foods are being developed to supplement natural foods.

Much of the world exists on a diet that contains no meat. Meat is a source of protein, but for

most of the world's population meat is either too expensive or not available. Since protein is a necessary part of a balanced diet, efforts are being made to discover a source of protein other than meat. **Kwashiorkor** is a disease caused by a lack of protein. Many children in underdeveloped nations die from this disease before reaching their fifth birthday. Hope for these people exists in discovering new agricultural methods and medical break-throughs.



Try this activity to discover different sources of protein.

These supplies are needed:

- labels from various food products such as soups, fish, peanut butter, cereals, jellies, dairy products, coffee, butter, soybeans, beef

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

- ☐ 1. Examine each label to discover the protein content of each food.
- ☐ 2. Arrange the labels in order from greatest amount of protein per ounce to least amount of protein per ounce.
- ☐ 3. Record your findings in a bar graph, labeling the horizontal axis "Types of Food" and the vertical axis "Protein per Ounce."

1.49 Which food had the greatest amount of protein per ounce? _____

1.50 Is protein available in more than one edible form? _____

1.51 Do all foods contain protein? _____

1.52 Could the benefits of meat be derived from some other source?



Sources of Protein Experiment



Write true or false.

- 1.53 _____ Some foods contain more protein than other foods.
- 1.54 _____ Meat is readily available for most of the world's population.
- 1.55 _____ Meat is a good source of protein, but protein is also available through other sources.

WASTE

Waste pollution is just as serious a concern as air and water pollution. How are we to dispose of throw-away items? These items range from disposable cups to disposable clothing. Perhaps the solution lies in one of three areas: produce less, throw away less, or recycle more effectively.

Produce less. We are not likely to produce less. Our population demands more consumer goods. Even though the population in the United States is beginning to stabilize (the number of people being born equals the number of people dying), the demand for consumer goods continues to increase. We are becoming a richer nation, able to buy more and to live better. An indicator of this situation is our production of garbage. We are producing more garbage per year and producing more garbage per person than ever before.

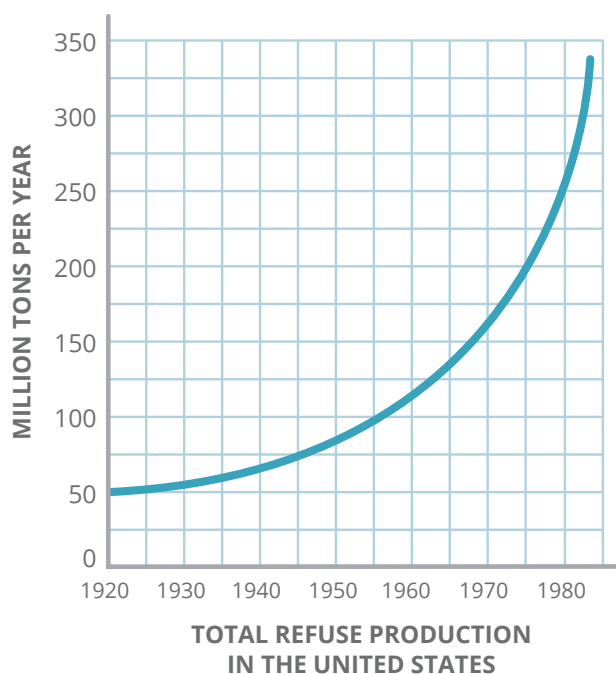


Figure 3: | Total Refuse Production in the United States



Look at Figure 3 and answer the following questions.

- 1.56 How many millions of tons of garbage were thrown away in the United States in 1920? _____
- 1.57 How many millions of tons of garbage were thrown away in the United States in 1950? _____
- 1.58 How many millions of tons of garbage were thrown away in the United States in 1980? _____
- 1.59 Did the average American throw away more, less, or about the same amount of garbage between the years of 1950 to 1980 as he did between the years of 1920 to 1950, and how do you know? _____



Write true or false.

- 1.60** _____ When the population increases, the production of waste, or garbage, material also increases.
- 1.61** _____ Figure 3 shows that America is producing garbage at a much less rapid rate with each passing year.

Throw away less. Efforts are being made to encourage people to throw away fewer disposable items (bottles, cans, and paper items). Companies are beginning to encourage people to return bottles, collect cans, and recycle paper products. These recycled materials can be manufactured into different products. Such efforts conserve our natural resources, beautify the landscape, and reduce the amount of waste we produce. Although recycling is helpful, the waste problem cannot be solved by this method alone. The success of this method depends upon manufacturers being committed to the idea of recycling. Recycling, at times,

proves to be more expensive than continually using new materials.

The success of this method also depends upon everyone's efforts. Everyone should want to be a part of a clean-up campaign. Many people are involved in both large and small efforts, but others are not involved at all for various reasons. Some people are ignorant of the problem; others are unaware of the solutions available; still others cannot, or will not, take the time or expend the effort to comply with these conservation campaigns. For these reasons, the total solution is difficult to achieve.



Do this activity to determine how many disposable items you use.

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

- ☐ 1. Look around your classroom and make a list of items that are meant to be used and then thrown away.
- ☐ 2. Look around your home and make a list of items that are meant to be used and then thrown away.
- ☐ 3. Compare your lists to see any similarities or differences.

1.62 Are any items presently being thrown away that could be reused with some effort?

1.63 Which items are thrown away both at school and at home?

1.64 Of what are the items made that are most commonly thrown away?



Determination of Disposables Experiment

Recycle more efficiently. This solution promises more than the two previous solutions. With greater production comes greater waste. Many people will not throw away less since our manufactured consumer goods come in containers that are intended to be thrown away. Great strides have already been made in the recycling efforts. New methods of compacting trash for sanitary landfills have been developed. Used glass has been crushed and manufactured to pave streets with “glassphalt.” Ash and cinder left over from our large industrial incinerators have been recycled to make cement. Rubber

from worn-out tires has been converted into carbon black to make new tires. **Cellulose** from corn stalks, wood chips, and sugar-mill waste has been treated to make a high protein food substance. Some companies have even converted garbage into usable fuels.

Nature has always made use of the recycling principle. The process of recycling in man’s world, motivated by his efforts, will not be easy. Man has a good example to follow in observing the world that his Creator has given him to inhabit. This third solution can prove successful with effective education and effort.

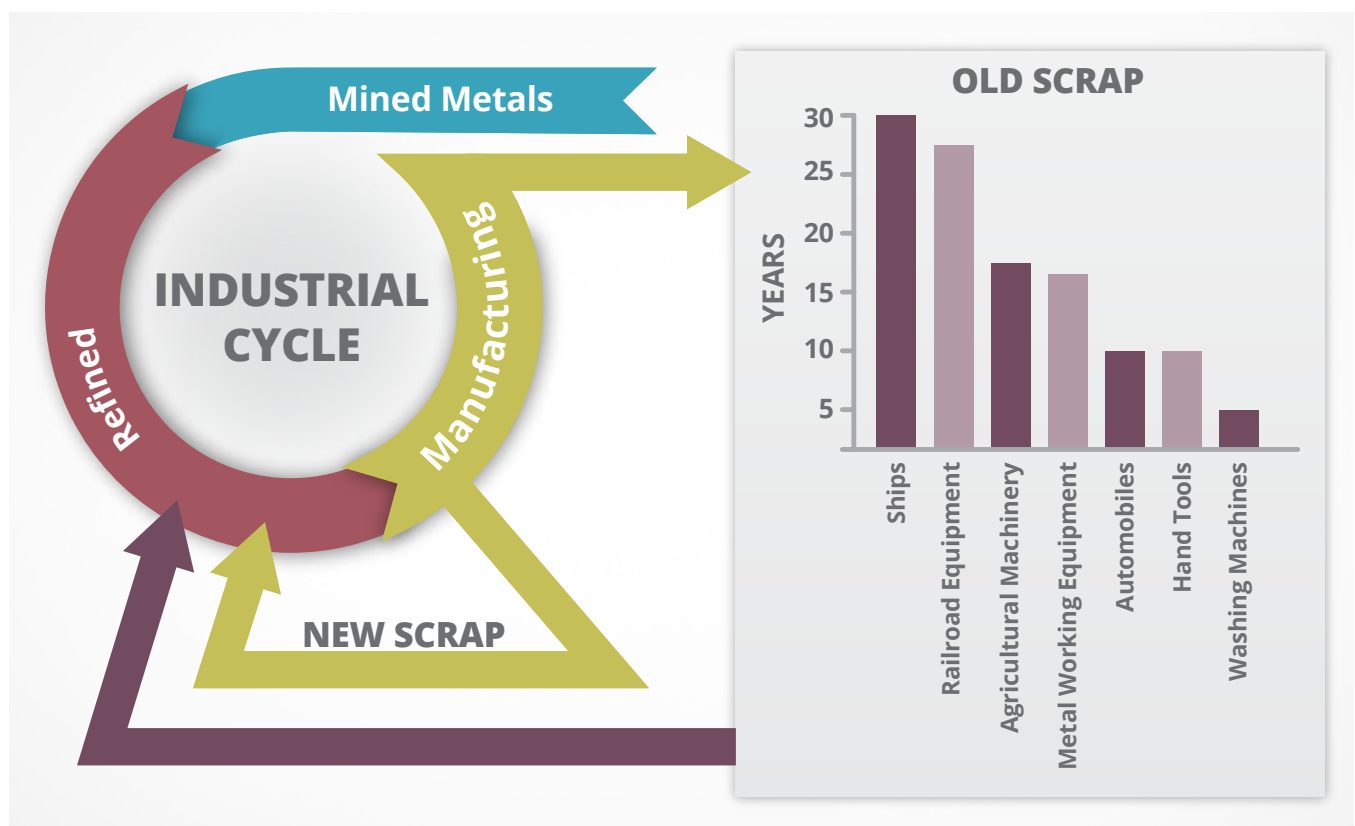


Figure 4 | Metal Use and Reuse



Look at Figure 4 and complete these sentences.

- 1.65 Before mined metals can be manufactured, they must first be _____.
- 1.66 The process of reusing worn-out materials is known as _____.

POPULATION

Population is a big concern. The growth of population in our country and in the world affects the way people live. As the population increases, so do the pressures and concerns exerted by that growth. Furthermore, people cannot be adequately represented by numbers; people have individual needs that demand satisfaction. Each person who has ever lived represents the image of God, as we are told in Genesis 1:26: "And God said, Let us make man in our image, after our likeness: and let them have dominion over the fish of the sea, and over the fowl of the air, and over the cattle, and over all the earth, and over every creeping thing that creepeth upon the earth." Every person is someone for whom Jesus Christ

died. John 3:16 states, "For God so loved the world, that he gave his only begotten Son, that whosoever believeth in him should not perish, but have everlasting life." Christians should be concerned with the physical and spiritual needs of our world's family.

The rate of growth. World-wide population is steadily growing. By the late 1970s, the population of the United States had more than doubled since World War I. In the year 2000, the census found that more than 281 million people resided in the United States. In the early years of this century, only a little over 100 million people lived in the U.S. The world population was more than 6 billion people in the year 2000.

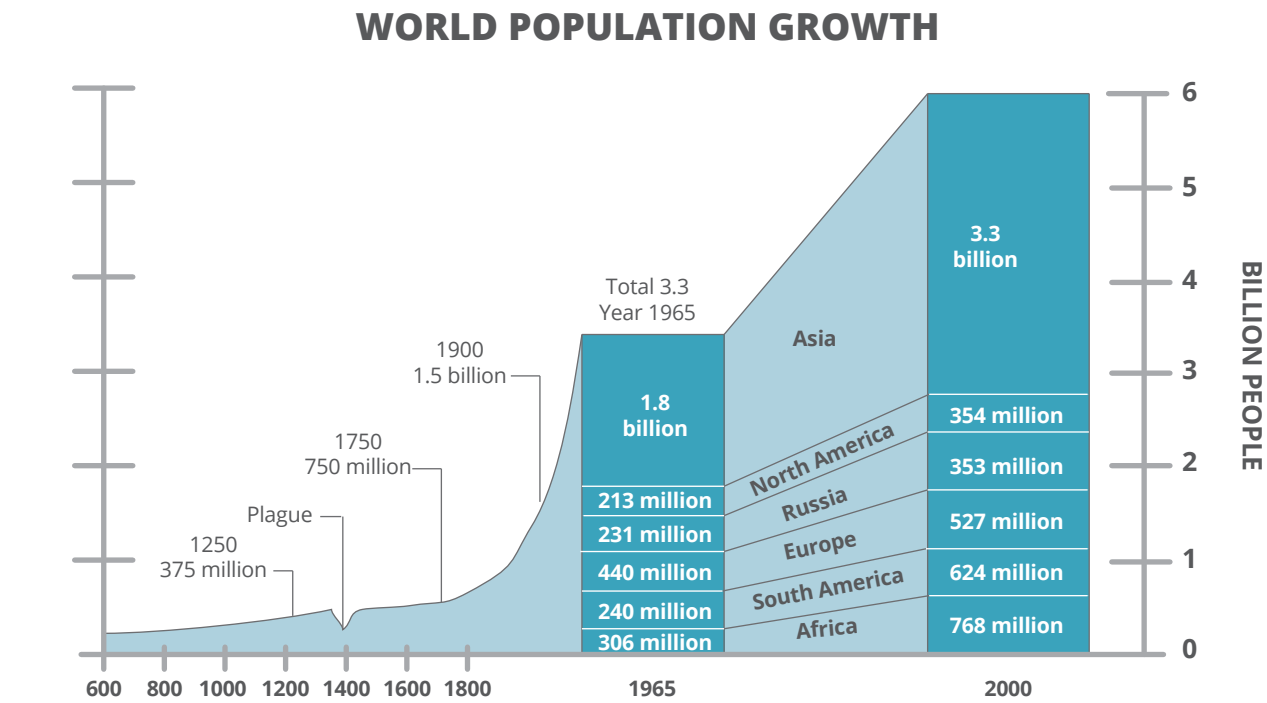


Figure 5 | World Population Growth



Look at Figure 5 and answer these questions.

- 1.67** How many people were living in the world in the year 2000? _____
- 1.68** In the year 2000 what percentage of the world population was living in North America?

- 1.69** Which area of the world possesses the largest number of people? _____
- 1.70** Which area of the world had the least number of people in the year 2000? _____

The problems of growth. A growing population exerts pressure in various forms, primarily in meeting the necessities of life. Some parts of the world are overcrowded. Such overcrowding leads to competition for food, housing, clothing, water, and other necessities. The medical profession is concerned about providing adequate medical care for so many people compacted into such limited living space. Overcrowding can be harmful psychologically. Man begins to

think, to act, and to live like his environment. Studies have been performed on animals forced to exist in overcrowded conditions. Results of such studies are not encouraging.

The problem of overcrowding must be faced and solutions offered. Charts showing population growth had been prepared as early as 1650. In recent years, population growth has taken a sharp increase.



Look at Figure 5 and write true or false.

- 1.71** _____ The years between 1650 and 1700 show the least growth in population.
- 1.72** _____ The population of the world decreased from 1800 to 1850.
- 1.73** _____ By 1900 the world had over two billion inhabitants.
- 1.74** _____ The population of the world nearly doubled between the years of 1965 and 2000.

The responses to growth. Populations are growing faster in some countries than in others. For example, the average resident of North America is surrounded by fewer people than is the average citizen of India. That average American will use over thirty times more natural resources than the citizen of India. Without the assistance of other industrialized nations, India may face more of the same problems of growth that North America experienced in its history.

With so many breakthroughs in medical and agricultural technology, the number of people living in the world is beginning to soar. Three hundred years ago, the world's population doubled every thousand years. Today, the population of the world doubles in less than thirty-five years.

Most people in the world live in under-developed nations. Those nations may not have enough natural resources to provide for a large number of people. Perhaps the natural

resources are available in those areas, but the people lack the ability to convert the resources into a usable form. One hundred pounds of soybeans must be fed to a hog or a cow to produce five pounds of meat protein. Although soybeans do not furnish a complete protein, the addition of certain substances such as milk to a diet of soybeans can furnish a person with a complete protein. In other words, by feeding

the animal the soybeans, ninety-five pounds of protein that could have fed many people is lost in the production of only five pounds of meat protein. Is such a loss of protein, realized on a much larger scale, wise or proper stewardship of our natural resources? How can we become better stewards of God's natural resources in the light of growing concerns facing an ever-demanding world population?



Write true or false.

- 1.75 _____ Population growth is uniform worldwide.
- 1.76 _____ India has a high population density.
- 1.77 _____ Today the world's population doubles in less than thirty-five years.
- 1.78 _____ Most people live in the developed nations.



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).

- | | | | |
|--------------|----------------------|----|--|
| 1.01 | _____ famine | a. | the relation of living things to their environment |
| 1.02 | _____ conservation | b. | a pesticide affecting birds of prey |
| 1.03 | _____ recycle | c. | to remove salt from sea water |
| 1.04 | _____ DDT | d. | a pesticide causing death or extreme physical harm |
| 1.05 | _____ ecology | e. | the result of a lack of food |
| 1.06 | _____ inner space | f. | needed to help prevent kwashiorkor |
| 1.07 | _____ desalinate | g. | the preserving of natural resources |
| 1.08 | _____ precipitation | h. | the possible fate of birds of prey |
| 1.09 | _____ methyl-mercury | i. | the ocean depths |
| 1.010 | _____ protein | j. | to use again |
| 1.011 | _____ "glassphalt" | k. | the result of condensation |
| 1.012 | _____ extinction | 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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date

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