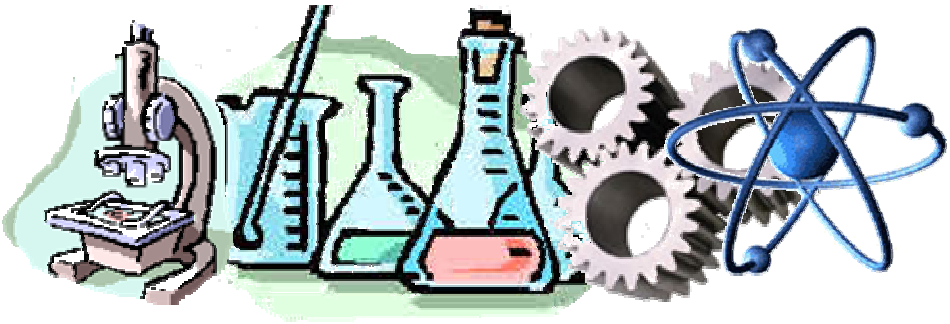
Project EASE

(Effective and Alternative Secondary Education)

INTEGRATED SCIENCE I



MODULE 11

BUREAU OF SECONDARY EDUCATION
Department of Education
DepED Complex, Meralco Avenue

Pasig City

Module 11
Earth's Resources

What this module is about

Humans need food as source of energy. We need water to maintain body temperature, eliminate waste matter, dissolve other substances and prevent dehydration. We need air because there is oxygen in air. Oxygen is used to burn the food we eat to release the energy stored in the food. We need firewood for cooking and as a source of light.

Where do we get food, water, air and other necessities? We get it from the many natural resources deposited/present in our abode. In this module we shall learn the following lessons:

- **Lesson 1 - The Earth's Resources**
- **Lesson 2 - The Earth's Freshwater**
- **Lesson 3 - The Earth's Ocean**
- **Lesson 4 - The Earth's Soil**
- **Lesson 5 - The Earth's Mineral**
- **Lesson 6 - The Earth's Biodiversity**

What you are expected to learn

After going through the module, you are expected to:

1. identify the resources of Planet Earth;
2. show how humans maintain and restore the integrity and balance of an ecosystem;
3. illustrate how the natural resource can be used wisely; and
4. discuss specific technologies /activities to conserve/protect nature.

How to learn from this module

1. Read the instructions carefully.
2. Take the pretest before reading the rest of the module.
3. Do all the activities and exercises.
4. Use the concept discussed in each lesson to explain the results of activities or exercises.
5. Take the posttest after you have finished the lessons and performed all activities or exercises.

What to do before (Pretest)

Direction: Select the letter of the word/group of words that best answers the question.

1. A natural resource is any material or element from the environment that humans
    a. have not created
    b. observe scientifically
    c. make for themselves
    d. use to meet their needs

2. A resource that people can use again and again without destroying it is called
    a. renewable
    b. unlimited
    c. non-renewable
    d. potentially renewable

3. The resource base varies in different parts of the world because resources are not
    a. sufficient to meet the needs of developed countries
    b. needed in the same amounts by all people
    c. taken from both land and water in all countries
    d. evenly distributed on the earth

4. The mineral particles in soil come from bits of rocks called
    a. plant food
    b. parent material
    c. topsoil
    d. subsoil

5. When heavy rains drain off nutrients from the soil, the soil is said to have become
    a. barren
    b. fertile
    c. sandy
    d. leached

6. Is the earth's freshwater uniformly distributed?
    a. Yes, because all places have the same amount of freshwater.
    b. No, because all places have the same number of surface water.
    c. No, because some places have more water supply than other places.
    d. It cannot be determined.

7. Which of the following is the source of biotic resources?
    a. manufacturing
    b. croplands
    c. wildlands
    d. living things

8. Which of the following is potentially renewable?
    a. wood
    b. fish
    c. corn
    d. all of them

9. Which of the following metal/minerals is used to make electrical wires, hardware, and pipes?
    a. bauxite
    b. copper
    c. gold
    d. tin

10. What stage of wastewater treatment makes use of microorganisms?
    a. primary treatment
    b. secondary treatment
    c. tertiary treatment
    d. all of the above

11. Why do we add chlorine to water during water purification?
    a. It bleaches the water.
    b. It kills the microorganisms.
    c. It removes odors.
    d. Both a and b

12. Which of the following practices makes soil infertile?
    a. use of fertilizer
    b. green manufacturing
    c. extensive agriculture
    d. use of compost matter

13. Conservation of resources means
    a. not using it at all
    b. using resources wisely
    c. using it in a way that does not damage the environment
    d. Both b and c


Key to answers on page 30

Before you start with the lessons in this module, familiarize yourself with the terms listed in Table 1:

Table 1 Terms we need to know in this module

Balance in nature	Refers to the state or condition in which the ecological process in a community go on smoothly
Biodiversity	Different life forms
Bioremediation	Recovering water and soil quality through the use of microorganisms
Conservation	To use resources wisely
Desalination	Process of removing salts from seawater
Natural resource	Refers to the planet's air, water, soil, and other resources
Renewable resource	Resource that can be renewed, replenished or regenerated in human time scale
Non-renewable resource	Resource that exists in a fixed quantity and can de depleted much faster than they are formed
Potentially renewable resource	Can be replenished fairly rapidly through natural process

Phtyoremediation	Removing pollutants from soil and water with the use of plants
Wastewater treatment	Technology to remove wastes from wastewater of industries and dirty bodies of freshwater
Water purification	Process of making potable water from surface water /groundwater for human consumption

Lesson 1 The Earth's Resources

You often hear it said that the Philippines is rich in terms of resources. What is a resource? We can look at it in two ways.

1. **Ecological resource**
   - is anything required by organisms like you for normal maintenance, growth and reproduction. Examples are water, shelter, food, and habitat.

2. **Economic resource**
   - is anything obtained from the environment to meet your needs and wants. Examples are food, water, shelter, manufactured goods, transportation, communication and recreation.

What is a natural resource?

Natural resource or natural capital is the planet's air, water, soil, wildlife, mineral and natural purification , recycling, and pest control processes. Solar capital is the energy from the sun.

You can see these resources in Fig. 1.1

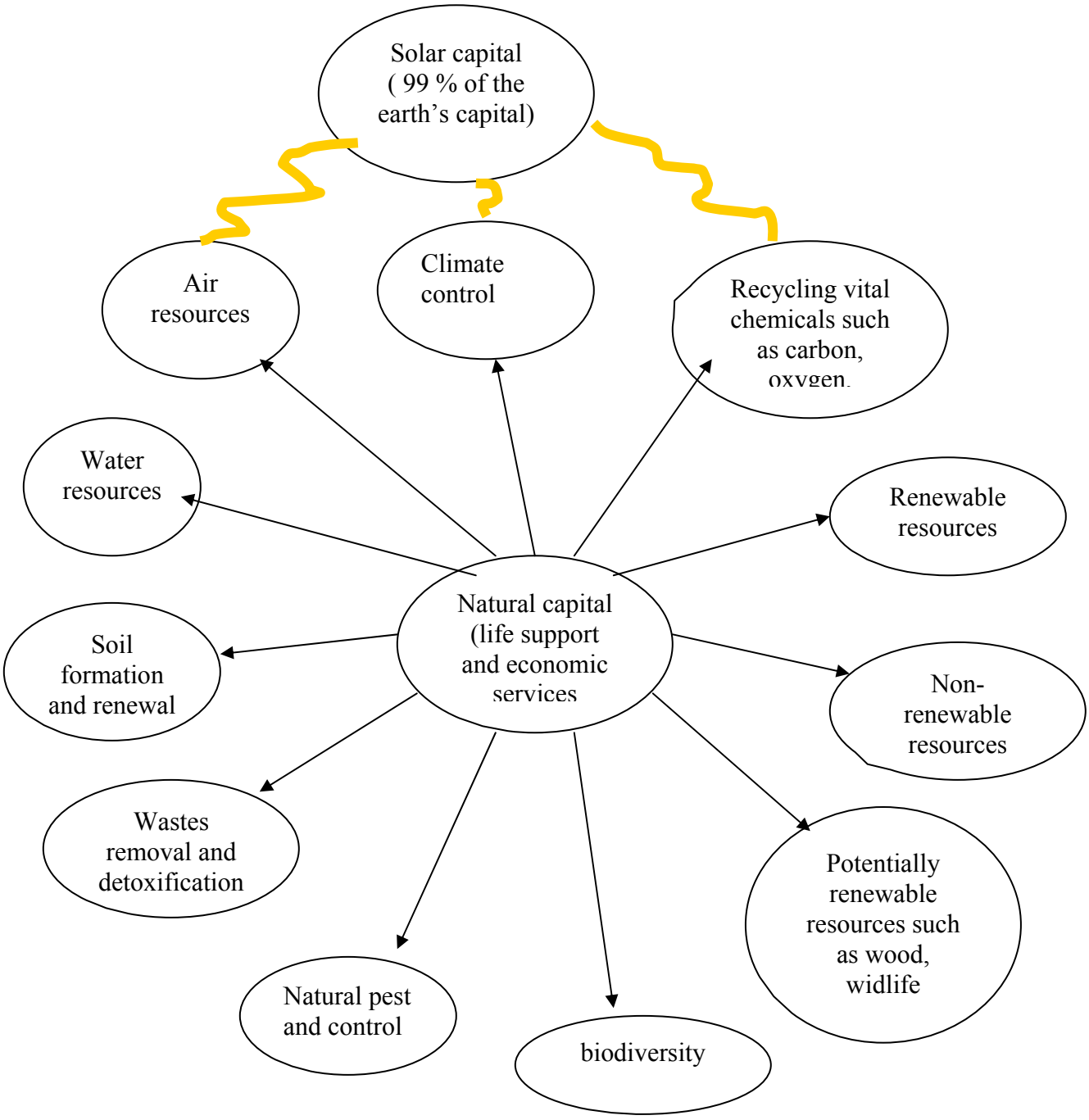


Fig. 1.1 Solar and natural capital taken from T. Miller (***Environmental Science***)

Based on the short human time scale, natural resources are classified into three categories. Table 1.1 lists the three categories of natural resources.

Table 1.1 Kinds of Resources

Categories	Description	Examples
1. renewable resources (perpetual resource)	Can be renewed, replenished or regenerated	Solar energy Geothermal energy Water power
2. potentially renewable	Can be replenished fairly rapidly (hours to decades) through natural processes	Forest trees, grassland grasses, wild animals, fresh lake and stream water, groundwater, fresh air and fertile soil
3. nonrenewable resources (exhaustible resource)	Exists in a fixed quantity and can de depleted much faster than they are formed New stores of these resources may not be available again for several thousands or even millions of years	Energy resources such as coal, oil, natural gas and uranium Metallic mineral resources such as iron, copper and aluminum which can be recycled Nonmetallic mineral resources such as clay, sand salt

We have a lot of resources to meet our needs. Some of these resources are finite. Other resources are renewable but it takes time to replace or replenish them. Unfortunately, the rapid consumption of these raw materials by our expanding population has led to the exploitation of the natural resources. Exploitative attitudes of humans rapidly reduce the availability of natural resources.

What you will do

Activity 1.1

1. Make a poster about the state of the different resources in your place that are needed for survival.
    a. Does the poster you make mirror available resources to you and your family?
    b. Which resources are not available? Why?
    c. As a person with needs and wants, how can you stop the depletion of the resources in your place?

Your answer in **1.c** brings us to the question," Are we going to use these depleting resources or not? As mentioned in lesson 1, we depend a lot on the natural resources to meet our needs and wants. We can not afford to lose any of the earth's resources as our survival depends on them. There is then a need to safeguard them. We can safeguard these resources through conservation.

Conservation means not to use any of the natural resources but to utilize, manage and preserve our natural resources properly. It requires wise use of natural resources. When using these resources, we need to make sure that the environment is not damaged in the process. The aims of conservation include the following:

1. **To ensure the continued availability of resources for future generations**
2. **To protect and maintain the quality of ecosystems that provide these resources**

Conservation measures for safeguarding different kinds of resources are interrelated since an effect on any kind of resource often influences another. For example, conserving forests by planting trees on bare land and mountainside improves the physical environment. Why? Trees prevent soil erosion. They provide dwelling places for tree-inhabiting animals. The leaves of trees use carbon dioxide, a greenhouse gas, as raw material for photosynthesis. Thus, forest conservation prevents global warming and conserves fertile topsoil and wildlife diversity.

What you will do

Self-Test 1.1

Direction: Select the letter of the choice that correctly answers the question.

1. Which of the following is a renewable resource?
   a. uranium as source of energy
   b. solar energy
   c. natural gas
   d. wood

2. A resource that is destroyed when used, but can be replaced is said to be:
   a recyclable
   b nonrenewable
   c renewable
   d. potentially renewable

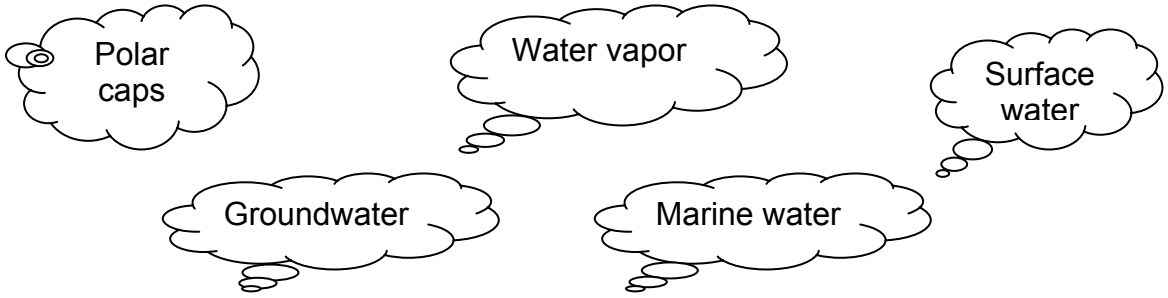
3. Which of the following does not belong to the natural capital/natural resource?
   a. air b. land c. water d. energy from the sun

4. Which of the following can not be depleted by human activities?
   a. trees b. solar energy c. natural gas d. coal

Key to answers on page 30

Lesson 2 The Earth's Freshwater Source

Water is important to all of us. Each of us drinks about 1.5 liters of water everyday. We depend on its good quality and quantity for drinking, cooking, cleaning , recreation, use in industry and growing crops. It is also vital to sustaining the natural systems on and under the earth's surface. Below are sources of the earth's freshwater.



Polar caps are frozen water formed in cold areas such as in high mountains and in the polar regions. These polar caps contain 2 % of the available freshwater on earth. This is the earth's water reserve. Scientists are trying to develop ways of sourcing freshwater from polar caps.

What you will do

Activity 2.1

1. Do you have a water pump in your place?
2. Do you and your family get water from a water pump?
3. List the uses of the water you get from the water pump.

The water you get through a water pump is called ***groundwater.*** Groundwater is the water that fills the tiny spaces between alluvial material (sand, gravel, silt, clay) or the crevices or fractures in rocks. It is a hidden resource. It accounts for more than 95 % of all available freshwater for use. Nearly 95% of rural residents rely on groundwater for drinking supply and for washing soiled clothes. Irrigated croplands use groundwater. Groundwater is also used for industries.

There are problems associated with groundwater. Contaminants such as pesticides and fertilizers sometimes find their way into groundwater supplies. If groundwater is extracted beside sewerage system or an underground chemical storage tank, it is possible for untreated waste from septic tanks and toxic chemicals from underground storage tanks to contaminate

groundwater over time. Road salt, toxic substances from mining sites, and used motor oil also contaminate groundwater. Drinking contaminated groundwater can have serious health effects. Diseases such as hepatitis and dysentery may be caused by contamination from septic tank waste. Poisoning may be caused by toxins that have leaked into well water supplies. Wildlife can also be harmed by contaminated groundwater. Other long term effects such as certain types of cancer may also result from exposure to polluted water.

Over extraction of groundwater can lead to lowered water table. Thus, the water table often dries up during summer. Ground subsidence may also occur.

Another source of freshwater is surface water. Surface water includes

Rivers	Streams and creeks	Lakes and ponds
Reservoirs such as dams and watershed		Cascade and waterfall

What you will do

Activity 2.2

1. Have you been to rivers, lakes, ponds or creeks in your place?
2. If so, what did you do?
3. List the uses of the water from a river, lake or creek.

Sources of surface water such as a river are more accessible than ground water. The Philippines has many rivers, lakes, ponds, streams and creeks. Watersheds provide much of our freshwater supply.

Watersheds are sloping regions of the land wherein run-of-the-river reservoir is established. The vegetation surrounding the watershed must be maintained. This ensures sustainable supply of freshwater.

A place may also adopt a storage reservoir by building dams. Most dams are built to prevent flooding. A good example of a dam that counteracts water shortage is the Pantabangan Dam in Bulacan.

The distribution of surface water source is not uniform. Some places have more of it while others have less. Thus, surface water is transferred from one basin to another through pipelines, reservoirs, canals or aqueduct. However the transfer of water from one place to another presents problems to water supplies. Below are some problems due to excessive water transfer.

Reduction of the size of the river or lake which affects the life of the village

Examples of the problems experienced in a the village:

1. reduced rainfall
2. reduced fish caught
3. increased average temperature
4. increased wind velocity
5. reduced supply of potable water

Freshwater from surface water is not used immediately as potable or drinking water. It has to undergo purification in filter plants for it to be fit for drinking. A good example of filter plant is the Balara Filter Plant in Balara, Diliman, Quezon City. The water is carried by huge pipes from La Mesa Dam. The water is screened to remove suspended particles. Aluminum sulfate and calcium oxide are mixed with water. The mixture is added as soon as water enters the plant. A gelatinous substance, aluminum hydroxide, is formed. The tiny particles in water aggregate with the gelatinous aluminum hydroxide to form big particles. In the sedimentation ponds, the aggregates settle to the bottom. The water is passed through a filter bed with grains of sands and activated carbon. To remove microorganisms, chlorine gas is added to water to produce hydrochloric acid and hypochlorous acid. Hydrochloric acid kills the microorganisms while hypochlorous acid bleaches the water. The disinfected water may be aerated by spraying it into air prior to distribution to different households and establishments. The entire technology is shown in Fig. 2.

Fig. 2.1 Water purification plant

Many bodies of freshwater in the country are polluted. Why? When we farm lands beside these bodies of water, fertilizers and other farm inputs seep into them when it rains. Also, Filipinos grow pigs and ducks near freshwater sources so wastes are emptied into

these water sources. We use bodies of freshwater as dumping grounds of domestic, agricultural and industrial wastes.

There is a need to rehabilitate major rivers and lakes by removing debris and other waste materials. An example of a rehabilitation program the government has created is the Laguna Lake Development Authority (LLDA) for Laguna de Bay alone. There is also a rehabilitation program for the Pasig River.

Bioremediation may be an answer to saving contaminated groundwater as well as polluted rivers, lakes and other bodies of freshwater in the country. How? Contaminated groundwater is pumped to the surface, where it is treated with microorganisms to feed on contaminants and then returned to the aquifer. The same can be done to polluted surface water. Another biological way is **phytoremediation**. It uses plants such as *kangkong* to remove heavy metals present in water. The current practice is to use genetically engineered plants. A good plant for phytoremediation is the fast-growing poplar trees which act as straws that suck contaminants in soil and groundwater. The contaminants are stored in their tissues or metabolize into safe compounds which are released into the atmosphere.

Many industries generate waste water. Some companies such as the subsidiaries of the San Miguel Corporation put up wastewater treatment plants. Each has its own wastewater treatment facility. We shall talk about the different steps in cleaning wastewater.

Preliminary Treatment (Karen Mancl)

Solid debris such as wood, rocks, dead animals and other solids pass through a series of screens of different mesh. These debris are grated or separated. Treatment equipment such as bar screens, comminutors (a large version of a garbage disposal), and grit chambers are used as the wastewater first enters a treatment plant. Once reduced to pieces, it is sent to a landfill.

Primary Treatment

Primary treatment is the second step. It removes suspended solids and grease from wastewater. This is done by keeping wastewater in a quiet tank for several hours to allow suspended particles to settle to the bottom and the greases to float to the top. The solids drawn off the bottom and skimmed off the top receive further treatment as sludge. The clarified wastewater flows on to the next stage of wastewater treatment. Clarifiers and septic tanks are some of the equipment at this stage.

Secondary Treatment

Secondary treatment is a biological treatment process to remove dissolved organic matter from wastewater. Sewage microorganisms are cultivated and added to the wastewater. The microorganisms absorb organic matter from sewage as their food supply. There are three secondary wastewater treatment approaches.

1. Fixed Film Systems

In this system, microorganisms are grown in rocks, sand or plastic. The wastewater is spread over the rocks, sands and plastics with microorganisms. As organic matter and nutrients are absorbed from the wastewater, the film of microorganisms grows and thickens. Trickling filters, rotating biological contactors, and sand filters are examples of fixed film systems.

2. Suspended Film Systems

Microorganisms are suspended and stirred in wastewater. As the microorganisms absorb organic matter and nutrients from the wastewater, they grow in size and number. After several hours in wastewater, the microorganisms are settled out as a sludge. Some of the sludge is pumped back into the incoming wastewater to provide "seed" microorganisms. The remainder is removed and sent on to a sludge treatment process. Activated sludge, extended aeration, oxidation ditch, and sequential batch reactor systems are all examples of suspended film systems.

3. Lagoon Systems

Lagoon systems are shallow basins which hold the wastewater for several months to allow for the natural degradation of sewage. These systems take advantage of natural aeration and microorganisms in the wastewater to remove sewage.

Final Treatment

Disease-causing organisms are removed from wastewater during the final treatment. This is done by adding chlorine or by using ultraviolet light. Too much chlorine harms aquatic life in receiving streams. Thus, chlorine-neutralizing chemical is added to the treated wastewater before stream discharge.

The entire process of cleaning wastewater from factories, dirty bodies of water like Pasig River and Septic Tank for domestic use is summarized in Fig. 3.1

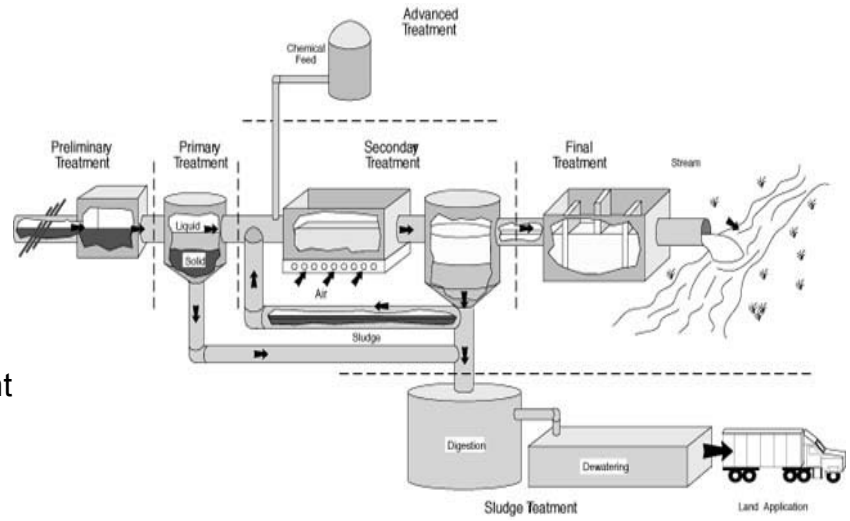


Fig. 3.1 Wastewater Treatment

What you will do

Self-Test 2.1

Direction: Select the letter of the choice that correctly answers the questions or completes the statements.

1. Which of the following is the water reserve of the earth?
   a. Surface water c. frozen water
   b. Ground water d. non of the above

2. The water that fills up every spaces between soil particles is called
   a. surface water c. meltwater
   b. groundwater d. watershed

3. The land area in which water runoff drains into a river or river system is called
   a. groundwater c. surface water
   b. meltwater d. watershed

4. A substance added to water to kill microorganisms is
   a. chlorine gas
   b. detergent
   c. fertilizer
   d. oxygen

5. What is the effect of bringing river water into another river basin?
   a. ground subsidence c. reduced size of the body of water
   b. collapse of river bed d. water pollution

6. Which of the following can be used to remove pollutants from water?
   a. phytoaccumulation c. burning
   b. biomagnification d. incineration

Key to answers on page 30

Lesson 3 Marine Water

We live in a country with 7100 islands. Thus, we have enough marine resources. These resources include the coastal areas where mangroves, seagrass communities, beach forest and coral reefs are found. They provide habitats for many marine organisms such as algae, mollusks, fishes and crustaceans. These organisms are used by man for food. Beaches are also popular recreational areas.

Marine water is very salty. Let us do Activity 3.1 to find out how much salt is present in marine water.

What you will do

Activity 3.1 How much salt in marine water

What you need:

beaker or aluminum pot, Stove/source of heat, seawater, weighing scale

What to do:

1. Get a glass of seawater.
2. Place it into an aluminum pot
3. Heat to dryness. When water is all gone, what do you see?
4. Weigh the residue left in the pot.

What you have obtained when you heated seawater to dryness was a white residue. It is the salt that we use with our food. The salt in marine water is about thirty five percent (35%). Thus, we can not drink seawater without removing the salt. If this salt is removed, the water becomes a potable water. How can we remove the salt?

This is done through desalination. **Desalination** is a process of removing salt from water. This is shown in Fig. 3.1

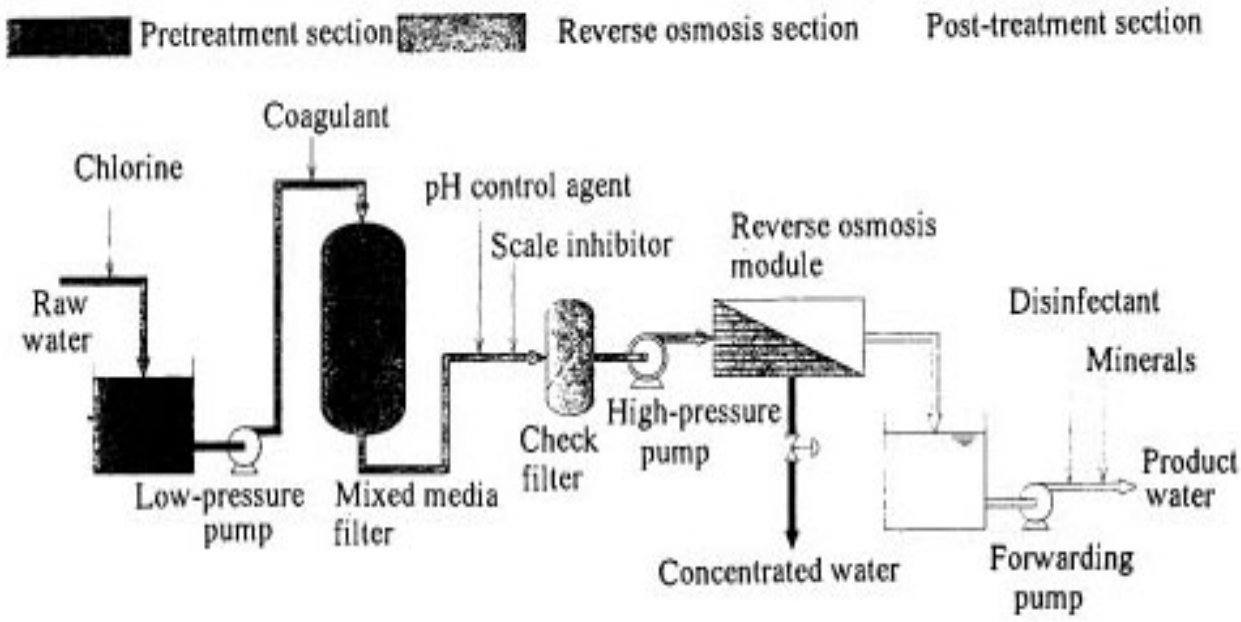


Fig. 3.1 A desalinating plant (Photo credited to http://nett21.unep.or.jp/)

There are different ways to desalinate salt water. One is through rapid spray evaporation (RSE). RSE ejects the salt water through a nozzle into a stream of heated air, forming a mist of droplets which vaporize almost instantly. Solid flakes of salt fall to the bottom of the container during the process and can be collected.

The coastlines of the Philippines measure 34600 km. More than half of the Filipinos live near coastal areas. They depend on fishing for their livelihood. However, over-fishing, compounded with dynamite, cyanide and moro ami fishing, has caused marine resources to decrease rapidly. Marine life has also been adversely affected by oil spills from motorboats or tankers and debris made of plastics from beach resorts.

Marine waters are contaminated with all kinds of pollutants. Garbage dumped into the ground and rivers all end up in the sea. You can even find plastic in Sargasso Sea, a sea very far from human dwelling places.

What you will do

Self-Test 3.1

Direction: Select the letter of the choice that correctly answers the question.

1. How do we utilize marine water as a source of drinking water?

   a. By distillation
   b. By evaporation
   c. By filtration
   d. By desalination

2. Which of the following degrades the quality of water?
    a. moro ami fishing
    b. cyanide fishing
    c. dynamite fishing
    d. all of the above.

3. We use marine water as
    a. food source
    b. means of transportation
    c. means of recreation
    d. all of the above

Key to answers on page 30

Lesson 4 Land and Soil

Land is teeming with life of myriad forms. A hectare of soil may contain at least 300 million invertebrates – mites, millipedes, insects, worms, and other tiny creatures. About 30 grams of soil may contain one million bacteria, 100,000 yeast cells and 50,000 fungus mycelium. Without these microorganisms, soil could not convert nitrogen, phosphorus, and sulfur to forms useful to plants.

Soil can support multitude of life forms which in turn enable it to support plants. Through constant self-reinforcing forces, the soil becomes enriched with dead organic matter that helps make soil fertile. Soil also contains water. We shall do Activity 4.1 to approximate the absorption rate of your soil .

Activity 4.1 Soil Absorption Rate Experiment

What you need:

Can, can opener, hammer, water, watch

What to do:

1. Cut the top and bottom from a can.
2. Hammer the can halfway into the ground you want to test.
3. Pour a specified amount of water into the can that is in the ground. The amount of water should not overflow the top of the can and you should be able to pour all of it into the can at one time.
4. With a stopwatch determine the number of seconds that elapse until the water is absorbed into the soil.
5. Divide the number of seconds by the number of ounces to get a rate in ounces per second.

Some soil have difficulty absorbing water. Such soil is not good for living things on land. Some soils cannot water long enough. The soil is also not good for planting crops. But

there are soils such garden soil can hold enough water for plants and other land creatures. It is this soil useful to farmers.

This natural resource is renewable but difficult to replace. Why? As learned in module 12, it takes time to form soil. One third of the earth's surface is covered by land, amounting to about 32 billion acres. Not all land is useful to man. Most are mountainous and rocky. Deserts do not have enough water to support crops. Snow-covered land cannot be used for farming.

What are the uses of land and soil? We build towns and cities to house the ballooning human population. We need land for industry and agriculture. Through agriculture, we are able to feed the growing number of humankind.

Huge tracks of land are also used in growing animals that are sources of food for man. These animals include chicken, pigs, cows, goat, sheep, and carabao. These animals have to be fed. So, we need lands to plant vegetation to feed them.

Despite the importance of land and soil to man, we degrade the quality of soil is lost or degraded through:

erosion by running water	erosion by wind	removal of vegetation	soil contaminants

Soil erosion can be avoided or reduced in many ways. These practices include the following:

Contour farming plows and plants crops in rows across the sloped contour of the land. This holds soil and slow water runoff.	Plant "row crops" such as corn or tobacco on a slope in strips alternating with grass or similar plants (strip cropping)	Terracing reduces soil erosion on steep slope
Alley farming or agroforestry is a form of intercropping in which several crops are planted together in strips or alleys between trees and shrubs that can provide fruit or fuelwood.	Windbreaks or shelterbreaks are long rows of trees are planted to partially block the wind.	Gullies created by water runoff can be reclaim by planting quick-growing shrubs, vines and trees.

Fertile soil is also lost through conversion of prime agricultural lands into urban and suburban development such as subdivisions. Filipinos should consider high rise dwelling places instead of single detached housing to reduce conversion of arable lands to subdivisions.

We throw cans, bottles, paper, plastics, and other objects into the ground. Some of these particles/objects are not biodegradable. Would you like to know how much garbage each of us produce everyday which we may dump into the ground? Let us do Activity 4.1

What you will do

Activity 4.1 Waste you generate everyday

1. It is Monday and you are leaving home. Bring a bag with you.
2. Into this bag, put all the solid wastes you produce the whole day
3. Once home, weigh the bag full of garbage. How much garbage did you accumulate the whole day?
4. If there are ten of you in the family, how many kilos of garbage does your family produce in a week?

If we dumped this much garbage everyday, we produce mountains of garbage after some time. These mountains of garbage destroy soil. Can we reduce the bulk of garbage we produce everyday? Yes, there are many ways of doing it.

1. sort the garbage
2. recycle used paper
3. reuse bottles and cans
4. bring metal scraps, metal cans to recycling plants

Many farmers use agrochemical farm inputs. Examples of agrochemical farm inputs are synthetic chemical fertilizers and pesticides. These farm inputs also destroy soil. Why?

synthetic chemical fertilizers which may harden soil or make soil acidic or basic

Pesticides such as insecticide, herbicide and fungicide which kill even the earthworms, the farmer's chemist

Since pest can not be avoided, farmers should consider Integrated Pest Management (IPM). You can start this technique by knowing the pest and their natural enemies. By doing so, effective and environment-friendly insect management control program can be designed.

To maximize the potential of land and soil for agriculture, new crops were developed, better farming techniques were designed, unfertile soil was made fertile and many more. One way to increase productivity of soil is through irrigation, which waters dry land. Thus, barren deserts are now productive. Crop rotation could help improve soil fertility. Farmers may use composted agricultural wastes and unprocessed crushed rocks containing potassium and phosphate ions. Green manure (fresh or growing green vegetables) is plowed into the soil to increase organic matter.

Finally, denuded forest should be reforested. If you live beside an empty lot, plant a tree – fruit-bearing tree like mango and avocado, gmelina, neem tree, madre de cacao, ipil-ipil, and other trees that do not require much care. When these trees are fully grown, their roots can hold water and soil. It can also remove carbon dioxide and other gaseous pollutants. It also provides homes to tree-dwelling animals.

What you will do

Self-Test 4.1

Direction: Select the letter of the choice that correctly answers the question.

1. Which of the following is most useful land?
   a. mountainous land
   b. rocky land
   c. snow-covered land
   d. plain

2. Which of the following practices is the best way to improve soil fertility?
   a. Apply synthetic chemical fertilizer.
   b. Use composted agricultural wastes.
   c. Use burnt agricultural wastes.
   d. all of the above

3. What is the consequence of using synthetic chemical fertilizers?
   a. soil becomes hard
   b. soil becomes acidic
   c. soil becomes basic
   d. all of the above

4. Which of the following causes soil infertility?
   a. application of composted farm wastes
   b. extensive agriculture
   c. over-grazing

d. b and c

5. Which of the following improves land productivity?
   a. better farming technique
   b. improved crop variety
   c. irrigation
   d. all of the above

Key to answers on page 30

Lesson 5 Mineral Resources

Our country needs dollars as well as raw materials for industries. Mineral deposits can supply these needs.

Activity 5.1 The minerals at home…

What to do:

1. Look at the ears, neck, fingers, wrists head of all members of the family? What do they have in these body parts?
2. Get the purse of the family members. What do you find in the purse?
3. Go the kitchen. You will find utensils and pots.

From steps 1 to 3, you will find metals used as jewelries, coins, utensils and cooking pots. Where do these metals come from? The come from metallic mineral ores.

Metallic mineral ores contain iron, aluminum and copper, which are important to construction industry. The same is true with non-metallic minerals such as quartz. Table 5.1 shows these important minerals to industries.

Table 5.1. Metallic/non-minerals and its uses

Metallic/nonmetallic minerals	Important substance	Product	Use
Iron ore	Iron	With chromium, iron is made into steel	Construction
Copper ore	Copper	Electric wires	Electrical wiring
Aluminum ore	aluminum	can	Food packaging
Native elements	Gold and silver	Jewelry	accessories

Minerals are removed from rocks through mining. Mining companies use the following methods to identify promising mineral deposits:

Information about plate tectonics and mineral formation	Aerial photos and satellite images can reveal rock formation associated with certain minerals	Instruments on aircrafts and satellites can detect mineral deposits by their effects on earth's magnetic or gravitational fields

Once mineral deposits are identified, there are several ways to obtain them. These are:

Surface mining is used to remove shallow deposits.

1. Open-pit mining creates holes to get sand, gravel, limestone, sandstone, slate, granite and marble.
2. Dredging uses chain buckets and draglines to scrape underwater mineral deposits
3. Strip mining uses bulldozers, power shovels or stripping wheels to remove coal and phosphate rock

Subsurface mining removes deep deposits.

We can also get mineral by mining the oceans. These minerals are found in seawater (magnesium, bromine and sodium chloride), sediments and deposits in shallow continental shelf (sand, gravel, phosphates, sulfur, tin, copper, iron, tungsten, silver, titanium platinum, and diamonds), and sediments and nodules on the deep-ocean floor (manganese, nickel, copper and cobalt).

Mining is one of humankind's oldest activities but the techniques used to extract minerals have not changed substantially for centuries. Ores are dug from the earth, crushed, then minerals such as copper and gold are extracted by extreme heat or toxic chemicals. Extraction can be done physically, chemically or both. The purified minerals are sent to manufacturing plants to be made into final products such as galvanized iron. Each step has an effect on the environment and our health. The following boxes show the effects of mining, extraction, and utilization of substances from ores.

Mining disrupts land	Mining pollutes land, water, and air	This affects biological diversity of the area

The environmental and health effects of traditional mining technologies have been harmful. The following alternatives had been identified.

Biomining

Now, the mining industries have turned to microorganisms to separate minerals from ores. This method of extraction, termed biomining, is more efficient and environment friendly. Using a bacterium such as *Thiobacillus ferooxidans,* to separate copper from rocks or mine tailings have improved recovery rates and reduced operating costs. Moreover, it allows extraction from low grade ores, an important consideration in the midst of depletion of high grade ores.

How does the bacterium extract the minerals from rocks? Poor quality metal ore such as copper sulfide and iron sulfide is dumped outside a mine and treated with sulfuric acid to encourage growth of *Thiobacillus ferooxidans* which can be obtained from sulfur-containing materials. The bacterium gets energy by oxidizing inorganic materials. The process releases copper or iron and the metal is collected from the solution. The sulfuric acid is recycled.

Recycling of metal scraps

About ½ of the iron requirement of steel industry comes from scrap. About 1/3 of aluminum needs of some industries comes from recycled cans. Recycling iron and aluminum brings energy savings. The energy required to produce one ton of secondary aluminum from scrap is only 5 % of the energy required to extract and purify primary aluminum from ore. Scrap is now a vital source of supply for metals.

Many products are packed in cans. Almost everybody patronize these products at home, restaurants and canteens. Instead of throwing away aluminum cans of soft drinks, tin cans and iron-containing cans, we can recycle them. Let us have can drive campus wide so as rusty metals lying some corners at home

What you will do

Self-Test 5.1

Direction: Select the letter of the choice that correctly answers the question.

1. How do we get mineral ore from great depths?
   a. placer mining c. open-pit mining
   b. gold panning d. subsurface mining

2. Where do we the find bacteria that are useful for biomining?
    a. cold spring c. pond
    b. hot spring d. soil

3. Which of the following substances is important to the growth of bacteria for biomining?
    a. sodium hydroxide c. sulfuric acid
    b. sodium chloride d. none of the three

4. Which of the following packaging material can be replaced by plastic?
    a. Aluminum c. tin
    b. Glass d. none of the three

5. Where does steel industry get its metal supply?
    a. newly mined raw materials
    b. metal scrap
    c. metal store
    d. none of the above

Key to Correction on page 30

Lesson 6 Biodiversity

Visit a pond, forest, or park near your home and do the activity found in the box below.

What you will do

Activity 6.1

1. Select an area in forest, park or pond

2. Identify the different plants located in that area.

3. Count the number of individuals per species

You have just seen the different life forms in soil, water and mining sites that best survive the variety of conditions found on Earth. They exemplify ***biodiversity***. Biodiversity is potentially renewable resource. There are three levels of biodiversity- genetic (variety in the genetic makeup among individuals in the species), species diversity (variety among the species or distinct types of organisms found in the different habitats of the planet), and ecological (variety of forests, deserts, grasslands, streams, lakes, oceans, wetlands, and other biological communities).

Biodiversity is not evenly distributed throughout the biosphere. It is highest in the tropics and declines toward each pole in land, freshwater and oceans. There are more species in coral reefs in Indonesian archipelago and declines westward across the Pacific Ocean. Some regions of the world contain unusually large concentrations of species and are called ***biodiversity hotspots***. The Island of Madagascar, the Cape region of South Africa, the Great Barrier reef of Australia are biodiversity hotspots.

Biodiversity has direct and indirect value to man.

Direct Value

1. medicinal value such as penicillin from fungus, tetracycline and streptomycin from certain species of bacteria from
2. agricultural such as wheat, corn and rice
3. consumptive use value like fish and shellfish

Indirect value

1. biogeochemical cycles
2. waste disposal
3. provision of freshwater
4. prevention of soil erosion
5. regulation of climate
6. ecotourism

This rich variety of genes, species, and biological communities gives us food, wood, fibers, energy, raw materials, industrial chemicals, and medicines. It also provides us with free recycling, purification, and natural pest control services.

Despite the enormous number of life forms on earth, many organisms have disappeared from the environment. Others are on the verge of being wiped out from the earth. There are many causes that lead to the decrease or disappearance (***extinction)*** of biodiversity. Some of the causes are

habitat loss or damaged dwelling places of organism	introduction of foreign organisms into an ecosystem	pollution that leads to acid rain, depletion of the ozone layer and global warming

overexploitation or removal of the organisms from a place that significantly reduces its number

The country has lots of endangered organisms. Examples are monkey-eating eagle in Mindanao, tamaraw in Mindoro and the smallest fish at Lake Buhi, Bicol. However, hope is not lost. We can do something to our biodiversity resource. We can reverse the trend and save biodiversity by

deciding which organism to conserve e.g tropical rain forest where we can find ¾ of the world's flora and fauna	preserving habitat of endangered organism such as forest	restoring damaged habitats such replacing narra trees or recovering former industrial sites

producing new habitats e.g. digging a garden pond or planting a forest

Conservation plan for biodiversity involves sampling to assess the number of organisms, devising a management plan to increase the population of organisms based on knowledge of its breeding requirement, carrying out the plan and re-sampling to assess the number of conserved organisms and to determine if the conservation plan is working. A good example of conservation plan is the breeding in captivity of the monkey-eating eagle in Calinan, Davao City. Another example is the restoration plan of the smallest fish in the world, ***Pandaca pygmeia*** , in Lake Buhi, Bicol.

Another activity of conservation biology is creation of national parks and wildlife. One of the best national parks is Mt. Guiting-guitingin Sibuyan Island, Romblon.

What you will do

Self-Test 6.1

Direction: Select the letter of the choice that correctly answers the question.

1. Which of the following is the concern of conservation biology?
    a. manage national parks
    b. write books and/or popular books on the value of biodiversity
    c. establish protected forests
    d. all of the above

2. Which of this is a true statement?
    a. Habitat loss is the most common cause of loss of biodiversity
    b. Introduction of alien organisms into an environment
    c. Global warming can cause decrease of life forms
    d. all of the above is true

3. Biodiversity is uniformly distributed throughout the world.
   a. true b. false

4. How do we call the large concentration of one organisms in a specific region?
   a. extinction c. biodiversity hotspot
   b. b. genetic biodiversity d. habitat

5. Which of the following is potentially renewable resource?
   a. fish b. narra c. corn d. all of the three

Key to answers on page 30

Let's summarize

1. Earth's resources are either solar capital or natural capital.
2. These resources may be renewable, non-renewable or potentially renewable.
3. Conservation of resources is important.
4. Earth's freshwater resources are frozen water, water vapor, groundwater, and surface water.
5. Water for domestic consumption undergoes purification before distribution.
6. Marine water can be made potable through desalination.
7. Earth's water sources can be polluted.
8. Water pollutants can be removed through wastewater treatment technology.
9. Mineral is another Earth's resource.
10. Soil is a resource important to growing food crops and domesticated animals.
11. Soil is degraded/lost in many ways.
12. Soil can be saved through technologies such as contour farming, terracing, crop rotation.
13. Biodiversity is the diverse forms of life in the biosphere.
14. The three levels of biodiversity are genetic, species and ecological.
15. Habitat loss, pollution and introduction of alien species in the area lead to extinction of some life forms.
16. Breeding in captivity is one strategy to save important life forms.

Posttest

Direction: Encircle the letter which answers the question

1. Which one does not belong to the group?
   a. solar capital b. water resources c. biodiversity d. soil
2. Because fish and animals produce young, they are considered
   a. limited
   b. recyclable
   c. exhaustible
   d. renewable
3. A resource that is destroyed when used, but can be replaced is said to be
   a. a mineral
   b. recyclable
   c. renewable
   d. nonrenewable
4. The thin layer of soil on which crops grow is called
   a. subsoil
   b. topsoil
   c. parent material
   d. weathered bedrock
5. Plowing across the slopes of hills to prevent topsoil erosion in known as
   a. fertilizing
   b. strip mining
   c. crop rotation
   d. contour farming
6. Which of the following sources of water that can easily be contaminated?
   a. groundwater
   b. surface water
   c. marine water
   d. polar caps
7. Which of the following is NOT a biotic resource?
   a. wood
   b. cotton
   c. leather
   d. petroleum
8. All of these resources are nonrenewable EXCEPT
   a. gold
   b. water
   c. iron ore
   d. petroleum
9. Which of the following minerals is used as soil conditioner?
   a. copper
   b. lead oxide
   c. calcium oxide
   d. magnesium oxide

10. Which of the following is NOT a method of soil conservation?
    a. building terraces to prevent erosion
    b. using contour faming to retain topsoil
    c. cutting forests to provide more cropland
    d. rotating crops to keep nutrients in the soil
11. In which step of wastewater treatment that microorganisms are utilized?
    a. primary water treatment
    b. secondary water treatment
    c. tertiary water treatment
    d. all steps employ microorganisms
12. The process of enriching the soil by planting different varieties of plants is known as
    a. fertilizing
    b. terracing
    c. crop rotation
    d. contour plowing
13. When people practice conservation, they
    a. increase deposits of mineral resources
    b. stop their use of energy resources
    c. worsen the problem of scarcity
    d. use the resources wisely
14. Building flat, step-like fields with rock barriers to hold back soil on mountains is
    a. alley farming
    b. cause of runoff
    c. crop rotation
    d. terracing
15. The material in soil formed from decayed plant material is called
    a. subsoil
    b. humus
    c. leachate
    d. nutrients
16. The process of removing topsoil to reach minerals near the surface is known as
    a. placer mining
    b. cross mining
    c. shaft mining
    d. strip mining
17. Which of the following minerals cannot be recycled?
    a. iron
    b. coal
    c. gold
    d. aluminum

Key to Correction on page 30

Key to Answers

Pretest

1. A
2. A
3. D
4. B
5. D
6. C
7. D
8. D
9. B
10. B
11. D
12. C
13. D

Self-test 2.1

1.C
2. B
3. D
4. C
5. C
6. A

Self-Test 4.1

1. D
2. B
3. D
4. D
5. D

Self-Test 6.1

1. D
2. D
3. B
4. C
5. D

Posttest

1. A
2. D
3. C
4. B
5. D
6. B
7. D
8. B
9. C
10. C
11. B
12. C
13. D
14. D
15. B
16. D
17. B

Self-Test 1.1.

1. D
2. D
3. D
4. B

Self-test 3.1

1. D
2. D
3. D

Self-Test 5.1

1. D
2. B
3. C
4. B
5. B

-End of Module-

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