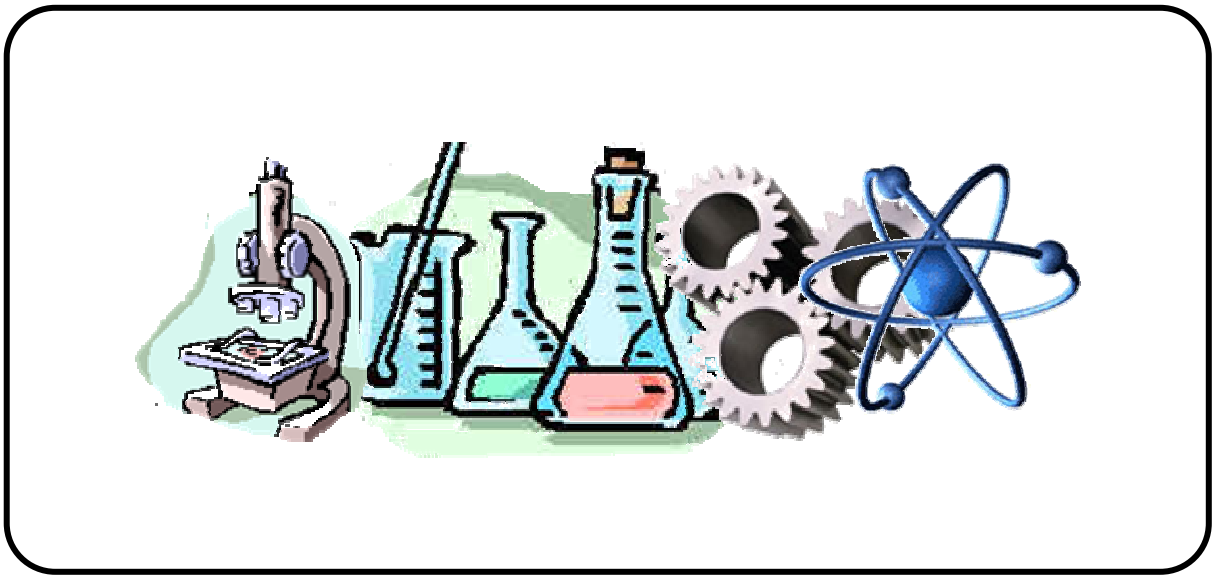
Project EASE

(Effective and Alternative Secondary Education)

INTEGRATED SCIENCE



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What this module is about

Water is all around us. If you look at any globe or map of the world, you can see that it is mostly blue. These blue areas represent the oceans, seas, and lakes on earth.

Water is a very important resource on earth. Almost every activity on earth needs water. Can you imagine what your life would be like without water?

In this module you will learn more about water. The module consists of these lessons:

- **Lesson 1 - Distribution of World's Water**
- **Lesson 2 - Earth's Fresh Water**
- **Lesson 3 - Ocean Water**
- **Lesson 4 - Human Impact on Earth's Water**

What you are expected to learn

After going through this module you should be able to:

1. discuss the distribution of the world's water;
2. describe the water cycle as a never – ending transfer of water between the atmosphere and the surface of the earth,
3. explain how porosity and permeability affect the amount and velocity of groundwater,
4. identify the regions of groundwater,
5. explain how wells and springs form from groundwater,
6. discuss how rivers and streams develop,
7. determine the composition of ocean water,
8. discuss the importance of ocean water, and
9. show that growth in population may affect consumption of freshwater on earth.

How to learn from this module

In order to achieve successfully the objectives of this module you have to be guided by the following:

1. Read and follow instructions carefully.
2. Answer the pretest before going through each lesson.
3. Take note and record points for clarification as you go on reading the module
4. Do the activities to fully understand each lesson.
5. Answer the post-test after you have gone over all the lessons and you feel you have learned the lessons well

What to do before (Pretest)

Direction: Choose the letter of the best answer and write this on your answer sheet.

1. Which of the following contains the greatest amount of water by volume on earth?
   a) oceans
   b) glaciers and ice sheets
   c) groundwater
   d) atmosphere

2. What term best describes the never-ending transfer of water between the atmosphere and the surface of the earth?
   a) oxygen cycle
   b) nitrogen cycle
   c) hydrologic cycle
   d) phosphorus cycle

3. It is the condensed water vapor that falls back to the surface of the earth.
   a) cloud
   b) table water
   c) precipitation
   d) groundwater

4. Of the following processes, which is responsible for getting water into the atmosphere?
   a) evaporation
   b) sublimation
   c) condensation
   d) precipitation

5. When spaces between rock particles fill with groundwater, the rock is
   a. eroded
   b. weathered
   c. evaporated
   d. saturated

6.The following affect the porosity of the soil or rock **EXCEPT**

a) shape of the particles
b) sorting of particles
c) packing of particles
d) slope

7. One of these is the correct sequence of the underground zones. Which is this?

a) water table, zone of aeration, zone of saturation
b) zone of aeration, zone of saturation, water table
c) zone of aeration, water table, zone of saturation
d) zone of saturation, water table, zone of aeration

8. It is the upper boundary of the zone of saturation.

a. aquifer
b. water table
c. zone of aeration
d. impermeable bedrock

9. Seawater is composed of different minerals. The mineral with the greatest percentage in seawater is ____.

a) sodium chloride
b) magnesium sulfate
c) calcium sulfate
d) magnesium chloride

10. Groundwater has many uses. It can be used as drinking water or as a source of water for the producers. On which region is groundwater mostly stored?

a) zone of saturation
b) zone of aeration
c) discharge zone
d) recharge zone

Key to answers on page 27

Familiarity with the following terms will help you get the most from this module:

Terms	Definition
1. Hydrosphere	- The dynamic mass of liquid that is continually on the move
2. Evaporation	- The process whereby fast moving molecules escape from the free surface of the liquid
3. Condensation	- The process whereby vapor changes from vapor to liquid
4. Hydrologic cycle	- The unending exchange of water among the continents, surface water, and atmosphere
5. Porosity	- The amount of pores or open spaces in rocks or sediments
6. Permeability	-The measure of how fast water passes through the open spaces in rocks and sediments
7. Recharge zones	- Locations where surface water infiltrates the groundwater system
8. Discharge zones	- Locations where groundwater flows or seeps out at the surface
9. Zone of saturation	-Rock layer where all the pore spaces are filled with water
10. Groundwater	- Water in the zone of saturation
11. Water table	- Upper boundary of the zone of saturation
12. Zone of aeration	- Area above the zone of saturation where the pore spaces are not yet fully filled with water
13. River	- Body of inland water that flows in natural channels
9. Spring	-Natural flow of groundwater when the water table intersects the ground surface
10. Wells	- Openings that may be bored into the zone of saturation where groundwater naturally flows
11. Salinity	- The percentage of salt in a given volume or mass of seawater

Lesson 1 Distribution of the World's Water

Water is one of the most abundant substances on earth. It can be found anywhere on earth. There is water on the earth's surface, in the subsurface, and around the earth. In this lesson you will learn how water is distributed over the earth's surface.

To find out the distribution of the earth's water, look at Table 1.1 below. Complete the third column by computing the corresponding volume of the water at different locations

Table 1.1 Distribution of Water by Percentage and Volume in Different Locations

Location	Amount of Water (%)	Volume (km^3)
Ocean	97.2	
Lakes, streams, subsurface water and atmosphere	0.65	
Ice sheets and glaciers	2.15	
Total	**100%**	**1.36 Billion**

What you will do

Activity 1.1

Using Table 1.1, answer the following questions:

1. Where is most of the water on earth found?
2. What percentage of the water on earth is found in the ocean?
3. What percentage of the water on earth is found in lakes, streams, or subsurface?
4. What is the total volume of water on earth in cubic kilometers?
5. What is the volume of water found in the ocean in cubic kilometers?
6. What is the volume of water found in lakes, streams, subsurface and atmosphere in cubic kilometers?
7. Explain why there is a need to conserve fresh water.

The earth's waters may be found in the atmosphere, on the surface, and underground. The total amount of water on earth is estimated to be 1.36 billion cubic kilometers. Of this total, 97.2% or 1.28 billion cubic kilometers is part of the world's oceans, 2.15% or .03 billion cubic kilometers exists as ice sheets and glaciers, and 0.65% or .009 billion cubic kilometers is divided among lakes, streams, subsurface water, and the atmosphere. Compared to the volume of water in the ocean, the volume of subsurface water or groundwater, which is the source of fresh water, is very small. A greater part of this freshwater is in the form of ice and is not available for consumption. With the growing population, demand for freshwater is increasing. There is really a need to conserve fresh water.

If you look at the globe or world map, you will find that the land and water are not evenly distributed between the two hemispheres. There are more land areas than water areas in the Northern Hemisphere while in the Southern Hemisphere there are more water areas than land areas. For this reason, the Northern Hemisphere is called the land hemisphere while the Southern Hemisphere is called the water hemisphere.

The hydrosphere is the dynamic mass of liquid that is continually on the move. How is water transferred in the different parts of the earth? To find out do the activity that follows.

What you will do

Activity 1.2 The Water Cycle

Materials Needed:

Wide-mouthed glass jar (heat resistant) with transparent cover
Hot water
Ice cubes, crushed

Procedure:

1. Pour hot water to a height of 3-cm to the wide-mouthed glass jar.
2. Cover the jar and place crushed ice cubes on the cover.
3. Observe what happens inside the jar.
4. Record your observations.

Did you notice that when the crushed ice was placed on the cover of a wide-mouthed bottle with hot water, smoke-like material was observed inside the bottle and after sometime moisture was formed in the sides of the bottle and the inside part of the cover? Did you also notice that water droplets fall back to the water from the top cover?

Water evaporates from the surface of hot water. **Evaporation** is the process whereby fast moving molecules in a liquid escape from the free surface of the liquid. The ice on the top cover cooled the upper air inside the bottle. When rising water vapor reached the top it also cooled because it gives off heat to the cold air on top and changed phase from gas to liquid. This process whereby water changes from gas to liquid is called **condensation.** Water vapor condensed as it is cooled to condensation temperature.

The same processes happen in the environment. Fast moving molecules of water escape from the free surface of the bodies of water. The water vapor mixes with air and is carried with air upward. As water vapor cools condensation occurs. Condensed water vapor falls to the ground when it becomes heavy. Condensed water vapor that falls to the ground is called **precipitation**. Precipitation may be in the form of rain, hail, snow, and sleet and may fall either on land or on bodies of water.

The unending exchange of water among the continents, surface water, and the atmosphere is called the hydrologic cycle or the water cycle. This cycle of water maintains the quantity of water on earth.

What you will do

Self-Test 1.1

To find out if you learned from the previous discussion answer the following questions

1. Why is there continuous supply of water all over the world?
2. What are the two processes involved in the water cycle? Explain these processes.

Key to answers on page 27

Lesson 2 Earth's Fresh water

What is fresh water? Where does fresh water come from? This lesson will help you learn more about the earth's fresh water and ways on how to use it best.

Groundwater

In the water cycle, condensed water vapor falls back to the surface of the earth as precipitation in different forms. Precipitation reaching the land areas may either flow as runoff and become part of the streams and rivers eventually reaching the oceans or may seep right into the soil. The seepage of precipitation into the earth is called **infiltration**. Infiltration of water is possible because there are spaces between soil or rock particles. Pores are usually filled with air that is forced out as water enters these pores. The water that fills the pores between rock particles is called infiltrates. Locations where surface water infiltrates the groundwater system are known as **recharge zones**, while places where groundwater flows or seeps out at the surface are **discharge zones**.

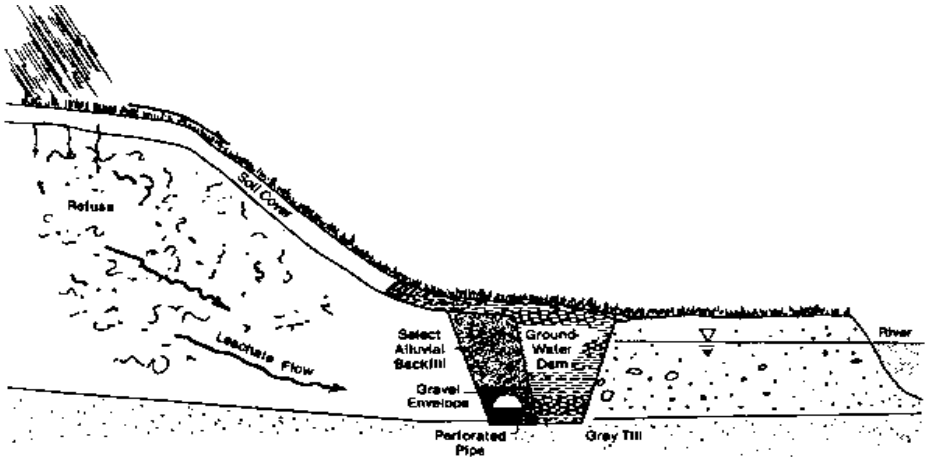

Figure 2.3: A cross-section of groundwater zones

Groundwater usually refers to the water that infiltrates. This is the water underground. Groundwater is a bountiful source of freshwater on earth. About 90% of the earth's freshwater is stored as groundwater.

Groundwater Movement

The movement of groundwater into the pores of rocks and sediments is affected by the porosity and permeability of rocks.

What you will do

Activity 2.1

Study Figure 2.1, then, answer the following questions:

1. Which is more porous, rock with loosely packed particles or rock with closely packed particles?
2. Which is more porous, rock with rounded-shaped particles or rock with angular-shaped particles?
3. How does sorting of rock particles affect porosity of rocks?
4. How does porosity affect the amount of water that could stay between rock particles?

Porosity refers to the amount of pores or open spaces in rocks or sediments. Sorting, shape, and packing of particles affect porosity (Figure 2.1). Sorting is the similarity in size of particles in rocks or sediments. Well-sorted sediments make the rock more porous. However, poorly sorted sediments make the rock less porous. Sediments with rounded particles are more porous than sediments with angular-shaped particles. Further, loosely packed sediments allow many open spaces for water to pass through, making the rock more porous. Tightly packed sediments, on the other hand, allow very few spaces for water

seepage. Generally, porous rocks allow more water to stay between particles in rocks.

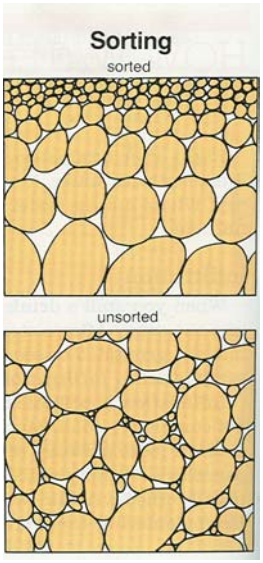

Figure 2.1. How Sorting, Shape, and Packing of Particles Affect Porosity

The permeability of a rock or sediment determines how fast water passes through the open spaces. To understand how permeability affects the amount of water that seeps to the ground, do the following activity, then, answer the questions that follow.

What you will do

Activity 2.2 Permeability

Materials needed:

Pencil, sharpened	stopwatch
Sand, clay, gravel	ruler
Graduated cylinder	rubber band
3 large plastic cups	cheesecloth
300-mL water	

1 empty mineral water plastic container (halved horizontally)

Procedure:

1. Make 7-10 holes at the bottom of each plastic cup using the pencil nail.
2. Cover the holes with cheesecloth and tie the cloth with a rubber band.
3. Measure 3-cm from top of each cup. Mark it with a pencil line.
4. Fill cup #1 with sand up to the pencil line. To cups #2 and #3, do the same but place clay and gravel instead.
5. Position the halved plastic container as shown. They will be used to support the plastic cup and contents.
6. Pour 100-mL water into the plastic cup.
7. Record the time it takes for water to drip through the holes of the cup.
8. Transfer the water collected in the receiving container to the graduated cylinder. Get its volume in mL.
9. Repeat steps # 6, 7 and 8 to cups 2 and 3.
10. Calculate the rate of drainage of each cup using this equation:

$$\text{Rate of drainage} = \frac{\text{Volume of water collected}}{\text{Time it takes for water to drain}}$$

10. Calculate the amount of water (in %) retained in the soils in cups 1, 2 and 3.

$$\textbf{\% of water retained} = \frac{\textbf{100 mL – volume of water collected (ml)}}{\textbf{100-mL}} \textbf{ x 100}$$

Questions:

1. In which cup is water free to pass through the greatest? Why?
2. In which cup is water retained the greatest? Why?
3. Which soil sample is the most permeable? Least permeable? Why?

What you will do

Activity 2.3

Study Figure 2.2, then, answer the questions that follow:

1. Which is more permeable, rock with large pores or rocks with small pores?
2. Which is more permeable, rock with interconnected pores or that with isolated pores?
3. In what type of rock does groundwater freely flow?

Permeability is affected by the size of the pores or spaces between particles in a rock or sediment (Figure 2.2). If the pores or spaces between particles are wide, the rock tends to be more permeable. Gravel is said to be more permeable. Clay, on the other hand, is less permeable because spaces in

between particles are small. Permeability also depends on how interconnected the pores are. If pores are interconnected, water can pass through easily.

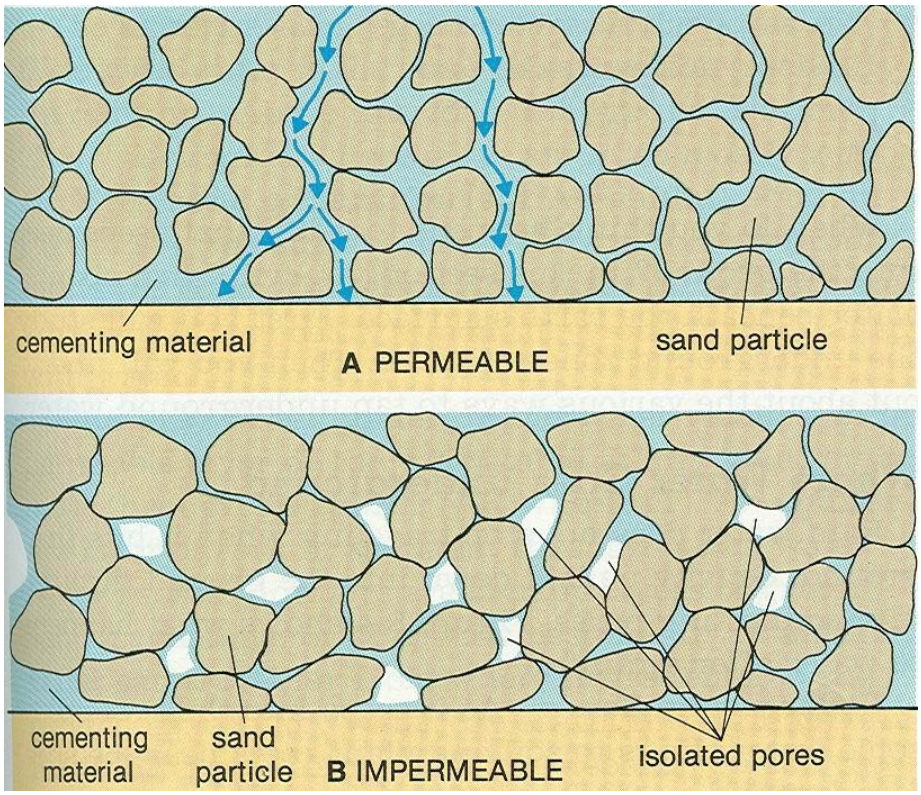

Figure 2.2 A: Rock with interconnected pores.
B: Rock with isolated pores.

Gravity and the permeability of rocks in the zone of saturation pull water downward. How fast groundwater flows is affected by the permeability of aquifers and the hydraulic gradient (steepness) of its water table.

The velocity of groundwater increases with increasing permeability of rocks and steepness of slope of water table.

Regions of the Groundwater

What you will do

Activity 2.4

Look at Figure 2.3, then, answer the following questions:

1. What are the regions of groundwater from the top to the bottom?
2. In what region or zone is groundwater mostly stored?
3. Where is the water table found?
4. What type of rock should be below the zone of saturation to keep groundwater from flowing down further?

As rainwater seeps into the ground, some water clings to soil and roots of plants near the surface. Some of this water provides plants with water they need. The remaining water continues to seep into the ground if the rock is porous and permeable. Aquifers are rocks that allow water to flow and wherein water can be stored because they are highly porous and highly permeable. Water that infiltrates may force out all the air in a rock and fills all the pores. This zone is called the zone of saturation. But for aquifers to be saturated with groundwater, the rock below it should be impermeable that will prevent the down flow of water from an aquifer. This rock is an aquiclude. The upper boundary of the zone of saturation is called the water table. Above the water table, the pore spaces in rocks are not yet completely filled with water. Some pore spaces are still filled with air. This zone is called the zone of aeration.

What you will do

Self test 2.1

Go over the previous discussions about groundwater and answer the following questions:

1. What is groundwater?
2. What is the source of groundwater?
3. Enumerate the factors that affect the movement of groundwater?
4. Explain how each factor enumerated in question 3 affects the movement of groundwater?

Key to answers on page 27

Springs

Recall that in the hydrologic cycle, condensed water vapor that falls to the ground seeps to the subsurface of the earth forming the groundwater. Where does groundwater go?

Whenever the water table intersects the ground surface, there is a natural flow of groundwater. This is called a spring. A spring is formed when the ground water naturally finds its way to the surface. It may be formed in a fracture so there is a continuous flow of water. It may also occur on a hillside but the flow of water is not continuous because the water table is low during summer. Spring water is generally fairly clean since it has been filtered through the permeable rocks in the aquifer. It contains dissolved minerals Can you identify some places in the country were springs are found?

Some springs contain so much dissolved minerals that they cannot be used for ordinary drinking or washing purposes. These are called mineral springs. Where do you think these minerals come from?

The high mineral content may come from very soluble rocks like salt beds. In some, many minerals are dissolved from rocks because the spring water contains large quantities of gases that form acids when mixed with water such as carbon dioxide or hydrogen sulfide. Or, if the spring water is very hot, it is likely to have a high mineral content since minerals dissolve better in hot water.

Wells

People have also devised ways to access groundwater. Openings may be bored into the zone of saturation forming wells. A well may dry up during dry season when the water table falls below the normal level.

Running Water

You might have read from world history books that the first civilizations emerged along fertile river valleys. The rivers' fertile floodplains have fostered human progress since the dawn of civilization. The Nile River, for example has been harnessed not only to supply hydroelectricity, but for constant irrigation. It is navigable the year round from its mouth to as far as Uganda. You are familiar with the Pasig River. Think of the many uses of that river.

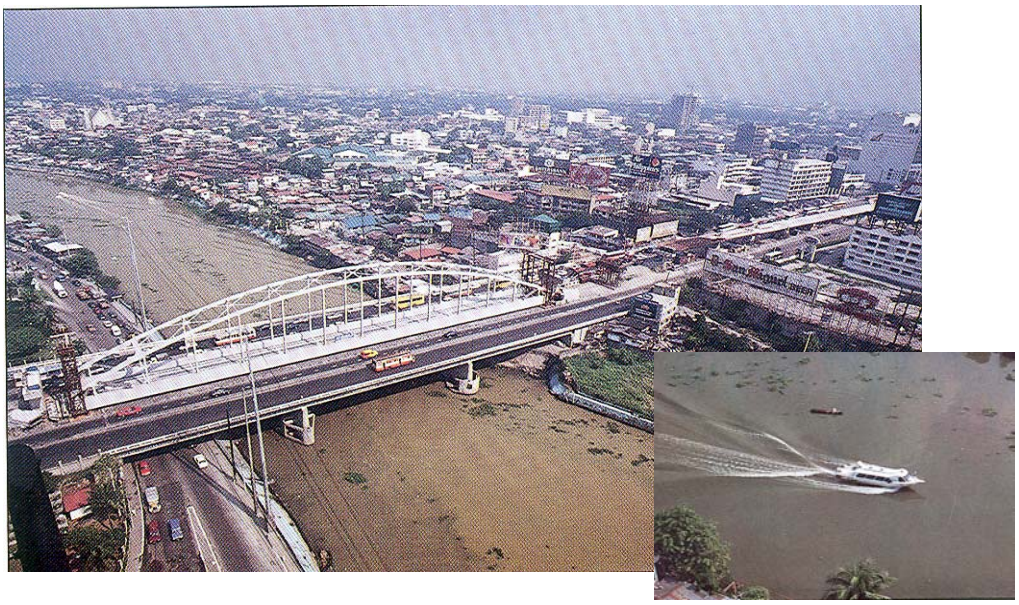

Fig. 2.4 The Pasig River as a means of transportation.

Rivers are bodies of inland water that flow in natural channels. Aside from being an important component of the hydrologic cycle, rivers and other running water have many uses. Silt deposited by the river's annual overflow has brought

agricultural prosperity throughout the world. We depend upon rivers for irrigation, transportation, energy, and for food. Do you know where rivers and other running water come from?

Spring water and water from wells flow on the earth's surface. This runoff initially flows over wide areas and enter small streams. As streams flow down mountain slopes they join with other streams. A stream that joins other streams is called a **tributary**. Water in small streams enters larger streams or rivers. Streams vary in size and shape. Larger streams formed by the meeting of small streams are sometimes called rivers, the two terms, are however, interchangeable. Water in streams eventually makes its way to the sea.

Stages in River Development

A river's drainage pattern and channel shape both change over time as does the landscape through which the river flows. A channel is the path of any stream.

First Stage: Young Stream

Young stream flow rapidly down the steep slopes of mountains or hills. They are characterized by steep slopes and rapid flow. A relatively small volume of water flows in young streams. As a stream flows downhill, particles of soil are carried along the ground. Because of the rapid flow, erosion happens fast resulting to narrow V – shaped valley. Waterfalls and rapids are associated with youthful rivers.

Second Stage: Mature Streams

Once a stream has cut its channel closer to base level, downward erosion becomes less dominant. Mature streams curve down graded slopes, eroding their sides on the way. The result is the widening of the valley producing floodplain. The stream flowing in the flood plain bends. This is called a meander. As the stream moves to the sides, the outer bank is eroded causing the meander to continually change position. Deposition of sediments like sand takes place since the stream current at the inside of the meander is slow.

Third Stage: Old Stream

Streams enter old age after it has cut its floodplain several times wider than the width of the meander. The stream at this stage is far from the valley wall. As the floodplain is no longer increasing, shifting of streams occur more rapidly.

Old rivers are very muddy, a consequence of large amount of sediments carried by a river with low velocity.

Lakes

These bodies of water have many uses to humans. Aside from providing people with a source of livelihood, lakes can generate electricity and can serve as a means of transportation. Lakes also add beauty and scenery to the place. Some famous lakes in the country are Taal Lake, Lake Lanao, and Laguna de Bay. What other lakes do you know?

The origin of the lakes can be traced to the following cases:

By volcanic action. During volcanic eruptions, a lava flow can build a dam across a valley. When a volcano runs out of magma, it collapses and leaves a depression that eventually becomes filled with water.

By diastrophism. During earthquakes, the earth's crust may move creating a depression which becomes a lake basin.

By river action. Fallen trees and other debris clog rivers creating a dam that will cause a river to back up thus forming a lake.

The previous discussion is concerned with natural formation of lakes. Lakes can also be formed by artificial means. Artificial lakes are those produced by humans. Deep excavations that are filled with water can give rise to a lake.

How do lakes die or disappear? The complete destruction of the lake basin causing loss of water can result in the disappearance of lakes. When a lake is filled with sediment or decayed vegetation, it may die. It will give rise either to a lake plain or a swamp.

What you will do

Self-Test 2.2

Classify the following bodies of water as fresh water or saltwater. When you are through answering the questions, check your answer against the answer key on page 31.

1. lakes _____
2. springs _____
3. wells _____
4. rivers _____
5. oceans _____
6. streams _____
7. coastal waters _____

Key to answers on page 28

Lesson 3 Ocean Waters

Do you know why the earth is called a blue planet? Look at the globe or world map. Do you notice that the earth consists mostly of water? The oceans cover 70% of the earth's surface, so it is called a blue planet. In this lesson, you will be able to:

- determine the composition of ocean water;
- identify the resources we get from sea water; and
- discuss the importance of ocean water.

What you will do

Activity 3.1

1. In a globe or the map, identify the (a) biggest ocean in the world and (b) the smallest ocean.

2. Name the seas in your province.

Oceans and seas are interconnected bodies of seawater. The five biggest bodies of water are the Pacific Ocean, Atlantic Ocean, Arctic Ocean, Indian Ocean, and the Antarctic Ocean. Of the five bodies of water, Pacific Ocean is by far the largest in terms of volume. It is also the deepest.

Composition of Seawater

When you swim in the sea, you sometimes accidentally drink water. What does it taste like? This section will help you learn about the composition of the ocean water.

Do the following activity to find out the composition of ocean water.

What you will do

Activity 3.2 What is in ocean water?

1. If your place is near the sea, get a spoonful of seawater. If far from the sea, get a spoonful of salt and dissolve in ¼ cup of water. This will represent your seawater. Get a spoonful from this solution.
2. Place the seawater or the salt solution in a beaker or any heat resistant container.
3. Heat the seawater or the salt solution until the water boils. Lower the flame. Continue heating until all the water has evaporated. Immediately remove the container from the flame once all the water has evaporated.
4. Observe what is left at the bottom and sides of the container.

Did you notice that whitish grains are left at the bottom and sides of the container? These grains are salt crystals. These make the seawater salty. These are the same particles you observe on your skin when you get out of the sea and water in your skin has dried up. The percentage of salt in a given volume of seawater is called **salinity**.

What you will do

Activity 3.3

1. Look at Figure 3.1 to learn more about the composition of ocean water or seawater.

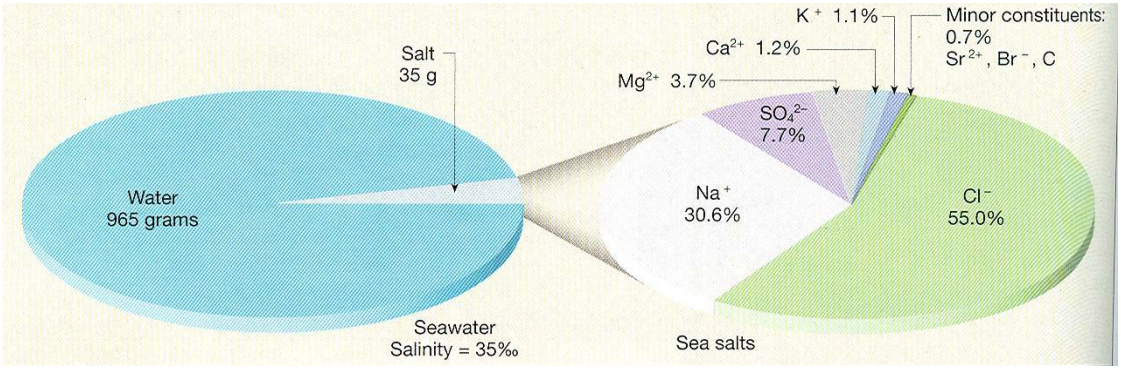

Fig. 3.1

2. Answer the following questions using figure 3.1:

Questions

1. What are the major constituents of seawater?
2. What element contributes the greatest percentage to the ocean's salinity?
3. What element contributes the least percentage to the ocean's salinity?
4. In 1000 grams of seawater with a salinity of 35%, how many grams is water? How many grams is salt?

The major constituents of seawater are chlorine, sodium, sulfate, magnesium, calcium and potassium. Chlorine contributes the greatest percentage to the ocean's salinity, while the minor constituents, composed of strontium, bromine, and carbon, contribute the least percentage to the ocean's salinity.

Resources from ocean water

Ocean water is a source of dissolved minerals. We get the salt we use everyday from seawater. Have you gone to Las Piñas and the coastal road going to Cavite? You might have seen mounds of salt along the road. How is salt produced?

Salt is produced by first confining seawater in evaporating ponds. Then, water is allowed to evaporate. After all the water has evaporated, salt crystals are left on the ground. These are then harvested and sold in the market. Other minerals such as magnesium and bromine are also obtained from the ocean.

Ocean water is also a source of food. Fish is the main catch. Modern fishing vessels are now equipped with radar, echo sounds and even refrigerators and other technologies to improve the fishing industry.

Importance of ocean water

Do you also know that the oceans play an important role in our global climate? How? The basic idea is a phenomenon called **thermohaline circulation**. Due to density differences, a mass of low density (warmer or less saline) water rises from below. This is replaced by a mass of water of greater density (colder or more saline). This deep ocean circulation is a global happening. It does not involve only a small mass of water. How are density and salinity changed? Water at the surface of the oceans is made colder by heat loss to the atmosphere. Through evaporation, some molecules of water at the surface escape from the free surface of the water. When water evaporates, the salinity of the remaining water becomes greater making the density greater. Water chilled in the polar region becomes denser. It sinks and displaces warmer water.

Water also has a high heat capacity. It can store more energy than an equal mass of other substances. This can also modulate climate.

Oceans are also home to small floating algae and other green plants, making oceans a major storehouse of carbon dioxide. Carbon dioxide is one of the greenhouse gases. Greenhouse gases absorb heat radiated from the earth's surface. Greenhouse effect keeps our atmosphere warm.

What you will do

Self-Test 3.1

Directions: Get a pad paper and answer the following questions briefly

1. What makes the ocean water salty?
2. What are the major constituents of ocean water?
3. What resources can we get from ocean water?
4. How do you differentiate ocean water from freshwater?

Key to answers on page 28

Lesson 4 Human Impacts on the Earth's Waters

Water is one of the basic needs of humans. Without water, it will be impossible for us to exist. But, nowadays, clean water is becoming scarce. Some causes of water scarcity are natural, others are human -made. However, the impact of natural processes can be aggravated by human activities. People can modify physical environment in a way that affects the earth's waters. There are many issues and problems related to the waters of the earth.

What you will do

Activity 4.1

1. Close your eyes, then, think about what will happen to you when you do not have water for one month. You may draw what you think you will become after one month.
2. Think of one problem the country is facing that you observe

Growth in population

The world's population is growing rapidly. The number of people and the number of households using water are also increasing. The demand for water is, therefore, increasing. A person needs water for drinking, for taking a bath, for cooking and cleaning. Nowadays water is scarce not only in the Philippines, but worldwide.

What you will do

Activity 4.1

Think of how much water you consume in one day in doing the different activities at home. Use Table 4.1 below in recording your data. Then, compute your water consumption in one month.

Table 4.1 Estimated Daily consumption of water at home

Activities	**Volume (Liters)**
Cooking	
Washing dishes	
Taking a bath	
Cleaning the house	
Drinking	
Flushing toilet	
Total (daily)	
Total (Monthly)	

Too much use of water for daily consumption

One of the problems being faced by most countries nowadays is the too much use of water for daily consumption. If you estimate the daily water consumption in your homes and project from this estimate the country's daily and monthly consumption, you will be able to have a projection for the whole world.

Growing demand for food

With growing population, demand for food is increasing. This is believed to be the most important cause of pressure on water resources. Irrigated farming expands, and poultry and piggery grow in number. Demand for processed food also increases. All these require enormous amount of water.

Climate Change

During dry season, Filipinos are usually warned to conserve water. In Metro Manila, the level of water in our reservoirs like La Mesa Dam is usually low during summer causing problems in the water supply. During rainy days, on the other hand, the level of water in our reservoirs is high. We usually do not have problems in our water supply. But, our main concern are problems caused by human activities that affect the waters of the earth.

The continued rise in the amount of carbon dioxide in the atmosphere is believed to have caused an increase in the global temperature. This phenomenon is termed **global warming**. Too much warming in polar latitudes has been observed to melt enough glacier to cause the rising of sea level. Warming of ocean water has also been observed to cause the expansion of seawater adding to the increase in the level of seawater. However, there are many other factors responsible to changes in climate other than global warming.

Many scientists believe that the building of cities worldwide has caused changes in the amount of precipitation. In cities, cementing of roads decreases the land areas covered with vegetation. Greater amount of precipitation become runoffs instead of being absorbed in soils and rocks. Aside from flash floods, another consequence of this increase in runoff is too much precipitation because the amount of water that evaporates increases. The water cycle is shortened, that is, water is exchanged between surface water and the atmosphere. You might have observed that we now have more frequent storms.

Contamination of existing water supply

Pollution of normal water destroys part of water resources. Nowadays, there are many sources of water pollution: industrial wastes, chemicals used in agriculture, disposal of human excreta, release of untreated sewage from municipal work, oil spills from giant ships, mine tailings, and household wastes.

Water pollution is a serious problem in many countries in this era of industrialization. Although industrialization is a means to achieve better socio-economic condition, it is accompanied by problems that endanger the health of people and the lives of plants and animals. In our country, fishpond operators have complained that toxic wastes from factories have poisoned their fishponds and killed fish.

Meanwhile, based on reports of the Pasig River Rehabilitation Program Committee, domestic liquid waste is the number one source of pollution in rivers.

This is about two-thirds of the Pasig River's system's total biological oxygen demand (BOD) load. These wastes are responsible for the destruction of the river's aquatic life.

Where do these wastes come from? These wastes are discharged by households when they wash clothes, flush toilet, bathe or clean the dishes.

Eutrophication

Eutrophication is a phenomenon in which water in rivers and lake becomes rich in nutrients that cause excessive growth of algae. Eventually, a great number of algae may die at the end of the growing season and sink to the bottom. This causes massive growth of bacteria the following year which also eventually die. Decomposition of decayed bacteria uses up oxygen, thereby, depleting the water with oxygen needed by valuable fishes. Nutrients in water may come from phosphates in detergents used in households and nitrates from fertilizers used in farms.

Excessive withdrawal of groundwater

Do you recall the news regarding the subsidence in a subdivision in Muntinlupa? Floors of some houses fell below the original level. Walls cracked as a result of land subsidence. One cause cited was the excessive withdrawal of groundwater. Sinking of the ground due to excessive pumping of groundwater has been reported worldwide.

What you will do

Self-Test 4.1

Get a pad paper and try answering the questions as best as you can. If you have difficulty answering the questions, go over the lesson again.

1. What are the different issues related to the earth's water?
2. One of the problems our country is experiencing now is over use of fresh water. How can you help reduce water consumption at home?
3. How does the building of cities cause changes on the amount of precipitation?
4. Enumerate the sources of water pollution in the Philippines.
5. Give one way by which water pollutants can affect the fishing industry.
6. What is the effect of excessive withdrawal of groundwater?

Key to answers on page 28

Let's summarize

1. Nearly 70% of the earth's surface is covered with water.
2. The unending exchange of water among the continents, surface water, and the atmosphere is called the hydrologic cycle or the water cycle. This cycle of water maintains the quantity of water on earth.
3. Precipitation is water that falls from the atmosphere to the ground in different forms.
4. Groundwater is precipitation that seeps into the ground stored in spaces between particles of rock in the zone of saturation.
5. Zone of saturation is the part of sediment and rock where all spaces in between particles are filled with water.
6. Water table is the upper boundary of the zone of saturation.
7. Zone of aeration is the area above the water table where the spaces between rock particles are not yet filled with water.
8. Groundwater flow from the ground to the surface through springs and wells.
9. Freshwater from springs and wells run off forming streams and rivers which eventually reaches the oceans.
10. Ocean water is made salty when mineral salts from rocks are dissolved as running water makes its way to the ocean.

11. Oceans are the biggest bodies of water where water in steams and rivers go.
12. Human activities affect the earth's waters. These changes on the earth's waters, in turn, affect people on earth.

Posttest

I. Direction: Choose the letter of the best answer and write this on your answer sheet.

1. Which of the following is true of ocean water?
   a) Warm ocean water has low density.
   b) Ocean water with high salinity has low density.
   c) Cold ocean water has low density.
   d) Ocean water with low salinity has high density.

2. Which is not true about surface water in the North Pole?
   a) It is cooler than the water in the equator.
   b) It is denser than the water in the equator.
   c) It is heated more by the sun.
   d) Its molecules move generally slower.

3. Which of the following contains the greatest amount of water by volume on earth?
   a) oceans
   b) glaciers and ice sheets
   c) groundwater
   d) atmosphere

4. Which of these water pollutants cause algal bloom?
   a) acids
   b) mercury
   c) toxic metals
   d) phosphates

5. Excessive withdrawal of groundwater may result to which of the following?
   a) eutrophication
   b) land subsidence
   c) poisoning of fishes
   d) water pollution

II. Completion Type: Complete each of the following sentences with a word or phrase .

1. _____ is second only to air in importance as a basic need for the existence of life on earth.

2. _____ is a dynamic mass of water on earth that is continually on the move.

3. Dumping untreated sewage into a river causes the water to become _____.

4. _____ is the unending exchange of water among the ocean, atmosphere, and the continents.

5-6. Two physical changes, _____ and _____ are part of the water cycle.

7. _____ is the water beneath the earth's surface.

8. Water that soaks into the ground reaches a zone called _____ where all the open spaces in rocks are completely filled with water.

9. The upper boundary of the zone of saturation is the _____.

10.The permeable layer of rock saturated with ground water is called _____.

Key to answers on page 29

Key to Answers

Pretest

1. c
2. c
3. a
4. d
5. a
6. a
7. d
8. c
9. a
10. a

Self-Test 1.1

1. The total volume of the world's waters has always remained the same from the time the earth was formed. This is due to a process called the hydrologic cycle.

2. The two processes involved in the water cycle are evaporation and condensation. Evaporation from surface waters brings water to the air. Condensation of water vapor in the air brings back the water to the surface.

Self-Test 2.1

1. Groundwater is water that infiltrates the ground. It is water found underground.
2. The source of groundwater is precipitation.
3. The factors that affect the movement of groundwater are porosity and permeability of rocks or sediments, and the steepness of the water table. Gravity helps pull the water downward.
4. The greater the porosity, the greater is the amount of groundwater that may stay in spaces between rock particles. Rocks are more porous if particles are well sorted, rounded, and loosely packed. The more permeable the rock is, the faster the movement of groundwater. Permeable rocks are those that have wide pores or the space between particles is large, and whose pores are interconnected.

Self -Test 2.2

1. fresh water
2. fresh water
3. fresh water
4. fresh water

5. seawater
6. fresh water
7. seawater

Self-Test 3.1

1. Ocean is made salty by the presence of mineral salts carried to the oceans from weathered rocks in the continents.
2. The major constituents of ocean water are chlorine, sodium, sulfate, magnesium, calcium, and potassium.
3. The resources we can get from ocean water are dissolved minerals like salt, magnesium, and bromine. It is also a source of food like fish.
4. Ocean water contains dissolved minerals like salt, magnesium and bromine. Freshwater comes from groundwater that finds its way out of the ground in the form of springs and wells. Freshwater unlike ocean water is a source of water for human consumption.

Self-Test 4.1

1. The different issues related to the earth's water are growth in population, growing demand for food, climate change, contamination of existing water supply, and excessive withdrawal of groundwater.

2. The following are some of the ways to conserve water at home:
   - Check if there are leaking faucets. Have them repaired at once.
   - Do not let water flow continuously while brushing your teeth. Use glass instead when you brush your teeth.
   - Water the plants in the afternoon or at night to prevent too much water from evaporating.
3. Building of cities reduces the land areas covered with plants. Cemented roads cannot absorb too much water increasing the amount of runoff that eventually go into bodies of water. This increases the amount of water that evaporates which, in turn, increases the amount

4. The sources of water pollutants in the Philippines are the industry, agricultural activities, domestic or household activities, oil leaks in ships, and mines.

5. Chemicals especially toxic wastes from industrial establishments may kill fish.

6. Excessive withdrawal of groundwater may cause ground subsidence that may endanger the life of people.

Posttest

I. 1. a
2. c
3. a
4. d
5. b

Completion

1. water
2. hydrosphere
3. polluted
4. water cycle
5. evaporation
6. condensation
7. groundwater
8. zone of saturation
9. water table
10. aquifer

-End of Module-

References

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