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ABSTRACT

Prepared for middle or intermediate grades, this student booklet provides a study of water--the location of major oceans and rivers; the relationship of ancient civilizations to bodies of water; active metals found in sea water; chemical concentrations in water and their effects on marine life; and the concepts of evaporation, transpiration, hydrology, percolation, and condensation. An activity is offered for each component of the unit indicating background material, directions, and space for completing the activity, usually in written form. Evaluation questions and a bibliography are also provided. This work was prepared under an ESEA Title III contract for the Interdisciplinary Environmental Education K-12 project. (BL)

WATER

AND SOMETHING ELSE

AN

INTERDISCIPLINARY

ENVIRONMENTAL

UNIT

FOR MIDDLE SCHOOL

AN ESEA TITLE III PROJECT

BROWARD COUNTY

FLORIDA

1972

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INTERDISCIPLINARY ENVIRONMENTAL EDUCATION PROJECT
An ESEA Title III Project

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W A T E R.....and something else!!

OBJECTIVES:

1. Using an unmarked outline map of the world, you should be able to locate and identify the five oceans. Trace and label at least one major river system on each of the six continents outlined on the map.

   (a) Indicate on each of the six river systems where you think the degree of pollution would be greatest.

   (b) Discuss the possible reasons why these major rivers are polluted at the locations you have indicated.

   (c) What short range and long range effects will these contaminated rivers have on the oceans into which they empty?

2. You will be able to write a brief description of at least one ancient civilization. The description will include where the civilization was located, the time in history that it existed, and a list of environmental factors which you think contributed to the civilization's failure.

3. You should be able to identify at least five metals naturally present in sea water and at least one metal present as a result of man's technology.

4. You should be able to identify areas of the sea that have high concentrations of oxygen, carbon dioxide, and sodium chloride. How would changes in these concentrations affect marine life in such areas?

5. In your own words you should be able to correctly define the following:

   EVAPORATION

   TRANSPIRATION

   HYDROLOGY

   PERCOLATION

   CONDENSATION

MEDIA REFERENCES:

BOOKS:

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Ancient Civilization: Human Adventure Series. Allyn and Bacon, Inc., 1971. (pp. 119-135)

Earth Science: The World We Live In. American Book Co., 1969. (pp. 106-112, 272-280)

Energy: Its Forms and Changes. Harcourt, Brace and World, 1968. (pp. 4-9)

Inter-American Studies: Investigating Man's World. Scott, Foresman and Company, 1970. (p. 93)

Molecules to Man: Biological Science, BSCS. Houghton-Mifflin Company, 1963. (pp. 83-86)

Science 6. Silver Burdett Company, Inc., 1968. (pp. 291-299)

Wonders of Water, The. James H. Winchester. New York: G. P. Putnam's Sons, 1963.

FILMS:

Use card catalogue of locally available films.

FILMSTRIPS:

Use card catalogue of locally available filmstrips.

RECORD OF COMPLETED ACTIVITIES:

1. Identified five oceans and a major river system on each of the six continents.

   Teacher signature_____ Date_____

2. Identified five ancient civilizations and the body of water near which each was located.

   Teacher signature_____ Date_____

3. Identified five active metals found in sea water.

   Teacher signature_____ Date_____

4. Identified and researched at least three suggested topics.

   Teacher signature_____ Date_____

5. Completed definitions.

   Teacher signature_____ Date_____

6. Completed comparative tests for water hardness.

   Teacher signature_____ Date_____

EVALUATION:

SCORE:_____

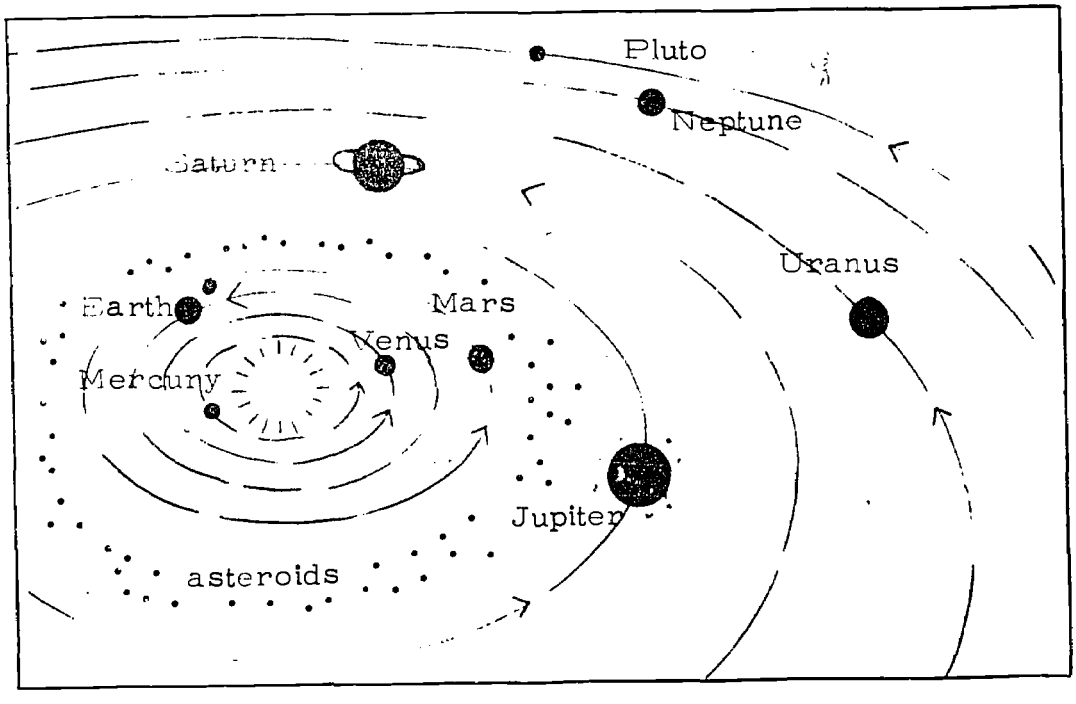
Teacher signature_____ Date_____

WATER.....and something else!

Because our planet occupies a unique position in the solar system, we take for granted some very unusual conditions that exist on earth. One of the most unique features of our planet is that it orbits the sun in a rather narrow belt in the solar system known as the "water zone". It is only at this distance from the sun that water exists as a liquid! Closer towards the sun it vaporizes at once and on the outer planets—if it exists at all—it does so as ice!

Venus, the second closest planet to the sun, is large enough for its gravity to hold gases. It has an atmosphere and a dense layer of white clouds which completely obscure its surface. These clouds contain much water, probably as ice crystals at the upper levels and water droplets at the lower levels.

Farther from the sun is the planet Mars. It is believed that Mars has a very thin atmosphere and perhaps a small amount of surface water. The giant planets that lie beyond—Jupiter, Saturn, Uranus, Neptune—are all much too cold to have oceans....although they probably have a great deal of water in the form of ice.

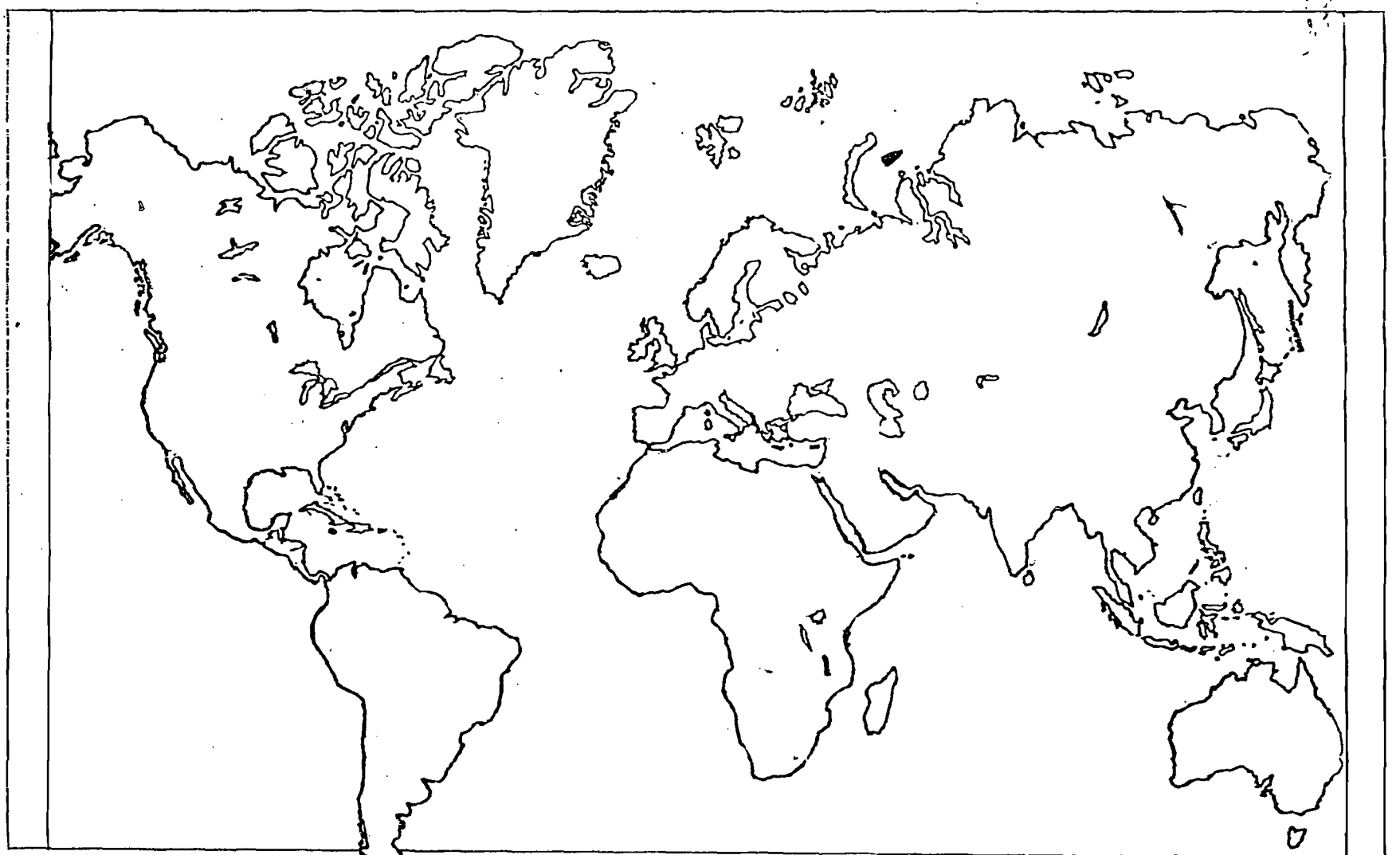


The earth's oceans, therefore, are unique in the sun's family of planets. They exist here because the earth has a surface temperature in that narrow range within which water can remain in a liquid state (between 32° Fahrenheit and 212° Fahrenheit).

Perhaps our planet has the wrong name! Our ancestors named it "Earth" after the land they found all around them. They believed for centuries that its surface consisted almost entirely of rocks and soil. If the ancients had known what the earth was really like, they undoubtedly would have named it "Ocean" after the tremendous areas of water that cover 70.8 percent of its surface.

Ours is indeed a water planet! There is no other like it in our solar system.

ACTIVITIES: Please complete the activities as set forth on the following pages.



ACTIVITY #1

On the map above, label the five oceans and at least one major river system of each of the six continents.

ACTIVITY #2

History records that the great civilizations of the past developed beside or near great rivers or seas. Look back in history and in the spaces below describe briefly at least five ancient civilizations. Include with your descriptions the NAME of the body of water which served as the basis for each civilization you identify and the approximate TIME when that civilization reached its apex.

	CIVILIZATION	BODY OF WATER
(1)		
(2)		
(3)		
(4)		
(5)		

ACTIVITY #2 (Continued)

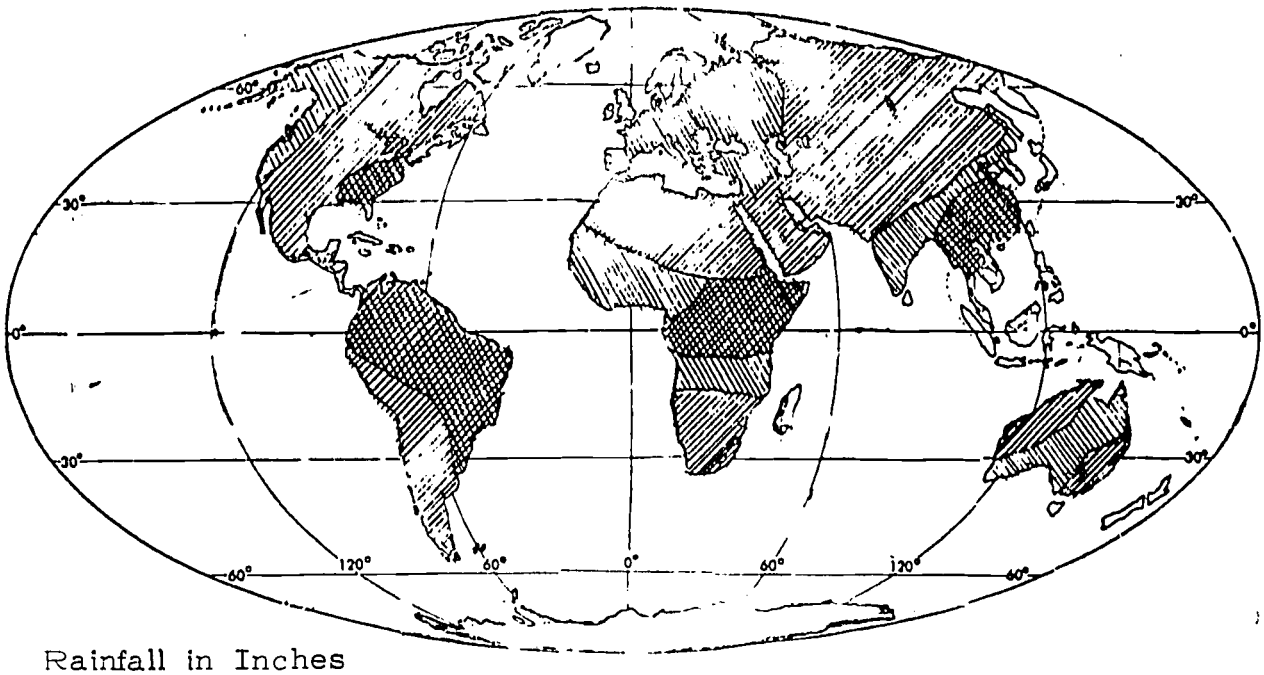
If the availability of water has played such an important role in the progress of man, he must indeed consider it a precious resource.....or does he? Maybe we have all been mistaken. Maybe water is not such a valuable thing after all! And even if it is, there is certainly plenty of it! After all, isn't 70.8 percent of our planet covered with water?

Is, then, all water precious and useful? A good question! Water as we know it is never simply water. The water we know is always "water.....and something else"! For example: Water vapor high in the atmosphere condenses to form "droplets" of liquid water. When water vapor changes to droplets—or crystals of water, it is likely to form about tiny particles of dust in the atmosphere. These droplets may form about minute crystals of salt that have been carried into the sky from storms at sea. Other droplets may form around dust from the prairies.....from volcanic actions.....smoke particles from forest fires.....or dust from industrial wastes above our cities.

The newly formed droplets of water in the clouds will not be "pure water". The droplets will contain a little oxygen (O_2), nitrogen (N_2), and carbon dioxide (CO_2), dissolved from the same atmosphere that contained the water vapor. They may also contain traces of ozone, nitrous oxides, argon, and other gases of the atmosphere. These droplets condense to rain that is water.....and something else!

Most rain water behaves like a very weak acid because of the carbon dioxide that it takes from the atmosphere. It may pick up other materials like sulfur dioxide or ammonia as it falls through the atmosphere that contains these gases; however, the carbon dioxide that rain water carries is usually the most important additional "something else".

When the weakly acid rain water falls on the earth's surface, it reacts with materials in soils and rocks and more things become added to the water. Materials that dissolve in weak acids are taken up.....calcium....magnesium....iron.....zinc.....and other metals. These tend to reduce the acidity of the water, but they increase the concentration of minerals in the water.



Rainfall in Inches

Under 10 20-40 Over 50

A NEVER-ENDING CYCLE

ACTIVITY #3

Over a long period of time rain water extracts much active metal from parts of the earth's surface. That is why the most active metals are found dissolved or in precipitates on the bottom of the seas.

Identify at least five ACTIVE METALS that are found in sea water.

(1) _____

(2) _____

(3) _____

(4) _____

(5) _____

ACTIVITY #3 (Continued)

The salts of the seas were carried from the earth's surface millions of years ago. The rivers still carry small residuals to the ocean. This is a l-o-n-g process. Water distills from the oceans to the atmosphere. Water vapor condenses in the skies to clouds and rain. The rain falls through the atmosphere and takes up atmospheric gases, including small amounts of acid producing carbon dioxide. The weakly acid water flows in streams through the soil and rocks to rivers....to lakes...and the seas. The water continues in cycles, but the salts that it takes from the rocks and soild remain in the seas. Since the beginning of time, water has been involved in this never-ending series of physical and chemical changes. The cycle of physical changes of evaporation, condensation and precipitation is known as THE HYROLOGIC CYCLE, or, just simply, the "water cycle".

ACTIVITY #4

Choose at least three of the following sets of questions to reseach and answer in detail.

(1) Why is carbon dioxide usually more plentiful in sea water than in the air? Why is there less carbon dioxide in sea water at greater depths than near the surface?

(2) Explain how the sun heats sea water. Why do deep waters look dark green or dark blue? Why doesn't all sea water freeze at the same temperature?

(3) What is a thermocline? Describe the temperature of the waters above and beneath the thermocline. What keeps the deep waters of the oceans cold?

(4) What is believed to be the origin of the minerals in sea water? Why are the oceans becoming more salty?

(5) Where is the salinity of ocean water below average and where is it above average? Why are there differences from one location to another?

(6) What is "pack ice"? How does it form? What are icebergs and where do they originate? Describe their usual path to the open sea.

ACTIVITY #5

Find and write definitions for the following words. Your definitions may be found in a dictionary or a text book.

(1) HYDROLOGY _____

_____

(2) CYCLE _____

_____

(3) PRECIPITATION _____

_____

(4) TRANSPIRATION _____

_____

(5) PERCOLATION _____

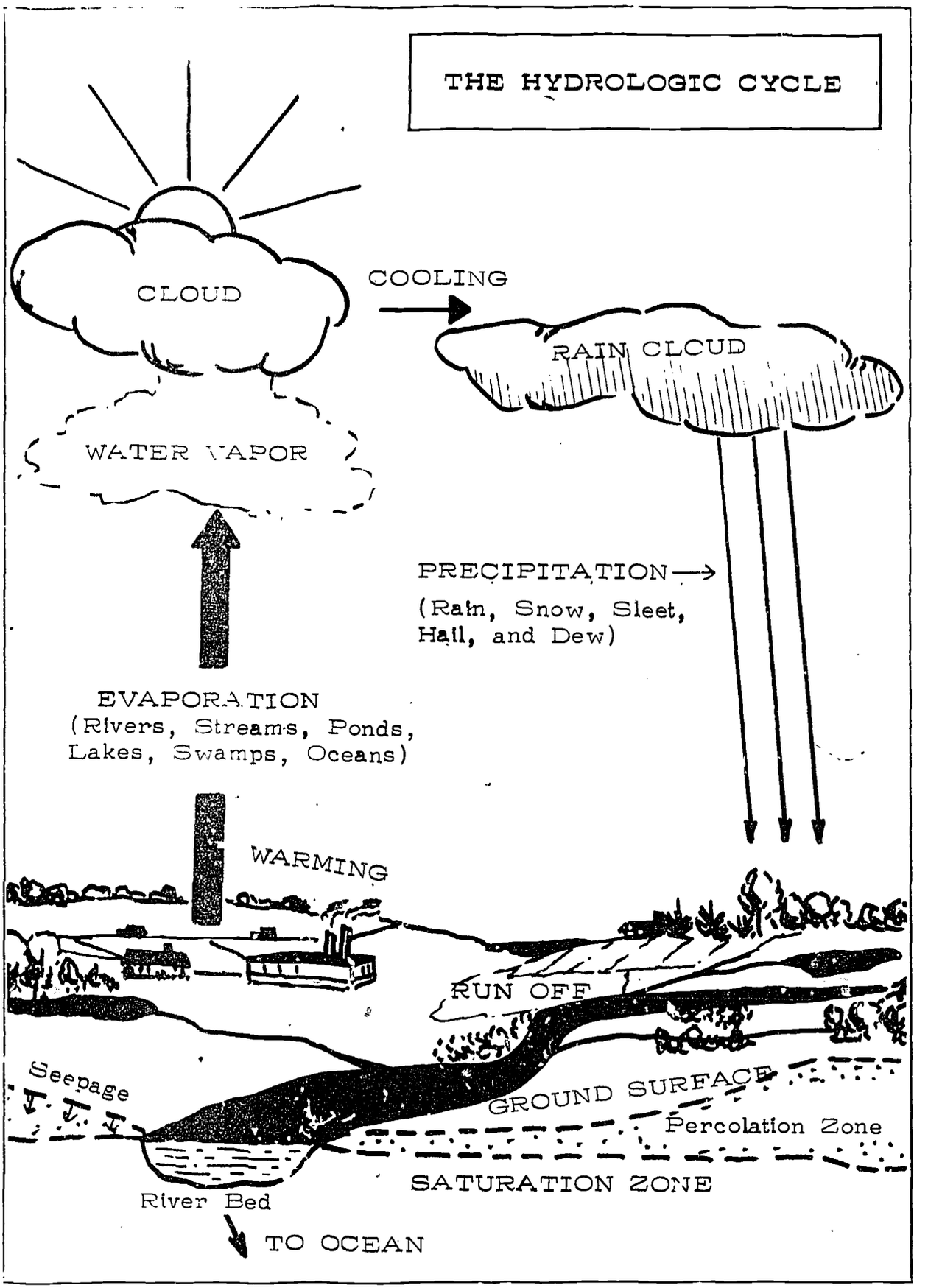
_____

(6) CONDENSATION _____

_____

The sun provides all the energy that makes the water cycle work. It is the sun's heat that evaporates the water and warms the humid air. The sun's heat also raises the surface temperature of the sea and land, which in turn warms the lower air, causing it to rise. Now, in the form of vapor, the water moves from cloud to cloud until it reaches a temperature cool enough to cause it to condense and fall to earth as rain, snow, sleet, or hail. When this precipitation hits the ground some soaks into the soil...and the rest runs along the surface into rivers and streams. The water that soaks into the ground sustains plant and animal life in the soil. Some seeps into underground reservoirs. Some of this water returns to the surface and to the atmosphere.....to begin the cycle over again....and again!

Man has little control over the water cycle rate; therefore, his primary supply of water is "fixed". But he can LEARN TO MANAGE THE WATER THAT <u>IS</u> AVAILABLE TO HIM....."pure water.....and something else"!


THE HYDROLOGIC CYCLE
CLOUD
COOLING
RAIN CLOUD
WATER VAPOR
PRECIPITATION
(Rain, Snow, Sleet, Hail, and Dew)
EVAPORATION
(Rivers, Streams, Ponds, Lakes, Swamps, Oceans)
WARMING
RUN OFF
Seepage
GROUND SURFACE
Percolation Zone
SATURATION ZONE
River Bed
TO OCEAN

SOMETHING ELSE

ACTIVITY #6

If you have done any traveling or visited friends in other communities you may have noticed that the odor, taste, and even the color of water from a faucet differs from place to place. This is caused by the different minerals dissolved in the water.

The mineral content determines the taste and quality of the water that flows from your faucet. Water in your community may contain minerals not present in water from another location. Perhaps you have noticed a film left in the basin after washing your hands. This film is caused by the presence of the elements calcium, magnesium, and iron, which are some of the minerals dissolved in water. When the quantity of these elements is high, the water is called "hard" water. Water that does not contain these elements is called "soft" water.

The HARDNESS of a sample of water can be determined by the following investigation:

TESTING THE HARDNESS OF YOUR WATER SUPPLY

In this investigation you will compare the hardness of the water you and your family use with water hardness in other states of the United States.

MATERIALS:

tap water
liquid soap
medicine dropper
water-hardness chart (See following page.)
test tube
graduated cylinder
cork

PROCEDURE:

Pour 125 milliliters of tap water into a clean, dry test tube. Add 10 drops of soap solution to the water in the test tube. Put a cork into the mouth of the test tube.

Shake the test tube vigorously. Then permit the test tube to remain undisturbed for approximately 5 minutes. Are the soapsuds still visible? If not, add another 10 drops of liquid soap to the water in the test tube. Follow this procedure until the soapsuds are visible after the water has remained undisturbed for 5 minutes. To convert your results to water hardness in parts per million (ppm), multiply the number of drops of soap that you added by 20. Using the table on the following page, compare the hardness of water in your community with other areas in the United States.

WATER HARDNESS in the UNITED STATES

State	Hardness (ppm)	State	Hardness (ppm)
Alabama	0-60	Montana	121-180
Alaska	61-120	Nebraska	180+
Arizona	180+	Nevada	121-180
Arkansas	0-60	New Hampshire	0-60
California	180+	New Jersey	61-120
Colorado	61-120	New Mexico	180+
Connecticut	0-60	New York	0-60
Delaware	0-60	North Carolina	0-60
Florida	180+	North Dakota	180+
Georgia	0-60	Ohio	121-180
Hawaii	0-60	Oklahoma	180+
Idaho	121-180	Oregon	0-60
Illinois	121-180	Pennsylvania	61-120
Indiana	180+	Rhode Island	0-60
Iowa	180+	South Carolina	0-60
Kansas	180+	South Dakota	180+
Kentucky	121-180	Tennessee	61-120
Louisiana	61-120	Texas	121-180
Maine	0-60	Utah	180+
Maryland	0-60	Vermont	0-60
Massachusetts	0-60	Virginia	0-60
Michigan	121-180	Washington	0-60
Minnesota	180+	West Virginia	61-120
Mississippi	0-60	Wisconsin	121-180
Missouri	121-180	Wyoming	180+

FLORIDA _____ (1) _____ _____

(2) _____ _____

(3) _____ _____

(4) _____ _____

(5) _____ _____

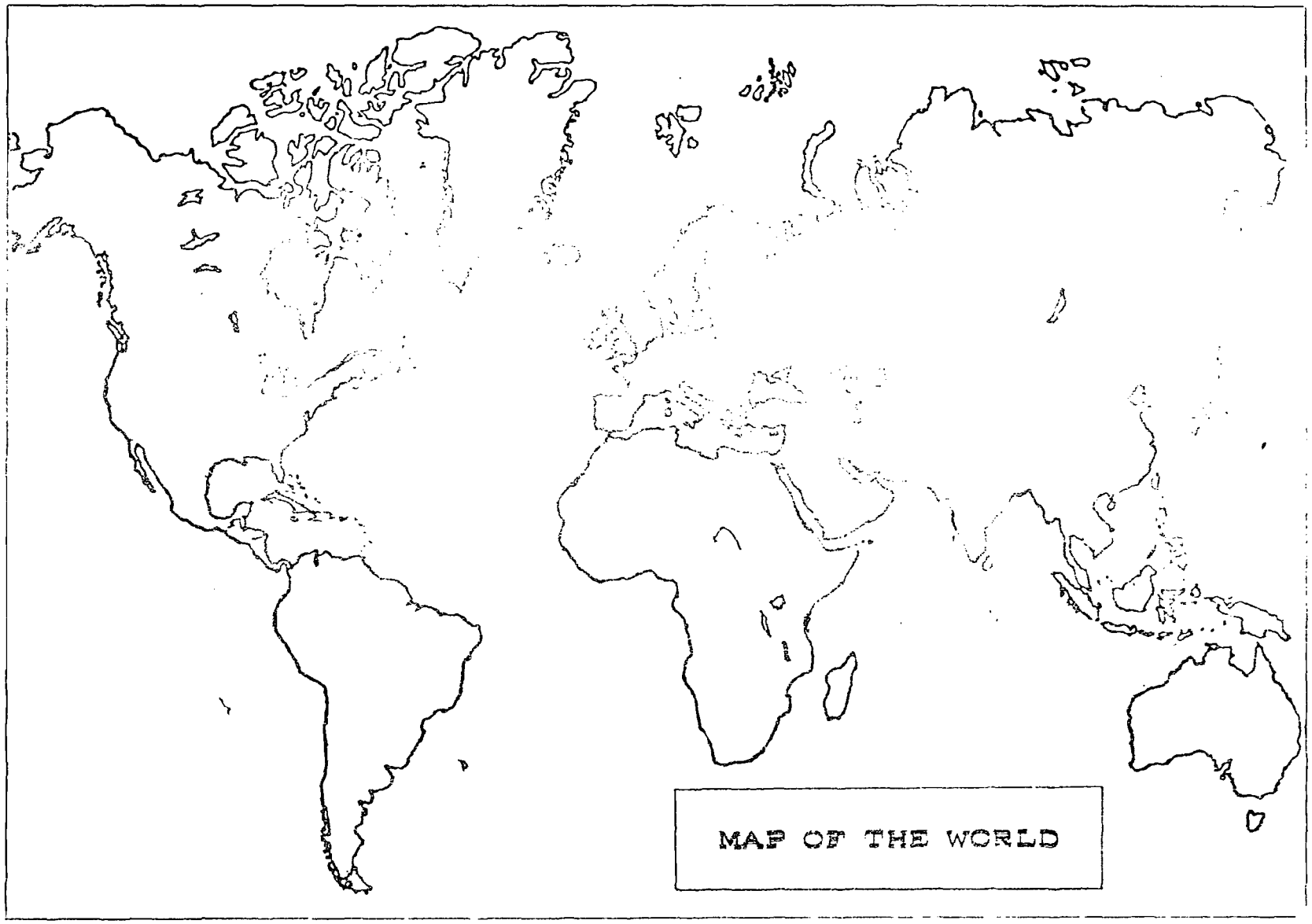
Repeat your investigation comparing tap water in your community with a sample of rain water.

Tap Water _____ Rain Water _____

EVALUATION

1. Using the map of the world on Page 16, trace and label at least one major river system on each of the six continents outlined.

2. In the space provided below write a brief description of at least one ancient civilization that developed near a river, ocean, or sea. Your descriptive paragraph should include the NAME of the civilization that you are identifying, the TIME in history that it flourished, the PLACE where the civilization was located, and your interpretation of WHY that civilization failed.


MAP OF THE WORLD

3. From the following lists of metals underline the names of at least five that are most commonly found in sea water:

uranium	potassium	calcium	cobalt
magnesium	copper	strontium	iron
sodium	gypsum	lead	nickel
quartz	zinc	gold	tantium

4. Underline the best completion for the following sentences:

(a) If testing for the presence of carbon dioxide in sea water, you would expect to find the greatest concentration

(1) at depths of 300 feet
(2) at depths of 600 feet.
(3) at depths of greater than 600 feet.
(4) in upper levels of sun's penetration.

(b) When testing for the presence of oxygen in sea water, you would expect to find the greatest concentration

(1) in depths of 300 feet.
(2) in depths of 600 feet.
(3) in depts of greater than 600 feet.
(4) in upper levels of sun's penetration.

(c) You would expect to find the greatest concentration of sodium chloride (salt)

(1) in polar seas.
(2) in tropical waters.
(3) near river mouths.
(4) in a sea near a tropical desert.

5. In the spaces provided write you own definition of at least five of the following words:

EVAPORATION _____

_____

TRANSPIRATION _____

_____

HYDROLOGY _____

_____

PERCOLATION _____

_____

EVAPOTRANSPIRATION _____

_____

CONDENSATION _____

_____

LIMNOLOGY _____

BIBLIOGRAPHY

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