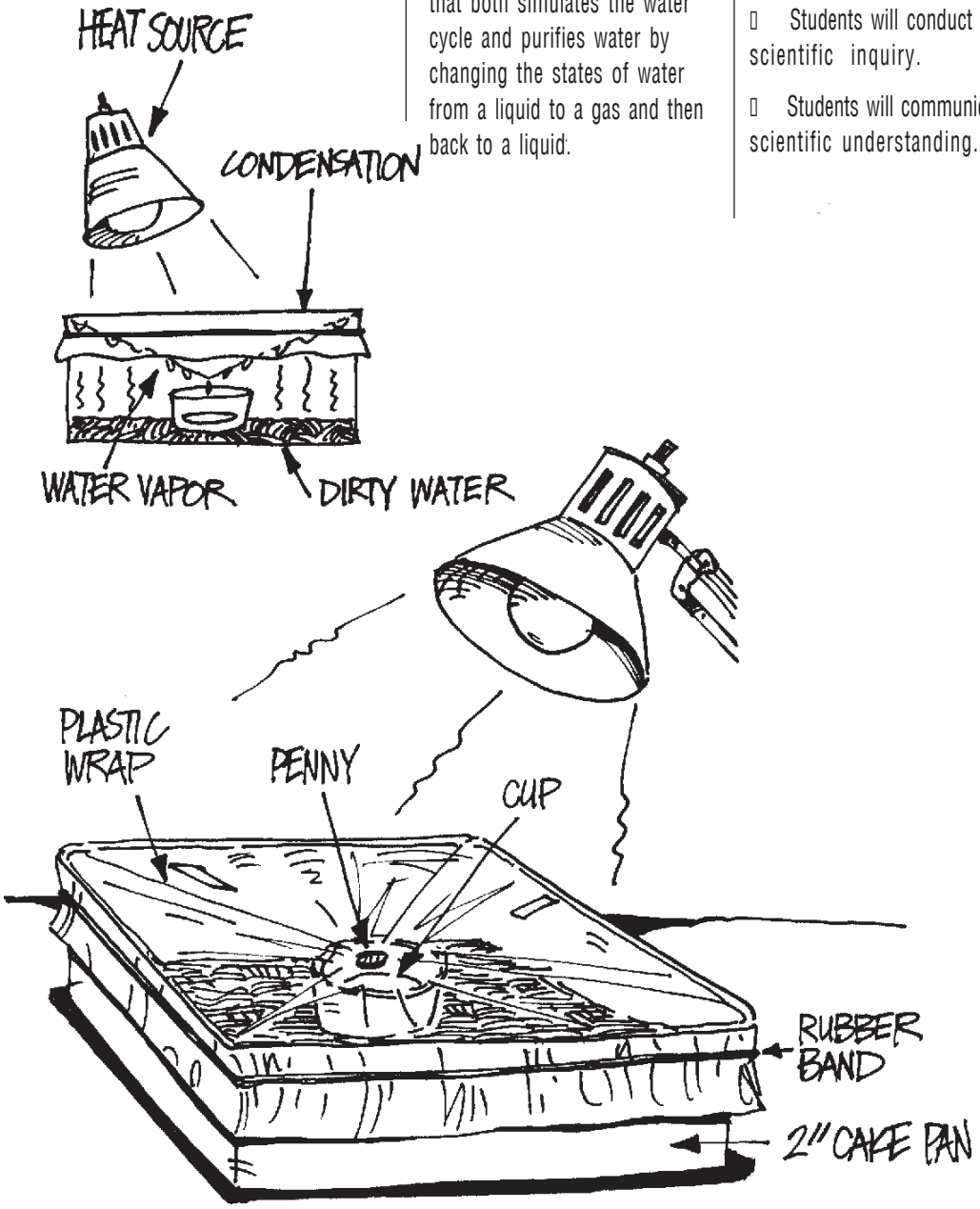
Unit 1
What is the Water Cycle?
Activity B

Can you make dirty water clean?

Introduction

In the previous lesson, students observed the physical properties of water and its three states. In this activity, students will apply this understanding to a lesson on water purification and the water cycle. Specifically, students will construct a model that both simulates the water cycle and purifies water by changing the states of water from a liquid to a gas and then back to a liquid.



Scientific Learning Goals and Objectives for this Activity:

Washington Grade Level Expectations (GLE's): 1.2.1; 1.3.3; 2.1.2; 2.1.3; 2.1.4

Goals

- Students will understand and apply scientific concepts and principles.
- Students will conduct scientific inquiry.
- Students will communicate scientific understanding.

Objectives

- Students will demonstrate understanding of the need for water to change states in order to be cleaned (purified).
- Students will apply knowledge by building a model that demonstrates the collection of clean water from a sample of dirty water.
- Students will communicate understanding that water is a finite resource that is being cleansed and distributed by the water cycle.

Teacher Preparation

Preparation Time:
20 minutes

Materials
Prepare for the Entire Class:

- transparency of world water distribution map
- large container with dirty H_2O (mix in class with oil, dirt, rocks, Kool-Aid, lint, etc.)
- plastic wrap
- paper towels
- cloth towels
- funnels/coffee filters
- aluminum screen/soil screens
- cheesecloth
- steel can/sand & gravel (optional)
- foil
- hot pads
- any additional items available that students may use in experiments

Prepare for Demonstration:

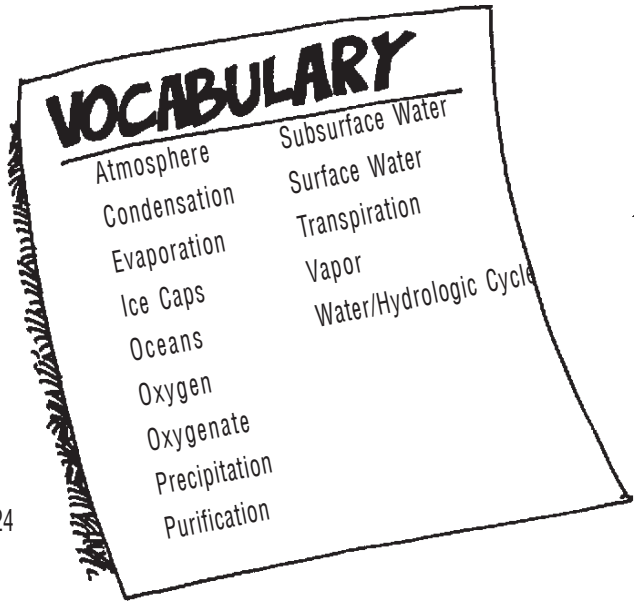
- square aluminum cake pan, 2" depth
- bottom of plastic cup, taped down
- large rubber band
- penny/metal washer
- heat source (sun, heat lamp, bare bulb)

Prepare for Each Team:

- clear container for team water sample (jar)
- square aluminum cake pan, 2" depth
- metal sauce cup or custard cup
- large rubber bands
- pennies
- heat source e.g., sun, heat lamp, bare bulb

Prepare for Each Student:

- copy of journal page
- copy of **Planning an Investigation Sheet (appendix)**



Student Involvement

Activity Time:
Day One—
50 minutes
Day Two—
50 minutes

Activity Processes:
Day One:

? Where is water located in the world?

1. Present an overhead of world water distribution map. Remind students of the three states of water. For each category listed on the map, ask students to predict/estimate the percentage of water this represents in the world. After discussion and consensus, write in the actual percentages determined by the U.S. Department of the Interior/ Geological Survey. These are: ice caps and glaciers 2.15%, surface water .02%, subsurface water .63%, oceans 97.2%, atmosphere (at sea level) .001%.

? How can clean water become polluted?

2. Students add a variety of materials to class container of water, e.g., oil, dirt, Kool-Aid, rocks, etc. Discuss how local water sources may become polluted. Place container on table with materials prepared for entire class.

? How can you create a water cycle to make dirty water clean again?

Have students imagine they are in a desert. They are hot and thirsty but have run out of water. They find a pond but the water looks dirty (dirty water from step two). Using only what's in their backpack and the clothes on their backs (teacher provided materials), have them clean up the water to drink. Introduce Planning an Investigation Sheet (appendix).

3. Teams design a water purification system using any available materials in three to seven minutes. Encourage each team to utilize changes in states of water as part of design. Students sketch and describe their system in journal.

4. Each team builds purification system. Using class sample of dirty water, teams test their system. Common methods tried include filtering and boiling the sample. Many substances are removed by these methods. The Kool-Aid color, however, will remain.

5. Teams that finish first record results in journal and present to class. Place team samples together on a table to compare color and clarity.

? How much of the initial water sample is left?

Discuss success/failure of each system type. For results with systems that need more time to

Student Involvement Continued

work, leave overnight and continue discussion/presentations the next class period.

6. Teacher should assemble demonstration model and place in inconspicuous place in room to begin purification process for next day's lesson.

Day Two:

1. Continue team presentations of systems. Discuss similarities and differences between system designs.

2. Teacher presents demonstration model from Day One. Compare and contrast demonstration model to student team systems.

? Why is water found in different places in the demonstration model? How did it get there?

Encourage students to utilize vocabulary such as: evaporation, condensation, and precipitation. Each student should describe in their journal each place where water was present in the demonstration model and why.

3. Relate water in the model to water found naturally, such as polluted rivers or lakes and precipitation such as rain or snow; clouds (water vapor).

? How is water purified in nature?

Fully define the term water cycle or hydrologic cycle. Relate this to what happened in the purification system. Students draw and label a landscape that shows the water cycle in their journal, include the 3 states of water. Arrows can be used to indicate the direction of the change of state. Encourage students to share sketch with team members.

Notes

Background Information: Events of Water Cycle
Snowfall creates snowpack in mountains; Rain and run-off from snowpack fills reservoir; Electricity is generated by hydroelectric power or the force of falling water; Water passes through turbines and returning unpolluted water to river; The sun draws moisture from the ocean forming clouds; The cycle begins again.

Teachers may allow students to design and test models over a period of days as an independent project or extra credit.

Day 1

Step 4:

Teacher should initial design before students begin construction. This will assure safety with hot plates and other ideas that may be potentially dangerous. Students should not drink any of the contaminated water.

Day 2

Step 2:

The water in the cup is clean, and has gone through the water cycle. However, it has traveled only a short distance from the plastic wrap to the cup. Thus, the water will not contain much oxygen and will taste flat like when you leave water is a glass and the water tastes "stale." At this point, you can also ask the class, "How does water oxygenate during the water cycle?" Explain that precipitation takes in oxygen and other gases when it passes through the atmosphere.

Step 4:

You can also introduce and explain the term transpiration. To demonstrate, place a small baggie over a house/potted plant (or just a leaf or stem) and observe captured water vapor. This reflects the part of the water cycle where plants and animals give off vapor as part of their na

If room is available, keep working models assembled fo
students an opportunity to monitor the models' progres

Journal 1B
Can you make dirty water clean?

Name _____

Team Name _____

Date _____

What were the results of your team's water purification system?

_____

_____

_____

_____

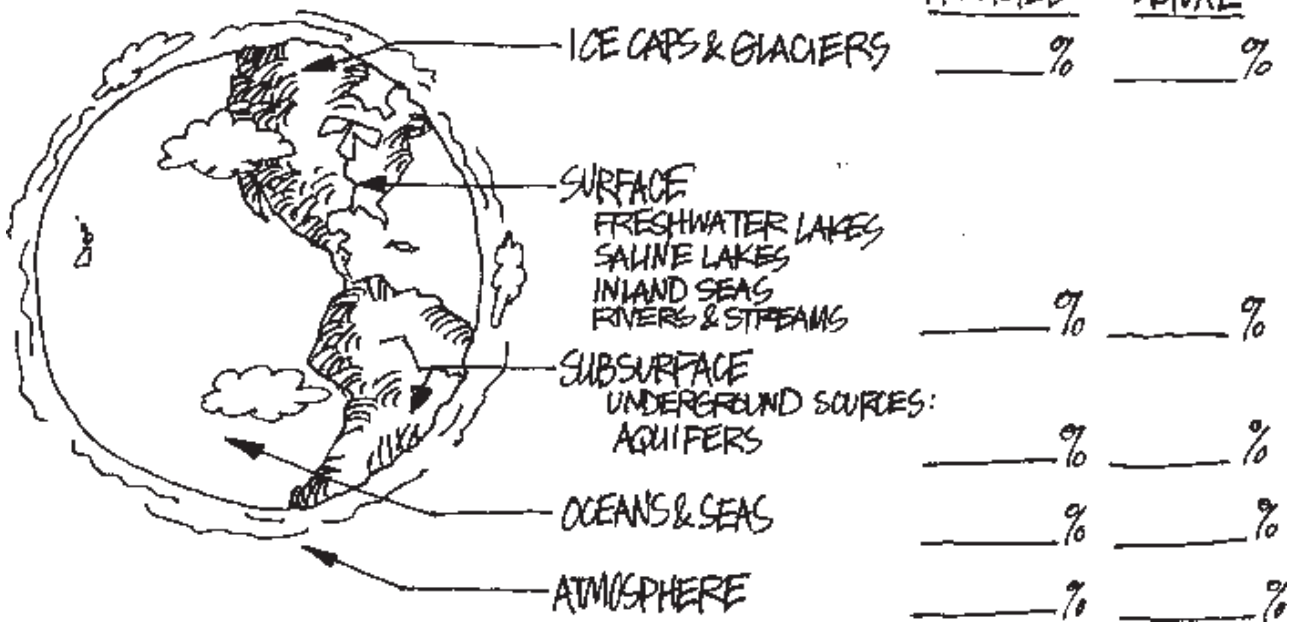
_____

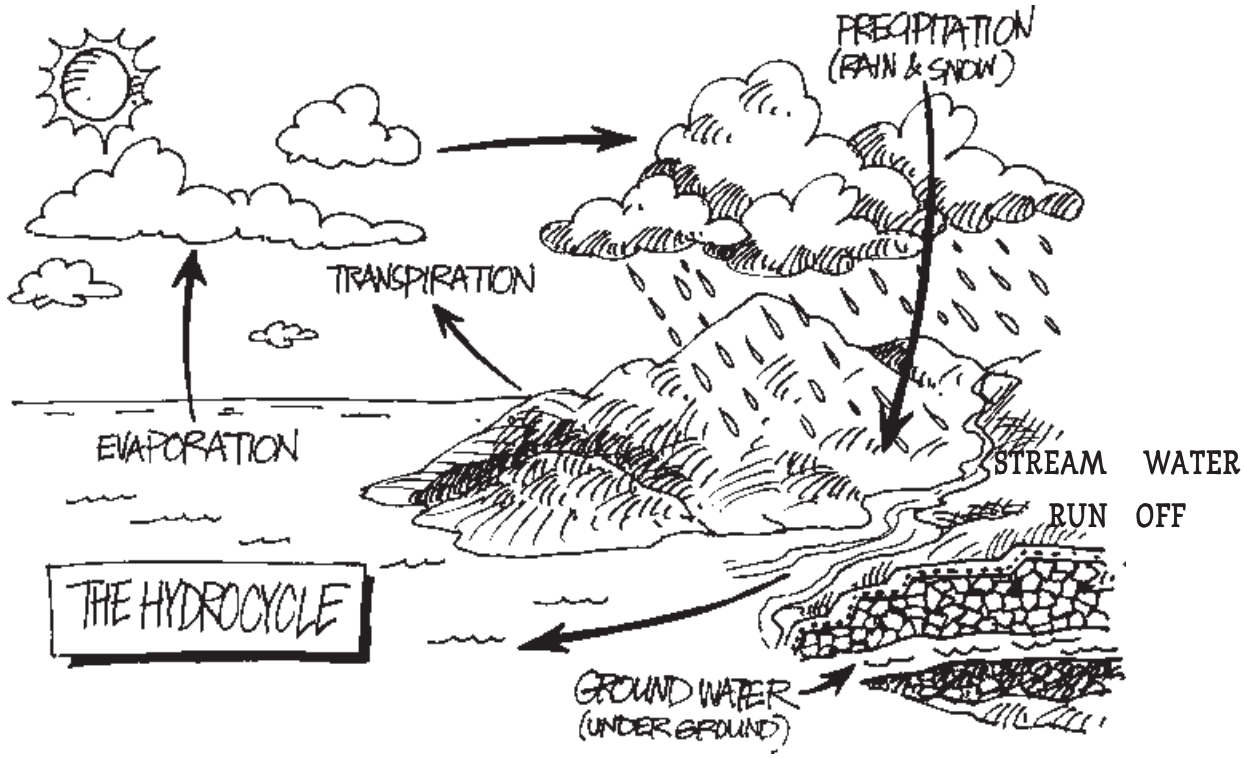
_____

Journal 1B Continued
Can you make dirty water clean?

Draw and label a landscape that shows the water cycle. Show water in each of three states: solid, liquid, and vapor. Use arrows to show the direction of changes in state (For example: clouds produce snow or rain).

WORLD WATER DISTRIBUTION MAP





THE HYDROCYCLE

Note: An excellent lesson for teaching world water distribution is located in Earth: The Water Planet (see Resource List).