



# Where does **water** come from?

## Lesson 1

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**GRADE LEVEL(s):**  
4th grade

**MAIN CONTENT AREA FOCUS:**  
Science and Social Studies

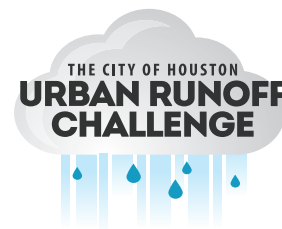
**SKILLS:**  
Discussion, Critical Thinking

**LESSON DURATION:**  
50 minutes

**GROUP SIZE:**  
Small groups of three to four students

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# Learning Objectives

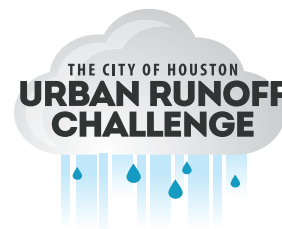
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## The students will...

- 1 Understand water's many uses by listing five ways water is used in their lives.
- 2 Understand the importance of water conservation through a group activity that represents the limited amount of usable water in the world.
- 3 Understand the water cycle through viewing a related instructional video and correctly sequencing images that represent the cycle.
- 4 Understand the sources of clean drinking water by exploring various filtration devices.

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# TEKS Objectives

## 4<sup>th</sup> grade:

### §112.15. Science, Grade 4, (b) Knowledge and skills.

- **Scientific investigation and reasoning.** The student conducts classroom and outdoor investigations, following home and school safety procedures and environmentally appropriate and ethical practices. The student is expected to: (B) make informed choices in the use and conservation of natural resources and reusing and recycling of materials such as paper, aluminum, glass, cans, and plastic.
- **Scientific investigation and reasoning.** The student uses scientific inquiry methods during laboratory and outdoor investigations. The student is expected to: (D) analyze data and interpret patterns to construct reasonable explanations from data that can be observed and measured; (F) communicate valid, oral, and written results supported by data.
- **Scientific investigation and reasoning.** The student uses critical thinking and scientific problem solving to make informed decisions. The student is expected to: (A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking by the student;
- **(7) Earth and space.** The students know that Earth consists of useful resources and its surface is constantly changing. The student is expected to: (C) identify and classify Earth's renewable resources, including air, plants, water, and animals; and nonrenewable resources, including coal, oil, and natural gas; and the importance of conservation.
- **(8) Earth and space.** The student knows that there are recognizable patterns in the natural world and among the Sun, Earth, and Moon system. The student is expected to: (B) describe and illustrate the continuous movement of water above and on the surface of Earth through the water cycle and explain the role of the Sun as a major source of energy in this process;

### §113.6. Social Studies, Grade 4, (b) Knowledge and skills.

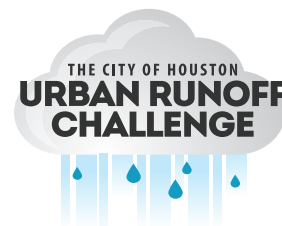
- **(9) Geography.** The student understands how people adapt to and modify their environment. The student is expected to: (A) describe ways people have adapted to and modified their environment in Texas, past and present; (B) identify reasons why people have adapted to and modified their environment in Texas, past and present, such as the use of natural resources to meet basic needs; and (C) analyze the consequences of human modification of the environment in Texas, past and present.

### §111.16. Mathematics, Grade 4, (b) Knowledge and skills.

- **(14) Underlying processes and mathematical tools.** The student applies Grade 4 mathematics to solve problems connected to everyday experiences and activities in and outside of school. The student is expected to: (A) identify the mathematics in everyday situations; (B) solve problems that incorporate understanding the problem, making a plan, carrying out the plan, and evaluating the solution for reasonableness; (C) select or develop an appropriate problem-solving plan or strategy, including drawing a picture, looking for a pattern, systematic guessing and checking, acting it out, making a table, working a simpler problem, or working backwards to solve a problem; and (D) use tools such as real objects, manipulatives, and technology to solve problems.

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# Key Vocabulary

## Evaporation

The process by which water changes from a liquid to a gas or vapor. Evaporation is the primary pathway that water moves from the liquid state back into the water cycle as atmospheric water vapor.

[HTTP://GA.WATER.USGS.GOV](http://ga.water.usgs.gov)

## Condensation

The process by which water vapor in the air is changed into liquid water. Condensation is crucial to the water cycle because it is responsible for the formation of clouds. [HTTP://GA.WATER.USGS.GOV](http://ga.water.usgs.gov)

## Transpiration

The process by which moisture is carried through plants from roots to small pores on the underside of leaves, where it changes to vapor and is released to the atmosphere. [HTTP://GA.WATER.USGS.GOV](http://ga.water.usgs.gov)

## Precipitation

Water released from clouds in the form of rain, freezing rain, sleet, snow, or hail. It is the primary connection in the water cycle that provides for the delivery of atmospheric water to the Earth. Most precipitation falls as rain. [HTTP://GA.WATER.USGS.GOV](http://ga.water.usgs.gov)

## Percolate

To drain or seep through a porous substance. Water percolates through sand. [HTTP://EN.WIKTIONARY.ORG/WIKI/PERCOLATE](http://en.wiktionary.org/wiki/percolate)

## Water Vapor

The gas phase of water. Water vapor is one state of water within the hydrosphere. Water vapor can be produced from the evaporation or boiling of liquid water or from the sublimation of ice.

[HTTP://EN.WIKIPEDIA.ORG/WIKI/WATER\\_VAPOR](http://en.wikipedia.org/wiki/water_vapor)

## Contaminate

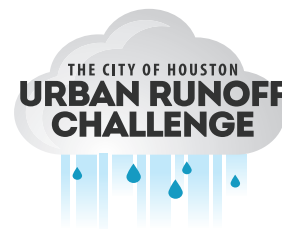
The presence of a minor and unwanted constituent contaminant in material, physical body, natural environment, at a workplace, etc. [HTTP://EN.WIKIPEDIA.ORG/WIKI/CONTAMINATION](http://en.wikipedia.org/wiki/contamination)

## Water Cycle

The water cycle, also known as the hydrologic cycle or H<sub>2</sub>O cycle, describes the continuous movement of water on, above and below the surface of the Earth. [HTTP://EN.WIKIPEDIA.ORG/WIKI/WATER\\_CYCLE](http://en.wikipedia.org/wiki/water_cycle)

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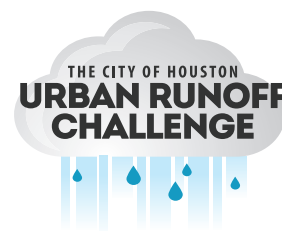


# Materials

- Scissors
- Red Marker
- Earth image ([DOWNLOAD](#))
- Two million people image ([DOWNLOAD](#))
- 100ml cylinder
- Petri Dish
- Water
- Eye dropper
- Urban Water Cycle image ([DOWNLOAD](#))
- Duct Tape
- Dirt
- Grass
- Leaves
- Vegetable or Olive Oil
- Paper
- Rocks
- Pebbles/Marbles
- Funnel
- Coffee Filters
- Cotton Balls
- Straws
- Toothpicks
- Rubber bands
- Bowls
- Two-Liter Bottles
- Activity Sheet
- Measuring Spoons
- Measuring Cups
- Procedural Sheet ([PDF](#))
- Procedural Group Result Sheet ([PDF](#))
- Performance Assessment ([PDF](#))
- Collaborative Work Skills Rubric ([PDF](#))

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# Lesson Plan

INQUIRY-BASED 5E INSTRUCTIONAL MODEL

## engage

Initiates the learning task. The activity should make connections between past and present learning experiences, and anticipate activities and organize students' thinking toward the learning outcomes of current activities.

### OBJECTIVE

Students will understand water's many uses by listing five ways water is used in their lives.

*Teaching Strategies: Create interest; Raise questions and problems; Elicits responses that uncover students' current knowledge about the concept/topic.*

*Optional: Introduce the lesson by playing a song (related to rain) as a transition into the lesson.*

*YouTube: Glee — Singing in the Rain & Umbrella*

*YouTube: (Burt Bacharach & B.J. Thomas) Raindrops Keep Falling on My Head*

### MATERIALS:

Scissors

Red Marker

Earth Image

Two million people photo

1. Place students into groups of three to four. Ask groups to develop a list of how water is being used in their everyday lives. Groups may list the following: showering, cooking, drinking, pools, water sprinklers, washing cars, mopping floors, flushing toilets, etc... Write group answers on the board. Try to have at least 10 different items listed on the board.

### VIDEO:

*Glee — Singing in the Rain & Umbrella*

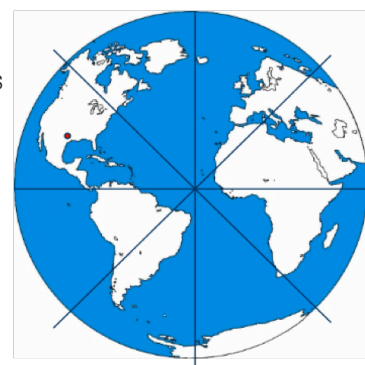
2. Pass out the **Earth Image** to students (using scissors the image should already be cut around the outline of the earth). One earth image will be handed to each student. Ask students to point to each **continent** and name all seven.

### VIDEO:

*(Burt Bacharach & B.J. Thomas) Raindrops Keep Falling on My Head*

a. Using a red marker, ask students to approximate the location of Houston, TX by placing a dot on their map. Inform students that the dot represents, over two million individuals living in Houston, TX alone. *[Photo representing two million people can be used to help represent the number.]*

b. Each group will now try to estimate population of the entire state of Texas. Groups will discuss and present their estimation to the class. Ask one student from each group to inform the class of their Texas state population estimation. Write each group's estimation on the board. After reviewing all group answers, notify the class that the answer is **25 million!** *[Photo representing two million people can be used to help represent the number. The image would need to be printed out or shown on the screen 12.5 times.]*



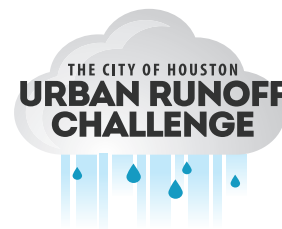
c. Now that students have a better grasp of their local population, inform students the world population is estimated to be over **six billion**. *[Photo representing two million people would need to be printed out 3,000 times to equal a representation of six billion people.]* Imagine all the water being used for everyday purposes!

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# Lesson Plan

INQUIRY-BASED 5E  
INSTRUCTIONAL MODEL

## engage (continued)

Initiates the learning task. The activity should make connections between past and present learning experiences, and anticipate activities and organize students' thinking toward the learning outcomes of current activities.

3. Ask students to notice the amount of water on their world image. Review the names of the oceans, local lakes, and rivers.
  - a. Ask each group to discuss and decide how much of the Earth's surface is made up of water. Write each group's response on the board. [Answer is 75%]
  - b. Now ask each group to decide how much of Earth's water is fresh and available for everyone to use in their everyday lives by representing the answer with the **world image**. Remind students that salt water is not fresh and usable.
  - c. If a group believes all Earth's water is available to use in our everyday lives, then groups would represent it by not doing anything to the world image.
  - d. If a group believes half of the Earth's water is available to use, then students would represent 50% by folding their world in half.
  - e. If students believe 25% of Earth's water is fresh and usable, then students would fold the world again to represent 1/4.
4. Have students discuss in their groups. Groups will decide a percentage of the water that can be used by folding their earth image over and over again.
5. Have each group share their answer and why the group decided that percentage.
6. Reveal the correct answer by folding the world image at least eight times (you may noticed it cannot be folded more than seven times).
  - a. Ask students to unfold their map and use a red marker to draw a line from the center of the world image to the edge. That line represents 1% of Earth's fresh usable water (showering, cooking, drinking, pools, water sprinklers, washing cars, mopping floors, flushing toilets, etc.)

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# Lesson Plan

INQUIRY-BASED 5E INSTRUCTIONAL MODEL

## explore

Provide students with a common base of experiences within which current concepts, processes, and skills are identified and developed.

### OBJECTIVE

Students will understand the importance of water conservation through a group activity that represents the limited amount of usable water in the world.

### MATERIALS:

100ml cylinder

Petri Dish Water

Eye dropper

*Teaching Strategies: Encourages students to work together without direct instruction from the teacher; Observes and listens to students as they interact; Asks probing questions to redirect students' investigations when necessary; Provides time for students to puzzle through problems*

1. Give each group a 100ml graduated cylinder, a petri dish, and eye dropper.

- a. One student from each group will fill the graduated cylinder with 75ml of water.
- b. Another student from the group will use the eye dropper to remove 1% of water (from the cylinder) and place it in the petri dish. Remind students that only 1% of Earth's water is fresh and usable.



2. Ask students: "If you equally shared the water with your group members, will that be enough to stratify your thirst? If not, why?" Student responses may vary.
3. Ask students to discuss with their groups: "If Earth's water is used for drinking, showering, cooking, drinking, pools, water sprinklers, washing cars, mopping floors, flushing toilets, etc. why do we still have water every day?"
  - a. Ask students to develop a theory and share their findings with the class.
  - b. While groups present their theory, listen for words such as: evaporation, condensation, precipitation, reuse, recycle, runoff, water cycle, etc. Depending on responses, ask groups to further elaborate and explain important terms. Note: Students would have prior knowledge from second grade regarding the processes of the water cycle, including evaporation, condensation, and precipitation, as connected to weather conditions. (Science TEK §112.13.b8C)
4. Review basic water cycle terms with the class, such as evaporation, condensation, and precipitation.

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# Lesson Plan

INQUIRY-BASED 5E INSTRUCTIONAL MODEL

## explain

Focus students' attention on a particular aspect of their engagement and exploration experiences, and provide opportunities to demonstrate their conceptual understanding, process skills, or behaviors. This phase also provides opportunities for teachers to introduce a concept, process, or skill.

### OBJECTIVE

Students will understand the water cycle through viewing a related instructional video and correctly sequencing images that represent the cycle.

### MATERIALS

Urban Water Cycle image

### VIDEO

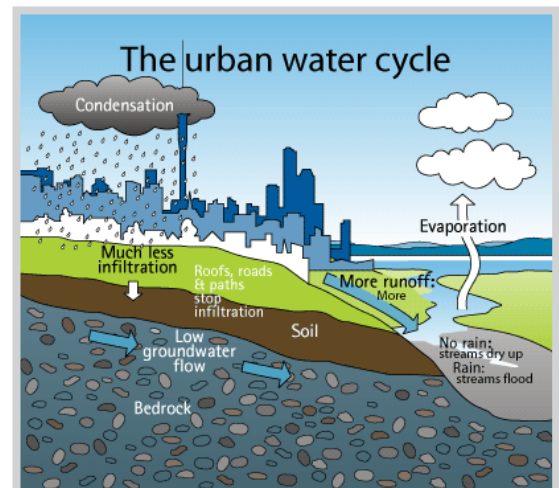
Eureka! Episode 18 — Evaporation and Condensation

### VIDEO

The Magic School Bus Wet All Over

*Teaching Strategies: Encourages students to work together without direct instruction from the teacher; Observes and listens to students as they interact; Asks probing questions to redirect students' investigations when necessary; Provides time for students to puzzle through problems*

1. Review the water cycle by drawing an urban landscape (modeled after Houston, TX) on the board. Do not include labels or arrows.
2. Inform the class that it is a drawing modeled after Houston, TX.
3. Ask each group to quickly discuss how they would label the drawing to represent the water cycle. Remind students of important terms: evaporation, condensation, and precipitation.
4. One representative of each group will approach the board. Representatives will label and/or draw an important aspect of the water cycle. Allow class participation.



- a. Students may have difficulty labeling the landscape since they are used to the traditional water cycle landscapes [example image; example video].

5. Verify student answers for accuracy. Review findings with the class.

- a. Optional: Use videos from Bill Nye the Science Guy, The Magic School Bus, or Eureka to explain the basics of the water cycle.

6. Inform students that water is constantly recycling. The water students are drinking today has been around as far back as the dinosaurs. The water students showered in yesterday could be someone's drinking water.

- a. Ask students: "How does the water become clean for others to use?"
- b. Answers may vary. Listen for answers that deal with filtration systems and ask students to elaborate.

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# Lesson Plan

INQUIRY-BASED 5E INSTRUCTIONAL MODEL

## elaborate

Challenge and extend students' conceptual understanding and skills. Through new experiences, the students develop deeper and broader understanding, more information, and adequate skills.

### OBJECTIVE

Students will understand the sources of clean drinking water by exploring various filtration devices.

### MATERIALS

- Scissors Duct Tape Dirt
- Grass Leaves
- Oil
- Paper
- Rocks Pebbles/Marbles Funnel
- Coffee Filters Cotton Balls
- Straws Toothpicks
- Rubber bands Bowls
- Two-Liter Bottles Activity
- Sheet Measuring Spoons and Cup Procedural Sheet (.pdf)
- Collaborative Work Skills Rubric (.pdf)

### VIDEO

[LifeStraw in Kenya: CO2 for H2O](#)

### PDF

[LifeStraw Brochure](#)

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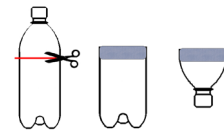
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*Teaching Strategies: Expects students to use vocabulary, definitions, and explanations provided previously in new context; Encourages students to apply the concepts and skills in new situations; Reminds and refers students of alternative explanations*

## Preparation: The teacher will...

1. Use scissors and safely cut two-liter bottles (one per group) in half. Refer to the diagram for guidance. Keep the tops of each bottle as it can be used as a funnel option for the group activity.



2. Use duct tape and carefully tape the edges of the bottle to prevent students from actually injuring themselves.
3. Use secure containers and collect the following items (one per container): glitter, shredded paper, dirt, cotton balls, rocks or pebbles, grass and leaves, rounded toothpicks, coffee filters, and drinking straws.
4. Fill an empty milk jug with water (not necessary if a water source is available nearby or in the classroom.) Water will be provided to students as part of the group activity.
5. Review materials with the class (two-liter cut bottles, glitter, shredded paper, dirt, cotton balls, rocks or pebbles, grass and leaves, rounded toothpicks, coffee filters, and drinking straws.) Allow students to observe the materials up close.

## Small Group Activity:

1. Students will observe the materials that are at the head of the class.



# Lesson Plan

INQUIRY-BASED 5E INSTRUCTIONAL MODEL

## elaborate

(continued)

Challenge and extend students' conceptual understanding and skills. Through new experiences, the students develop deeper and broader understanding, more information, and adequate skills.

### OBJECTIVE

Students will examine why water samples may have less contaminants than others by comparing their results with the class.

### MATERIALS

[Procedural Group Result Sheet \(PDF\)](#)

### VIDEO

[TEDtalk: Michael Pritchard's water filter turns filthy water drinkable](#)

2. The teacher will pass out a Procedural Sheet (one per group) and review the directions.

3. The teacher will provide necessary materials as stated on the Procedural Sheet and will use the Collaborative Work Skills Rubric to help observe students throughout the activity.

4. Students will have five minutes to discuss in their groups which materials they would like to use, write out the filtration process they would like to attempt, and estimate the result of their water. The teacher will advise groups to consider putting the filtration materials in layers and consider the amount of materials to use.

5. While students are discussing, the teacher will begin to create the dirty water for each pre-cut bottle (one per group). The dirty water will include the following:

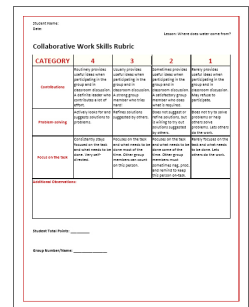
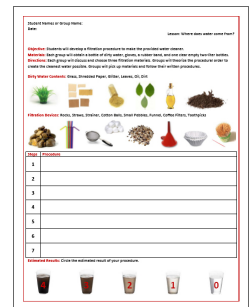
- a. 1 cup of clean water
- b. 2 tablespoons of oil
- c. 1/4 cup of shredded paper
- d. 1/4 cup of dirt
- e. 1/4 cup of grass and leaves
- f. 1 tablespoon of glitter

6. The teacher will mix the contents up with a spoon.

7. After five minutes, the teacher will show students the dirty water and explain that each group's goal is to make their water as clear as possible. The teacher will now pass out the dirty water to each group at this time.

8. The teacher will remind students to NOT drink water samples and that each group MUST follow their procedures exactly.

9. The teacher will allow two students per group to gather any necessary filtration materials (rocks, pebbles, funnel, straws, cotton balls, coffee filter, and toothpicks) as part of their procedures. The teacher will provide any assistance and will confirm that students are only collecting materials as stated on their Procedural Sheet.



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# Lesson Plan

INQUIRY-BASED 5E  
INSTRUCTIONAL MODEL

## elaborate

(continued)

Challenge and extend students' conceptual understanding and skills. Through new experiences, the students develop deeper and broader understanding, more information, and adequate skills.

### DID YOU KNOW?

*Students will examine why water samples may have less contaminants than others by comparing their results with the class.*

10. Groups will build their filtration systems.
11. When all groups are ready to test out their filtration systems, the teacher will pass out one bottle of dirty water to each group.
12. Groups will now test their filtration systems.
13. Allow 5 minutes for their dirty water to pass through the filtration system.
14. After 5 minutes allow groups to write their observations on the back of their Procedural Sheet.

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# Lesson Plan

INQUIRY-BASED 5E INSTRUCTIONAL MODEL

## evaluate

Observes students as they apply new concepts and skills; Assess student's knowledge and/or skills; Allows students to assess their learning and groups process skills; Asks open-ended questions such as, What evidence do you have? What do you know about the problem? How would you answer the question?

### OBJECTIVE

Students will examine why water samples may have less contaminates than others by comparing their results with the class.

*Teaching Strategies: Expects students to use vocabulary, definitions, and explanations provided previously in new context; Encourages students to apply the concepts and skills in new situations; Reminds and refers students of alternative explanations*

### MATERIALS

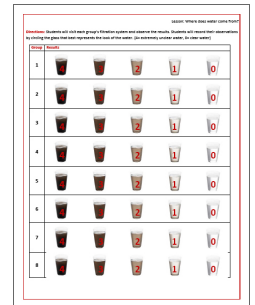
[Procedural Group Result Sheet \(PDF\)](#)

### VIDEO

[TEDtalk: Michael Pritchard's water filter turns filthy water drinkable](#)

## Whole Group Activity:

1. The teacher will pass out the Procedural Group Result Sheet to each student (one per student) and explain the directions.
2. In an organized manner, the teacher will rotate groups to visit other group filtration systems.
3. Students will rate each group filtration system and the results of the water.
4. After all observations are complete, students will return to their desk.
5. The teacher will ask students (by a show of raised hands) which group has the cleanest water. For example, ask: "How many of you believe Group 1 had the cleanest water (or the water with the least amount of contaminates)? How many believe Group 2 had the cleanest water?"
6. The teacher will write the tally of answers on the board.
7. The teacher may ask the following questions:
  - a. What did the group with the cleanest water do differently? Why did their water come out so clean (with less contaminates)? Can you tell what each material filtered from the water?
  - b. Do you think the water is now safe to drink? Why or Why not?
  - c. Did it take a long time for your water to pass through your filtration system? Why or Why not?
  - d. If you had more time and materials, what would you do differently to improve your water filtration system?



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# Lesson Plan

INQUIRY-BASED 5E  
INSTRUCTIONAL MODEL

## evaluate

(continued)

Observes students as they apply new concepts and skills; Assess student's knowledge and/or skills; Allows students to assess their learning and groups process skills; Asks open-ended questions such as, What evidence do you have? What do you know about the problem? How would you answer the question?

- e. Do you think all countries have water filtration systems? Why or Why not?
- f. If water is reusable and is replenished by the water cycle, should we still be concerned about the 1% of usable water in the world? Why or Why not?
- g. Were you here during Hurricane Ike? Did you have clean water available at home?

*To help close the lesson, the teacher will ask students to state the main purpose of the lesson and to state strategies students may now consider to keep Earth's water clear of contaminates in their everyday lives.*

## Additional Resources:

### EVENTS

- Water Works Educational Center
- Green Houston Calendar of Events

### INFORMATIONAL SITES

- City of Houston Public Works and Engineering
- City of Houston Solid Waste Management Department
- City of Houston Water Use/ Water Quality

### LIFESTRAW VESTERGAARD FRANDSEN

- LifeSaver Bottle Michael Pritchard

### YOUTUBE VIDEOS

#### LIFESTRAW IN KENYA: CO2 FOR H2O

- NASA The Water Cycle
- Eureka! Episode 18 — Evaporation and Condensation
- The Magic School Bus Wet All Over
- Bill Nye the Science Guy — “Water Cycle Jump”
- Glee — Singing in the rain & Umbrella
- (B.J. Thomas) Raindrops Keep Falling on My Head — Sungha Jung
- Michael Pritchard's water filter turns filthy water drinkable

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Many thanks to Kappa Delta Pi Zeta Omega Chapter, Keep Houston Beautiful, City of Houston Public Works, Populations Connection via Indiana University Purdue University Indianapolis, the Environmental Protection Agency, the U.S. Department of the Interior U.S. Geological Service, the Rain Garden Network, and <http://www.worldofrenewables.com/> for help with this lesson. 2012

