Incredible Journey

This Activity is modified from a Project WET curriculum guide. www.projectwet.org

Investigative Question: How are trees a part of the water cycle?

Goal: Students will simulate the movement of water within the water cycle, focusing on our region and tree ecology.

Objectives: Students will describe the movement of water in the water cycle. Students will recognize what fraction of time was spent at each station/state of water. Students will identify the ecological interactions between trees and water.

Knowledge: Students will simulate and describe a complex water cycle in which living things play an important role, including an explanation of the specific role of water in helping trees survive. Students will recognize and describe fractions as parts of a whole (in the form of the number of turns at a station out of all turns).

Skills: Students will record their movements in the game in a data table, working cooperatively to collect data (comparing results for accuracy as it is collected), and then representing the data as fractions. They will add fractions with like denominators.

Value: Students will appreciate that clean, healthy water is necessary for all living things. They will learn how water moves through their region, and understand that it may get "stuck" in certain forms or that it may move on to influence a new place.

SOL:
Math
3.3 – representing fractions up to twelfths
3.7 – adding and subtracting proper fractions with like denominators of 12 or less
Science
3.9 – Water cycle

Materials:
- Large dry erase board and markers
- Pipe cleaners
- 8 station signs with supports
- 8 different colors of pony bead
- 8 cardboard cube "dice" with labels to direct students
- (optional)Map of the area with water sources labeled
- Student data sheets

Special Safety

Procedure
- Set up the stations in a rough circle. At each station, put a container of beads (place the beads in a way that makes sense to you, the leader. For example, green goes with trees).
- Draw the first few columns of the datasheet on the dry erase board.

	1	2	3
Solid			
Liquid			
Gas			

1. Divide students into teams of 2-3. Give each student or team a data sheet, clipboard and pencil and have them write team member names on the sheet.
2. Introduce the game: Students *teams* will playing the part of a drop of water as it moves through a water cycle. Ask students to describe the water cycle and illustrate their description on the board,

asking for each stage of the cycle which state of matter the water is in (evaporation: gas, condensation: liquid, precipitation: solid or liquid).

3. They will be moving together as a group through the game; team members need to take turns rolling the dice, but they all record the same information as their teammates. Model a turn and recording of the data (describe and do so the students can see):
   - This game has 12 turns. How many numbered columns are in the data table? (point to the example) Each column has a space for students to record data for one turn.
   - Student groups will be sent to a station. At that station will be a die and a container of beads. One team member should roll the die. *As soon as* the die is rolled, all teammates need to pick up a bead and place it on their pipe cleaner. The pipe cleaner and beads is one way to record their journey.

	1	2	3
Solid	X		
Liquid	B		
Gas	X		

   - They then read the roll of the die. The first word will tell them their state of matter. Model recording the station and state in the data sheet on the dry erase board. Write the station letter in the row representing the state of matter and then placing an X in the other two boxes for that turn. (B liquid is shown) The datasheet is a second way to record the journey and should reflect the same stations as the pipe cleaner.
   - The team reads the rest of the roll, discovering where they go next on their journey.
   - Walk through the stations so that students know where each is located and what each says.
   - Point out that it is possible that the die may tell them to "stay" and have them describe what they should do (take another turn at that station). It is also possible that they may move back and forth between stations, and may not visit every station. That is OK – we want to see where the water goes!
   - Have the students reiterate the steps of a turn (roll, add bead, record station and state, read and move), modeling it as per their instructions.
4. Distribute one pipe cleaner to each student. Have the students knot one end to secure beads.
5. Remind the students that they are moving as a team. When their team has taken all 12 turns, they are finished with the game. After tying the ends of their pipe cleaners off to make a loop, they can then draw or describe the journey their drop took in the space provided on the datasheet (encourage them to think of it as the diary of a water droplet).
6. Spread your student teams out to the eight game stations (Clouds, Animals, Chesapeake Bay, Shenandoah River, Lake Frederick, Blue Ridge Mountains, Groundwater, and Trees).
7. When all students have completed 12 turns, discuss their journeys, connecting the reality of the gameplay to the living things missing from the original water cycle.
   - Ask students to share their cycle with the rest of the group. Did every team have the same cycle? Did they all go to each station? Did any of the groups get "stuck" either in a particular location or in a back and forth between two stations? Bring out the original water cycle illustration: what did this game show you about the water cycle? What was missing from our original cycle? Why do living things, like trees need water? (transport food energy and waste around the body, to give plants shape and rigidity – without water they can wilt)
   - Tell students that we'll now be looking at exactly how many turns out of the entire game they spent at each station. (Note: these instructions are an *introduction* to fractions – amend the activity based on student knowledge)Model by having all groups count how many turns they spent in station A (all students in a team should have the same response). Select one group and write their response on the dry erase board. Explain: when talking about parts of a whole, in this case – how many turns out of a whole game – we can use fractions. In a fraction, the number of parts goes on the top (the numerator), a line is drawn under it that means "out of" (draw the line), and you write how many parts it takes to make a whole on the bottom. In this case, how many turns did it take to play a whole game (write the 12 under the line)? Have all groups record the fraction of time spent at each station on the data sheet.
   - Depending on time and prior knowledge, model adding the fractions by counting the number of turns spent in trees AND in animals to get the fraction spent in living things. Have student complete the remainder of the data sheet.

8. Wrap up: Ask groups to share the fraction of the game they spent "in" living things. This is not often represented as part of the water cycle, but is it important to think about? Have students offer explanations as to why or why not.

Possible Extensions: (optional)
- The datasheets can be used to create a wide variety of representations – from graphs to models.
- Twelfths were chosen because 12 has so many factors and therefore the student responses could easily be simplified into proper halves, thirds, quarters, and sixths for more advanced fraction practice.
- All of the group journeys could be considered together for a much larger quantity of data. How does doing so change how much time water spent in each location?
- Use the journey logs as the basis for a writing exercise. This could either be nonfiction or a fictional "journal", either of which could involve research into local waterways.

Incredible Journey Student Data Sheet   group members_____

	1	2	3	4	5	6	7	8	9	10	11	12
Solid												
Liquid												
Gas												

At each turn, record the letter of station next to solid, liquid or gas. Put an X in the empty boxes for that turn.
Draw or describe your journey here:

What fraction of the 12 turns did you spend at each station? (Use your data or beads to help you figure it out.)

Clouds $\frac{?}{12}$	Trees	Chesapeake Bay	Shenandoah River	Groundwater	Animals	Lake Frederick	Blue Ridge Mountains
A	B	C	D	E	F	G	H

What fraction of turns did you spend in living things?	What fraction of turns did you spend in surface water?	What fraction of turns did you spend in each state?		
(trees + animals)	(Bay + River + Lake)	Solid	Liquid	Gas