Lesson Title: Water Pollution in Agriculture

Time: 40 minutes

Standards:
PA Academic Standards for Environment and Ecology, 4.8.7 Humans and the Environment
A. Explain how people use natural resources in their environment
C. Explain how human activities may affect local, regional and national environments: Describe what effect consumption and related generation of wastes have on the environment
D. Explain the importance of maintaining the natural resources at the local, state, and national levels

Materials:
Gallon jug, 8x11 water-use cards, water table demo

Objective:
Students should leave with an understanding of how much water goes into agriculture and the production of everyday goods and how this extensive use of water is connected to our global water footprint and the health of our environment overall.

Lesson Plan and Activities:
Introduction (5 minutes): Start the class by holding up a jug of water and asking students how much water is in the jug (answer: one gallon of water). Now, ask the students how many gallons of water they think they use when they take a shower (answer: showers on average use about 3 gallons per minute, so a 10 minute shower uses 30 of the one gallon jugs). The teacher should head to the wipe off board and write the following questions on the board: Where do we get our water in Meadville? What do we use water for on a daily basis? In what other ways to we utilize water? (Q1: sink, tap, stream, elsewhere?; Q2: drink, shower, toilet, wash hands, etc.; Q3: agriculture, industry, hydropower). Work with the students to answer these questions as a group. Next, tell the students that we are going to do an activity where they are to try and figure out how many gallons of water are involved in the processing of different goods and foods.

Activity 1: How many gallons of water is in a…? (10 minutes)

- Materials: envelope of pictures of different goods printed on paper, a gallon jug of water, 8X11 sized pictures with the answers on them
- Each group will be given an envelope that is to be kept sealed until directions are given. The teacher explains what is in the envelops and how students are to organize the pictures from least water usage to most water usage. They are also to take a guess as to how many gallons it takes to produce the item. Once teams complete the activity, the teacher will provide the actually answers. The teacher will tape the 8X11 pictures to the board in order so the students can see the numbers.

Debriefing discussion on activity: Use these questions to discuss the activity more deeply
- How many did you guess correctly?

Although this project is funded in part by the Environmental Protection Agency, it does not necessarily reflect the opinion or position of the EPA

- What surprised you the most?
  - Why do we need so much water to produce meat? (answer: grow the corn to feed the animals)
  - Why do you think fruits and vegetables are at the low end of the chain? (answer: do not require as much water to grow)
- Do you think this is potential drinking water that is going into production of these goods? If so, how do you feel about all this water going into hamburgers when people in other countries don't have drinkable water?
- If we are trying to protect our water why are we using so much?

Discussion: Now we will move on to talk about the worksheets the students handed in before class. Using the data from the worksheets, we will calculate how many gallons of water this class uses on a typical school day.

Activity 2: "Think, Pair, Share" or teacher led discussion (5 minutes): Give the students five minutes to pair up and come up with answers to the following questions. Teachers should write questions on board and have discussion with students on their answers.

- How can our water sources get contaminated?
- What would happen if our water sources were to become contaminated and we did not have any fresh drinking water?

Transition: Now we are going to talk about water and its relationship to agriculture. The teacher will set up the water visual aid for the class to see and then begin the activity (This third activity can be used with or without the visual aid; however, the visual aid provides a great representation of the material being covered).

Activity 3: Water, Agriculture, and our Environment (10 minutes)

- Materials: visual aid on ground water pollution, three cups of water and red and green food dye. Simply use the cups if visual aid is not present. (instructions for the visual aid are provided)
- Discuss with students how water is used in farming, how much water is used, and how farming can harm our water sources if not managed well (demonstrated through activity)
- Visual aid is set up to depict a farm, cow, and water well. Pour clear water down tube for water well. The clear water now represents the groundwater that the farmer and his/her family reply on for drinking and cooking. Then talk about growing crops and how run off from fields can contain pesticides or fertilizers, pour green water down tube for farm. Students will see how the groundwater is no longer clear. Last, run off from cow manure can also contaminate our water sources, pour red water down tube by cow. Students can visually see how agriculture can affect drinking water. Use the pipet to draw up water and ask the students if they would ever want to drink this. (If visual aid is not present, poor water into the cup containing clear water and write the source of the contaminated water (cow, fertilizer/pesticide) on the other two cups).

Although this project is funded in part by the Environmental Protection Agency, it does not necessarily reflect the opinion or position of the EPA

Debriefing discussion on activity: Use these questions to discuss the activity more deeply

- From this activity, how has poorly maintained agriculture affected the environment? How about humans? (answer: groundwater pollution)
- Talk about water scarcity and how much water we actually have available on Earth
    - How much of earth's surface is water: 70-80%
        - Of all that water how much is ocean? 97%
        - How much of world's water is frozen and unusable? 2%
        - So how much water is left for us to drink? 1%
        - From a global standpoint, agriculture accounts for 92% of our water footprint
- If we are using so much water in agriculture to make our goods (as talked about in activity 1) and agriculture is also potentially harming our water sources, do we need to be concerned about protecting water as a natural resource?

Ending discussion: When people see a product like a leather bag, a new car, pair of jeans, or cotton shirt they do not always realize the amount of water that goes in to growing or producing the different parts to make a good. With high consumptions of water, and a small amount of available fresh water on Earth, we need to protect our water sources.

The following are some measures we are taking to try and protect our water sources from pollution and becoming depleted:
- Putting fences around our streams to keep cows and farm animals from destroying vegetation and stream banks, and to keep them from going to the bathroom in the streams
- We can replant vegetation around the stream to soak up runoff from fields to catch the fertilizers
- Avoid using chemical fertilizers and pesticides and switch to organic farming
- Conserve water in your household by taking shorter showers, getting low flush toilets, and shutting the water off while you brush your teeth
- protecting our wetlands and forests; repair and replant these areas because they have important roles in filtering water

Materials for Activity 1: How many gallons of water is in a…?
*Print and cut out the cards

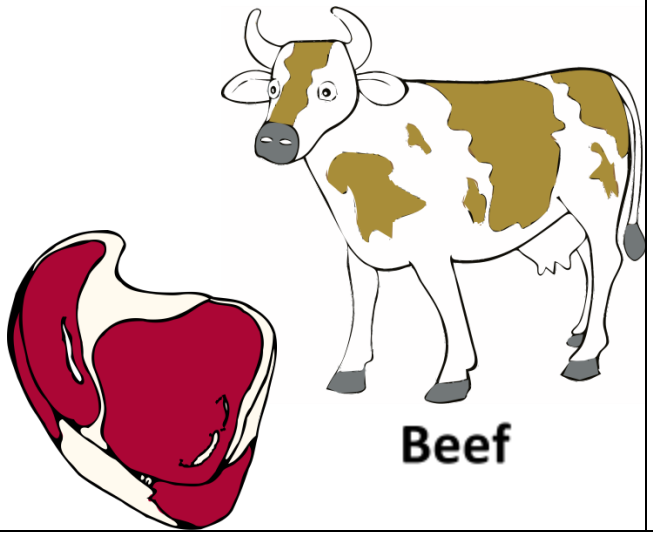
Although this project is funded in part by the Environmental Protection Agency, it does not necessarily reflect the opinion or position of the EPA

Pair of Jeans

Cotton T-shirt

A Car

Bottle of Water



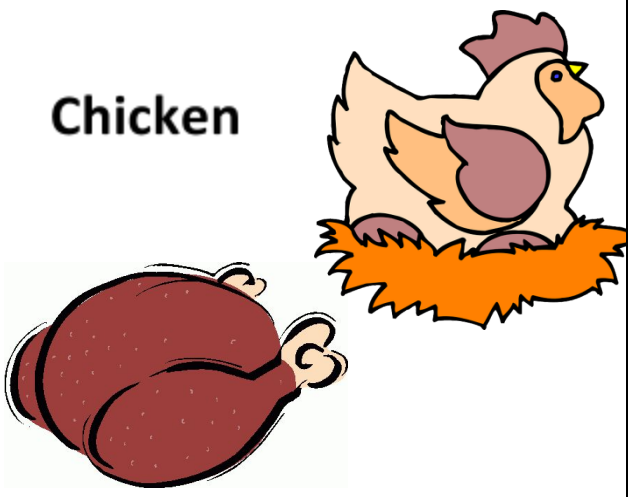
Beef

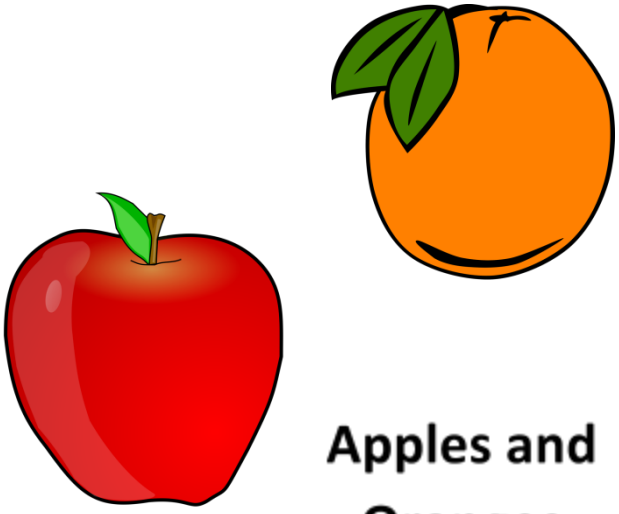
Lettuce

Although this project is funded in part by the Environmental Protection Agency, it does not necessarily reflect the opinion or position of the EPA

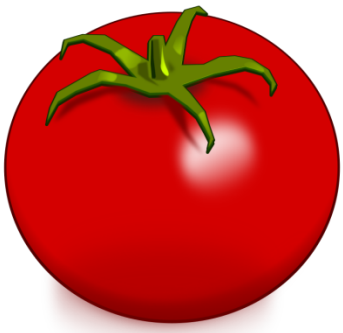
Corn

Chicken





Apples and Oranges



Tomatoes

Although this project is funded in part by the Environmental Protection Agency, it does not necessarily reflect the opinion or position of the EPA

Pictures retrieved from Microsoft Office Clipart
Information below sourced from
http://www.treehugger.com/green-food/from-lettuce-to-beef-whats-the-water-footprint-of-your-food.html and
http://www.treehugger.com/clean-technology/how-many-gallons-of-water-does-it-take-to-make.html

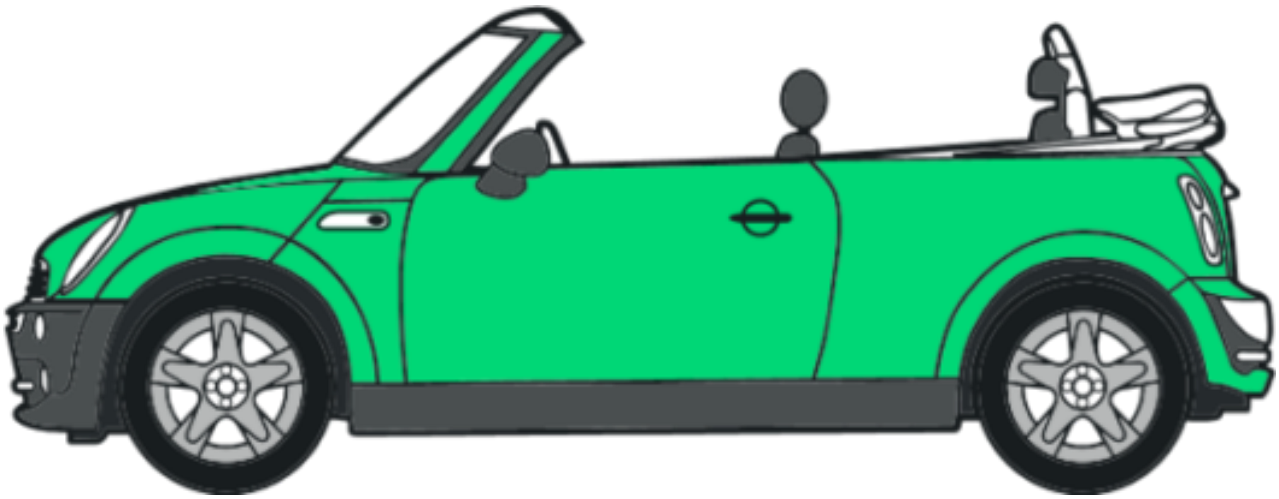
Although this project is funded in part by the Environmental Protection Agency, it does not necessarily reflect the opinion or position of the EPA

Cotton T-Shirt

400 gallons

To grow the cotton to produce one shirt

Although this project is funded in part by the Environmental Protection Agency, it does not necessarily reflect the opinion or position of the EPA



A Car

39,090 gallons

To build a car!

Each tire takes 518 gallons to make!

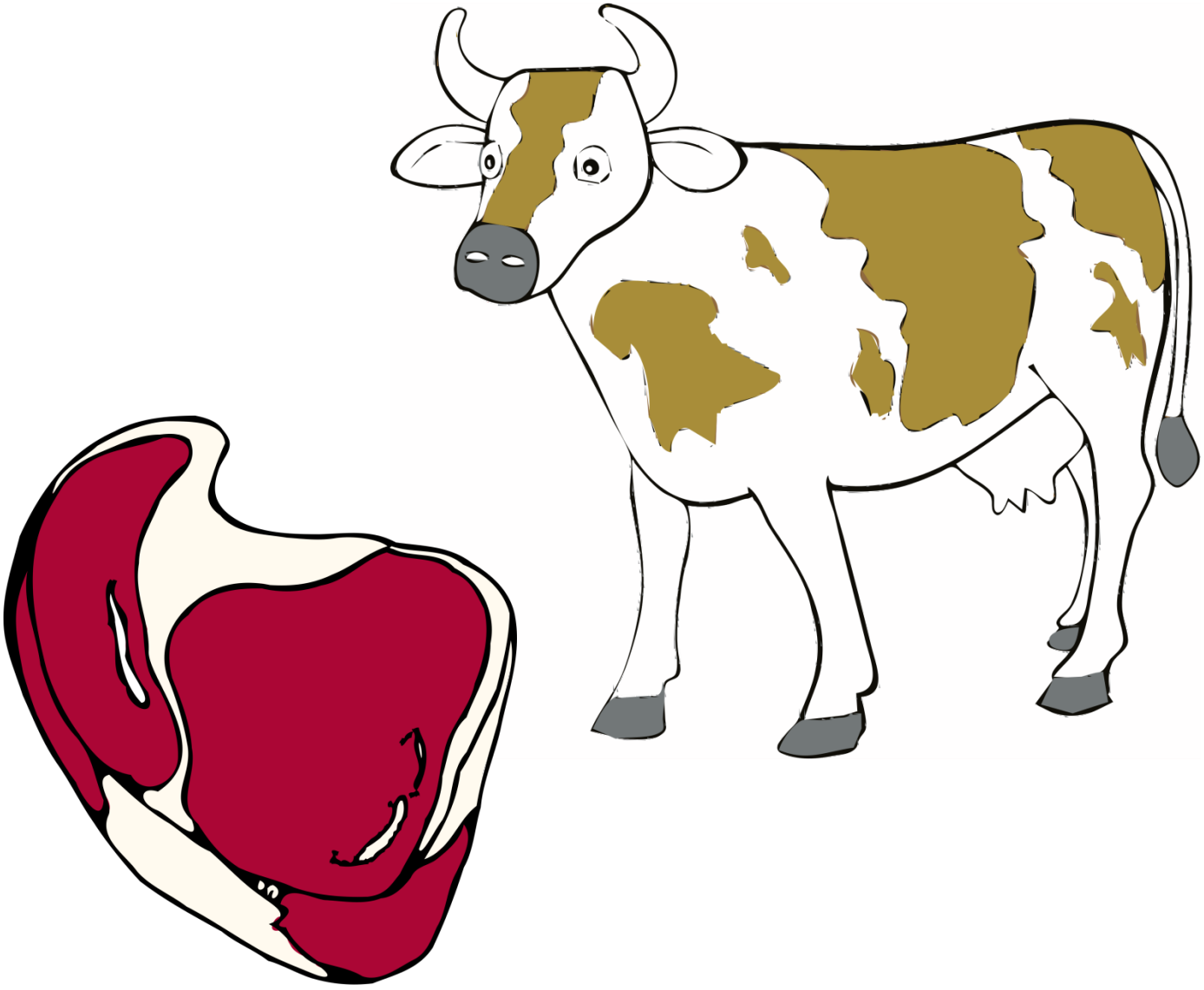
Although this project is funded in part by the Environmental Protection Agency, it does not necessarily reflect the opinion or position of the EPA

A Bottle of Water

1.85 gallons

To make the plastic for the bottle

Although this project is funded in part by the Environmental Protection Agency, it does not necessarily reflect the opinion or position of the EPA



Beef

2,500-5,000 gallons

Although this project is funded in part by the Environmental Protection Agency, it does not necessarily reflect the opinion or position of the EPA

Lettuce

15 gallons

Although this project is funded in part by the Environmental Protection Agency, it does not necessarily reflect the opinion or position of the EPA

Corn

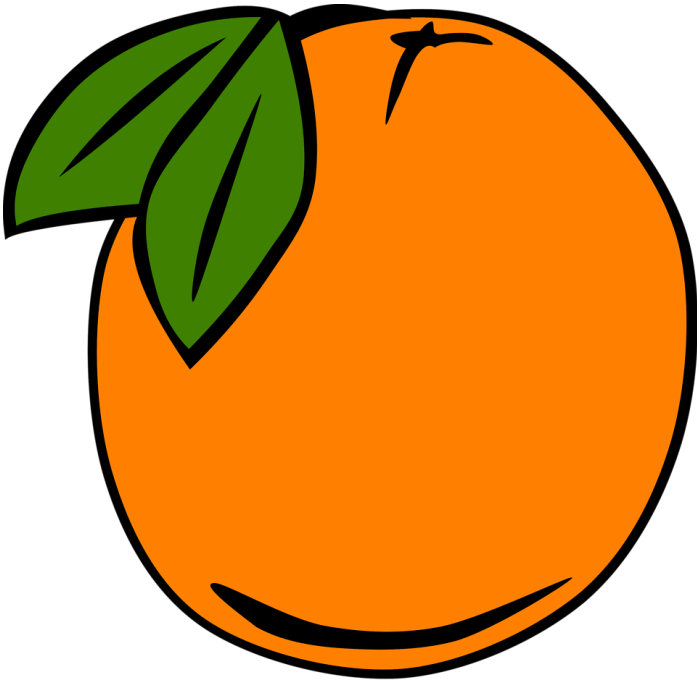
107 gallons

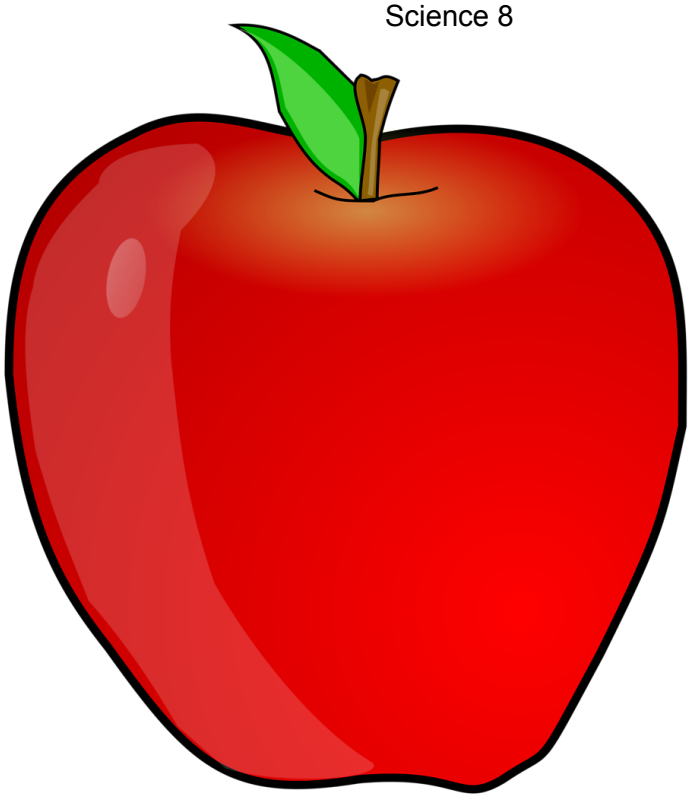
Although this project is funded in part by the Environmental Protection Agency, it does not necessarily reflect the opinion or position of the EPA

Chicken

815 gallons

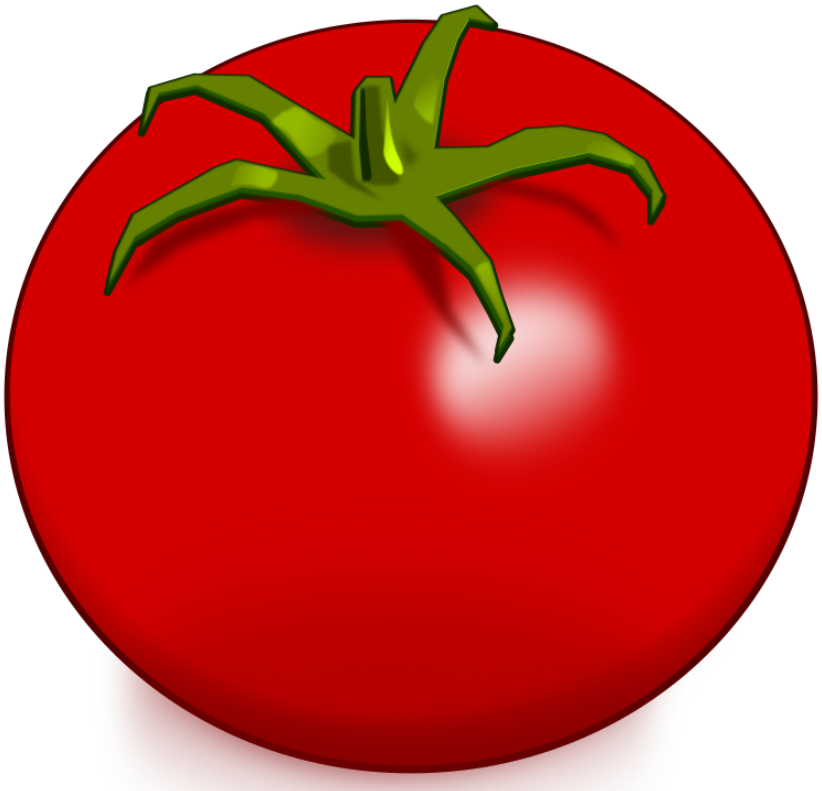
Although this project is funded in part by the Environmental Protection Agency, it does not necessarily reflect the opinion or position of the EPA





Oranges	Apples
55 gallons	83 gallons

Although this project is funded in part by the Environmental Protection Agency, it does not necessarily reflect the opinion or position of the EPA



Tomatoes

22 gallons

Although this project is funded in part by the Environmental Protection Agency, it does not necessarily reflect the opinion or position of the EPA

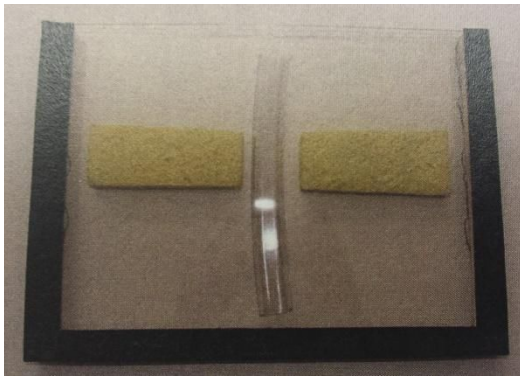
Making the visual aid for “Water, Agriculture, and our Environment”

Materials:
- two 8’’ X 10’’ sheets of plexiglass
- one square dowel rod, ½’’ X ½” X 36’’
- three 6.5” clear vinyl tubes, 5/8” outside diameter
- clear silicone caulking
- black duct tape or gorilla tape
- 30ml syringe
- plastic pipette
- one ½” thick kitchen sponge
- three clear plastic cups of water
- green and red food coloring
- plastic book stand to hold visual aid upright

Instructions for making the visual aid:
- Cut one 10” and two 7.5” pieces of the dowel rod
- Using the silicone caulk, glue the pieces of the dowel rod onto one sheet of plexiglass. Use additional caulk at corners. Three sides of your first piece of plexiglass should know have a dowel rod border.

- Place the tube in a vertical position in the middle of the plexiglass
- Add caulk to the exposed sides of the dowel rod border and then place the second piece of plexiglass on top, squishing the tube between the two pieces of glass. You now have an enclosed box with the top being open.
- Allow to dry and then test water tightness by pouring water down into the box. If it leaks, allow area to dry and apply more caulk.

Although this project is funded in part by the Environmental Protection Agency, it does not necessarily reflect the opinion or position of the EPA



- Run caulk around the outside edges and apply a single piece of black tape around the entire dowel-rod border. Fold the edges of the tape around the glass to form the frame.
- Insert two pieces of sponge on each side of the rubber tube about halfway down. The glass should hold them into place.
- Laminate the scene, provided, and paste it to the front of the box so that the sponges and tube cannot be seen.

Instructions for running the activity found in lesson plans.

Picture sources:

https://s-media-cache-ak0.pinimg.com/236x/9f/25/fd/9f25fdfa2109ea65defc3f59277066c7.jpg
Instruction photos sourced from: Living Waters for the World, CWU-102 Teaching Manual
Clipart

Although this project is funded in part by the Environmental Protection Agency, it does not necessarily reflect the opinion or position of the EPA