



HOW DOES WATER MOVE THROUGH THE GROUND?

FOCUS:



OBJECTIVES:

- Students will predict and record how long it takes for water from the EarthBox reservoir to completely moisten dry potting mix.
- Students will describe how water moves up through the potting mix in an EarthBox.

NATIONAL STANDARDS ADDRESSED:

Science (National Science Education Standards)
I, D.2

Mathematics (Principles and Standards for School Mathematics)
Measurement, Communication

Reading (Standards for the English Language Arts)
1, 3, 5

- MATERIALS:**
- One EarthBox Ready-to-Grow kit
 - Empty 1 gallon milk container
 - Measuring cup or other graduated measuring device

Important Note – This lesson requires daily observations and should be started on a Monday to avoid having it run into the weekend

PROCEDURE:

PART I, 45 MINUTES



STEP 1: As a class, review the setup and planting instructions for the EarthBox. Then, work together to set up the EarthBox according to the instructions with the following exceptions:

- Do not add any water to the potting mix or reservoir as you fill the EarthBox. Fill the EarthBox with dry material only.
- No seeds or plants are necessary at this time, so do not add fertilizer, do not plant anything in the EarthBox, and do not cut holes in the fitted cover.




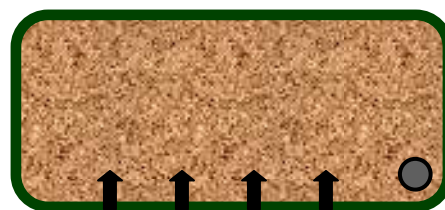
STEP 2: Once the EarthBox has been set up according to the modified instructions above, have a student fill the reservoir through the fill tube until water runs out the overflow hole. Have the students open their workbooks to page 5 and write the day and time in the appropriate space (start time).





STEP 3: At the bottom of the page, have the students write predictions in their workbooks about how long they think it will take for water from the reservoir to completely moisten the dry potting mix.




PART II

 **STEP 4:** Once a day, starting one day after setting up the **EarthBox**, pull back the plastic cover and have three or four students stick their fingers into the potting mix on the side of the **EarthBox** that has the watering tube (see the diagram to the right – the arrows indicate where students should sample the potting mix). The students should be checking to see if the potting mix is wet or dry to the touch. Have the class record the results for the day in the appropriate space on page 5 of their workbooks.



 **STEP 5:** After sampling the potting mix each day, the water reservoir needs to be re-filled. In order to collect valid data, have a student volunteer practice pouring water from the graduated measuring device before adding water to the reservoir in small, measured amounts. Add the water slowly and stop adding water as soon as water is seen dripping out of the overflow hole. After the student has watered the **EarthBox**, have the entire class record the volume of water added in the appropriate space on page 5 of their workbooks.

 **STEP 6:** When students clearly detect that the potting mix in the **EarthBox** is moist to the touch, the experiment is complete. Have them note the day and time in the appropriate space on page 5 of their workbooks. Have a student add a measured amount of water to fill the reservoir one final time, and have the class also write this amount in their workbooks.

   **STEP 7:** Have the class open their workbooks to page 6 and take turns reading out loud the passage on groundwater movement. After they have finished, allow the students several minutes to answer the follow-up questions in their workbooks, and then lead the class in a brief discussion of what they learned.

ANALYSIS & QUESTIONS:

- Why is this movement of water through the potting mix so important to any plant grown in an **EarthBox**?
- What other examples, if any, can you think of where you have seen water slowly move from a wet area to a dry area?
- How did your predictions compare to the actual results of the experiment?

STUDENT READING: Water, like many other things, will move from wet areas to dry areas on its own. In the **EarthBox**, water moved from the wet **reservoir** up through the dry potting mix until the mix was wet too. Individual drops of water stay together and move up through the tiny air spaces in the potting mix. This is called **capillary action**. This is also how water moves from the roots to the top of a plant. When you plant a plant in the **EarthBox**, its roots take water from the potting mix. Capillary action continues moving water up from the reservoir to keep the mix wet. This cycle continues as long as there is water in the reservoir. Capillary action is also how water moves through the ground.

TEACHER EXPLANATION: Water, like many substances, has a natural tendency to move from areas where it is abundant to areas where it is scarce (high concentration to low concentration). In soil and other porous materials, water moves by the principle of **capillary action**. Capillary action occurs due to two forces: **cohesion** (the force that holds individual water molecules together) and **adhesion** (the force that makes water molecules stick to other surfaces). Capillary action is also the force behind the movement of water from the roots to the leaves of a plant.

In this activity, water moved through the soil by capillary action. In a planted **EarthBox**, the roots of the plant take in water from the potting mix immediately adjacent to them. This locally dries out the potting mix, however capillary action replenishes the drier potting mix with water

drawn up from the reservoir. Capillary action will not work as well in soil types that are less porous, such as clay. The potting mix used in **EarthBoxes** is rich in organic matter and maintains a light, fluffy, porous texture, even when wet. This is crucial for capillary action to continue to bring water from the reservoir directly to the roots of the plants growing in them.

EXTENSION: If time permits, have the class run the experiment again, this time using a different type of soil. They may either use local soil from outside the school or topsoil or other mixes available from a local garden supply center. Whatever type of soil or mix the class uses, make sure it is thoroughly dry before starting the experiment and make sure that there is enough soil to fill an **EarthBox** (2 ft³).

RESOURCES: The following is the USGS Water Science for Schools website:

<http://ga.water.usgs.gov/edu/>

The following is the Groundwater Foundation's Kids Corner website. It contains numerous games and activities as well as additional information about groundwater.

<http://www.groundwater.org/kc/kc.html>



Name _____ Date _____

How Does Water Move Through the Ground?

RECORD YOUR DATA!

Write the following information in the table below for each day of your experiment:

- The date and time
- If the potting mix was wet or dry when you stuck your finger in it
- The amount of water added to the EarthBox (NOTE – Day 1 is the first day, so no water will be added this day)

Day	Date	Time	Dry or Wet?	Water Added
1 (Start)				
2				
3				
4				
5				



WHAT ARE YOUR PREDICTIONS?

How long do you think it will take for the dry potting mix to become wet to the touch?

TIME TO READ!

Water, like many other things, will move from wet areas to dry areas on its own. In the EarthBox, water moved from the wet **reservoir** up through the dry potting mix until the mix was wet too. Individual drops of water stay together and move up through the tiny air spaces in the potting mix. This is called **capillary action**. This is also how water moves from the roots to the top of a plant. When you plant a plant in the EarthBox, its roots take water from the potting mix. Capillary action then moves water up from the reservoir to keep the mix wet. This cycle continues as long as there is water in the reservoir. Capillary action is also how water moves through the ground.

HOW MUCH DID YOU LEARN?

1. How many days did it take for the dry potting mix to get wet? _____
2. How close was your prediction to the actual number of days it took for the potting mix to get wet?

3. In your own words, explain how water moved up through the dry potting mix:

