



GROUNDWATER

Narrative



BIG IDEAS:

Groundwater...

- is between the grains of sand and gravel.
- moves because gravity works underground just like it does above ground.
- is connected to surface water.
- is part of the water cycle.
- We use groundwater as a part of our water supply.

MATERIALS:

Earth Material Tubes:

One filled with sand
One filled with gravel
Plastic bag for wet sand
Container to catch water
Container with dry sand

2 Groundwater Models, including:

2 wooden stands
1 hand pump with tubing
1 flask
2 recharge bottles
Diluted green food coloring

Student groundwater models including:

15 reusable models with pumps
15 1-2 L containers of water
15 100mL graduated cylinders

ENGAGE — Earth Material Tubes – 5 Minutes.



How does water move through different earth materials? Look at these tubes full of earth materials. **What do you see inside the tubes?** Sand and gravel. **What will happen if we pour water into the tubes? Will it flow through?** Have students predict how long it will take for water to move through each tube. Have one student pour water in the gravel tube and another student act as the “boss”. The boss will instruct the pourer when to begin and watch for water to come through the bottom of the tube. Have the rest of the class count out loud while the water moves through the tube. **What did you observe?** The water went through the gravel fast. **Why?** Because the large spaces or pores in between grains of gravel allow water to flow easily. Repeat the process for the sand tube. **Did water flow through the sand? How?** There are small spaces between sand particles that water can still get through; just not as fast as the gravel.

Q AND A — Introduce Groundwater Flow Models – 3 Minutes.



What does it look like underground? Sand, gravel and other rock materials. Have students pair share: **How do we find out what it looks like under the ground?** We dig. **How can we go really deep?** With a drill. We drill a well and note the earth materials that we go through as we drill. **What is a model? This groundwater flow model represents what it might look like if you were to sink down in the ground below our feet 200 feet. It's a side view of the ground, called a cross-section. From one side to the other represents miles and miles and miles and from the surface to bottom of the model represents 100's of feet down.**

What do you notice about this groundwater model? What do you see? As students note various features, introduce them. They might see the different layers represented here. **Can you tell me what one of them is made of?** Gravel. Refer back to earth

material tubes. **What about another layer?** Sand. Refer back to earth material tubes. They might point out 2 kinds of **wells**: The 2 **pumping wells**, with rectangular boxes at the end, are used to pump water from the groundwater. There are also **observation wells** that are used to look at the water level and take samples.

EXPLORATION — Movement of Water through the Ground – 9 Minutes.



What is groundwater? Water that is in the ground. **Where does groundwater come from?** Rain. **Where does it rain most often around here?** Up in the mountains. Have a student put the recharge bottle up on left side of model. **This is our mountain rain or recharge. Often it snows up on the mountains, creating snow pack.**

As the water bubbles out of the bottle, point out the holes in the column on the left side of the model allowing water to enter. **When snow pack melts, it seeps into cracks or fractures inside the rock that the mountain is made of.** As water comes out of the outlet hole on the right, ask: **Where is the groundwater?** Give the students time. **It's hard to see isn't it? Where must it be?** The answer is: ***In the spaces between the grains of sand, gravel and soil!*** *If students still don't get this answer, point back to earth material tubes to remind them. This is a big idea! It's not a big lake down there!*

Have three different volunteers put green dye into three of the observation wells that end in the *sand layer*. Tell them to: **put the squeeze bottle in nice and snug and squeeze until a big blob comes out in the sand.** Make sure the recharge bottle is flowing. **What is happening to the green dye?** It's spreading. **Is it spreading in all directions? Or one direction more than the others?** It's moving down. ***Groundwater is moving? Why?*** Water flows from *higher areas* (point to the recharge bottle) to *lower areas* (point to the outlet on the right side of the model). If they don't get this, drop a pen and ask why that pen dropped. Gravity works underground just like it works above ground. Groundwater flows underground through earth materials. **This is a big idea! Gravity works underground too!**

Why do we care about groundwater? Because we use it and drink it. **This is a big idea!** **How do we get groundwater out of the ground?** We pump it out! **We use a well with a pump installed and a screen to keep soil from being drawn in with the water.** Have a few volunteers come up in pairs to pump the pumping well that ends in the sand layer. While they pump, ask: **what happens to the green dye?** It moves into the well. Review the big ideas, while they pump.

EXPLORATION—Groundwater/Surface Water Connection – 10 Minutes.



Tell students to pair up and find a small rectangular model. Tell them to listen first and then they'll get to work the model. **This model represents a groundwater system. From the long side to the other is miles and miles across and from the short side to the other is miles and miles across. From top to bottom represents 100's of feet. Pick up a piece of the brown rubber. What do you think this represents in our system?** Earth materials or gravel.

Refer to the groundwater flow model: **Remember the wells that we pumped over here? What do you think the pumping well is in the model in front of you?** The white tube with the pump in it. **If the white tube represents our well, then what do you think the green plastic container represents in the natural system?** Talk about this with your partner. **What do you think?** It represents a lake or surface water.

Now, look at the side of the model. Can you find the water level? Take your finger and trace the water level. Below this line, what is between the earth materials? Water. **What kind of water does this represent in our model?** Groundwater.

Look up here for 1 minute so that I can give you 3 directions.

- 1) One person will be the observer; observing what happens in your model when water is added.
- 2) The other person will be the pourer; you will pour water onto the “ground”. Point to the ground, the brown material.
- 3) You and your partner will measure 100 mL of water from the container into your graduated cylinder and pour the water onto the ground. Show them the graduated cylinder and show them the 100 mL mark. Now pour that water onto the ground.

It will be easiest to walk around to the pairs of students. **Ask them: What did you observe? Start your sentence with: *When I poured water on the ground...*** Possible answers: 1) the water level went up in the ground and 2) the water went up in the lake. Accept their answers for now.

Get the groups’ attention again. **Now we’re going to observe what happens when we pump water out of the ground. Remember doing that in the big model?** Demonstrate how to pump the well: two fingers go below the pump, thumbs go on top of pump.

Here are your directions:

- 1) One team member should pump 100 mL of water from the well into the graduated cylinder and then pour it back into the pitcher. Demonstrate where to pour.
- 2) The other team member should observe the lake.
- 3) The team will then discuss what they saw.
- 4) Switch roles.
- 6) The team will discuss what they saw again.

Walk around and ask questions about what they observe: **Where are you pumping the water from?** The ground. **What happened to the lake?** It went down. **How?** Groundwater and surface water are connected. Don’t give them the answer, keep asking the questions.

Q AND A—Debrief Student Models – 2 Minutes.

Okay, let me get your attention up here. **What did you observe? Start your sentence with: *When I pumped water out of the ground ...*** the water went down in the lake. **So wait a minute, where did the water that you pumped come from again?** The Ground.



What kind of water was it then? Groundwater. So how did that make the lake go down? They are connected! **Groundwater is connected to surface water.** This is a big idea! **So is groundwater part of the water cycle?** Yes.

EXPLANATION — Review the Big Ideas – 1 Minute.



- Is groundwater connected to surface water?
- Is the groundwater system part of the water cycle system?
- Does groundwater move through sand and gravel underneath the land surface? How?
- Why do we care about groundwater? How do we get groundwater out of the ground so that we can use it?



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Cliffs Notes



Min.	ELEMENT:	What You Ask:	Big Ideas:
5	ENGAGE: Earth Materials Tubes	<ul style="list-style-type: none"> • How does water move through different earth materials? • What do you see inside the tubes? • What will happen if we pour water into these tubes? • What did you observe? Why? • Did water flow through the sand? How? 	<ul style="list-style-type: none"> • Water moves through the spaces between grains of sand and gravel.
3	Q & A: Introduce Groundwater Flow Model	<ul style="list-style-type: none"> • What does it look like underground? • How do we find out what it looks like under the ground? • What is a model? • What do you notice about the groundwater model? What do you see? 	
9	EXPLORATION: Movement of Water Through the Ground	<ul style="list-style-type: none"> • What is groundwater? • Where does groundwater come from? • Where does it rain most often? • Where is the groundwater? • What is happening to the green dye? • Groundwater is moving? Why? • Why do we care about groundwater? 	<ul style="list-style-type: none"> • Groundwater is between the grains of sand and gravel. • Groundwater moves because gravity works underground just like it does above ground. • We use groundwater as part of our water supply.



Min.	ELEMENT:	What You Ask:	Big Ideas:
10	EXPLORATION: Groundwater/Surface Water Connection	<ul style="list-style-type: none"> • Pick up a piece of brown rubber. What do you think this represents in our system? • What do you think the pumping well is in this model? • What do you think the green plastic container represents in the natural system? • Look at the side. Can you find the water level on this model? What is between the earth materials? • What kind of water does this represent? 	<ul style="list-style-type: none"> • Groundwater is between the grains of sand and gravel underground. • Groundwater and surface water are connected.
2	Q & A: Debrief Student Models	<ul style="list-style-type: none"> • When you poured water on the ground... what happened to the lake? • When you pumped water out of the ground, what happened to the water in your lake? • Where did the water that you pumped come from? What kind of water was it then? • So how did that make the lake go down? • Is groundwater part of the water cycle? 	<ul style="list-style-type: none"> • Groundwater and surface water are connected. • Groundwater is part of the water cycle.
1	EXPLANATION: Wrap-Up and Big Ideas	Big ideas to review: <ul style="list-style-type: none"> • Is groundwater connected to surface water? • Is the groundwater system part of the water cycle system? • Does groundwater move through sand and gravel underneath the land surface? How? • Why do we care about groundwater? How do we get groundwater out of the ground so that we can use it? 	Groundwater: <ul style="list-style-type: none"> • is connected to surface water. • is part of the water cycle. • moves because gravity works underground. • is between the grains of sand and gravel. • We use groundwater as part of our water supply.

