💧 Lesson Plan: Groundwater Resources

Grade Level: 6
Subject: Earth Science
Duration: 45–60
NGSS MS-ESS3-1: Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.

🎯 Learning Objectives

By the end of this lesson, students will be able to:

- **Define** what an aquifer is and explain how it stores and transmits groundwater.
- **Describe** the natural processes that recharge groundwater and the factors that affect the

- **Regolith:** The blanket of loose, uncemented rock particles and biological material covering the bedrock of any particular region, also called the soil profile.
- **Cone of Depression:** The lowered water table around a well when water is pumped out faster than it can be replenished.
- **Porosity:** A measure of the pore spaces between the grains in an aquifer, which determines how much water can be stored.
- **Permeability:** A measure of how connected the pore spaces are in an aquifer, which determines the ability of water to move through it.

- **Artesian Spring:** A natural formation where fresh water squirts out under pressure through breaks in an impermeable cap rock above an aquifer.

💼 Materials Needed: (all links are included in this PDF)

- Printed copies of the Study Guide (https://newpathworksheets.com/api/guide/study-guide-science-grade-6-groundwater-resources-1.pdf)
- Vocabulary matching worksheet (https://newpathworksheets.com/api/vocabulary/vocabulary-science-grade-6-groundwater-resources-1-1.pdf)
- Worksheet: Groundwater Resources (Set 0) (https://newpathworksheets.com/api/worksheet/worksheet-science-grade-6-groundwater-resources-1-0.pdf)
- Worksheet: Groundwater Resources (Set 1)

groundwater-resources-1.pdf)

- Explain that today's lesson will explore how groundwater is stored, moves underground, and why it is a vital resource for communities.

Step 2: Direct Instruction (15 minutes)

- Use the Study Guide to explain the concept of an aquifer and how groundwater is stored in regolith and bedrock. (https://newpathworksheets.com/api/guide/study-guide-science-grade-6-groundwater-resources-1.pdf)
- Demonstrate a simple aquifer model: layer sand, gravel, and pebbles in a clear container, then pour water slowly to show how it percolates and fills the pore spaces.

- Discuss the water table, porosity, and permeability, emphasizing how these factors determine water storage and movement. (https://newpathworksheets.com/api/guide/study-guide-science-grade-6-groundwater-resources-1.pdf)
- Introduce the cone of depression concept and explain how wells draw water from aquifers. (https://newpathworksheets.com/api/guide/study-guide-science-grade-6-groundwater-resources-1.pdf)

Step 3: Guided Practice (15 minutes)

- Distribute the vocabulary matching worksheet and work through it as a class, reinforcing key terms such as aquifer, water table, cone of depression, and artesian spring. (https://newpathworksheets.com/api/vocabulary/vocabulary-science-grade-6-groundwater-resources-1-1.pdf)
- Show diagrams from the Study Guide illustrating point-source and nonpoint-source pollution, and discuss how each type affects groundwater quality. (https://newpathworksheets.com/api/guide/study-guide-science-grade-6-groundwater

Step 5: Assessment (10 minutes)

- Conduct a quick oral review by asking students to define key vocabulary terms and explain the difference between porosity and permeability.
- Have students classify real-world examples: Is runoff from a farm field point-source or nonpoint-source pollution? Is a leaking underground fuel tank point-source or nonpoint-source?
- Review completed worksheets for accuracy, focusing on students' ability to identify aquifer components and explain groundwater movement.

(https://newpathworksheets.com/api/worksheet/worksheet-science-grade-6-groundwater-resources-1-0.pdf)

Differentiation Strategies

For advanced learners:

- Challenge advanced learners to research and present on a local aquifer or groundwater issue, such as the Ogallala Aquifer depletion or Florida's karst topography and sinkhole formation.
- Have students design a model wastewater treatment system and explain how it prevents groundwater pollution.

For learners needing support:

- Provide pre-labeled diagrams of aquifer cross-sections with color-coded layers (regolith,

Complete List of Available Resources:

- NewPathWorksheets: Groundwater Resources (https://newpathworksheets.com/science/grade-6/groundwater-resources-1)
- Study Guide: Groundwater Resources (https://newpathworksheets.com/api/guide/study-guide-science-grade-6-groundwater-resources-1.pdf)
- Worksheet: Groundwater Resources (Set 0) (https://newpathworksheets.com/api/worksheet/worksheet-science-grade-6-groundwater-resources-1-0.pdf)

- Worksheet: Groundwater Resources (Set 1) (https://newpathworksheets.com/api/worksheet/worksheet-science-grade-6-groundwater-resources-1-1.pdf)
- Worksheet: Groundwater Resources (Set 2) (https://newpathworksheets.com/api/worksheet/worksheet-science-grade-6-groundwater-resources-1-2.pdf)
- Vocabulary: Groundwater Resources (Set 1) (https://newpathworksheets.com/api/vocabulary/vocabulary-science-grade-6-groundwater-resources-1-1.pdf)
- Vocabulary: Groundwater Resources (Set 2) (https://newpathworksheets.com/api/vocabulary/vocabulary-science-grade-6-groundwater-resources-1-2.pdf)

GROUNDWATER RESOURCES

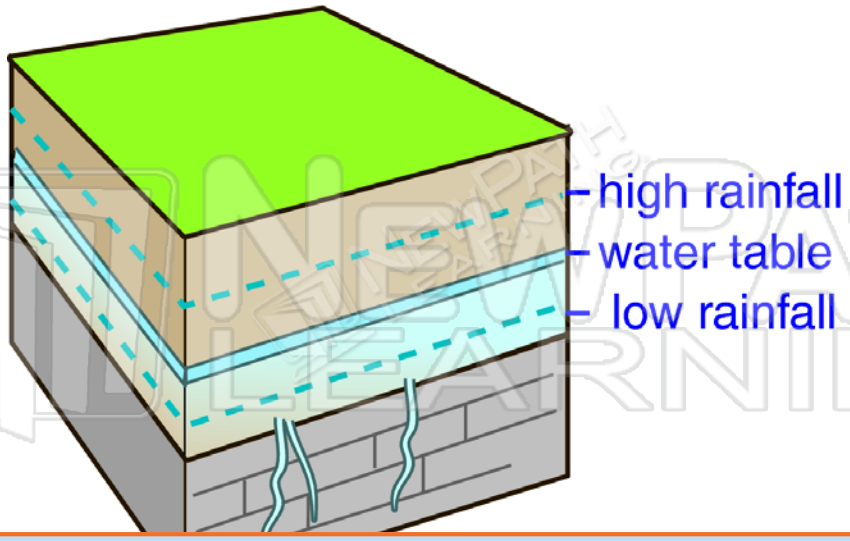
Groundwater is a vital source of water for individual homes and entire communities. Some groundwater reservoirs are so large they provide water for homes and farms over hundreds of square miles.

Groundwater is fresh water stored in **regolith** and **bedrock**. (Regolith is un-cemented rock and soil.) Even though solid rock like granite or marble has no pores, it often has a series of cracks and possibly faults. Water accumulates in the cracks in solid bedrock and, at times, is a source of water. A layer of rock material that can store water and allow the movement of water through the ground is called an **aquifer**.

- Second, the water table is affected by the amount of water that is removed from the aquifer for use by people.

The water table marks the division between the **aeration zone** above and the **saturation zone** below.

WATER TABLE LEVELS



PREVIEW

Please Sign In or Sign Up to download the printable version of this worksheet

porosity and **permeability** of the aquifer.

- Porosity is a measure of the pore spaces between the grains in the aquifer. The porosity determines how much water can be stored.
- Permeability is a measure of how connected the pore spaces are. The permeability determines the ability of the water to move through the aquifer.

Lesson Checkpoint:
What is the cone of depression in a well?

Artesian Well

Aquifers have an impermeable bedrock underneath them. In some instances, they can also have an impermeable **cap rock** on top of them. This results in pressure on the aquifer. In breaks in the cap rock, fresh water can squirt out as a spring. This type of spring is called an **artesian spring** (also called an **artesian well**).

The difference between a well and an artesian spring is that a well is drilled or dug and an artesian spring is a natural formation.

Groundwater Pollution and Overuse

Though traditionally thought of as a **renewable resource**, overuse and unmanaged pollution can eradicate a water resource, either depleting it completely or making it unusable for very long periods of time, turning it into a **nonrenewable resource**. Consequently, water preservation and pollution management is essential.

region. The pollution is transported by the runoff of groundwater. Runoffs from city streets, fertilizers from farmland, seepage from septic tanks in housing tracts are all examples of nonpoint-source pollution.

If polluted water is returned to the ground, it becomes very, very difficult to clean. In fact, it moves so slowly through the aquifer that it will take extraordinary measures to get it out of the aquifer and make the aquifer usable again. Consequently, it is preferable to collect wastewater and transport it to a water purification facility where it can be properly treated so that clean, usable water can be returned to the environment.

Caves and Other Groundwater Features

When groundwater flows through limestone, natural acids interact with the limestone. The natural acid that dissolves limestone, creating underground caves and cave features, is carbonic acid. The chemical reaction is as follows: $CO_2 + H_2O$ produces H_2CO_3 (carbonic acid). When dissolved in water, the carbonic acid ionizes into a hydrogen ion and a bicarbonate ion. The hydrogen ion chemically reacts with the limestone (which is made of calcium carbonate). This process dissolves away the limestone. This limestone dissolution

terrain of dramatic peaks and valleys that form on the surface of the Earth above limestone that has been dramatically dissolved away by groundwater are called **karst topography**. When karst topography forms on the surface, extensive limestone dissolution has occurred below the surface. In many cases, large caves have formed but the limestone structure is solid enough that there is no evidence on the surface that caves lie below.

Lesson Checkpoint:
What is a stalactite?

Groundwater Resources

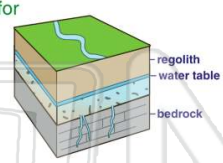
Sci F

Name_____ Class_____ Date_____

1 Groundwater moves through the topmost portion of the earth's crust. This blanket of rock particles and biological material is loose and uncemented. Geologists refer to it as the **soil profile**.

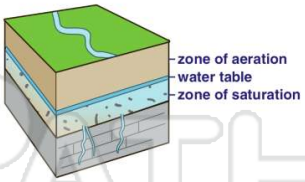
Another geological term for this material is _____.

A lithosphere
B regolith
C bedrock
D aquifer



2 The **uppermost portion** of **regolith** through which water percolates, but which contains significant air, is called the _____.

A bedrock
B zone of saturation
C zone of aeration
D humus



3 The **sources** of water on earth, from **smallest to largest**, are _____.

A lakes, streams, ice, groundwater, oceans
B streams, ice, lakes, groundwater, oceans

4 Groundwater is **held** by _____.

A only regolith
B only bedrock
C regolith and bedrock
D bedrock and limestone

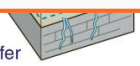
5

PREVIEW

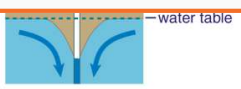
Please Sign In or Sign Up to download the printable version of this worksheet

7

the aquifer
C it rises higher in the aquifer
D it forms a large bubble of water

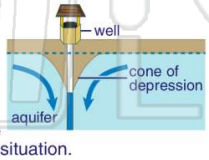


B empty zone
C cone of depression
D water well cone



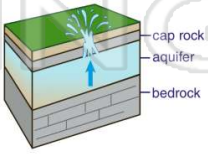
9 This cross section shows a well on a farm. If the farmer decides to build **10 houses close together**, each with its own **well**, what will likely occur?

A The aquifer will recharge them equally.
B The wells could run dry as their cones of depression intersect.
C Cones of depression are less likely to form in this situation.
D The water table will fall, but the wells will remain full.



10 Aquifers have an impermeable bedrock underneath them. In some instances, they can also have an impermeable **caprock** on **top** of them. This results in pressure on the aquifer. In **breaks** in the caprock, fresh water can squirt out. This is called a(n) _____.

A cone of depression
B karst formation
C artesian spring
D dry well



Groundwater Resources

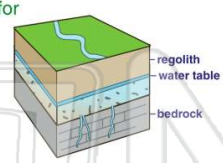
Sci F

Name_____ Class_____ Date_____

1 Groundwater moves through the topmost portion of the earth's crust. This blanket of rock particles and biological material is loose and uncemented. Geologists refer to it as the **soil profile**.

Another geological term for this material is _____.

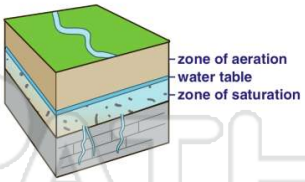
A lithosphere
B regolith
C bedrock
D aquifer



B

2 The **uppermost portion** of **regolith** through which water percolates, but which contains significant air, is called the _____.

A bedrock
B zone of saturation
C zone of aeration
D humus



C

3 The **sources** of water on earth, from **smallest to largest**, are _____.

A lakes, streams, ice, groundwater, oceans
B streams, ice, lakes, groundwater, oceans

D

4 Groundwater is **held** by _____.

A only regolith
B only bedrock
C regolith and bedrock
D bedrock and limestone

C

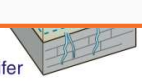
5

C

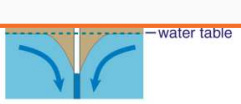
7

C

the aquifer
C it rises higher in the aquifer
D it forms a large bubble of water

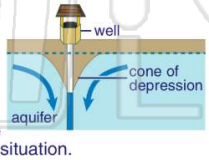


B empty zone
C cone of depression
D water well cone



9 This cross section shows a well on a farm. If the farmer decides to build **10 houses close together**, each with its own **well**, what will likely occur?

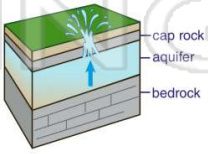
A The aquifer will recharge them equally.
B The wells could run dry as their cones of depression intersect.
C Cones of depression are less likely to form in this situation.
D The water table will fall, but the wells will remain full.



B

10 Aquifers have an impermeable bedrock underneath them. In some instances, they can also have an impermeable **caprock** on **top** of them. This results in pressure on the aquifer. In **breaks** in the caprock, fresh water can squirt out. This is called a(n) _____.

A cone of depression
B karst formation
C artesian spring
D dry well



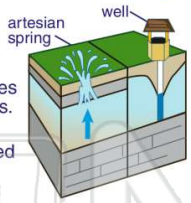
C

Groundwater Resources

Sci F

Name_____ Class_____ Date_____

1 What is the difference between a **well** and a **spring**?



A A well goes straight down and a spring comes out at an angle.
B A well occurs in wet climates and a spring in dry climates.
C A well is a natural feature and a spring is dug or drilled by humans.
D A well is dug or drilled by humans and a spring is a natural feature.

2 When groundwater flows through limestone, **natural acids** interact with the limestone. The natural acid that dissolves limestone, creating underground caves and cave features, is _____.

A acid rain
B carbonic acid
C hydrochloric acid
D nitric acid

3 A **large cavity** formed underground by the dissolution of limestone by groundwater is called a _____.

A cavern
B karst
C stalagmite
D stalactite

4 The rough terrain of dramatic **peaks and valleys** that form on the surface of the earth above limestone that has been dramatically dissolved away by groundwater is called _____.

A cave landscape
B karst topography

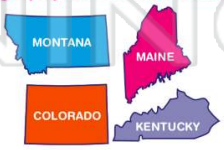
5

C cavern
D sinkhole

9 When a stalactite and a stalagmite grow **together**, they form a _____.

A statue
B sinkhole
C pillar
D flowstone

10 The bedrock of Maine is mostly **granite**, of Kentucky is **limestone**, of Montana is **volcanic rock**, and of Colorado is mostly **igneous rock**. Which of these states likely has karst topography, stalactites, stalagmites, and caves?



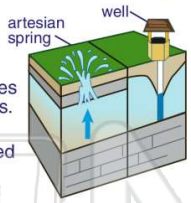
A Maine
B Kentucky
C Montana
D Colorado

Groundwater Resources

Sci F

Name_____ Class_____ Date_____

1 What is the difference between a **well** and a **spring**?



A A well goes straight down and a spring comes out at an angle.
B A well occurs in wet climates and a spring in dry climates.
C A well is a natural feature and a spring is dug or drilled by humans.
D A well is dug or drilled by humans and a spring is a natural feature.

D

2 When groundwater flows through limestone, **natural acids** interact with the limestone. The natural acid that dissolves limestone, creating underground caves and cave features, is _____.

A acid rain
B carbonic acid
C hydrochloric acid
D nitric acid

B

3 A **large cavity** formed underground by the dissolution of limestone by groundwater is called a _____.

A cavern
B karst
C stalagmite
D stalactite

A

4 The rough terrain of dramatic **peaks and valleys** that form on the surface of the earth above limestone that has been dramatically dissolved away by groundwater is called _____.

A cave landscape
B karst topography
C cavern
D sinkhole

B

5

B

7

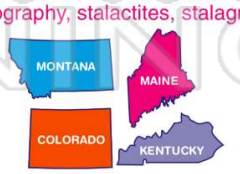
B

9 When a stalactite and a stalagmite grow **together**, they form a _____.

A statue
B sinkhole
C pillar
D flowstone

C

10 The bedrock of Maine is mostly **granite**, of Kentucky is **limestone**, of Montana is **volcanic rock**, and of Colorado is mostly **igneous rock**. Which of these states likely has karst topography, stalactites, stalagmites, and caves?



A Maine
B Kentucky
C Montana
D Colorado

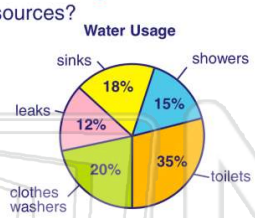
B

Groundwater Resources

Sci F

Name_____ Class_____ Date_____

1 Based on this graphic, which water usage represents the most manageable **waste** of groundwater resources?



A toilet use
B clothes washers
C showers
D leaks

2 The standard amount of water used to flush a toilet used to be **19** liters per flush (Lpf). Today, **low-flow** toilets use **6 Lpf**. If you used the toilet 10 times a day for 5 years, how much water would you **save** using a low-flow toilet?

A 130 liters
B 650 liters
C 150,000 liters
D 237,250 liters

3 Waste water goes through a series of steps to purify it from physical, biological, and chemical waste. The part of the treatment process where wastewater is **aerated** (mixed with air) and **treated with chlorine** is called _____.

A septic system
B primary treatment

4 Because it is so abundant, water is usually considered to be a renewable resource. Water can be **overused** to the point that it is a nonrenewable resource.

A true
B false

5

7

particles to settle

pollution
C petrochemical pollution
D septic pollution

9 Name two examples of **nonpoint-source** pollution.

A drainage from farms and factory waste pumped into a stream
B a leaking gas tank and water runoff from paved streets
C used motor oil poured into the woods and an oil tanker accident
D fertilizers washed off of farmers' fields and salt washed off of roads after winter

10 It is possible to **overuse** a water resource to the point that it can actually disappear.

A true
B false

PREVIEW

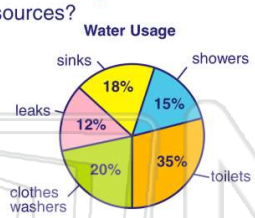
Please Sign In or Sign Up to download the printable version of this worksheet

Groundwater Resources

Sci F

Name_____ Class_____ Date_____

1 Based on this graphic, which water usage represents the most manageable **waste** of groundwater resources?



A toilet use
B clothes washers
C showers
D leaks

D

2 The standard amount of water used to flush a toilet used to be **19** liters per flush (Lpf). Today, **low-flow** toilets use **6 Lpf**. If you used the toilet 10 times a day for 5 years, how much water would you **save** using a low-flow toilet?

A 130 liters
B 650 liters
C 150,000 liters
D 237,250 liters

D

3 Waste water goes through a series of steps to purify it from physical, biological, and chemical waste. The part of the treatment process where wastewater is **aerated** (mixed with air) and **treated with chlorine** is called _____.

A septic system
B primary treatment

C

4 Because it is so abundant, water is usually considered to be a renewable resource. Water can be **overused** to the point that it is a nonrenewable resource.

A true
B false

A

5

B

7

particles to settle

pollution
C petrochemical pollution
D septic pollution

A

9 Name two examples of **nonpoint-source** pollution.

A drainage from farms and factory waste pumped into a stream
B a leaking gas tank and water runoff from paved streets
C used motor oil poured into the woods and an oil tanker accident
D fertilizers washed off of farmers' fields and salt washed off of roads after winter

D

10 It is possible to **overuse** a water resource to the point that it can actually disappear.

A true
B false

A

Groundwater Resources

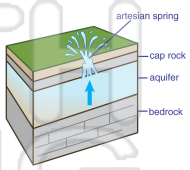
Sci F

Name_____ Class_____ Date_____

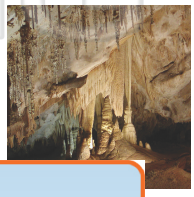
Match each of the following terms to its definition:

Artesian spring	Karst topography	Pillar	Regolith
Sinkhole	Cone of depression	Cavern	Stalactite

1. - a source of water that comes from an aquifer through a crack in an overlying bed of rock; the water comes out under pressure



2. - a large underground cavity formed by the dissolution of limestone by groundwater

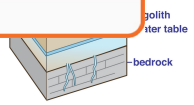


3.

4. that fo
drama

5. stalag

6. and bi
called the soil profile



7. - the depression formed on the Earth's surface when an underground limestone cave collapses

8. - cave formations that hang from the ceiling of an underground limestone cave

Groundwater Resources

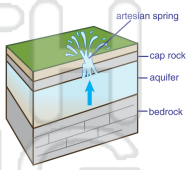
Sci F

Name_____ Class_____ Date_____

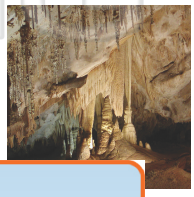
Match each of the following terms to its definition:

Artesian spring	Karst topography	Pillar	Regolith
Sinkhole	Cone of depression	Cavern	Stalactite

1. artesian spring - a source of water that comes from an aquifer through a crack in an overlying bed of rock; the water comes out under pressure



2. cavern - a large underground cavity formed by the dissolution of limestone by groundwater

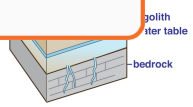


3. con

4. kar
form c
dissolv

5. pill
togeth

6. reg
mater
profile



7. sinkhole - the depression formed on the Earth's surface when an underground limestone cave collapses

8. stalactite - cave formations that hang from the ceiling of an underground limestone cave