

Who Powers It? Sorting the Water Cycle's Words by Energy and Gravity

Learning target: I can sort the processes of the water cycle by what drives them and by the change of state involved, and use the terms correctly in new situations.

Vocabulary in action

About 35 min

Individual

MS-ESS2-4 · practice

independent practice

visual modeling

discussion

Name _____

Date _____

Period _____

Directions

Start with the word bank; read every definition once. Then do Part A (sort), Part B (which term fits), Part C (apply the terms to new situations) and Part D (relationships) in order. In Part A, a process can go in only one column. Use the exact term from the word bank in every answer; spelling counts.

You will need: This worksheet, Pencil

water cycle

The never-ending movement of water among the ocean, the air, the land, underground, and living things. The sun's energy and gravity keep it going. It has no starting point.

water vapor

Water in the gas state. It is invisible. Clouds, fog and 'steam' you can see are made of tiny liquid droplets or ice crystals, not vapor.

evaporation

The change from liquid water to water vapor at the surface of the liquid. It happens at any temperature, not only at boiling, because the fastest-moving molecules at the surface escape into the air.

transpiration

The movement of water from a plant's roots up to its leaves, where it evaporates inside the leaf and leaves through tiny pores (stomata) as water vapor.

melting

The change from solid ice to liquid water when ice gains enough energy.

condensation

The change from water vapor to liquid water. It happens when vapor cools enough, or when the air holds as much vapor as it can, and the slowed molecules gather on tiny specks of dust or salt. Water gives off energy to its surroundings as it condenses.

crystallization

The change into solid ice crystals. This lesson uses the word for both liquid-to-solid (scientists call that freezing) and gas-to-solid (scientists call that deposition, the way frost forms straight from vapor). Water gives off energy as it crystallizes.

precipitation

Water falling from clouds to the surface as rain, snow, sleet or hail, pulled down by gravity once the droplets or crystals grow heavy enough.

runoff

Liquid water flowing downhill over the land surface into streams, rivers, lakes and the ocean, moved by gravity.

infiltration

Liquid water soaking down from the surface into the open spaces in soil and rock, pulled by gravity.

groundwater

Water stored underground in the small spaces (pores) between grains of soil and rock. It is not an underground lake; it fills the gaps the way water fills a sponge.

aquifer

A body of rock or sediment whose pores are connected so that groundwater can flow through it, with enough water in it for a well or spring to draw on.

groundwater flow

The slow movement of groundwater through connected pores, downhill under gravity, toward springs, streams, lakes and in many places the ocean.

Part A: Sort nine processes by what drives them

Nine processes move water around the cycle: evaporation, transpiration, melting, condensation, crystallization, precipitation, runoff, infiltration and groundwater flow. Each one belongs in exactly one of three columns. Column 1: water **gains** energy, supplied by the sun. Column 2: water **gives off** energy as it cools. Column 3: **gravity** moves water that already is liquid or solid, with no change of state required.

1. Write each of the nine processes in the correct column. Columns will not be equal in length. Then, next to each process in Columns 1 and 2, write the change of state it involves (for example, *liquid to gas*).

Column 1: water gains energy (sun)	Column 2: water gives off energy (cooling)	Column 3: gravity moves it
Process		
Process		
Process		
Process		

2. Two of the nine processes are often described as 'powered by the sun' in diagrams, but the sun does not directly cause them: they happen when water vapor **loses** energy. Which two are they, and what actually has to happen to the vapor for them to occur?

Part B: Which term fits?

3. A hiker's wet socks dry on a rock in the shade at 15 °C. The water left the socks by _____.

4. On a freezing night, feathery ice forms on a car windshield that was dry at sunset. The lesson calls this _____; a scientist would add that because it went straight from gas to solid, it is also called deposition.

5. After a storm, water seeps down through the soil of a baseball field instead of flowing across it. That process is _____, and once it is below the surface it is called _____.

6. A cornfield on a hot July day puts far more water into the air than the bare road next to it. The extra water leaves the plants by _____.

7. A spring bubbles out of a hillside even in a dry month. The water reaching the spring arrived by _____ through an _____.

Part C: Apply the terms to new situations

8. A glass of ice water sits on a picnic table. Within minutes the outside of the glass is wet. Someone says the glass must be leaking. Use two terms from the word bank to explain what really happened and where the water came from.

9. You breathe out on a cold morning and see a small white cloud. Is the white cloud water vapor? Use the terms *water vapor* and *condensation* to explain what you are seeing.

10. A city paves a large field to build a parking lot. Using *runoff*, *infiltration* and *groundwater*, predict two changes to how rainwater moves on that land after the paving.

11. A snowbank on a sunny, below-freezing day (-3°C) shrinks over a week without any puddle forming underneath. Which change of state must have happened, and why does this show that water can leave a solid without melting first? (The scientist's word for solid-to-gas is *sublimation*.)

Part D: Relationships between terms

12. *Evaporation* and *condensation* are often called opposites. In what way are they opposites, and what is the one thing they have in common when you think about energy?

13. *Groundwater* and *aquifer* are not the same thing. Explain the difference in one or two sentences, the way you would to a sixth grader.

14. Odd one out: *precipitation*, *runoff*, *infiltration*, *condensation*. Which term does not belong with the other three, and why? (There is more than one defensible answer; explain yours.)

Two questions for every process

If you are stuck in Part A, ask two questions about the process. Question 1: Does the water change state? If it goes to a 'faster' state (solid to liquid, liquid to gas) it is gaining energy; if it goes to a 'slower' state (gas to liquid, gas or liquid to solid) it is giving off energy. Question 2: If the state does not change, what is moving the water? If it is going down or downhill, gravity is the answer.

A tenth process

The lesson lists nine processes, but water can also go straight from solid ice to water vapor without melting; scientists call this sublimation, and it is why snow can shrink on a cold, dry, sunny day. Write a word-bank-style definition of sublimation, decide which column of Part A it belongs in and explain why, and name one place on Earth where you would expect a lot of it (think cold, dry, and sunny).