LESSON MAKER PRO

Water on the Move

Use fractions to track water through a cycle model.

GRADES 6-8 · MS-ESS2-4

MS-ESS2-4 "Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity. Clarification Statement: Emphasis is on the ways water changes its state as it moves through the multiple..."

NAME _____ DATE _____

TRACK THE WATER

In a water-cycle model, find the amount that moves by multiplying the total amount by the fraction that moves. Water is conserved as it changes location or state. The sun provides energy for evaporation and transpiration, while gravity pulls water down as precipitation, runoff, and infiltration. Water mass is conserved. Liquid volumes in these problems describe the amount before vaporization, not the volume occupied by the resulting gas; vapor takes up a different volume. A water unit tracks a fixed amount of water material.

WORKED EXAMPLE

A model begins with 48 cups of liquid water in a lake. The sun supplies energy for 1/3 of it to evaporate. What amount of the original liquid becomes vapor?

1. Start with 48 cups of liquid water.
2. Multiply: 48 x 1/3 = 16.
3. 16 cups of the original liquid evaporate; this does not mean the vapor occupies 16 cups.

Answer: The amount originally measured as 16 cups of liquid becomes vapor.

PRACTICE 6 problems

1 A pond model contains 60 mL of liquid water. Solar energy helps 1/4 evaporate. What amount of the original liquid becomes vapor?

ANSWER _____

2 A cloud model contains 72 water drops. Gravity pulls 2/3 of them down as precipitation. How many drops fall?

ANSWER _____

3 A hillside receives 90 L of rainwater. Gravity causes 1/5 of the water to flow downhill as runoff. How many liters become runoff?

ANSWER _____

4 A cloud contains 84 g of water vapor. If 3/7 of the vapor condenses, how many grams become liquid water drops?

ANSWER _____

5 A soil model holds 56 mL of rainwater. Gravity pulls 3/8 of the water deeper into the ground. How many milliliters infiltrate?

ANSWER _____

6 A plant has 96 mL of water in its leaves. Solar energy helps 5/6 leave as vapor through transpiration. What amount of the original liquid leaves?

ANSWER _____

APPLY IT Show your work

1 The school environmental club makes a water-cycle model for a video. It starts with 120 water units in a pond. The sun evaporates 3/10 of the units. Then 1/2 of that water vapor condenses, and the club assumes all of the condensed water falls as precipitation. How many water units fall as precipitation?

WORK SPACE

ANSWER _____

2 After rain, 144 L of water collect in a shallow basin near a community skate park. Gravity moves 1/4 of the water downhill as runoff. Of the water left in the basin, 2/3 infiltrates into the soil. How many liters infiltrate?

WORK SPACE

ANSWER _____

CHALLENGE One step up

A water-cycle model begins with 192 water units in the ocean. The sun evaporates 1/3 of the units. Half of the water vapor condenses and falls as rain. Gravity moves 1/4 of the rainwater as runoff, and the rest infiltrates into groundwater. How many water units enter groundwater? Explain how the sun and gravity move water in this model. Then develop your own labeled water-cycle model on separate paper. Include ocean/lake water, atmospheric vapor, cloud droplets, ice or snow, groundwater and a plant. Use arrows to connect evaporation, condensation, precipitation, runoff, infiltration, plant uptake/transpiration, freezing and melting into more than one possible route. Label liquid, gas and solid states; add distinct arrows/labels showing solar energy and gravity driving changes or movement. Trace two different routes back to a starting reservoir and explain how water mass is conserved. Show the challenge's computed amounts on its matching pathway; do not imply all water follows it.

WORK SPACE AND ANSWER

ANSWER KEY

Water on the Move

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	A pond model contains 60 mL of liquid water. Solar energy helps 1/4 evaporate. What amount of the original liquid becomes vapor?	**15 mL of the original liquid evaporate; the vapor volume is not 15 mL.**
2	A cloud model contains 72 water drops. Gravity pulls 2/3 of them down as precipitation. How many drops fall?	**48 drops fall as precipitation.**
3	A hillside receives 90 L of rainwater. Gravity causes 1/5 of the water to flow downhill as runoff. How many liters become runoff?	**18 L become runoff.**
4	A cloud contains 84 g of water vapor. If 3/7 of the vapor condenses, how many grams become liquid water drops?	**36 g become liquid water drops.**
5	A soil model holds 56 mL of rainwater. Gravity pulls 3/8 of the water deeper into the ground. How many milliliters infiltrate?	**21 mL infiltrate the ground.**
6	A plant has 96 mL of water in its leaves. Solar energy helps 5/6 leave as vapor through transpiration. What amount of the original liquid leaves?	**80 mL of the original liquid leave as vapor; this is a liquid-equivalent amount.**

PART 2 · APPLY IT

1. **18 water units fall as precipitation.** First find the evaporated amount: 120 x 3/10 = 36. Then find the amount that condenses and falls: 36 x 1/2 = 18.
2. **72 L infiltrate into the soil.** Runoff is 144 x 1/4 = 36 L, so 108 L remain. Then 108 x 2/3 = 72 L infiltrate.

CHALLENGE

24 water units enter groundwater. The sun evaporates 192 x 1/3 = 64 units. Half condenses and falls as 32 units of rain. Gravity moves 1/4 of 32, or 8 units, as runoff, so 32 - 8 = 24 units infiltrate into groundwater. The learner also produces a connected model, not only the arithmetic. For example: lake liquid → vapor by evaporation using solar energy → cloud liquid by condensation → snow/ice by freezing and precipitation → liquid by melting → lake by runoff under gravity. Another route passes through soil/groundwater, plant uptake and transpiration. Cooling transfers energy out during condensation/freezing; solar heating can contribute to melting. Gravity moves precipitation, runoff and water downward through soil; capillary and biological processes also affect soil/plant movement.

Accept equivalent multiplication or fraction work when the final amount and unit are correct. For the challenge, accept explanations that identify sunlight as the driver of evaporation and gravity as the driver of precipitation, runoff, or infiltration. Require the original calculations plus a learner-created, multi-route model with three states, named processes and distinct solar-energy/gravity annotations. Check arrow directions and conservation of water material. Do not accept equal liquid/gas volumes as evidence of conservation. Real pathways have additional drivers and timescales; a closed classroom model tracks total water mass, including material in every reservoir.