Evaluate a Water-Cycle Model

Use source evidence to improve a model across Earth systems.

ES.2 "Obtain, evaluate, and communicate information to model the cycling of matter through the biosphere, atmosphere, hydrosphere, and geosphere, including the flow of carbon, water, nitrogen, phosphorus, and sulfur."

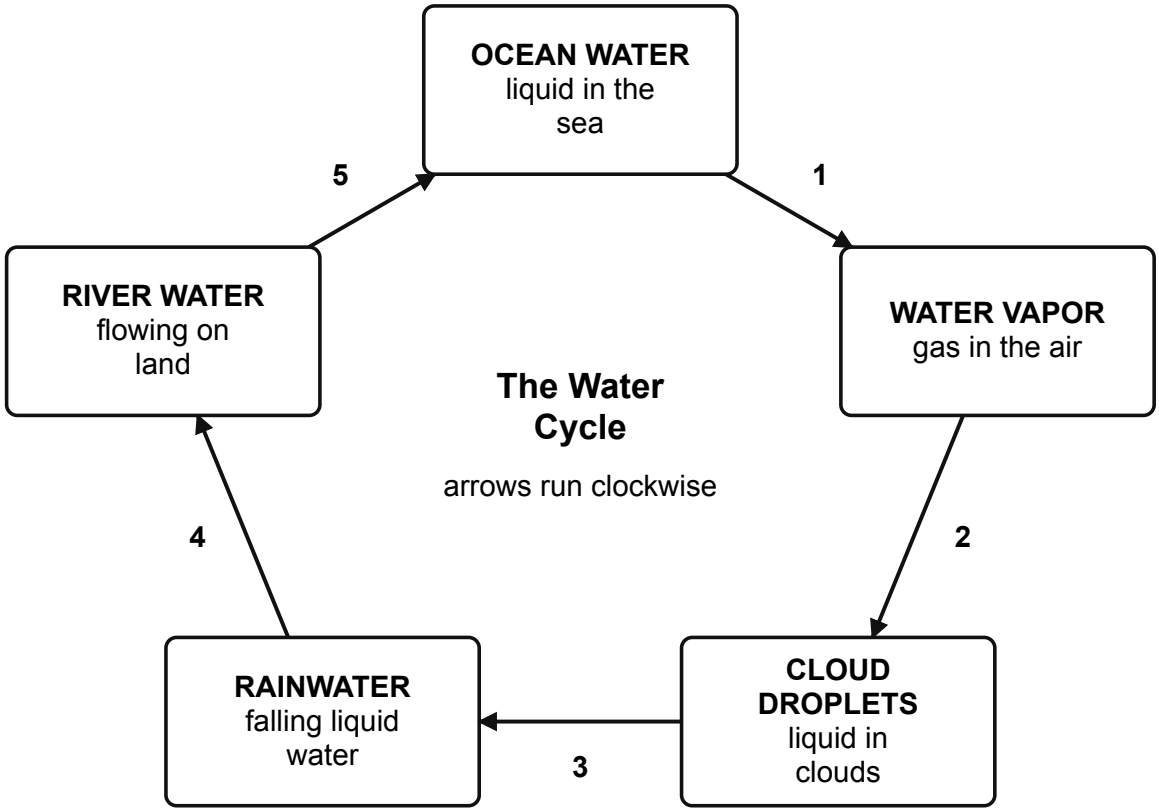
NAME _____ DATE _____

1 LABEL THE MODEL

Word bank below

Fill the arrow boxes from the word bank. Source notes, paraphrased from USGS Water Science School: water can infiltrate soil; roots absorb soil water; leaves release water vapor by transpiration. Use these notes and the loop to answer the questions. Source: usgs.gov/water-cycle.

WORD BANK Condensation · Evaporation · Precipitation · River flow · Surface runoff



Arrow numbers match the response boxes on the next student section.

Label the arrows

Use the word bank to write the process for each numbered arrow.

Arrow 1	Arrow 2	Arrow 3
_____	_____	_____

Arrow 4	Arrow 5
_____	_____

2 RUN THE MODEL

Use your finished diagram

1. Which parts of the printed loop represent the atmosphere and hydrosphere? Which source-note reservoirs are missing?

2. Use the source notes to write an arrow chain from rainwater through soil and plants to atmospheric vapor. Label each transfer.

3. A student says doubling ocean evaporation must double rain over our town the same day. Can this loop establish that claim? Explain what evidence is missing.

3 CHECK IT

Before you turn it in

- [ ] I used the source notes as evidence.
- [ ] I connected water in all four Earth systems.
- [ ] I distinguished a pathway model from a quantitative prediction.

TEST THE MODEL

Describe an observation that could test your proposed plant-to-air arrow, and one comparison needed to rule out evaporation from soil.

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PART 1 · COMPLETED MODEL

ARROW	FROM	TO	PROCESS
1	OCEAN WATER liquid in the sea	WATER VAPOR gas in the air	Evaporation
2	WATER VAPOR gas in the air	CLOUD DROPLETS liquid in clouds	Condensation
3	CLOUD DROPLETS liquid in clouds	RAINWATER falling liquid water	Precipitation
4	RAINWATER falling liquid water	RIVER WATER flowing on land	Surface runoff
5	RIVER WATER flowing on land	OCEAN WATER liquid in the sea	River flow

PART 2 · RUN THE MODEL

1. **Vapor and clouds represent atmospheric water; ocean and river water represent the hydrosphere. The loop omits soil-water storage within the geosphere and water in plants, the biosphere.** (Which parts of the printed loop represent the atmosphere and hydrosphere? Which source-note reservoirs are missing?)
2. **Rainwater → soil water: infiltration; soil water → plant water: root uptake; plant water → atmospheric vapor: transpiration. These branches add geosphere and biosphere connections to the model.** (Use the source notes to write an arrow chain from rainwater through soil and plants to atmospheric vapor. Label each transfer.)
3. **No. The loop shows possible transfers, not rates, storage, transport paths or travel times. Local precipitation observations and atmospheric transport/rate data would be needed to test the prediction.** (A student says doubling ocean evaporation must double rain over our town the same day. Can this loop establish that claim? Explain what evidence is missing.)

TEST THE MODEL (SAMPLE ANSWERS)

- Collect moisture around leaves while covering the soil, and compare with a setup without a plant.
- Compare moisture collected near a leafy plant with an otherwise matched leaf-free control; keep light and time the same and prevent soil evaporation.

Evaluate the scientific rationale, not exact wording. A valid chain conserves water and correctly names transfer processes. Soil water links the hydrosphere with the geosphere; plants are part of the biosphere. A source-informed pathway alone cannot quantify local rain. This worksheet focuses on water, not all five matter cycles in the parent standard.