

Energy in Earth's Systems: Mastery Check

Learning target: I can show that I know Earth's four systems and the geosphere's layers, tell the three energy transfers apart, explain convection with density and gravity, and describe how energy from the sun and Earth's interior moves matter within and between the systems.

Retrieval and mastery check

About 40 min

Individual

MS-ESS2-1 · assesses

MS-LS2-3 · supports

MS-ETS1-4 · supports

independent practice

writing

Name _____

Date _____

Period _____

Directions

Work alone without notes. Answer every item. For multiple-choice items, circle one letter. For numeric items, show the calculation and include units. For the drawing, label every arrow. Part B is a short paragraph; plan it on scrap paper before writing. You have about 40 minutes.

You will need: This worksheet, Pencil, Scrap paper, Calculator for q6

Part A: Retrieval (12 items)

- Which energy transfer can cross the nearly empty space between the sun and Earth?
 - Conduction, because the sun and Earth are connected by gravity
 - Convection, because hot gas from the sun travels to Earth
 - Radiation, because energy travels as light that needs no matter
 - None; the sun's energy is stored in the atmosphere
- Which statement about the geosphere's layers is correct?
 - The crust is the densest layer because it is made of solid rock
 - The core is the densest layer and is made mostly of iron and nickel
 - The mantle is a liquid layer of magma between the crust and the core
 - The three layers all have about the same density
- True or false: In a pot of water heated from below, heat itself floats upward, which is why the water at the top gets warm.
 - True
 - False Explain your thinking:

4. In a mantle convection cell, what directly causes the cooled rock near the crust to move back down?
- ☐ A. Pressure from the crust pushing the rock down
 - ☐ B. Gravity pulling more strongly on the rock because it has become denser
 - ☐ C. The hot core pulling the rock toward it like a magnet
 - ☐ D. The rock melting and dripping downward
5. Complete each sentence with the name of an Earth system. A cloud is part of the _____ and the _____. A worm in garden soil is part of the _____ living inside the _____.

6. A 500 cm^3 sample of warm water has a mass of 495 g. A 500 cm^3 sample of cold water has a mass of 500 g. Calculate the density of each (density = mass $\div$ volume) to two decimal places, and state which sample would sink if the two were gently combined.

7. A fluid is heated from below. Explain why energy enters the fluid by conduction **before** convection can begin.

8. Biosphere 2 was built as a closed system. What does that mean?

- ☐ A. Nothing could cross its walls, including sunlight
- ☐ B. Matter could not enter or leave, but energy such as sunlight and heat could cross
- ☐ C. Energy could not enter or leave, but air and water could be added
- ☐ D. The doors were locked so the crew could not leave

9. In a food chain, decomposers return something to the soil that plants can use again, but there is something they cannot send back. Name both and say where the second one goes.

10. On a sunny day, how does most of the air near the ground get warm?

- ☐ **A.** Sunlight is absorbed directly by the air as it passes through
- ☐ **B.** Sunlight is absorbed by the ground and water, which then warm the air touching them
- ☐ **C.** Warm air blows up from Earth's hot interior through cracks
- ☐ **D.** The air is warmed by convection from the sun

11. Draw a side view of the ocean between the equator (left) and a pole (right). Show one convection loop with arrows. Label: where the sun's energy enters and by what method; where water is warm and less dense; where water becomes cold, salty and denser; where gravity pulls water down; and the direction of the deep current.



12. Give two reasons polar surface water becomes denser than the water around it, and name the one force that then makes it sink.

Part B: Synthesis

13. Write a paragraph (6-8 sentences) answering: **How does energy move matter within and between Earth's systems?** Your paragraph must name both energy sources, use all three transfer methods correctly, explain one convection loop with density and gravity, and give one example of matter crossing from one system into another.

A map for Part B

Plan the paragraph as four lines on scrap paper before writing: Line 1, the two sources (interior, sun). Line 2, the three methods and one place each happens. Line 3, one loop: warm, less dense, rises; cools, denser, gravity pulls it down. Line 4, one border crossing (water evaporating into the air, rock erupting into the air, carbon dioxide taken from the air by a plant). Then turn each line into one or two sentences.

Revise your day-one explanation

Find your answer to the first explanation question from W1 (why the warm red water rose and the cold blue water sank). Rewrite it using what you know now, then underline every phrase that changed and write a sentence for each explaining why the old version was incomplete or wrong. Finish with one question about convection that the lesson has not answered for you yet.