

Mantle Motion Loop

Trace matter through convection and plate tectonics.

HS-ESS2-3 "Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection. Clarification Statement: Emphasis is on both a one-dimensional model of Earth, with radial layers determined by density..."

NAME _____

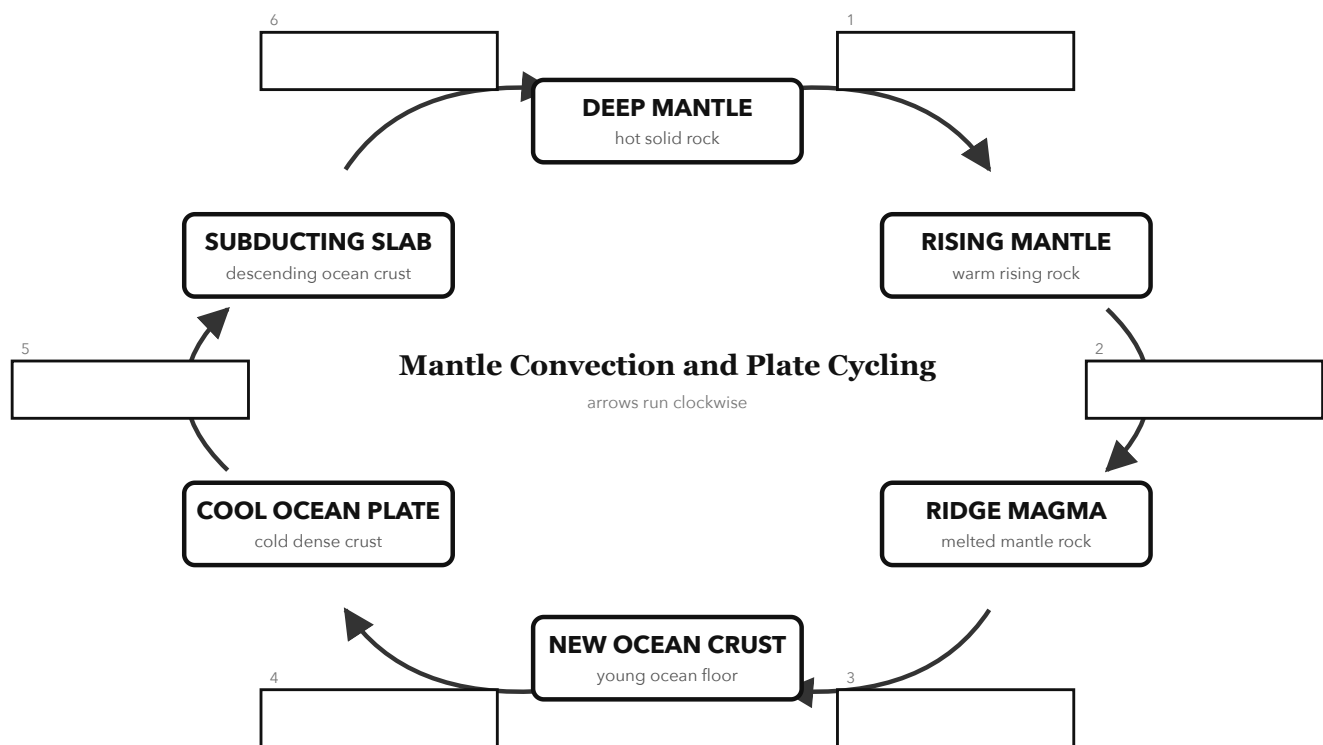
DATE _____

1 LABEL THE MODEL _____ Word bank below

Write one process from the word bank in each numbered arrow box. Then use the completed cycle and the seismic evidence question to explain how Earth scientists test this model.

WORD BANK

- Cooling forms new crust
- Heating lowers density
- Pressure drop melts rock
- Slab sinks and reheats
- Spreading and cooling
- Subduction sends slab down



2 RUN THE MODEL Use your finished diagram

1 Which process changes RISING MANTLE into RIDGE MAGMA?

2 Why is the COOL OCEAN PLATE more likely to move into the SUBDUCTING SLAB stage than NEW OCEAN CRUST?

3 Seismic wave maps show a cold, high-speed slab deep below an ocean trench. Which stage represents this material, and which process placed it there?

3 CHECK IT Before you turn it in

☐ I matched each arrow to a process.

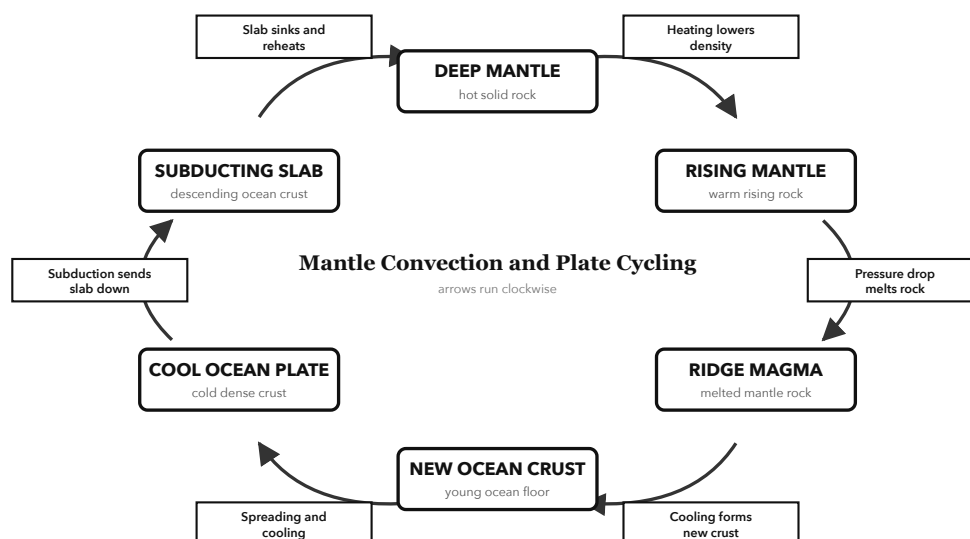
☐ I traced matter through the full loop.

☐ I used seismic evidence to test the model.

TEST THE MODEL

What important feature of real mantle convection or Earth evidence does this simple loop leave out?

PART 1 • COMPLETED MODEL



PART 2 • RUN THE MODEL

1. **Pressure drop melts rock.** (Which process changes RISING MANTLE into RIDGE MAGMA?)
2. **It is cooler and denser, so it can sink.** (Why is the COOL OCEAN PLATE more likely to move into the SUBDUCTING SLAB stage than NEW OCEAN CRUST?)
3. **SUBDUCTING SLAB, placed there by subduction sends slab down.** (Seismic wave maps show a cold, high-speed slab deep below an ocean trench. Which stage represents this material, and which process placed it there?)

TEST THE MODEL (SAMPLE ANSWERS)

- It leaves out the many separate convection cells in the mantle.
- It does not show how seismic wave speeds reveal cold slabs and hot mantle.

The process list is in cycle order, from each stage to the next stage. The seismic evidence item connects the model to three-dimensional maps of Earth's interior, where cold subducting slabs commonly produce faster seismic-wave speeds.