Layers That Overlap

Model Earth by composition and by how its layers behave

ESS.6.c "Develop and interpret a model of Earth's internal structure and composition, including inner core, outer core, asthenosphere, lithosphere, mantle, and crust."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline each statement about what a layer is made of, and circle each statement about how a layer behaves. Number the crust, mantle, outer core, and inner core in order from the surface inward so you can use both kinds of information in a model.

Two Paths Toward Earth's Center

1. Imagine placing two imaginary shafts, one through the floor of an ocean and one through a continent. Neither shaft could reach Earth's center, but each would cross a thin rocky crust first. Oceanic crust is generally thinner than continental crust. Below either crust lies the mantle, a much thicker region of hot, mostly solid rock. Deep inside Earth, the mantle gives way to a core made mainly of iron and nickel. A model of these shafts can show both the shared order of Earth's materials and the different thicknesses of the two kinds of crust.

2. A second way to organize the model is by how materials behave. The lithosphere is the rigid outer shell, made of the crust and the uppermost solid mantle. Beneath it, the asthenosphere is a weaker part of the upper mantle. Its rock remains mostly solid but can flow very slowly over long periods. Deeper mantle rock is also solid and moves slowly. A boundary based on strength does not always match a boundary based on composition. Both the rigid rock just below the crust and the weaker asthenosphere belong to the mantle, even though they behave differently.

3. At the mantle's lower boundary, the liquid outer core begins. Farther inward, the inner core is solid despite its greater temperature, because immense pressure keeps its iron-rich material from melting. Scientists cannot watch these layers directly. Instead, they measure earthquake waves traveling through Earth. Waves that cannot pass through liquids reveal the liquid outer core, while other wave patterns help locate the solid inner core. In a useful model, the outer core surrounds the inner core, and the mantle surrounds both. The model should also show that lithosphere and asthenosphere describe behavior, while crust and mantle describe composition.

2 ANSWER WITH EVIDENCE

Use the passage

1. In two models drawn from the surface toward Earth's center, which material layer would differ in thickness beneath an ocean and a continent? Which material layer would lie directly below it in both models?

2. A model labels the lithosphere as only crust. What must be added to that label, and where should the asthenosphere be shown?

3. How should a model place the two core layers inside the mantle, and what state of matter should it show for each?

4. A model shows the outer core as solid. What evidence from earthquake waves shows that this part of the model needs to change?

3 YOUR TURN

Your own words

In two panels, draw simplified cross sections from an ocean floor and from a continent to Earth's center. Show the difference in crust thickness, label crust, mantle, lithosphere, asthenosphere, outer core, and inner core in each panel, and add one caption explaining why your lithosphere label overlaps two material layers.

ANSWER KEY

Layers That Overlap

HIGH SCHOOL · ESS.6.c

PART 1 · READ AND MARK

Underline each statement about what a layer is made of, and circle each statement about how a layer behaves. Number the crust, mantle, outer core, and inner core in order from the surface inward so you can use both kinds of information in a model. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	In two models drawn from the surface toward Earth's center, which material layer would differ in thickness beneath an ocean and a continent? Which material layer would lie directly below it in both models?	**The crust would differ in thickness: oceanic crust is generally thinner. The mantle would lie directly below the crust in both models.**
2	A model labels the lithosphere as only crust. What must be added to that label, and where should the asthenosphere be shown?	**The lithosphere must also include the rigid uppermost mantle. The asthenosphere belongs below the lithosphere, within the upper mantle.**
3	How should a model place the two core layers inside the mantle, and what state of matter should it show for each?	**The mantle surrounds the liquid outer core, which surrounds the solid inner core.**
4	A model shows the outer core as solid. What evidence from earthquake waves shows that this part of the model needs to change?	**Some earthquake waves cannot pass through liquids, and their paths reveal that the outer core is liquid.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

Ocean panel: A thin crust sits above the mantle. A lithosphere bracket spans the crust and rigid uppermost mantle; the asthenosphere is labeled in the upper mantle below it. Deeper inward are the rest of the mantle, the outer core, and the inner core. Continent panel: The same arrangement is shown, but the crust is thicker. Caption: The lithosphere label crosses the crust-mantle boundary because the lithosphere includes both crust and rigid uppermost mantle.

Accept cross sections that are not drawn to scale. Check that both panels place the asthenosphere within the upper mantle, the outer core around the inner core, and the lithosphere across the crust-mantle boundary.