Earth’s Interior Layers

Use this key to check answers and read the explanations.

1. On a cutaway of Earth, which of the four main layers lies immediately beneath the crust?
   - A. Mantle
   - B. Outer core
   - C. Inner core
   - D. Atmosphere

   Correct answer: A. Mantle

   The mantle extends from the base of the crust to the top of the core.

2. Which named part of Earth occupies the very center?
   - A. Lower mantle
   - B. Outer core
   - C. Inner core
   - D. Oceanic crust

   Correct answer: C. Inner core

   The inner core is the central solid part. The liquid outer core surrounds it.

3. In a model that begins at Earth’s center and travels straight outward, which layer follows the inner core?
   - A. Crust
   - B. Outer core
   - C. Upper mantle
   - D. Lower mantle

   Correct answer: B. Outer core

   A route outward crosses the outer core before reaching the lower and upper mantle.

4. A geologist colors the rigid part of a tectonic plate. What should be colored?
   - A. Only the material below the plate
   - B. The crust and the entire mantle
   - C. The outer core and the inner core
   - D. The crust and the uppermost rigid mantle

   Correct answer: D. The crust and the uppermost rigid mantle

   The lithosphere includes the crust and the rigid uppermost mantle. It moves as plates over softer material below.

5. Compared with typical continental crust, which description fits typical oceanic crust?

A. Thicker and less dense
B. Thinner and denser
C. Thinner and less dense
D. Thicker and denser

Correct answer: B. Thinner and denser
Oceanic crust is usually thinner and has a higher average density than continental crust.

6. Seismic speeds change at the Mohorovičić discontinuity, also called the Moho. Which parts of Earth does it separate?

A. Crust and mantle
B. Outer and inner core
C. Mantle and outer core
D. Atmosphere and crust

Correct answer: A. Crust and mantle
The Moho marks the transition from crust to mantle. A change in rock properties alters seismic-wave speeds there.

7. How can rock beneath a rigid plate move over millions of years while remaining mostly solid?

A. The pressure from the crust pushes the entire mantle outward once.
B. All rock becomes liquid at the base of a plate.
C. The mantle is made mainly of air pockets.
D. The hot rock can deform and flow slowly under long-lasting stresses.

Correct answer: D. The hot rock can deform and flow slowly under long-lasting stresses.
Mantle rock can deform under sustained stress. Solid rock can move on geologic time scales without melting wholesale.

8. A chart gives approximate layer thicknesses of 30 kilometers for the crust, 2,900 for the mantle, 2,260 for the outer core, and 1,220 for the inner core. Which layer spans the most depth?

A. Outer core
B. Inner core
C. Mantle
D. Crust

Correct answer: C. Mantle
The mantle’s 2,900 kilometers is the greatest thickness in the chart.

9. Which pair of metals best matches the standard model of the core’s main ingredients?

A. Iron and nickel
B. Aluminum and tin
C. Calcium and sodium
D. Silver and lead

Correct answer: A. Iron and nickel
Models describe Earth’s core as mainly iron, along with nickel and smaller amounts of lighter elements.

10. In the geodynamo model, motion in which layer helps generate Earth’s magnetic field?

A. Uppermost rigid mantle
B. Oceanic crust
C. Solid inner core alone
D. Liquid outer core

Correct answer: D. Liquid outer core
Flow in the electrically conducting liquid outer core helps sustain the field.

11. The inner core is hotter than the outer core. What helps explain why the inner core remains solid?

A. The surface traps all heat outside the inner core.
B. Its density drops enough for liquid to float out.
C. Its much higher pressure raises the temperature needed to melt the material.
D. The inner core contains solid crust that cannot melt.

Correct answer: C. Its much higher pressure raises the temperature needed to melt the material.
The pressure deep inside Earth raises the melting temperature of the iron-rich material. At inner-core pressures it is solid even at the higher temperature.

12. A cross section shows a P-wave path changing direction as it enters the outer core. What explains the bending?

A. The wave must hit a cliff on Earth’s surface.
B. The wave’s speed changes as it crosses into different material.
C. The wave switches into a sound wave traveling through air.
D. The earthquake moves while the wave is traveling.

Correct answer: B. The wave’s speed changes as it crosses into different material.
Wave speed depends on the properties of the material. Changing speed across a boundary refracts the wave.

13. Seismic records help locate boundaries within Earth. If the measured average density of Earth exceeds that of its surface rocks, what further inference is reasonable?

A. Everything under the surface is empty space.
B. All interior layers have the same density as the surface.
C. The atmosphere has a larger mass than the mantle.
D. Some interior material is denser than the surface rocks.

Correct answer: D. Some interior material is denser than the surface rocks.
A planet made entirely of material with the density of typical surface rocks would have a lower average density. Denser material in the interior accounts for the difference.

14. Which comparison correctly distinguishes a crust–mantle boundary from a lithosphere–asthenosphere boundary?

A. The first distinguishes rock types. The second distinguishes how rigidly the material behaves.
B. Both distinguish liquid metal from solid metal.
C. The first is defined by weather. The second is defined by latitude.
D. The first lies below the outer core. The second surrounds the inner core.

Correct answer: A. The first distinguishes rock types. The second distinguishes how rigidly the material behaves.
Crust and mantle are separated by a compositional boundary. Lithosphere and asthenosphere are distinguished by mechanical behavior.

15. Use a simplified Earth radius of 6,370 kilometers and a core radius of 3,480 kilometers. At what depth below the surface does the outer core begin?

A. 6,370 kilometers
B. 3,480 kilometers
C. 2,890 kilometers
D. 9,850 kilometers

Correct answer: C. 2,890 kilometers
Both radii are measured from the center. Subtract the core radius from Earth’s radius to get the depth of the boundary.