

2. LAYERS OF THE EARTH

TEACHING TASK

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Multiple Choice Questions

Multiple Choice Questions

1. Which layer of the Earth is primarily composed of solid rock?

- a) Outer Core b) Mantle c) Inner Core d) Crust

Key: D

Solution: The crust is the outermost solid rock layer of the Earth, consisting of both continental (granitic) and oceanic (basaltic) rock.

2. What is the main composition of the Earth's inner core?

- a) Iron and nickel b) Silicate minerals
c) Liquid magma d) Water and ice

Key: A

Solution: The inner core is a solid sphere primarily made of iron and nickel, despite extreme temperatures, due to immense pressure.

3. Which layer of the Earth is responsible for Earthquakes?

- a) Inner Core b) Mantle c) Crust d) Outer Core

Key: C

Solution: Earthquakes occur in the crust and upper mantle due to tectonic plate movements along faults.

4. The Earth's crust is thicker under:

- a) Oceans b) Continents
c) Both have the same thickness d) None

Key: B

Solution: Continental crust (30–50 km thick) is much thicker than oceanic crust (5–10 km).

5. The layer between the crust and the mantle is known as:

- a) Moho b) Mantle Transition Zone
c) Asthenosphere d) Lithosphere

Key: A

Solution: The Mohorovicic discontinuity (Moho) is the boundary separating the crust from the underlying mantle.

ADVANCED LEVEL

More than one answer type

6. Which layers of the Earth are primarily composed of iron and nickel?

- a) Crust b) Mantle c) Outer Core d) Inner Core

Key: C, D

Solution:

The outer core is liquid iron and nickel.

The inner core is solid iron and nickel due to extreme pressure.

The crust and mantle are silicate-rich, not metal-dominated.

Fill in the blanks

7. The _____ is the outermost layer of the Earth where we live.

Key: Crust

Solution: The crust is the thin, solid outermost layer (5–70 km thick) comprising continents and ocean basins.

8. The mantle transition zone lies between the upper mantle and the _____.

Key: Lower mantle

Solution: The transition zone (410–660 km depth) separates the upper mantle (rigid) from the lower mantle (more viscous).

Matching Type

- | | | |
|----|------------|--|
| 9. | Crust | a. Composed of liquid iron and nickel |
| | Mantle | b. Outermost layer, where we live |
| | Outer Core | c. Responsible for generating Earth's magnetic field |
| | Inner Core | d. Behaves like a viscous fluid over geological timescales |

Key: B, D, A, C

Answer the following questions

10. How do you think the temperature changes as you go deeper into the Earth?

Why is the inner core solid despite being extremely hot?

Solution:

1. Temperature increases with depth (geothermal gradient: $\sim 25^{\circ}\text{C}/\text{km}$).

2. The inner core remains solid due to immense pressure from overlying layers, which raises the melting point of iron/nickel beyond their actual temperature.

Even at $\sim 5,700^{\circ}\text{C}$, pressure at the core (3.6 million atm) prevents melting.

11. Imagine you are digging a hole in your backyard. As you go deeper, what layers of the Earth would you encounter?

Solution:

1. Crust (topsoil ? bedrock)

2. Mantle (if you could reach $\sim 30\text{--}50$ km down)

3. Outer core ($\sim 2,900$ km depth)

4. Inner core ($\sim 5,150$ km depth)

In reality, humans can't dig past the crust (deepest hole: Kola Superdeep, ~ 12 km).

Layers are inferred from seismic wave studies.

LEARNER'S TASK

Multiple Choice Questions

1. Which layer of the Earth is the hottest?

- a) Crust b) Mantle c) Outer Core d) Inner Core

Key: D

Solution: The inner core is the hottest layer ($5,000\text{--}7,000^{\circ}\text{C}$), even hotter than the outer core, due to extreme pressure and radioactive decay.

2. What is the outermost layer of the Earth?

- a) Mantle b) Crust c) Outer Core d) Inner Core

Key: B

Solution: The crust is Earth's thin, solid outermost layer (5-70 km thick) where all life exists.

3. What is the primary composition of the Earth's mantle?

- a) Liquid iron and nickel
- b) Solid iron and nickel
- c) Silicate minerals rich in iron and magnesium
- d) Granite and basalt

Key: C

Solution: The mantle is mostly solid silicate rocks (e.g., olivine) with iron/magnesium, not metallic like the core.

4. What is the temperature range at the Earth's inner core?

- a) 1000-2000 degrees Celsius
- b) 5000-7000 degrees Celsius
- c) 200-500 degrees Celsius
- d) 10,000-15,000 degrees Celsius

Key: B

Solution: The inner core reaches 5,000-7,000°C—hotter than the Sun's surface but solid due to pressure.

5. Which layer of the Earth is solid despite its high temperature?

- a) Outer Core
- b) Mantle
- c) Inner Core
- d) Crust

Key: C

Solution: The inner core stays solid because pressure overrides extreme heat, preventing melting.

ADVANCED LEVEL

More than one answer type

6. Which layers of the Earth are differentiated based on their composition?

- a) Crust
- b) Mantle
- c) Outer Core
- d) Inner Core

Key: A, B, C, D

Solution: All layers differ compositionally:

Crust: Silicates (granite/basalt)

Mantle: Iron/magnesium silicates

Core: Iron/nickel (outer liquid, inner solid).

Fill in the blanks

7. Despite its high temperature, the Earth's inner core remains _____ due to immense pressure.

Key: solid

Solution: Pressure at the core (~3.6 million atm) raises iron's melting point, keeping it solid.

8. The Earth's inner core is primarily composed of solid _____ and nickel.

Key: iron

Solution: The inner core is a solid iron-nickel alloy, unlike the liquid outer core.

Matching Type

- | | |
|---------------|---|
| 9. 1. Crust | A. Composed primarily of liquid iron and nickel. |
| 2. Mantle | B. Thickest layer of the Earth. |
| 3. Outer Core | C. Behaves like a viscous fluid over geological timescales. |
| 4. Inner Core | D. Composed of solid iron and nickel despite higher. |

Key: B, C, A, D

Solution:

- 1.The crust is not explicitly matched here (options focus on deeper layers).
- 2.Mantle matches B (it's the thickest layer at ~2,900 km) and C (flows slowly, driving plate tectonics).
- 3.Outer core matches A (liquid iron/nickel).
- 4.Inner core matches D (solid due to pressure).

Answer the following questions

10. Draw a diagram of the layers of the Earth and label each layer. Explain why you think each layer is important for life on Earth.

Solution:

- 1.Crust: Supports life, provides resources (soil, minerals).
- 2.Mantle: Drives plate tectonics (volcanoes, earthquakes).
- 3.Outer Core: Generates Earth's magnetic field (protects from solar radiation).
- 4.Inner Core: Stabilizes the magnetic field.

A simple diagram would show concentric layers labeled from outside in: Crust, Mantle, Outer Core, Inner Core.

11. Imagine you're explaining the layers of the Earth to a friend who has never heard about them before. How would you describe each layer in simple terms?

Solution:

- 1.Crust: "Earth's skin" (like an apple's peel)—where we live.
- 2.Mantle: "Hot, thick pudding" that moves slowly, causing earthquakes/volcanoes.
- 3.Outer Core: "Liquid metal ball" creating Earth's magnetic shield.
- 4.Inner Core: "Solid metal center" (like a diamond under pressure).

Use everyday analogies: e.g., "Imagine Earth as a peach—the pit is the core, the flesh is the mantle, and the skin is the crust!"

TEACHING TASK

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Multiple Choice Questions

1. Which type of rock forms from the solidification of molten material?

- a) Sedimentary b) Metamorphic c) Igneous d) None

Key: C

Solution: Igneous rocks form when magma/lava cools and solidifies (e.g., granite, basalt).

2. Granite is an example of which type of rock?

- a) Sedimentary b) Metamorphic c) Igneous d) None

Key: C

Solution: Granite is an intrusive igneous rock formed from slowly cooled magma.

3. What is the main process responsible for the formation of sedimentary rocks?

- a) Crystallization b) Metamorphism
c) Weathering and erosion d) Volcanic activity

Key: C

Solution: Sedimentary rocks form from weathered fragments (sediments) compressed over time.

4. Limestone is a common example of which type of rock?

- a) Sedimentary b) Metamorphic c) Igneous d) None

Key: A

Solution: Limestone forms from accumulated marine fossils/minerals (sedimentary).

5. Which type of rock forms from the alteration of pre-existing rocks through heat, pressure, and/or chemically active fluids?

- a) Sedimentary b) Metamorphic c) Igneous d) None

Key: B

Solution: Metamorphic rocks like marble or slate are "changed" from parent rocks.

ADVANCED LEVEL

More than one answer type

6. Which of the following rocks are formed from the alteration of pre-existing rocks through heat and pressure? (Select all that apply)

- a) Marble b) Slate c) Granite d) Quartzite

Key: A, B, D

Solution:

1.Marble (from limestone)

2.Slate (from shale)

3.Quartzite (from sandstone).

4.Granite is igneous, not metamorphic.

7. Which of the following rocks are formed from the accumulation and compaction of sediments?

- a) Sandstone b) Marble c) Shale d) Quartzite

Key: A, C

Solution:

1.Sandstone (sand particles)

2.Shale (clay/mud).

3.Marble/quartzite are metamorphic.

Fill in the blanks

8. _____ rocks are formed from the solidification of molten material.

Key: Igneous

Solution: Igneous rocks like basalt or granite crystallize from magma/lava.

9. _____ rocks are primarily formed from the accumulation and compaction of sediments.

Key: Sedimentary

Solution: Examples: limestone, sandstone, shale.

Matching Type

10. Igneous Rocks

A. Formed from the accumulation and compaction of sediments.

Sedimentary Rocks

B. Formed from the solidification of molten material.

Metamorphic Rocks

C. Formed from the alteration of pre-existing rocks through heat, pressure, and chemically active fluids.

Key: 1-B, 2-A, 3-C

Answer the following questions

11. What are sedimentary rocks made of, and how are they formed?

Solution:

Composition: Fragments (sand, clay, fossils) or minerals (e.g., calcite).

Formation: Weathering - Erosion - Deposition - Compaction/Cementation.

Example: Sandstone forms when sand layers harden over millions of years.

12. How are metamorphic rocks different from other types of rocks? Give one example of a metamorphic rock.

Solution:

Difference: Formed from existing rocks changed by heat/pressure (not melted).

Example: Marble (from limestone) or slate (from shale).

Metamorphic rocks often have foliation (layers) or crystals, unlike sedimentary/igneous.

LEARNER'S TASK

Multiple Choice Questions

1. What is the main characteristic texture of sedimentary rocks formed from the accumulation of mineral fragments?

- a) Foliated b) Coarse-grained c) Clastic d) Crystalline

Key: C

Solution: Clastic texture describes sedimentary rocks made of fragments (e.g., sandstone).

2. Basalt is an example of which type of rock?

- a) Sedimentary b) Metamorphic c) Igneous d) None

Key: C

Solution: Basalt is a fine-grained igneous rock from rapidly cooled lava.

3. What type of rock is primarily formed from the precipitation of minerals dissolved in water?

- a) Sedimentary b) Metamorphic c) Igneous d) None

Key: A

Solution: Examples: limestone (from calcite) or rock salt (from halite).

4. Which type of rock often exhibits layering or banding due to the alignment of mineral grains?

- a) Sedimentary b) Metamorphic c) Igneous d) None

Key: B

Solution: Metamorphic rocks like gneiss exhibit foliation due to pressure.

ADVANCED LEVEL

More than one answer type

5. What are the common minerals found in metamorphic rocks?

- a) Quartz b) Mica c) Feldspar d) Calcite

Key: A, B, C, D

Solution: All are common (e.g., quartz in quartzite, mica in schist).

6. What are some examples of foliated metamorphic rocks?

- a) Schist b) Marble c) Quartzite d) Gneiss

Key: A, D

Solution: Schist and gneiss show layering; marble/quartzite are non-foliated.

Fill in the blanks

7. _____ rocks form from the alteration of pre-existing rocks through heat, pressure, and/or chemically active fluids.

Key: Metamorphic

Solution: Formed under heat/pressure (e.g., slate from shale).

8. _____ rocks are commonly associated with volcanic activity and are formed from rapidly cooling lava on the Earth's surface.

Key: Extrusive igneous

Solution: Examples: basalt or obsidian.

Matching Type

- | | | |
|-----|--------------|--|
| 10. | 1. Schist | A. Composed almost entirely of quartz grains. |
| | 2. Quartzite | B. Mostly composed of calcite or dolomite minerals. |
| | 3. Marble | C. Contains minerals such as mica, quartz, and feldspar. |

Key: 1-C, 2-A, 3-B

Answer the following questions

11. What is the difference between igneous, sedimentary, and metamorphic rocks?

Solution: Igneous forms from cooled magma, sedimentary from compacted fragments, and metamorphic from altered rocks under heat/pressure. Each has unique textures and origins.

12. How are igneous rocks formed? Can you name one example of an igneous rock?

Solution: They crystallize from molten magma (intrusive like granite) or lava (extrusive like basalt). Cooling rate determines grain size.

TEACHING TASK

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Multiple Choice Questions

1. What type of mineral is composed primarily of carbon and is used in pencils?

- a) Graphite b) Talc c) Magnetite d) Feldspar

Key: A

Solution: Graphite is pure carbon used in pencils because it's soft and leaves marks.

2. Which mineral is the primary source of aluminum?

- a) Quartz b) Bauxite c) Hematite d) Galena

Key: B

Solution: Bauxite is processed to extract aluminum, making it the primary source.

3. What mineral is used in the production of Portland cement, a key ingredient in concrete?

- a) Quartz b) Gypsum c) Calcite d) Feldspar

Key: B

Solution: Gypsum controls the setting time of Portland cement in concrete.

4. What is the name for the way a mineral reflects light?

- a) Cleavage b) Streak c) Luster d) Fracture

Key: C

Solution: Luster describes a mineral's shine, like metallic or glassy appearance.

5. Which mineral is commonly used as a source of iron?

- a) Hematite b) Quartz c) Calcite d) Gypsum

Key: A

Solution: Hematite contains 70% iron, making it a major iron ore.

ADVANCED LEVEL

More than one answer type

6. Which minerals are commonly used in the production of electrical wiring?

- a) Copper b) Gold c) Silver d) Quartz

Key: A, B, C

Solution: Copper, gold and silver conduct electricity well for wiring.

Fill in the blanks

7. _____ is the hardest naturally occurring mineral on Earth.

Key: Diamond

Solution: With perfect hardness (10 on Mohs scale), diamond can't be scratched.

8. _____ is a mineral commonly used in the manufacturing of glass and electronics.

Key: Quartz

Solution: Silicon from quartz is essential for glass and computer chips.

Matching Type

- | | | |
|----|---------------|--------------------------------------|
| 9. | 1. Quartz | A. Cement production |
| | 2. Calcite | B. Electrical wiring and electronics |
| | 3. Copper ore | C. Glass manufacturing |

Key: C, A, B

Answer the following questions

10. What are some ways minerals are used in everyday life?

Answer: Minerals build homes (gypsum walls), power devices (quartz chips), and make everyday items (graphite pencils). They're in everything from toothpaste to cars.

11. What are some properties of minerals that can help you identify them?

Answer: Test hardness with Mohs scale, streak color on porcelain, and observe cleavage patterns. Luster and crystal shape also help identification

LEARNER'S TASK

Multiple Choice Questions

1. Which mineral is commonly used as a soil conditioner in agriculture?

- a) Limestone b) Gypsum c) Halite d) Quartz

Key: B

Solution: Gypsum conditions soil by adding calcium and improving water flow.

2. Which of the following is a characteristic property of minerals?

- a) Color b) Size c) Shape d) Density

Key: D

Solution: Density is constant for each mineral, unlike variable color/size.

3. Which mineral is the hardest naturally occurring substance on Earth?

- a) Diamond b) Quartz c) Talc d) Feldspar

Key: A

Solution: Diamond's perfect crystal structure makes it the hardest substance.

4. Which mineral is commonly used in the production of glass?

- a) Gypsum b) Quartz c) Halite d) Pyrite

Key: B

Solution: Quartz sand is the main ingredient in glass manufacturing.

ADVANCED LEVEL

More than one answer type

5. Which of the following minerals are essential components of limestone?

- a) Quartz b) Calcite c) Gypsum d) Dolomite

Key: B, D

Solution: Limestone contains calcite and dolomite minerals formed from shells.

Fill in the blanks

6. _____ is a metallic mineral commonly used in electrical wiring and plumbing.

Key: Copper

Solution: Copper's conductivity makes it perfect for wires and pipes.

7. _____ is a non-metallic mineral commonly used as a fertilizer and soil conditioner.

Key: Gypsum

Solution: Gypsum fertilizes soil by providing calcium and sulfur nutrients.