Interior of the Earth

The Earth is a dynamic planet composed of several concentric layers, each with distinct properties. The outermost layer is the crust, which is the thinnest layer, about 35 km thick on continents and 5 km thick on ocean floors. Beneath the crust lies the mantle, extending up to 2,900 km deep, made of solid rock that flows slowly. Below the mantle is the core, divided into the liquid outer core and solid inner core, primarily composed of iron and nickel. The outer core generates Earth's magnetic field through its flowing molten metal, while the inner core remains solid due to immense pressure despite high temperatures.

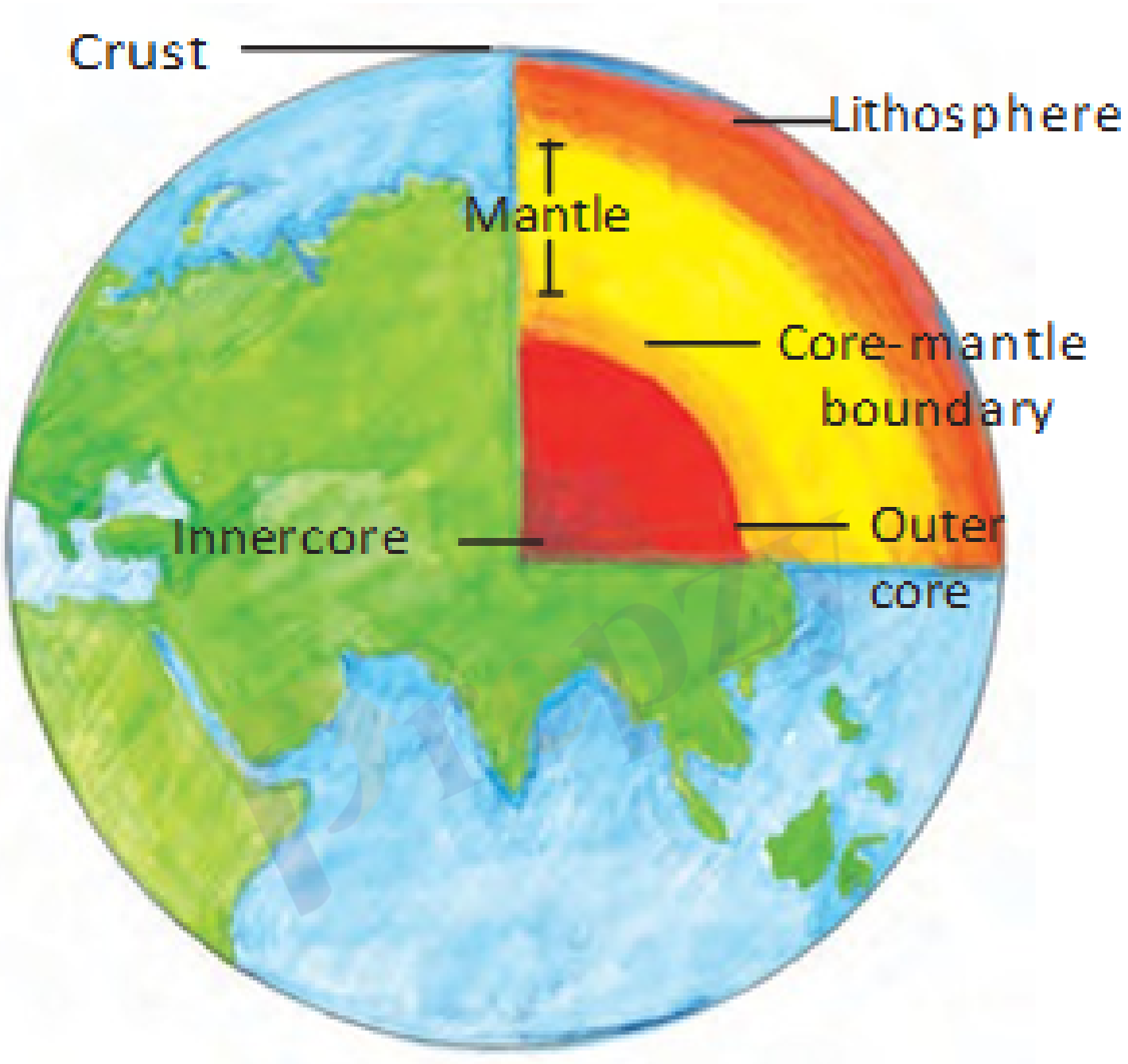

Fig.2.1:Interior of the Earth

Layers of the Earth

- **Crust:** The Earth's outer solid layer where we live.
- **Lithosphere:** Includes the crust and upper mantle; broken into tectonic plates.
- **Mantle:** Thick layer beneath the crust, made of solid but flowing rock.
- **Outer Core:** Liquid layer of molten iron and nickel generating Earth's magnetic field.
- **Inner Core:** Solid center composed mainly of iron and nickel.

Exam Questions

Q1: What are the main layers of the Earth?
A1: The main layers are the crust, mantle, outer core, and inner core.

Q2: Why is the inner core solid despite high temperatures?
A2: Because of the immense pressure at the center of the Earth.

Composition of the Earth's Crust

The Earth's crust varies in composition between continental and oceanic regions. The continental crust mainly consists of silica and alumina, called sial, while the oceanic crust is rich in silica and magnesium, called sima. The mantle lies beneath the crust, extending to about 2,900 km depth. The core, with a radius of about 3,500 km, is composed mainly of nickel and iron, known as nife. The crust forms only about 1% of Earth's volume, the mantle 84%, and the core 15%. The Earth's radius is approximately 6,371 km.

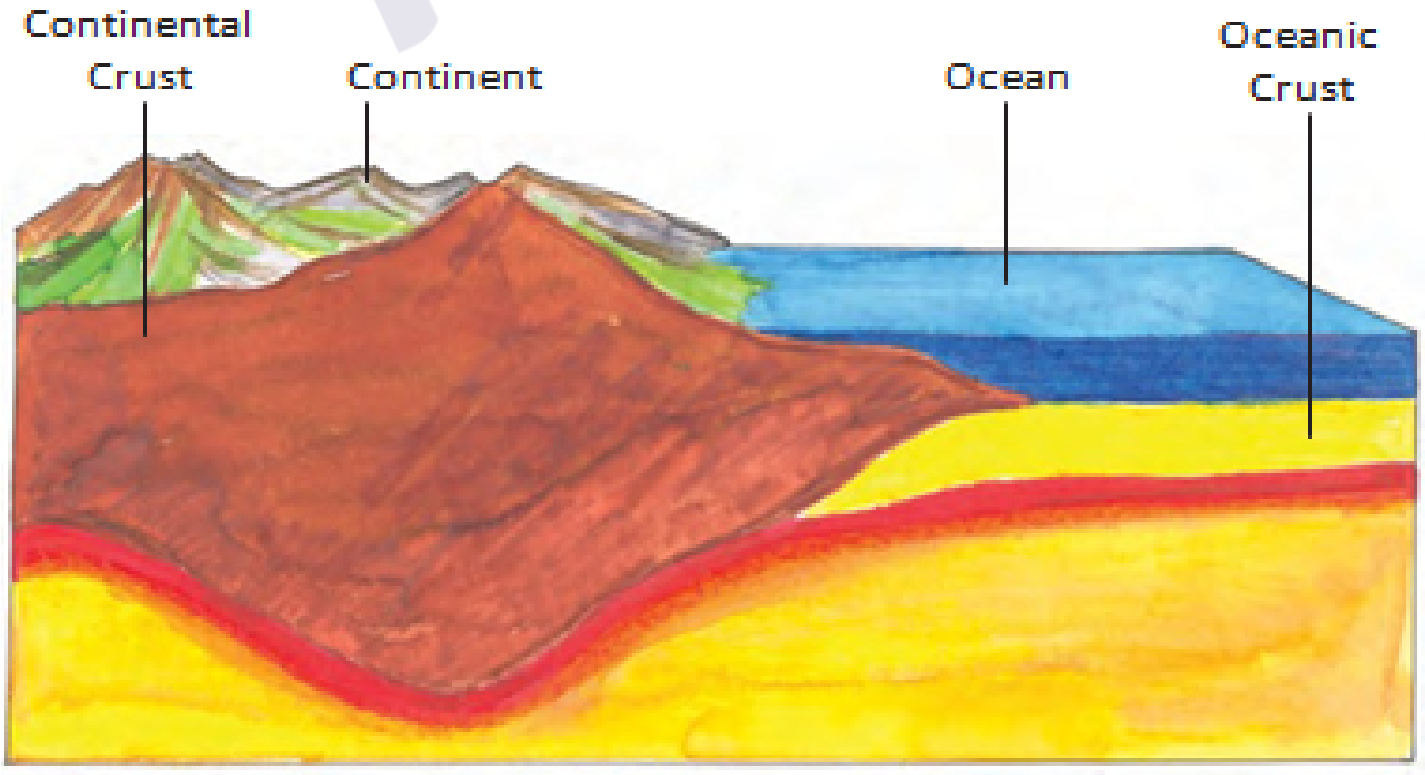

Fig.2.2:Continental Crust and Oceanic Crust

Continental and Oceanic Crust

- **Continental Crust:** Thick, less dense, made of granitic rocks.
- **Oceanic Crust:** Thin, denser, made of basaltic rocks.

Exam Questions

Q1: What are the main minerals in the continental crust?
A1: Silica and alumina (sial).

Q2: What is the oceanic crust mainly made of?
A2: Silica and magnesium (sima).

Types of Rocks

Rocks are natural masses of mineral matter forming the Earth's crust. There are three major types of rocks: igneous, sedimentary, and metamorphic.

Igneous Rocks

Formed when molten magma cools and solidifies. They are primary rocks and include:

- **Intrusive Igneous Rocks:** Formed when magma cools slowly beneath the surface, resulting in large grains (e.g., granite).
- **Extrusive Igneous Rocks:** Formed when lava cools rapidly on the surface, resulting in fine grains (e.g., basalt).

Exam Questions

Q1: What is the difference between intrusive and extrusive igneous rocks?
A1: Intrusive rocks cool slowly beneath the surface forming large grains; extrusive rocks cool quickly on the surface forming fine grains.

Sedimentary Rocks

Formed from sediments that are compressed and hardened over time. They often contain fossils and have visible layers. Example: sandstone.

Exam Questions

Q1: How are sedimentary rocks formed?
A1: By compression and hardening of sediments deposited by wind, water, or ice.

Metamorphic Rocks

Formed when igneous or sedimentary rocks undergo heat and pressure without melting, changing their structure and texture. Example: slate from clay, marble from limestone.

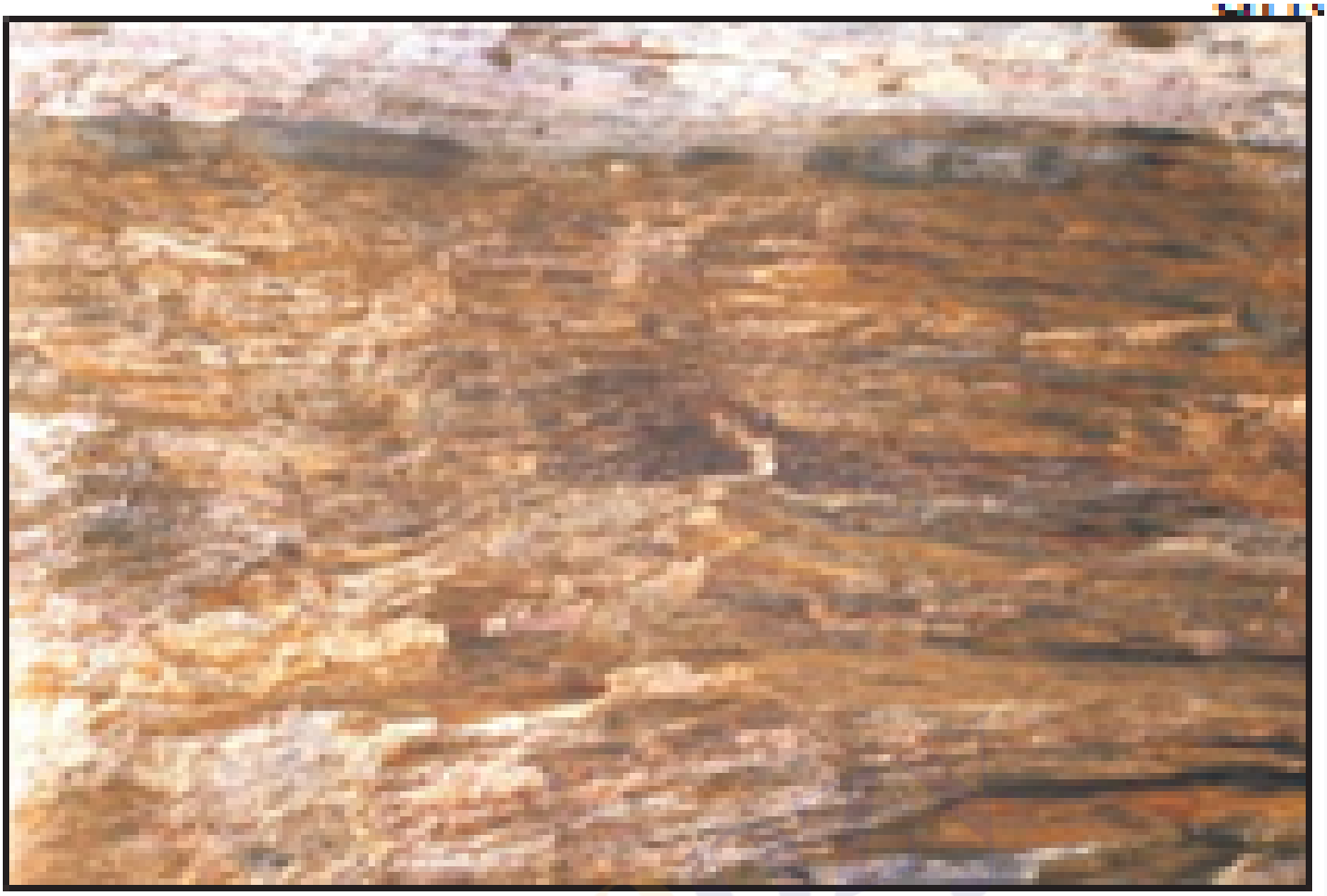

Fig. 2.3:Sedimentary rock turned into a Metamorphic rock

Exam Questions

Q1: What causes the formation of metamorphic rocks?
A1: Heat and pressure change existing rocks without melting them.

Rock Cycle

The rock cycle describes how rocks transform from one type to another over time through natural processes:

- Magma cools to form igneous rocks.
- Igneous rocks break down into sediments.
- Sediments compress to form sedimentary rocks.

- Heat and pressure transform rocks into metamorphic rocks.
- Metamorphic rocks melt to become magma again.

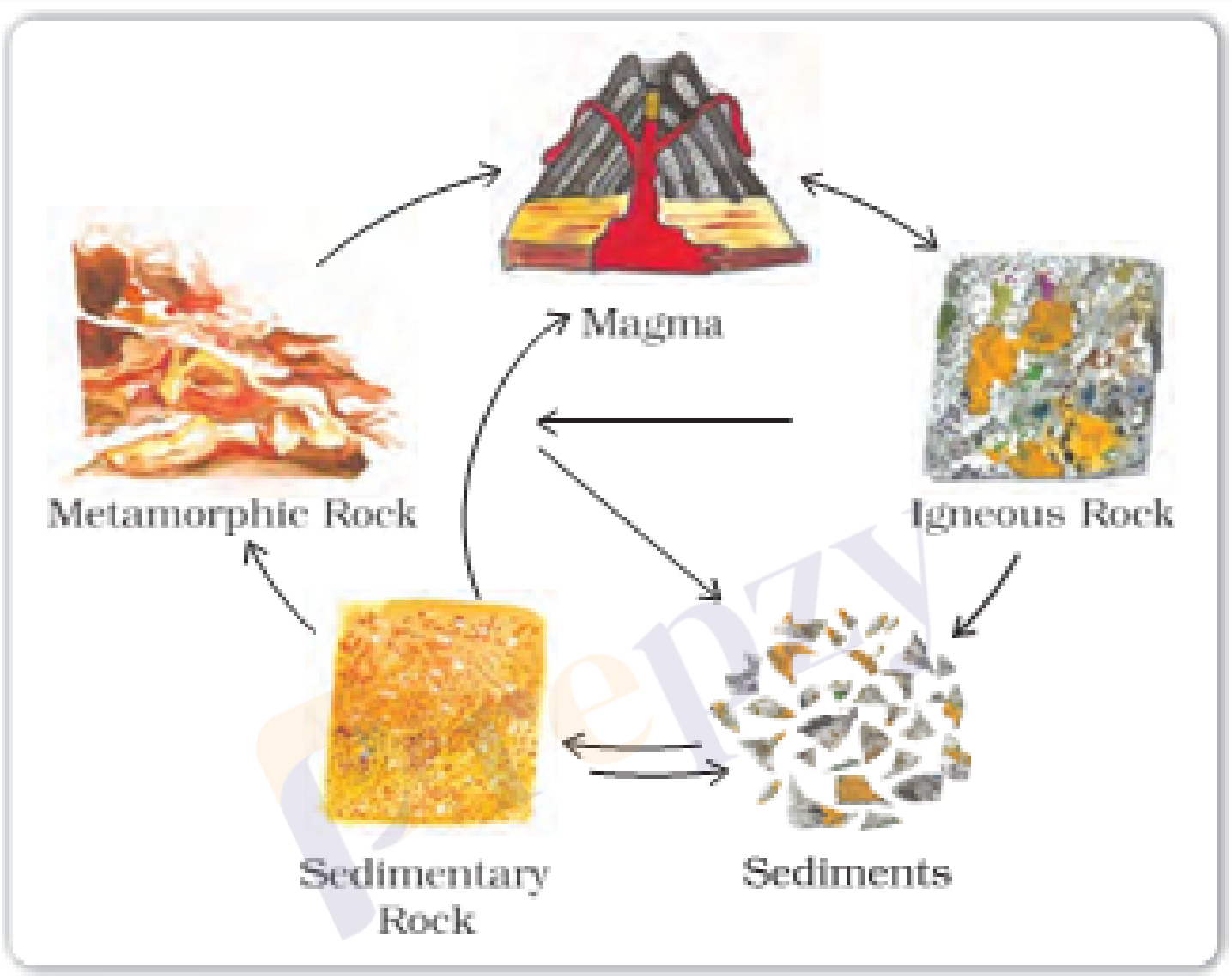

Fig.2.4:Rock Cycle

Exam Questions

Q1: What is the sequence of the rock cycle?
A1: Magma → Igneous rock → Sediments → Sedimentary rock → Metamorphic rock → Magma.

Importance of Minerals

Minerals are naturally occurring substances with definite chemical composition and physical properties. They are essential for human use in fuels (coal, natural gas,

petroleum), industries (iron, aluminium, gold, uranium), medicine, and fertilizers.

Exam Questions

Q1: Name some minerals used as fuels.
A1: Coal, natural gas, and petroleum.

Rocks Used in Monuments

Many famous monuments are built using different types of rocks:

- **Red Fort:** Made of red sandstone, a sedimentary rock giving it a reddish color.
- **Taj Mahal:** Made of white marble, a metamorphic rock known for its smooth and shiny surface.

Collectpicturesofsomemonumentsandfindoutwhicharetherocks usedtobuildthem.Twopictureshavebeencollectedforyou.

TheRedFortismadeofredsandstone

TheTajMahalismadeofwhitemarble

Exam Questions

Q1: What type of rock is red sandstone?
A1: Sedimentary rock.

Q2: What type of rock is marble?
A2: Metamorphic rock.

Glossary

- **Fossils:** Remains of dead plants and animals trapped in rock layers.
- **Igneous:** Derived from Latin 'Ignis' meaning fire; rocks formed from cooled magma.
- **Sedimentary:** From Latin 'sedimentum' meaning settle down; rocks formed from compressed sediments.
- **Metamorphic:** From Greek 'metamorphose' meaning change of form; rocks changed by heat and pressure.

Quick Reference

- Earth's layers: Crust, Mantle, Outer Core, Inner Core.
- Types of rocks: Igneous, Sedimentary, Metamorphic.
- Rock cycle: Magma → Igneous → Sediments → Sedimentary → Metamorphic → Magma.
- Minerals are essential for fuel, industry, and agriculture.

Solved Examples

Example 1: Explain why the Earth's inner core is solid despite high temperatures.
Solution: The inner core remains solid because the immense pressure at the Earth's center prevents the iron and nickel from melting, even though the temperature is very high.

Example 2: Describe the difference between intrusive and extrusive igneous rocks.
Solution: Intrusive igneous rocks form when magma cools slowly beneath the Earth's surface, resulting in large crystals (e.g., granite). Extrusive igneous rocks form when lava cools quickly on the surface, resulting in fine-grained texture (e.g., basalt).

Practice Set

Easy

- What is the outermost layer of the Earth called?
- Name the three main types of rocks.

Moderate

- Explain the process of formation of sedimentary rocks.
- What causes metamorphic rocks to form?

Challenging

- Describe the rock cycle and its significance.
- How does the composition of continental crust differ from oceanic crust?

Answer Key

- **Easy 1:** Crust.
- **Easy 2:** Igneous, sedimentary, and metamorphic rocks.
- **Moderate 1:** Sedimentary rocks form by compression and cementation of sediments deposited by wind, water, or ice.
- **Moderate 2:** Metamorphic rocks form due to heat and pressure changing existing rocks without melting them.
- **Challenging 1:** The rock cycle is the continuous process of transformation of rocks from one type to another, involving magma, igneous, sedimentary, and metamorphic rocks. It explains the dynamic nature of Earth's crust.
- **Challenging 2:** Continental crust is thicker, less dense, and mainly composed of silica and alumina (sial), while oceanic crust is thinner, denser, and composed mainly of silica and magnesium (sima).