LEVEL 1: The Structure of the Earth

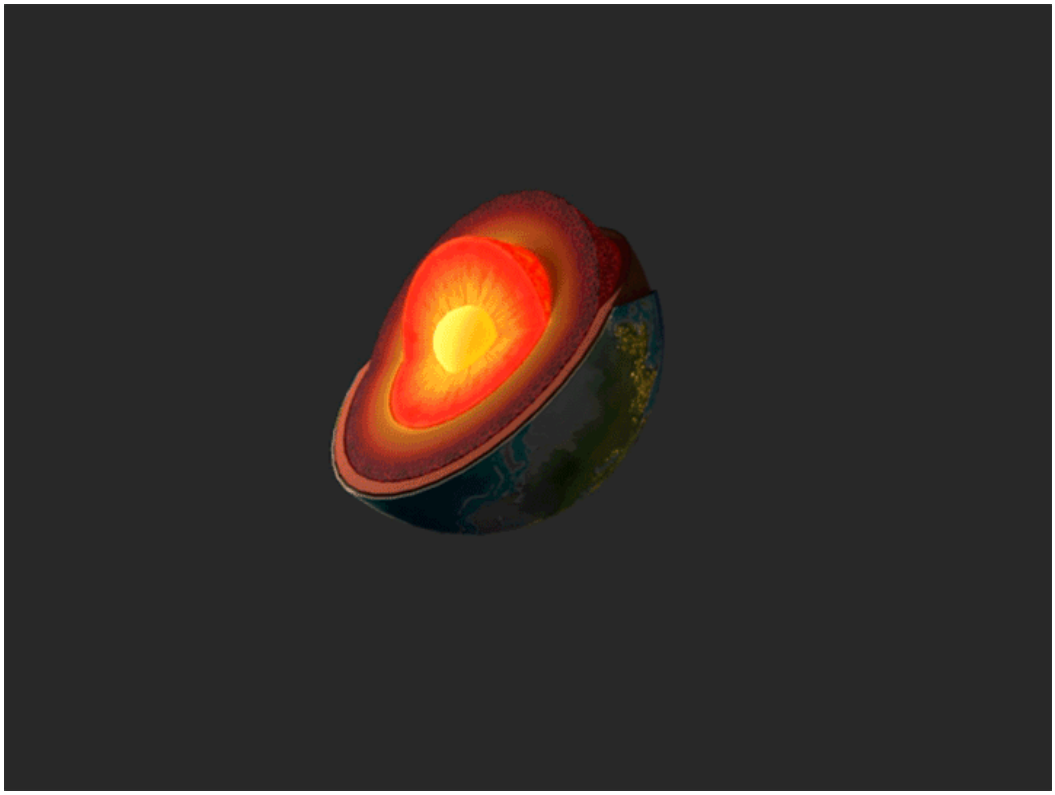
Mission Goal:
Explore the different layers of the Earth to understand how each of those layers contributes to the planet's overall structure and function.

Objectives:
By the end of this level you will be able to:

- Identify the different layers of the Earth
- Explain how these layers work together to form our planet
- Appreciate how learning about the Earth's structure helps us to understand our world better

Checkpoint 1: What's Beneath the Surface?

The Earth is divided into a series of layers: the inner core, outer core, mantle crust, asthenosphere, and lithosphere. Each of these layers has its own chemical and mechanical properties.



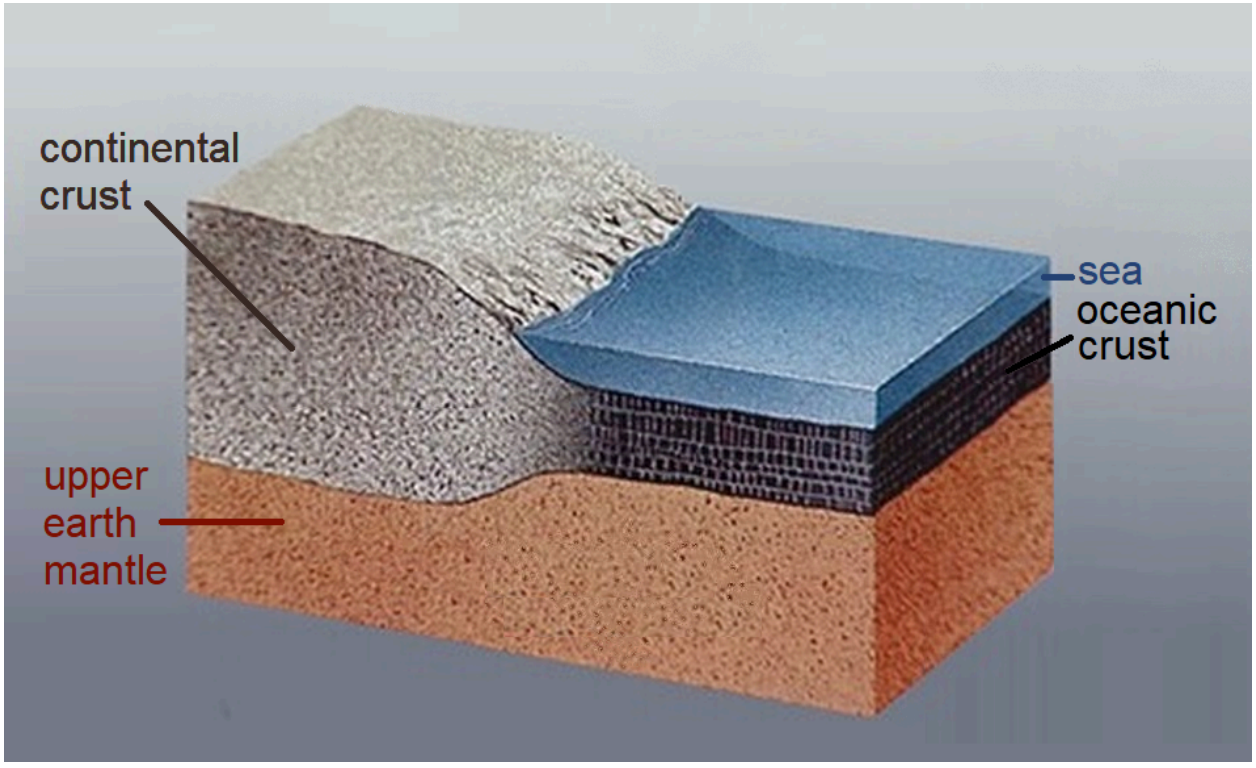
Checkpoint 2: The Layers of the Earth

1. **Crust**

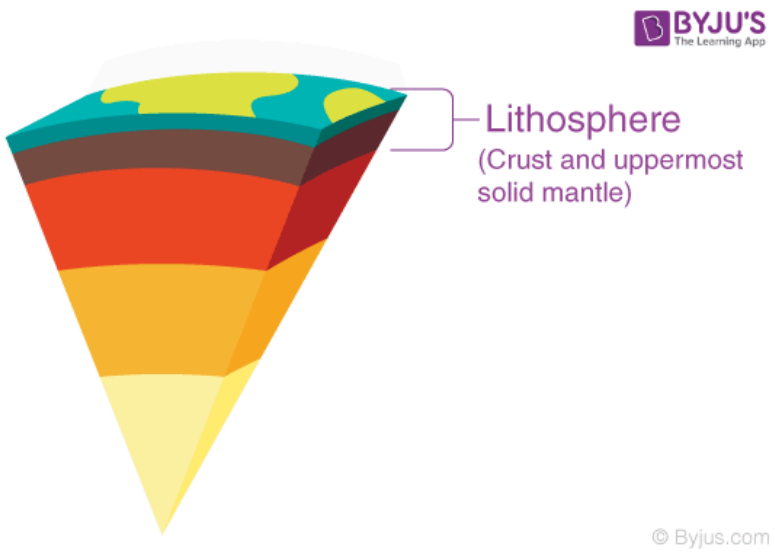
- The outermost layer of the Earth is the crust. The crust is the thinnest layer and It is made of solid rock. There are two types of crust:

- **Continental Crust**
- Continental crust is thicker, less dense, older, and composed of granite, forming the continents.

- **Oceanic Crust**
- Oceanic crust is thinner, denser, younger, and made of basalt, forming the ocean floor.

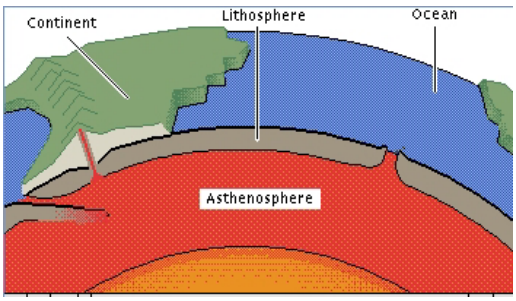


2. **Lithosphere**
- The rigid outer part of the Earth that consists of the **crust and upper mantle.**



3. **Asthenosphere**

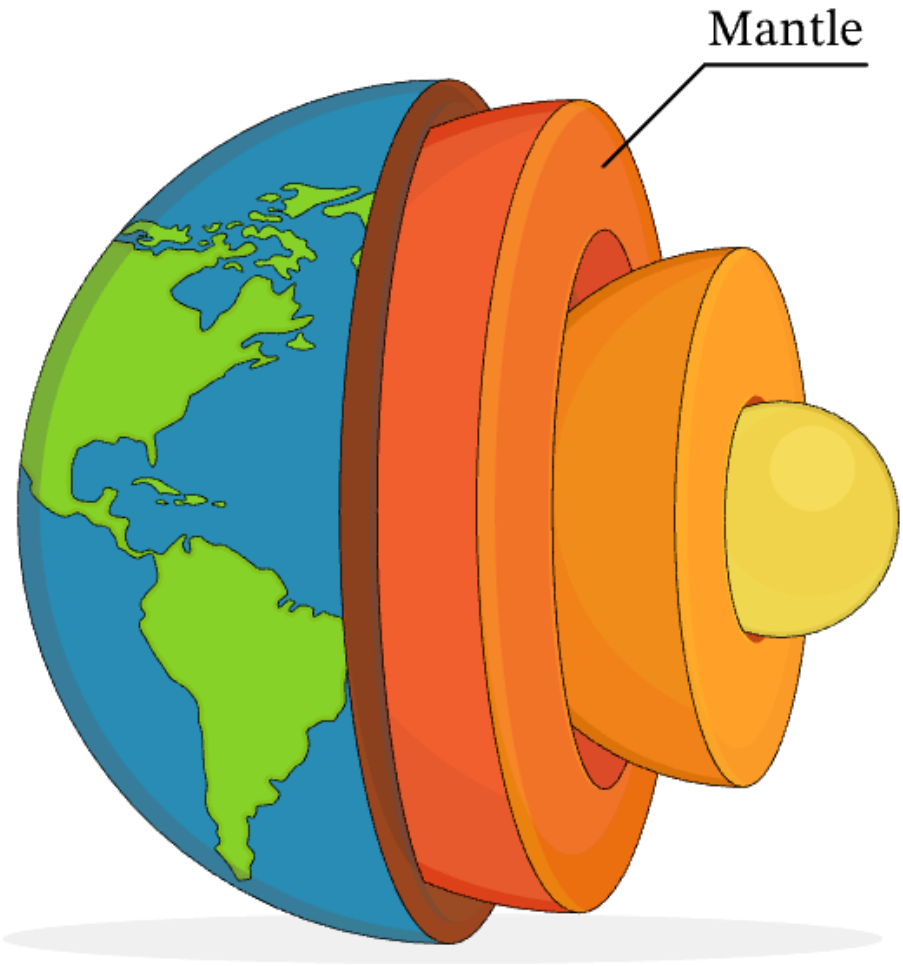
- The soft, semi-molten layer of the **upper mantle** located beneath the **lithosphere**.It is made of partially melted rock that can **flow slowly**, allowing the **tectonic plates** above it to move.



4. **Mantle**

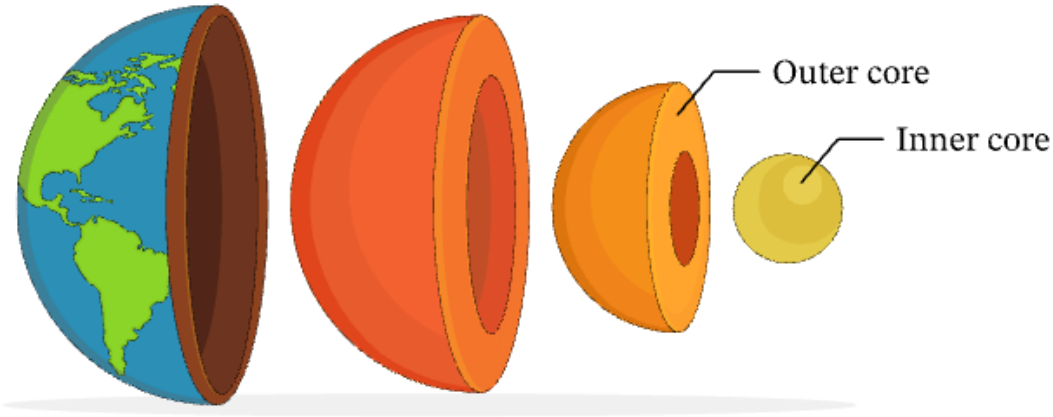
- Located beneath the crust, the mantle is the thickest layer, extending for about 1,800 miles. It is composed of hot, viscous rock that is mostly solid but can flow over long periods. **This layer is responsible for generating the Earth's**

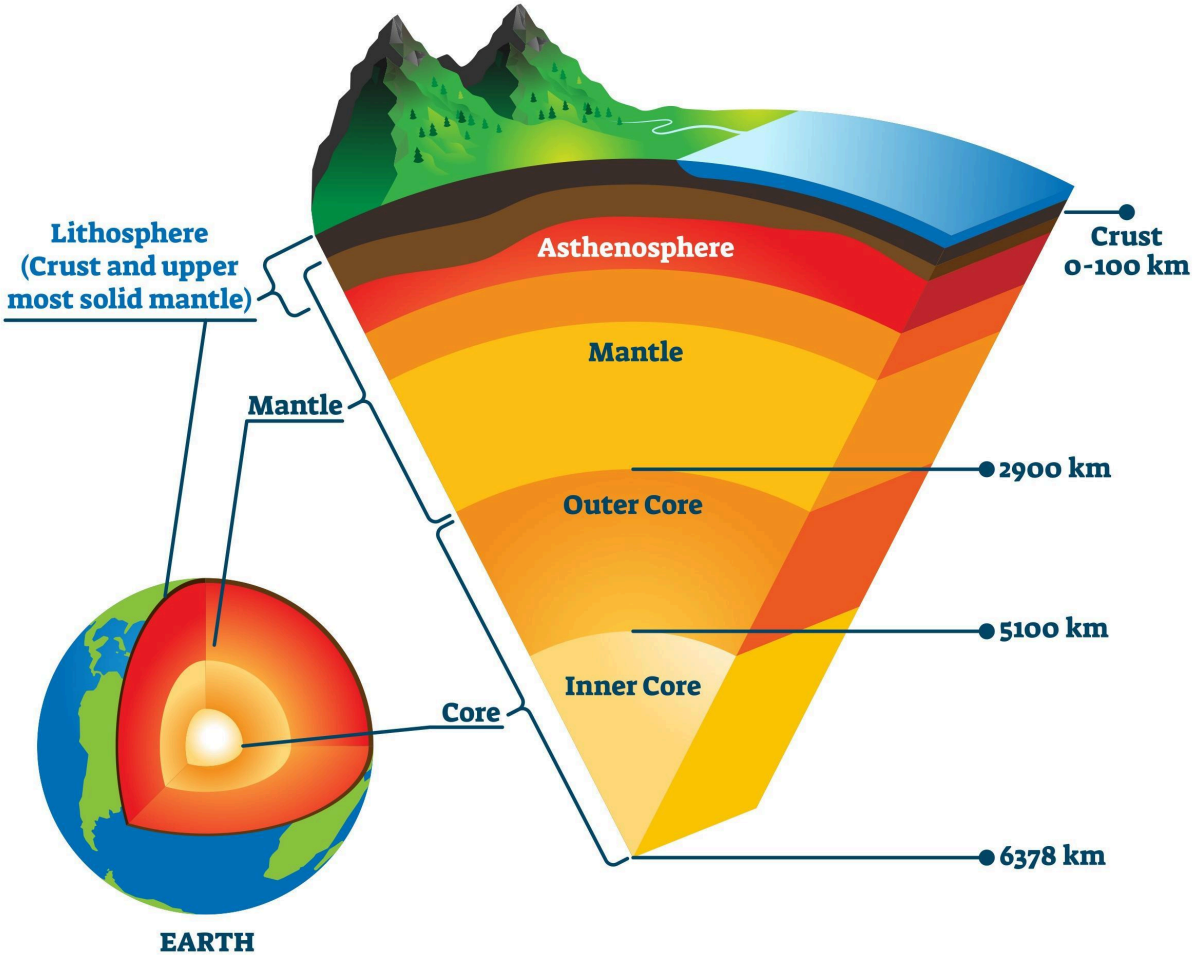
magnetic field.



5. **Outer Core**
- This is a liquid layer of mostly iron and nickel, about 1,400 miles thick. The churning of this liquid metal is what generates Earth's magnetic field.

6. **Inner Core**
- At the very center of the Earth is the inner core, which is a solid sphere of iron and nickel. Despite being an extremely hot, solid ball, the immense pressure keeps it from melting.


Outer core
Inner core


Lithosphere
(Crust and upper
most solid mantle)
Asthenosphere
Crust
0-100 km
Mantle
Mantle
2900 km
Outer Core
5100 km
Inner Core
Core
6378 km
EARTH

Fun Facts

- The crust and the upper mantle form the lithosphere, which is solid and brittle, and is approximately 100 km thick.
- The lithosphere is divided into large sections, known as tectonic plates. Tectonic plates consist of sections of the lithosphere. The oceanic lithosphere is topped by oceanic crust, and the continental lithosphere is topped by continental crust.
- A common misconception is that the mantle is made of liquid magma. In fact, it is made of solid rock.
- The outer core is made up of liquid iron and nickel. The inner core, a solid mass of iron and nickel, forms the Earth's centre.

Check Out this Video and Learn More!

Structure Of The Earth | The Dr. Binocs Show | Educational Videos For Kids

Level 1 Mini Quiz: "Be an Earth Explorer!"

1. Which layer of the Earth is responsible for generating the planet's magnetic field?
A. Mantle
B. Inner Core
C. Outer Core
Answer: A

2. What are the two main types of Earth's crust?
A. Continental and Oceanic
B. Mantle and Lithosphere
C. Inner and Outer Core
Answer: C

3. Which statement about the mantle is true?
A. It is completely liquid and made of magma.
B. It is the thinnest layer of the Earth.
C. It is made of hot, solid rock that can slowly flow.
Answer: A

4. What two layers make up the lithosphere?
A. Crust and upper mantle
B. Mantle and outer core
C. Inner and outer core
Answer: A

5. Why does the inner core stay solid even though it is very hot?
A. Because the pressure at the Earth's center is extremely high

B. Because it is made of rock
C. Because the outer core cools it
Answer: A

Level Complete!
Great work, Explorer!
You've completed level 1!
Next level unlocked 🔓

LEVEL 2: Plate Boundaries

Mission Goal:
Learn how Earth's tectonic plates move and what occurs where the plates meet.

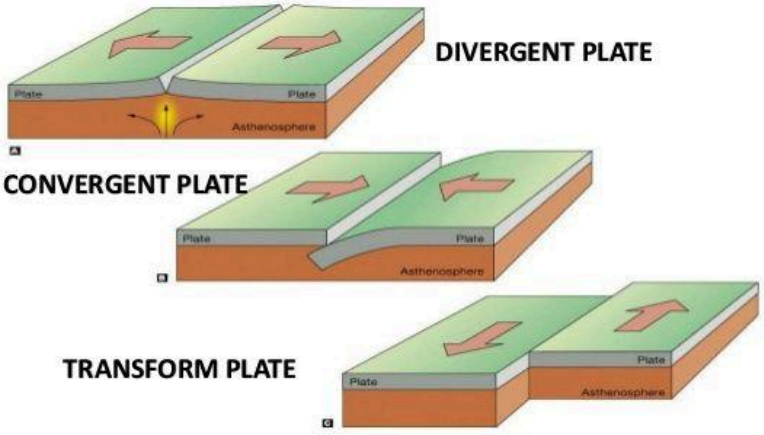
Objectives:

By the end of this level, you should be able to:

- Identify the three main types of plate boundaries.
- Describe how each boundary moves.
- Match each boundary to the landforms or events it creates.

Checkpoint 1: What Are Plate Boundaries?

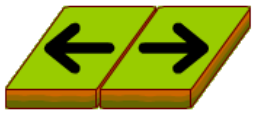
The Earth's crust is divided into large pieces called tectonic plates.
Where these plates meet are called plate boundaries — areas full of movement, earthquakes, and volcanoes.



Fun Fact:
The Philippines sits at the edges of several tectonic plates, which is why our country often experiences earthquakes and volcanic eruptions.

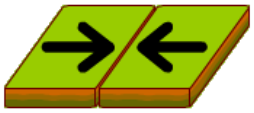
Checkpoint 2: The Three Types of Boundaries

1. Divergent Boundary

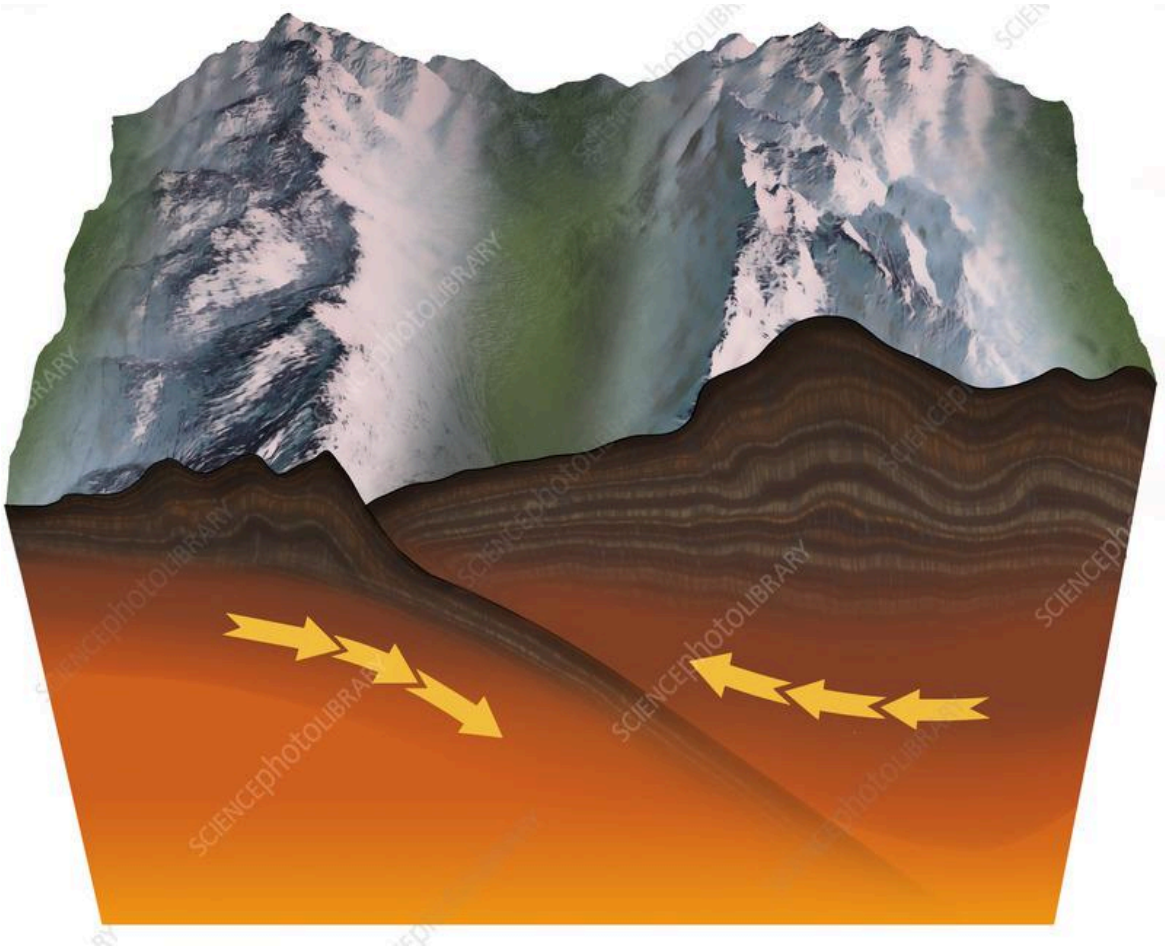


- **Plates move away from each other, allowing magma to rise and form a new crust.**
- This can be seen in mid-ocean ridges or rift valleys.
  Example: Mid-Atlantic Ridge (show picture)

2. Convergent Boundary



- **Plates collide or move toward each other, and one plate may sink beneath another (subduction).**
- **This causes volcanic arcs, deep ocean trenches, and strong earthquakes.**
  Example: Himalayas Mountain



3. Transform Boundary

- Plates slide past each other horizontally.
- No new crust is made or destroyed, but this movement causes many shallow earthquakes.
  Example: San Andreas Fault, USA

Check Out this Video and Learn More!

Plate Boundaries-Divergent-Convergent-Transform

Level 2 Mini Quiz: “Which Boundary Is It?”

Choose the correct answer for each:

1. Plates move apart → _____
   A. Convergent
   B. Transform
   C. Divergent
   Answer: C
2. Deep trenches form here → _____
   A. Divergent
   B. Convergent

C. Transform
Answer: B

3. Plates slide past each other → _____
   A. Convergent
   B. Transform
   C. Divergent
   Answer: B
4. New crust is formed → _____
   A. Convergent
   B. Divergent
   C. Transform
   Answer: B
5. The Philippines is mostly affected by → _____
   A. Convergent
   B. Divergent
   C. Transform
   Answer: A

Level Complete!
Great work, Explorer!
You've completed level 1!
Next level unlocked 🔓

LEVEL 3: Seafloor spreading

Mission Goal:
Discover how the new ocean floor is formed through the process of seafloor spreading.

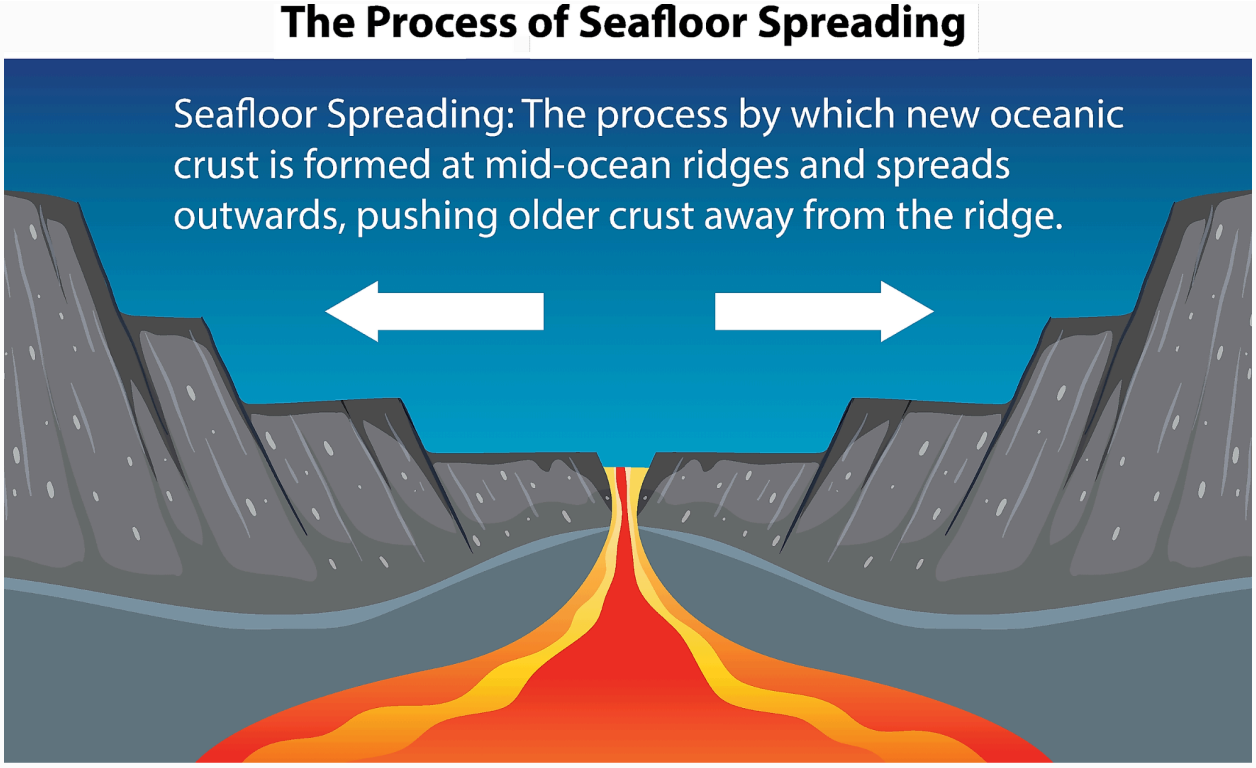
Objectives:
By the end of this level, you should be able to:

- Explain what seafloor spreading is and how it happens.
- Describe the role of mid-ocean ridges in forming new crust.
- Identify the evidence that supports seafloor spreading.
- Understand how this process helps shape Earth's surface over time.

Checkpoint 1: What is Seafloor Spreading?

Seafloor spreading is the **process where new oceanic crust is formed at mid-ocean ridges** and moves outward as magma rises from the mantle, cools, and solidifies. This process constantly creates new seafloor, pushing older crust away from the ridge and slowly moving the continents in the process.

This discovery provided strong evidence for the Theory of Plate Tectonics, helping scientists explain how continents drift and how the ocean floor is renewed over time.



Checkpoint 2: How New Crust is Formed

1. **Mid-Ocean Ridge**

- A long, underwater mountain range where magma rises through cracks in the ocean floor.
- Example: Mid-Atlantic Ridge — one of the best-known mid-ocean ridges on Earth.

2. **Magma and New Crust Formation**

- When magma reaches the surface at these ridges, it cools and solidifies to form new oceanic crust.

- Over time, this new crust pushes older crust away from the ridge, expanding the ocean floor.

3. **Seafloor Movement**

- As new crust continues to form, it slowly pushes older crust outward, causing the seafloor to spread on both sides of the ridge.
- **Older oceanic crust sinks into trenches and gets recycled.**

Checkpoint 3: Evidence of Seafloor Spreading

Scientists found several clues that support this theory:

- **Magnetic Striping** – Patterns of magnetic minerals on the ocean floor show symmetrical stripes on both sides of mid-ocean ridges, recording Earth's magnetic field reversals.
- **Age of Rocks** – Rocks near the ridge are younger, while those farther away are older — showing new crust forms at the ridge and spreads outward.
- **Sediment Thickness** – Sediments are thinner near the ridge and thicker farther away, indicating continuous formation and outward movement.
- **Subduction Zones** – In some places, old oceanic crust sinks back into the mantle, balancing the creation of new crust at ridges.

Fun Fact

The sea floor spreading happens very slowly, about the same speed as your fingernails grow.

Check Out these Videos and Learn More!

Sea Floor Spreading with Arrows
A clean visual animation showing how new crust forms and moves outward with annotated arrows.

Sea floor spreading by Hess - UPSC, IAS
See how hot magma rises, cools, and creates new crust that pushes older layers away — a process that supports the **Theory of Plate Tectonics**.

Level 3 Mini Quiz: "Ridge Builders!

Choose the correct answer for each:

1.) What happens when magma rises through cracks in the ocean floor?
A. It forms new oceanic crust after cooling
B. It creates earthquakes under the sea
C. It destroys the old crust completely
Answer: A

2.) What is the process called where new crust forms and spreads outward from the ridge?
A. Continental drift
B. Plate movement
C. Seafloor spreading
Answer: C

3.) What happens to old oceanic crust in subduction zones?
A. It stays in place near the ridge
B. It sinks back into the mantle and melts
C. It turns into magma near volcanoes
Answer: B

4.) What causes the sea floor to move and spread apart?
A. Ocean currents
B. New crust pushing outward
C. Wind pressure
Answer: B

5.) Which feature shows where old crust is destroyed?
A. Ocean ridge
B. Rift valley
C. Subduction zone
Answer: C

Level Complete!
Great work, Explorer!
You've completed level 1!
Next level unlocked 🔓

LEVEL 4: Earthquakes

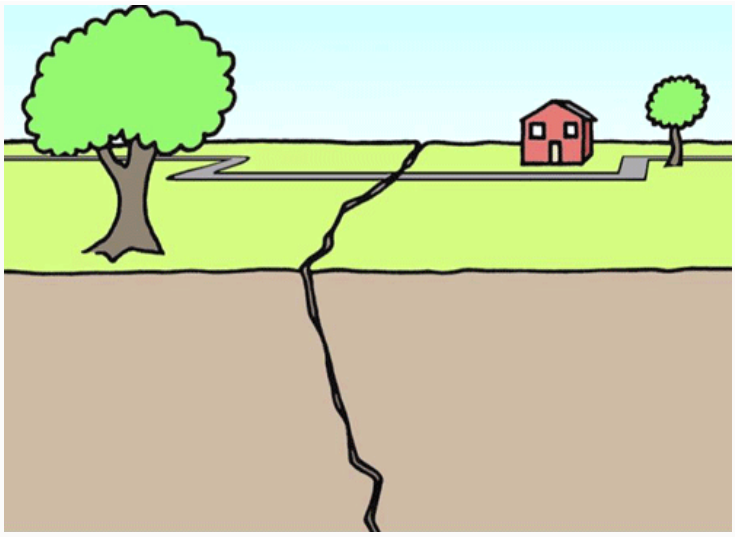
Mission Goal:
Discover how and why the ground shakes. Learn what happens deep inside the Earth when rocks suddenly move and release powerful energy.

Objectives:
By the end of this level, you should be able to:

- Explain what causes earthquakes.
- Identify the main parts of an earthquake.
- Describe how energy travels through the Earth during a quake.
- Recognize the effects of earthquakes on people and the environment.

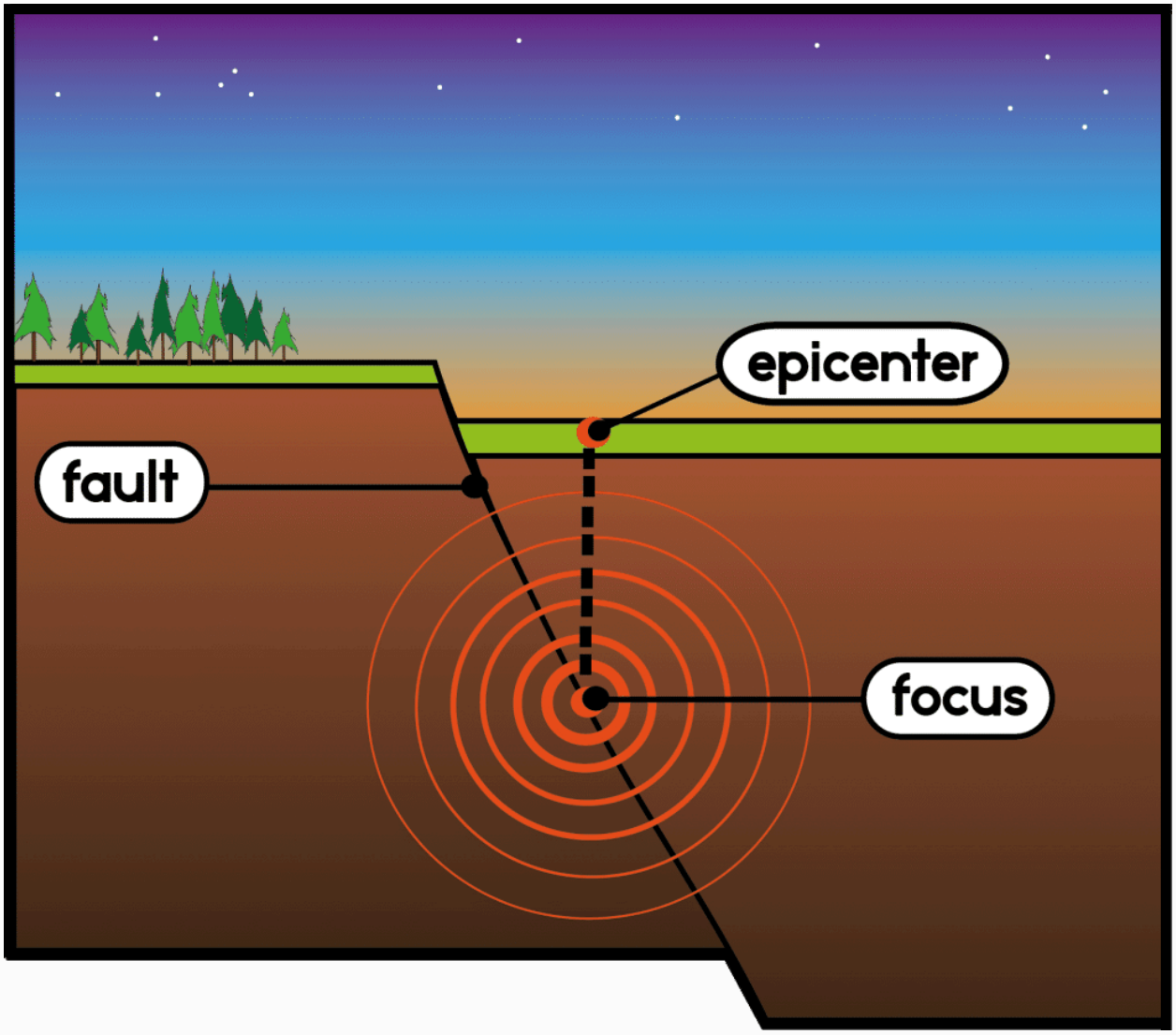
Checkpoint 1: What is an Earthquake?

An earthquake is the shaking of the ground caused by a sudden release of energy within the Earth's crust. This energy builds up when rocks along a fault get stuck and then suddenly break free, sending shock waves through the ground.



Fun Fact:
Every day, thousands of earthquakes happen around the world, but most are too weak to be felt!

Checkpoint 2: Parts of an Earthquake



1. Focus (or Hypocenter) – **The point inside the Earth where the earthquake starts.** It's the origin of the shaking.
2. Epicenter – **The point on the Earth's surface directly above the focus.** This is usually where the strongest shaking happens.
3. Fault Line – A crack in the Earth's crust where rocks move past each other.

Checkpoint 3: What Causes Earthquakes?

Earthquakes occur because tectonic plates are constantly moving.
These movements are caused by convection currents in the Earth's mantle — where hot rock rises, cools, and sinks again, pushing the plates above.

When plates:

- Collide – stress builds up until rocks break, creating strong quakes.

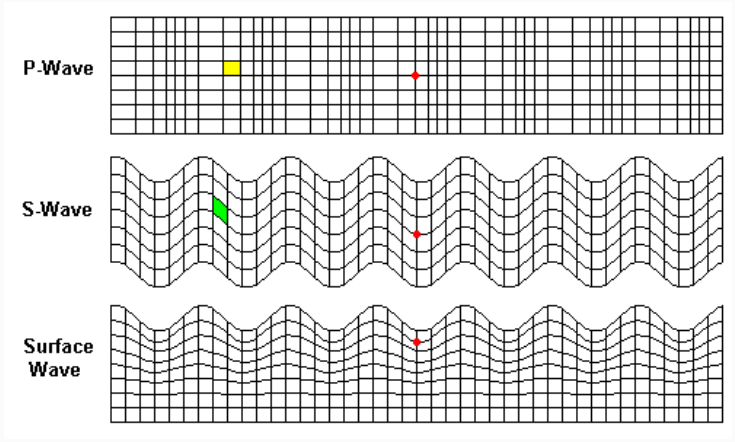
- Slide past each other – friction causes sudden slips, like along the San Andreas Fault.
- Pull apart – new crust forms and smaller quakes can occur.

Fun Fact:
The Philippines lies within the Pacific Ring of Fire, one of the most earthquake-prone regions on Earth!

Checkpoint 4: Seismic Waves and Their Effects

When rocks break, they send out seismic waves—**vibrations that travel through the Earth.**

There are three main kinds of waves:



- P-waves (Primary waves) – Move the fastest and are felt first. They push and pull the ground forward and backward.
- S-waves (Secondary waves) – Arrive after P-waves and move the ground side to side. They cause more damage.
- Surface waves – Travel along the Earth's surface and cause the most visible shaking and destruction.

These waves can make buildings sway, crack roads, trigger landslides, and even generate tsunamis if the quake happens under the ocean.

Keep in mind: Seismic waves suddenly changing speed and direction indicate that the Earth's layers differ in density and state of matter.

Fun Fact:
The strongest recorded earthquake in the Philippines was the 1990 Luzon Earthquake, with a magnitude of 7.8!

Check Out this Video and Learn More!

▶ What Is An Earthquake? | The Dr. Binocs Show | Educational Videos For Kids

Level 4 Mini Quiz: “Shake It or Break It!”

Choose the correct answer for each:

1. The point inside the Earth where an earthquake begins is called → _____
   A. Epicenter
   B. Fault line
   C. Focus (or Hypocenter)
   Answer: C
2. The point on the Earth’s surface directly above the focus is called → _____
   A. Crust
   B. Fault
   C. Epicenter
   Answer: C
3. The vibrations that travel through the Earth during an earthquake are called → _____
   A. Sound waves
   B. Seismic waves
   C. Shock lines
   Answer: B
4. What causes tectonic plates to move and create earthquakes?
   A. Winds and ocean currents
   B. Convection currents in the mantle
   C. Earth’s rotation
   Answer: B
5. When two plates slide past each other, the sudden release of stress causes → _____
   A. Mountain formation
   B. Earthquakes
   C. Volcanic eruptions
   Answer: B

Level Complete!
Great work, Explorer!
You’ve completed level 1!
Next level unlocked 🔓

LEVEL 5: Volcanic Eruption

Mission Goal:

To explore how volcanoes form, shape the Earth's surface over time, and understand their impacts on people and the environment.

Objectives:

By the end of this level, you should be able to:

- Know more about volcanic formation.
- Explain how volcanoes result in landforms.
- Differentiate the four main types of volcanoes.

Checkpoint 1: What is Volcanic Formation?

Volcanoes form when magma rises to the Earth's surface, a process driven primarily by the movement of tectonic plates. Magma collects in a magma chamber, and when pressure builds, it erupts through cracks in the crust. Over time, repeated eruptions of lava and ash build up layers, forming the cone or mountain structure of the volcano.

Checkpoint 2: How Do Volcanoes Result in Landforms?

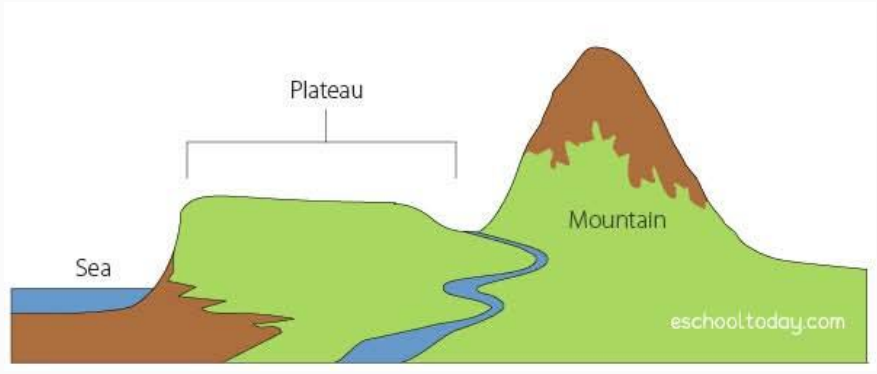
Landforms formed from the volcanic activity will depend on the kind of volcano it is or the material produced.

• Craters and Calderas

- These are circular depressions that collect rainwater or snowmelt and are created by very explosive and gaseous eruptions. They are formed by a collapse of a volcanic structure. Craters are smaller in size (less than 1km in diameter), and Calderas are larger (between 1km–50km).

• Plateau

- This is an elevated portion of the land with a flat surface. It often has steep slopes or cliffs at one or more sides. It is nicknamed tableland because it looks like a table. They are very common and believed to cover a third of the total land area of planet earth.



Checkpoint 3: Types of Volcanoes

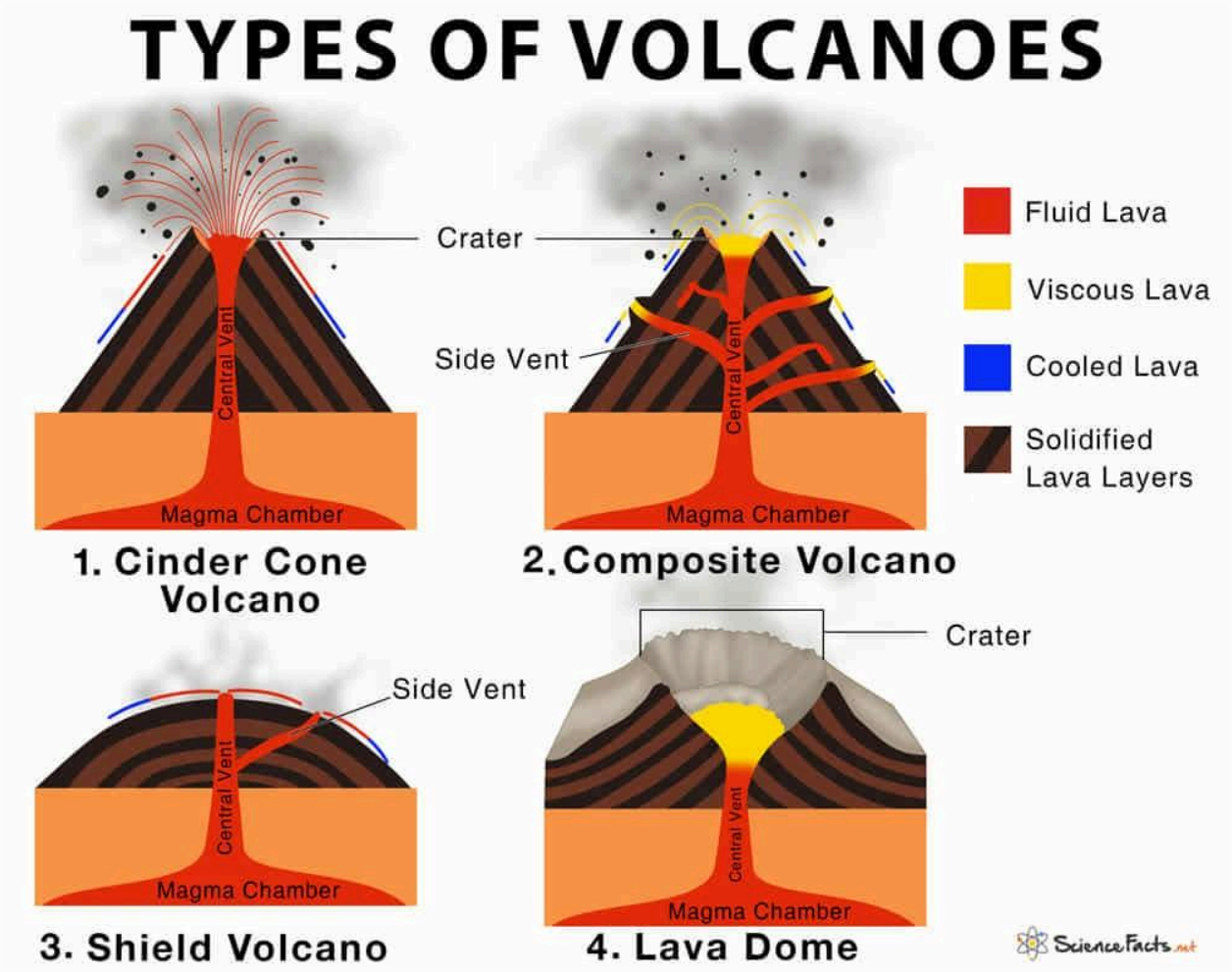
Checkpoint #3: TYPES OF VOLCANOES

1. **Shield Volcano**
- Broad, **gently sloped mountains** with a "shield" shape, formed by effusive eruptions of low-viscosity (fluid) lava that flows great distances. Examples include the Hawaiian Islands.

2. **Composite Volcano**
- Steep, conical mountains built from alternating layers of hardened lava flows, volcanic ash, and cinders. They are often the most explosive type due to viscous lava. Also known as stratovolcanoes, they can rise very high, like Mount Fuji and Mt. Mayon.

3. **Cinder Cone**
- Smaller, cone-shaped volcanoes made from a single vent that erupts with gas-charged lava. The explosions blast lava into the air, which breaks into small fragments that cool and harden into cinders and fall around the vent. They are often the smallest type of volcano and may erupt only once.

4. **Lava Dome**
- Rounded, steep-sided mounds formed by very viscous lava that is too thick to flow far from the vent. The lava piles up around the vent, creating a dome shape.



Fun Facts

• **The hot, melted rock found beneath the Earth's surface is called magma.**

• **The Pacific Ocean is surrounded by many volcanoes in a region called the Ring of Fire.**

• **Lava is actually magma that has reached the Earth's surface,** it flows out during eruptions and can create new land as it cools.

Check Out this Video and Learn More!

▶ What Are Volcanoes and How Are They Formed?

Level 5 Mini Quiz: "Molten Mayhem!"

1.Which type of volcano is steep, tall, and often produces explosive eruptions?

A. Shield Volcano

B. Cinder Cone

C. Dome Volcano

Answer: B

2. The area around the Pacific Ocean where many volcanoes are found is called the _____.
A. Circle of Magma
B. Fire Belt
C. Ring of Fire
Answer: C

3. What do you call the opening at the top of a volcano where lava and gases escape?
A. Crater
B. Mantle
C. Fault
Answer: A

4. What type of volcano has a broad base and gentle slopes, often producing quiet eruptions?
A. Cinder Cone
B. Composite Volcano
C. Shield Volcano
Answer: C

5. What happens when pressure builds up inside a volcano?
A. The volcano cools down
B. An eruption occurs
C. The lava hardens inside
Answer: B

Level Complete!
Great work, Explorer!
You've completed level 1!
Next level unlocked 🔓

LEVEL 6: Tectonic plate movements and their effects

Mission Goal:
Understand how tectonic plate movements shape Earth's surface and cause natural events around the world.

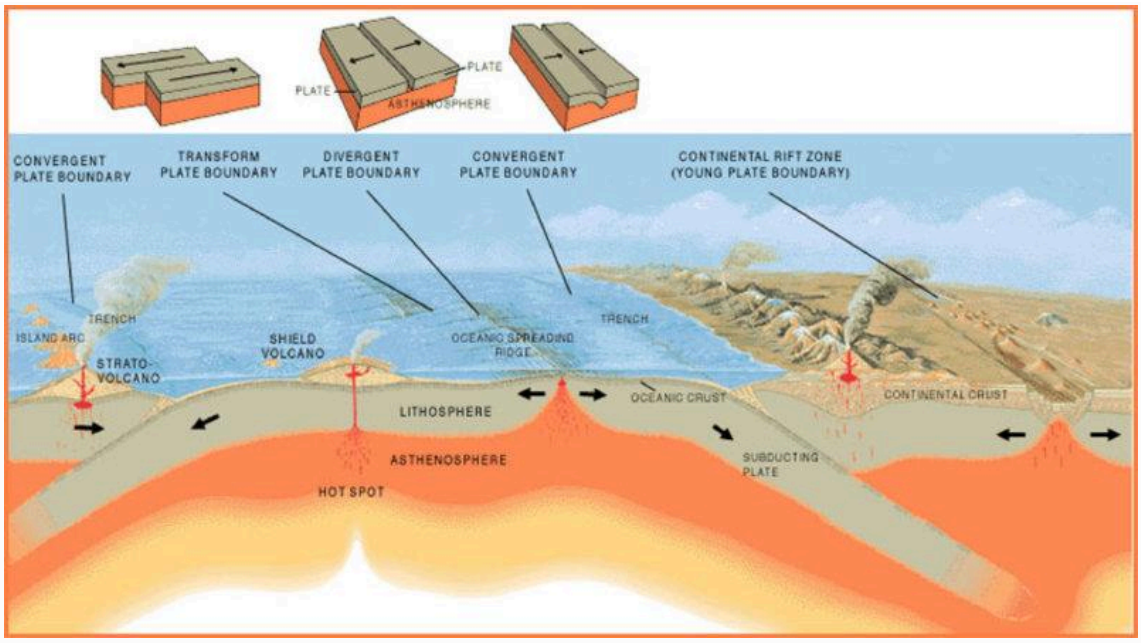
Objectives:
By the end of this level, you should be able to:

- Explain how tectonic plates move and interact with each other.
- Identify the effects of plate movements such as earthquakes, volcanoes, and mountain formation.
- Describe how different plate boundaries lead to various landforms and geological events.
- Recognize the importance of tectonic activity in changing Earth's surface over time.

Checkpoint 1: What are Tectonic Movements?

The Earth's outer layer, called the lithosphere, is broken into large pieces known as tectonic plates. These plates slowly move on top of the soft, flowing asthenosphere below.

Millions of years ago, all continents were joined together as Pangaea, but as plates moved apart, they formed the continents we see today. When plates collide, slide, or separate, they create powerful natural events like earthquakes and volcanic eruptions.



Checkpoint 2: Effects of Tectonic Plate Movements

- **Earthquakes:** Sudden release of energy caused by plate movement. Most earthquakes occur near plate boundaries.
- **Volcanoes:** Formed when magma escapes through cracks caused by moving plates.
- **Mountain Formation:** Colliding plates push the crust upward, forming ranges like the Himalayas.

- **Ocean Trenches:** Created when one plate is forced beneath another during subduction.
- **Islands and Ridges:** Underwater volcanic activity can create islands (like the Philippines) or ridges on the seafloor.
- **Tsunamis:** Underwater earthquakes caused by plate shifts can create large ocean waves.
- **Continental Drift:** Over millions of years, plates' movement causes continents to drift and change positions.

Fun Fact

Mount Everest keeps getting taller because the Indian Plate is pushing into the Eurasian Plate, the Himalayas rise a little bit higher every year.

Check Out these Videos and Learn More!

Plate Tectonics Explained | Plate Boundaries | Convection Currents
See how convection currents deep in the mantle drive the movement of tectonic plates, creating divergent, convergent, and transform boundaries that shape Earth's surface.

Animated Maps: Tectonic Plate Movement
Watch how Earth's continents slowly move, collide, and separate, forming mountains, oceans, and valleys over time.

Level 6 Mini Quiz: "Plate Power!"

1.) What supercontinent existed millions of years ago?
A. Gondwana
B. Eurasia
C. Pangaea
Answer: C

2.) How fast do tectonic plates move?
A. About the speed of a cheetah
B. About the speed of a snail
C. About the speed of toenail growth
Answer: C

3.) What natural event often occurs when tectonic plates suddenly shift along a fault line?
A. Volcano formation
B. Earthquake

C. Mountain building
Answer: B

4.) What is the result when two continental plates push against each other over a long period?
A. Volcano eruption
B. Ocean trench
C. Mountain range formation
Answer: C

5.) What can form when one tectonic plate is forced beneath another in a subduction zone?
A. Deep ocean trench
B. Rift valley
C. Plateau
Answer: A

Level Complete!
Great work, Explorer!
You've completed level 1!
Next level unlocked 🔓

Oops! Try Again.

Level Not Complete

Review the lesson and give the quiz another shot. You can do it!

You've reached the finish line! 🏁

Your journey through the structure of the Earth, plate boundaries, seafloor spreading, earthquakes, volcanoes, and plate movements is complete.

You're officially a tectonics expert!

Congratulations!