

GRADE 6 EARTH SCIENCE

Earth's Dynamic Interior

Revision Booklet

Read through this booklet to review the key ideas.

Then test yourself with the online review at: learnlattice.org/students/exam-revision

Name:

Class:

Date:

MYP Key Concept: Change

Global Context: Orientation in Space and Time

Section 1: Earth's Layers

Earth is not a solid ball of rock all the way through. It is made up of **four main layers**, each with different properties. The deeper you go, the hotter it gets.

The Four Layers

Layer	Thickness	State	Temperature	Made Of
Crust	5–70 km	Solid	Cool	Rock (granite + basalt)
Mantle	~2,900 km	Solid (flows slowly)	Hot	Silicate rock
Outer Core	~2,200 km	Liquid	Very hot	Iron and nickel
Inner Core	~1,200 km radius	Solid	~5,000°C	Iron and nickel

Important Details About Each Layer

Crust — The thin outer shell we live on. There are two types: **oceanic crust** (thin, 5–10 km, denser) and **continental crust** (thick, 30–70 km, less dense). This density difference matters for plate tectonics.

Mantle — By far the thickest layer (about 84% of Earth's volume). It is **solid rock**, but over millions of years it can flow very slowly — like extremely thick honey being heated. This slow flow is what drives plate tectonics.

Outer Core — The only **liquid** layer. Made of iron and nickel. Its swirling movement creates Earth's **magnetic field**, which protects us from harmful radiation from the Sun.

Inner Core — The hottest part of Earth (over 5,000°C), yet it is **solid**. The enormous **pressure** from all the layers above squeezes the iron and nickel so tightly that it cannot melt, even at extreme temperatures.

Common Misconception

Many students think the mantle is liquid because it flows. It is actually **SOLID** rock that moves incredibly slowly over geological time. Think of it like very thick toffee — solid, but it can gradually ooze if you wait long enough.

Key Terms

Key Term	Definition
Crust	Thin outer layer of Earth (5–70 km); we live on it
Mantle	Thickest layer (~2,900 km); solid rock that flows very slowly
Outer core	Liquid layer of iron and nickel; creates Earth's magnetic field
Inner core	Solid ball of iron and nickel at Earth's centre; kept solid by extreme pressure
Oceanic crust	Thin (5–10 km) and dense; found under the oceans

Continental crust	Thick (30–70 km) and less dense; makes up the continents
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Section 2: Convection Currents

Convection currents in the mantle are the **engine** that drives plate tectonics. They explain how and why tectonic plates move.

What Is a Convection Current?

A convection current is a **circular flow** of material caused by heating from below. The same process happens when you heat soup in a pot:

1. **Hot material near the heat source rises** because it expands and becomes less dense.
2. **It reaches the top and spreads sideways** because it cannot rise any further.
3. **It cools down** as it moves away from the heat source and becomes denser.
4. **The cooler, denser material sinks** back down toward the heat source.
5. **The cycle repeats** continuously as long as there is a heat source.

Convection in the Mantle

In Earth's mantle, the same process happens on an enormous scale:

- The **heat source** is Earth's core (radioactive decay and leftover heat from Earth's formation).
- Hot rock near the core **rises slowly** through the mantle because it becomes less dense.
- When it reaches the top of the mantle (just below the crust), it **spreads sideways**. This sideways movement **drags the tectonic plates** along with it.
- The rock then **cools**, becomes denser, and **sinks back down** toward the core.
- This creates a continuous loop that moves plates at about **2–10 cm per year** — roughly as fast as your fingernails grow.

The Key Idea

Convection currents are the **MECHANISM** that moves tectonic plates. Without them, plates would not move, and we would have no earthquakes, volcanoes, or mountains.

Key Terms

Key Term	Definition
Convection current	A circular flow caused by heating: hot material rises, cools, sinks, repeats
Density	How much matter is packed into a space. Hot rock is less dense and rises

Radioactive decay	The main heat source inside Earth that drives convection in the mantle
Mechanism	The explanation of HOW something happens (not just that it happens)

Section 3: Plate Tectonics and Boundaries

Earth's outer shell is broken into large pieces called **tectonic plates**. These plates float on the mantle and move slowly due to convection currents. Where plates meet, we call it a **plate boundary**.

Three Types of Plate Boundary

Boundary	Movement	What Happens	Example
Divergent	Plates move apart	Magma rises to fill gap; new crust forms	Mid-Atlantic Ridge
Convergent	Plates push together	One plate subducts (sinks under); mountains form	Andes Mountains
Transform	Plates slide past each other	Friction builds stress; earthquakes occur	San Andreas Fault

Divergent Boundaries

At a divergent boundary, plates **pull apart**. Magma from the mantle rises to fill the gap, creating new oceanic crust. This is called **sea-floor spreading**. The best example is the **Mid-Atlantic Ridge**, an underwater mountain chain running down the middle of the Atlantic Ocean.

Convergent Boundaries

At a convergent boundary, plates **push together**. What happens depends on what type of crust is involved:

- **Oceanic + Continental:** The denser oceanic plate sinks under the continental plate (**subduction**). This creates deep ocean trenches and volcanic mountain chains (e.g. the Andes).
- **Continental + Continental:** Neither plate subducts because both are too buoyant. Instead, the crust crumples upward, forming **fold mountains** (e.g. the Himalayas).

Transform Boundaries

At a transform boundary, plates **slide past each other sideways**. The friction between them builds up stress over time, then releases suddenly as an **earthquake**. The most famous example is the **San Andreas Fault** in California.

Key Terms

Key Term	Definition
Tectonic plate	A large slab of Earth's crust and upper mantle

Plate boundary	The place where two tectonic plates meet
Divergent	Plates move apart; new crust forms (e.g. mid-ocean ridge)
Convergent	Plates push together; subduction, mountains, or trenches form
Transform	Plates slide past each other sideways; causes earthquakes
Subduction	Denser oceanic plate sinks beneath a less dense plate
Mid-ocean ridge	Underwater mountain chain formed at a divergent boundary
Sea-floor spreading	New oceanic crust forms as magma fills the gap at a divergent boundary

Section 4: Continental Drift

In 1912, a German scientist named **Alfred Wegener** proposed a bold idea: all of today's continents were once joined together in a single supercontinent he called **Pangaea** (meaning "all lands" in Greek).

Wegener suggested that Pangaea broke apart around 200 million years ago and the pieces slowly drifted to their current positions. He called this idea **continental drift**.

Wegener's Evidence

Type of Evidence	What It Shows
Fossil evidence	The same fossils of land animals (like Mesosaurus) found on continents separated by wide oceans. These animals could not swim across, so the land must have been joined.
Rock evidence	Matching rock types and mountain chains line up when continents are pushed together.
Shape evidence	The coastlines of South America and Africa fit together like jigsaw puzzle pieces.
Climate evidence	Fossils of tropical plants found in cold places (like Antarctica), and glacial scratches found in places that are now tropical.

Why Was Wegener's Theory Rejected?

Even though Wegener had strong evidence **that** continents had moved, he could not explain **how** they moved. He could not describe the mechanism — the force that could push entire continents across the Earth's surface. Without a mechanism, most scientists rejected his idea during his lifetime.

It was not until the **1960s** that scientists discovered **sea-floor spreading** and **convection currents** in the mantle. These provided the missing mechanism and confirmed Wegener's theory.

How Science Works

Wegener's story shows that in science, having good evidence is not always enough. Scientists also need a convincing mechanism (an explanation of HOW something happens). It took 50 years for technology to catch up and provide the evidence Wegener needed.

Section 5: Putting It All Together

Everything you have learned in this unit connects through one big idea: what happens **deep inside** Earth directly causes what we experience on the **surface**.

The Cause-Effect Chain

1. Radioactive decay and residual heat keep Earth's core extremely hot.
2. This heat causes convection currents in the mantle — hot rock rises, cool rock sinks.
3. The sideways movement of convection currents drags tectonic plates slowly across Earth's surface.
4. Where plates meet (boundaries), they either pull apart, push together, or slide past each other.
5. This produces the features we see: earthquakes, volcanoes, mountains, ocean trenches, and mid-ocean ridges.

Boundary Type → Surface Features

Boundary	What Happens Below	What We See
Divergent	Plates pull apart; magma rises to fill the gap	Mid-ocean ridges, rift valleys, volcanic islands (e.g. Iceland)
Convergent (ocean + continent)	Denser oceanic plate subducts; melts and rises as magma	Volcanoes, deep ocean trenches, earthquakes (e.g. Andes)
Convergent (continent + continent)	Neither plate subducts; both crumple upward	Fold mountains (e.g. Himalayas), earthquakes
Transform	Plates grind sideways past each other; friction builds stress	Earthquakes (e.g. San Andreas Fault)

The Key Concept: Change

Everything in this unit connects through the concept of CHANGE. Heat changes rock behaviour. Convection changes plate positions. Plate movement changes the surface. Earth is a dynamic, constantly changing system — most of this change is incredibly slow but relentless. The Earth you stand on today is not the same Earth that existed 200 million years ago.

Revision Checklist

Before your assessment, make sure you can:

- Name and describe the four layers of the Earth
- Explain the difference between oceanic and continental crust
- Describe how convection currents work in the mantle
- Explain how convection currents move tectonic plates
- Describe what happens at divergent, convergent, and transform boundaries
- Explain subduction and why it happens
- Describe Wegener's evidence for continental drift
- Explain why Wegener's theory was rejected and what changed in the 1960s
- Trace the cause-effect chain from Earth's core to surface features
- Draw and label a force diagram for convection currents

Ready to test yourself?

Complete the interactive online review at: learnlattice.org/students/exam-revision