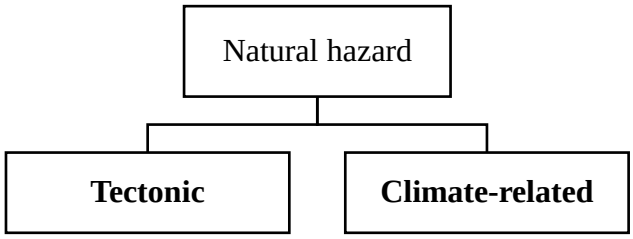
Chp 1 Gateway 1 – Why are Some Areas More Prone to Tectonic Hazards?

Main points:

- Types of natural hazards
- Internal structure of the earth
- Tectonic plates and why they move
- Different types of plate boundaries

Natural hazards



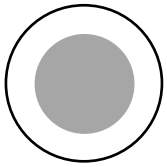
Natural hazard: naturally occurring event that threatens human lives + damages property

Types	Caused by	Examples	Occurrence
1. **Tectonic**	Plate movements (continental crusts, ocean floors move)	(a) Earthquakes (b) Volcanic eruptions	Concentrated – coastlines of Pacific Ocean
2. **Climate-related**	Severe, extreme weather and climate conditions	(a) Storms (b) Floods (c) Droughts (d) Tropical cyclones	Widely distributed

Internal structure of the earth

Structure

1. **crust** (oceanic crust + continental crust)
2. **mantle** (upper mantle + lower mantle)
3. **core** (inner core + outer core)



Layers	Composition	Characteristics	Thickness (km)	Temperature (°C)
1. **Crust**	1) Basalt rock 2) Granite rock	• Types 1) **Oceanic crust**: beneath oceans 2) **Continental crust**: beneath continents • **Magma**: rock in lithosphere melt → hot molten rock	70	
2. **Mantle**	Solid rock (high temp. + pressure)	• Most of earth's total volume • 2 layers 1) Upper mantle 2) Lower mantle	2900	800 | 3000

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Lithosphere

Outer part of mantle +
Overlying crust

Asthenosphere

High temperature + pressure
Rocks close to melting point
→ easily deformed

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<td>3. Core</td>
<td>1) Iron
2) Nickel</td>
<td>Divided into
<table>
<tr><td>Layer</td><td>State</td></tr>
<tr><td>Inner</td><td>Solid (extreme pressure)</td></tr>
<tr><td>Outer</td><td>Liquid</td></tr>
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<td>3500</td>
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Tectonic plates and plate boundaries

Tectonic plates

Crust: broken into tectonic plates

- Move in relation to one another
- Part of lithosphere
- Made up of:
  1. Oceanic crust
  2. Continental crust
  3. Combination

Differences

Crust	Location	Thickness (km)	Rock	
			Type	Age
1. **Oceanic**	Beneath deep oceans	5 | 8	Basalt (mainly) • Heavy, dense rock • Formed from magma, cool quickly	200 million
2. **Continental**	• Beneath continental land masses • Under shallow seas, close to continents	35 | 70	Light rock (granite)	Wide range

Why tectonic plates move

Plate movement caused by:

1. **Convection currents**
2. **Slab-pull force work**

Process

1. Plates move when core heats up magma
2. Heated magma expands and rises
3. Spreads out below plates → plates diverge
4. Cools and sinks → plates converge
5. **Subduction**
    - **Slab-pull force** occurs
    - Dense, sinking oceanic plate at subduction zones → pull rest of the plate behind it
    - Main driving mechanism for plate movement
6. Magma heated by high temperature in mantle, rises
7. **Convection currents**: continuous heating and cooling of magma

Continental drift theory (Alfred Wegener)

- Earth's crust floating on denser rock moved
- Supercontinent breaks up

Different types of plate boundaries

Important plates to remember

1. **North American** Plate
2. **South American** Plate
3. **Eurasian** Plate
4. **Indian** Plate
5. **African** Plate
6. **Nazca** Plate
7. **Pacific** Plate
8. **Philippine** Plate
9. **Australian** Plate

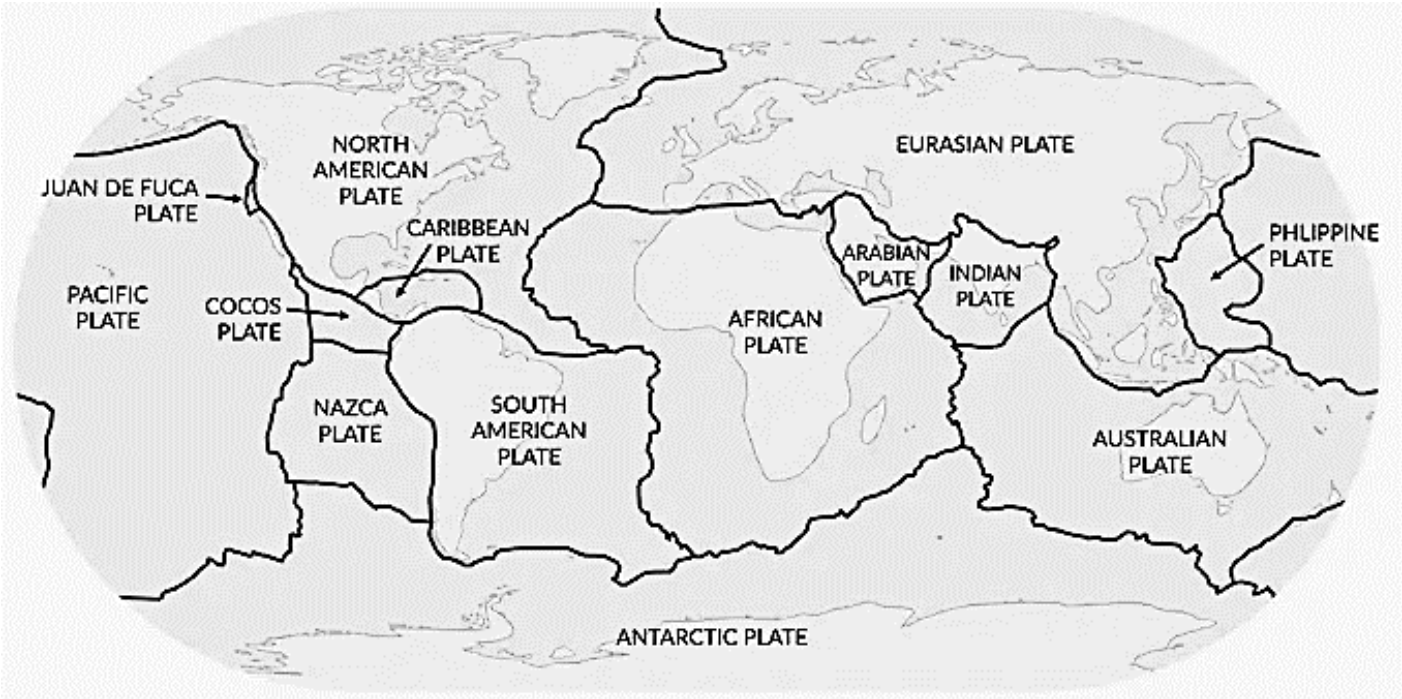
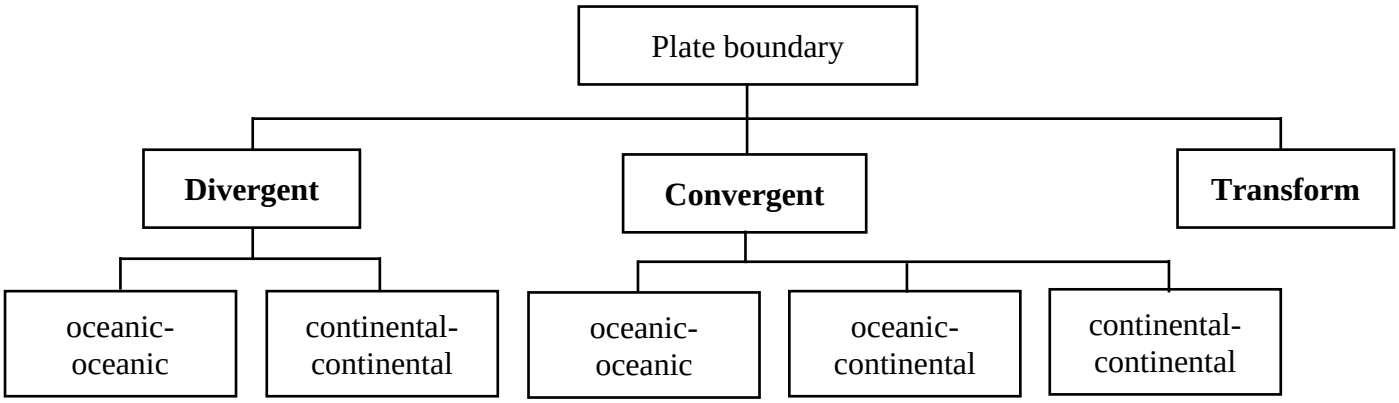


Plate boundaries

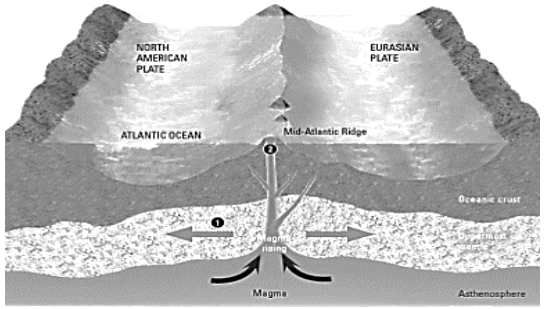
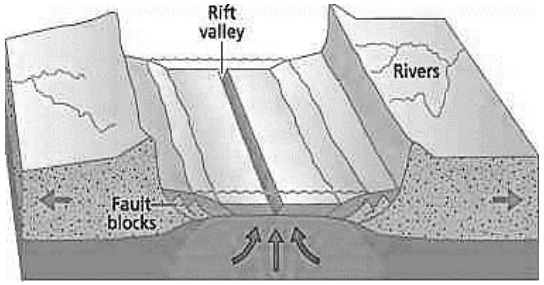
Category	Movement of plates
1. **Divergent** (constructive)	Move **away** from each other
2. **Convergent** (destructive)	Move **towards** each other
3. **Transform** (conservative)	Move **past** each other



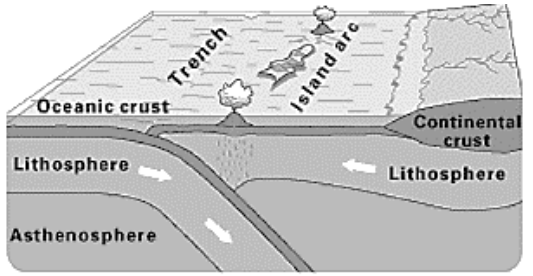
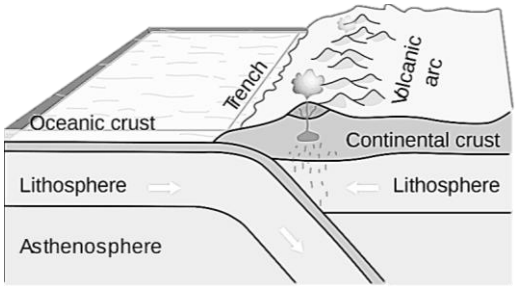
Landforms at various plate boundaries

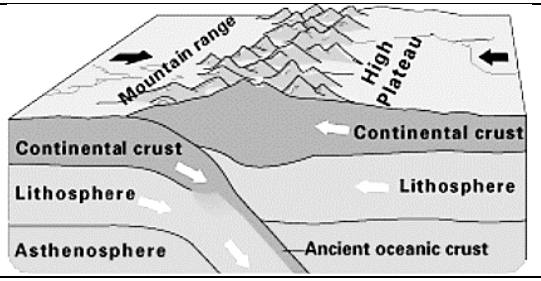
Plate boundary	Result	Example	Tectonic plates
Divergent: oceanic-oceanic	• Sea floor spreading • **Mid-oceanic ridge** • **Undersea volcanoes** • **Volcanic islands** • Earthquake	Mid-Atlantic Ridge	North American Plate Eurasian Plate
Divergent: continental-continental	• **Rift valleys** • **Block mountains** • Earthquake	East African Rift Valley	African Plate (Nubian) African Plate (Somalian)
Convergent: oceanic-oceanic	• **Oceanic trench** • Subduction • **Volcanoes** • **Arc of islands** • Earthquake	Mariana Trench Mariana Islands	Pacific Plate Philippine Plate
Convergent: oceanic-continental	• **Oceanic trench** • Faulting • Subduction • **Volcanoes** • Folding • **Fold mountains**	Himalayas	Indian Plate Eurasian Plate
Convergent: continental-continental	• **Fold mountains** • Folding • Earthquake	Sunda Trench	Australian Plate Eurasian Plate
Transform	• Faulting • **Earthquake**	San Andreas Fault	Pacific Plate North American Plate
		North Anatolian Fault	Eurasian Plate Anatolian Plate

Divergent plate boundaries

Divergence	Process	Examples
Oceanic-oceanic	1. **Sea floor spreading** • Fractures: plate boundary • Magma rise: at zone of divergence → new sea floor • Lava flows out onto sea floor → cool, solidify 2. **Mid-oceanic ridge** • More magma pile, solidify • Chain of mountains on side of spreading zone 3. New mountains formed • Plates move apart, mountains move away from spreading zone • Youngest: nearest to spreading zone Oldest: furthest from spreading zone 4. **Undersea volcanoes** • Points along mid-oceanic ridge • Magma build up, solidify 5. **Volcanic islands**: volcanoes grow above sea level	North American Plate & Eurasian Plate → Mid-Atlantic Ridge 
Continental-continental	1. Faulting • Tensional forces → fractures stretched • Fault: fracture in rocks when rocks are displaced 2. **Rift valley**: valley with steep sides • Sections of crust extend along fault lines • Central block of land: subside between pair of parallel faults → linear depression • Along the valley: 1) Volcanoes 2) Earthquakes 3. **Block mountain**: steep slopes higher than surrounding land • Tensional forces → land surrounding block of land subside • Formed between pair of parallel faults	African Plate – Nubia & Somalia boundary → East African Rift Valley 

Convergent plate boundaries

Convergence	Process	Examples
Oceanic-oceanic	1. **Subduction** zone: dense plate subduct under less dense 2. **Oceanic trench**: long narrow depression in sea floor → formed at subduction zone 3. Magma: mantle material above subducted plate → melt 4. **Volcanoes**: magma rise through fractures 5. **Arc of islands**: few volcanoes 6. Friction → **earthquake** (subduction process)	Pacific plate & Philippine Plate 1) Mariana Trench 2) Mariana Islands (chain of volcanic islands) 
Oceanic-continental	1. Subduction … 2. Oceanic trench … 3. Magma … 4. Volcanoes … 5. **Fold mountains**: continental plate buckle & fold 6. Earthquake (continental)	Australian Plate & Eurasian Plate 1) Sunda Trench 2) Barisan Mountains (fold mountains) Nazca Plate & South American Plate 1) Peru-Chile Trench 2) Andes Mountains (fold mountains) 
Continental-continental	1. Plates: too thick & buoyant (no subduction) 2. **Folding** • Plates break, slide along fractures in crust • Layers of rock (upper part of crust) compressed • Compressional force → immense pressure	Indian plate & Eurasian Plate 1) Himalayas (Mt. Everest & K2) 2) Nepal Earthquake

	→ layers of rock: buckle & fold 3. **Fold mountains**: layers fold upwards / sideways 4. **Earthquakes** 5. Folded rock layer: 1) <u>Anticline</u>: upfold 2) <u>Syncline</u>: downfold	

Transform plate boundaries

Plate	Process	Examples
Transform	1. Transform **fault**: plates slide past each other 2. Stress: build up along plate boundaries • Friction between moving plates • Energy stored up in crust 3. Energy released • Rocks: no longer contain pressure • Radiates out in shock waves (crust → surface) 4. **Earthquake**: large fault → rocks break up, sudden jerks	Pacific Plate & North American Plate → San Andreas Fault Eurasian Plate & Anatolian Plate → North Anatolian Fault