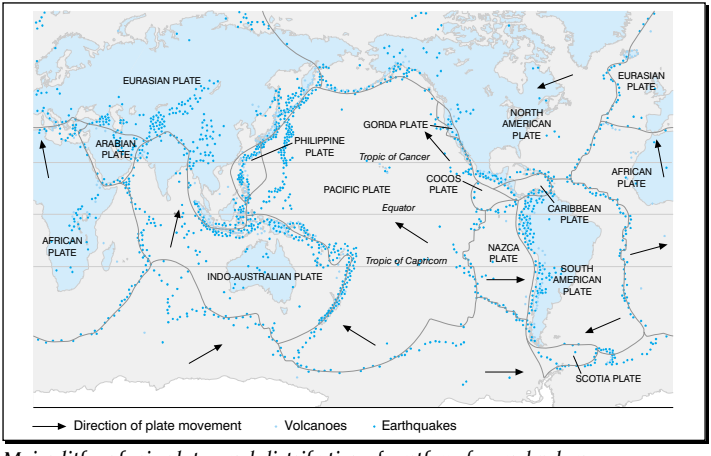
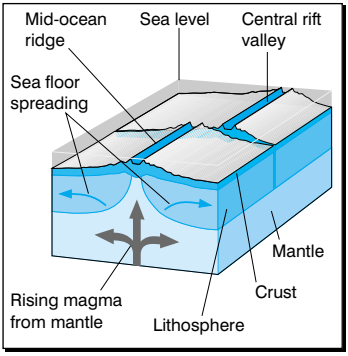
Earthquakes

- Both earthquakes and volcanoes can be explained by the theory of **plate tectonics**. The earth's crust consists of a series of plates. There are seven main plates and many smaller ones. Some plates consist of **continental crust** others are made of largely **oceanic crust**.
- **Convectional activity** causes the plates to move. The edges of plates are called **plate margins**. There are three types of plate margins. At a **destructive** boundary the plates move together, but at a **constructive** boundary the plates move apart. At a **conservative** boundary the plates move side by side.

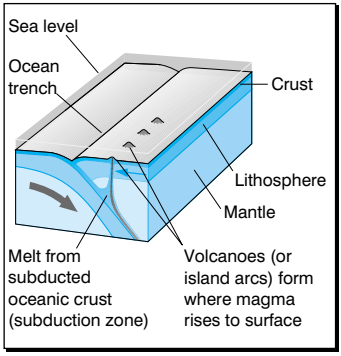


Major lithospheric plates and distribution of earthquakes and volcanoes

- At a constructive boundary molten rock or **magma** rises to the surface forming new crust. This forces the existing crust apart causing **sea floor spreading**. This causes **continental drift**. At destructive margins one plate is forced under another into the **subduction zone**.



Constructive plate margin (mid-ocean ridge)



Destructive plate margin (subduction zone)

- **Seismic** waves, as a result of plate movement, cause **earthquakes**. The **focus** of an earthquake is a **fault** deep in the earth's crust. The shock waves move out from the focus and reach the earth's surface at the **epicentre**. Most earthquakes occur along plate margins.
- The effect of an earthquake can be measured on the **Richter** or **Mercalli** scales. The Richter scale measures the strength on a scale of 1–10. An earthquake measuring 7 on the Richter scale is 100 times stronger than one measuring 5. The Mercalli scale measures the physical effects of an earthquake on a scale of 1–12.
- LEDCs suffer the greatest loss of life from earthquakes. This is because buildings are not as strong and emergency services are not as efficient. The economic cost of earthquakes can be greater in MEDCs as the economic life of a MEDC suffers greater disruption.
- There have been many attempts to reduce the effects of earthquakes. More accurate forecasting of earthquakes allows earlier evacuation. Use of cross bracing and installing rubber shock absorbers in foundations make buildings more resistant to shock.

Volcanoes

- **Volcanoes** occur where there is a weakness in the earth's crust. This allows magma to move to the surface where it forms **lava**. An **active** volcano is one that has erupted in living memory. A **dormant** volcano is one that last erupted in historical times. It can never be assumed that a volcano is **extinct**.
- Mount Pinatubo in the Phillipines erupted violently in 1991 having been dormant for 600 years.
- Magma can also bubble up to the earth's surface through **fissures** or cracks, which eventually forms **lava plateaux**.

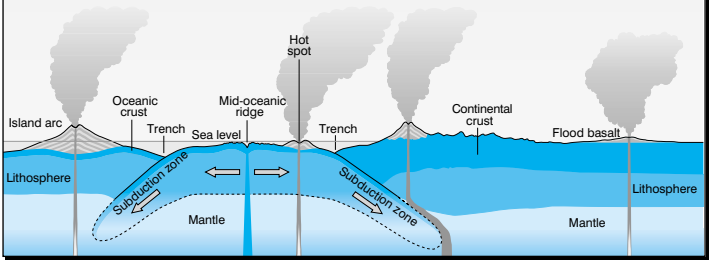
Island arcs (e.g. Aleutian Islands) Where two oceanic plates converge (e.g. western Pacific). One plate is pushed downwards (subducted) into the mantle. As the subducted plate melts, magma rises to the surface forming numerous volcanoes or island arcs.

Mid-oceanic ridges (e.g. Iceland) Tension in the crust leads to deep rifts. Magma rises up to the ocean floor along these rifts, forming new crust. The ridges form a continuous line of submarine volcanoes. In places the volcanoes rise above sea level.

Hot spot volcanoes Rising plumes of magma reach the surface in the centres of plates, e.g. Hawaii.

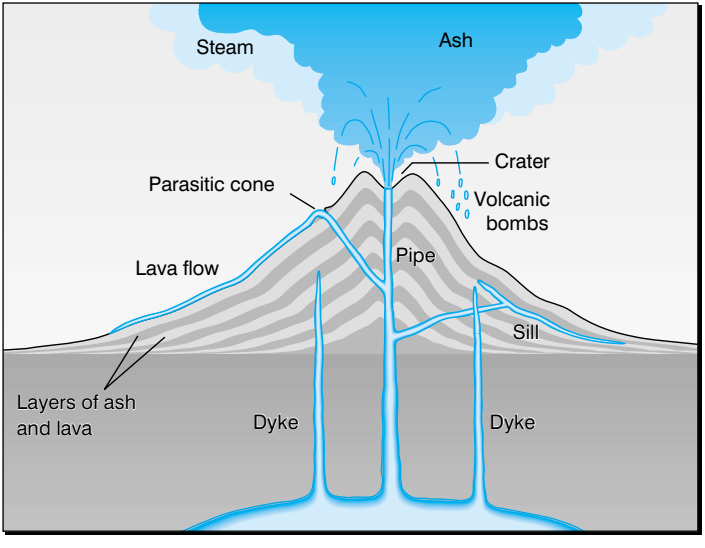
Continental-oceanic plate margins. Here the oceanic plate is subducted beneath the thicker continental plate. As it melts some of the lighter oceanic plate magma forces its way to the surface, forming volcanoes, e.g. Andean volcanoes.

Flood basalts Magma reaches surface through great cracks or fissures in crust (caused by tension) allowing vast amounts of magma to reach the surface. These eruptions build-up great thicknesses of lava, known as flood basalts.



Earthquakes and Volcanoes (4)

- The build up of material from a series of eruptions forms a volcanic cone. The shape of the cone depends on the type of material and the chemical composition of the lava. Viscous lava forms a steep sided cone. Thin, **non-viscous** lava produces a low-angle, **shield** volcano. Many cones are **composite** as they consist of layers of ash and lava.



- Other volcanic hazards include **nueés ardents,** which are superheated clouds of gas and dust, **lahars**, which are mudflows, as well as ash, **pumice** and **toxic gas**.
- Despite the danger people still live close to volcanoes. Volcanic soils are very fertile. Tourists like to see **volcanic hot springs**, **geysers** and **boiling mud**. **Geothermal energy** produces electricity. **Precious stones** and **minerals** are often found in extinct volcanoes.

Earthquakes and volcanoes (1–4)

1 What causes the plates on the earth's surface to move? (1)

2 Which way do plates move at a constructive plate margin? (1)

3 At what kind of boundary is a subduction zone found? (1)

4 What point on the earth's surface is likely to suffer the greatest damage from an earthquake? (1)

5 How many times more powerful is an earthquake measuring 6 on the Richter scale compared to one that measures 4? (1)

6 What part of a volcanic cone does the lava come out from? (1)

7 Name an example of a shield volcano. (1)

8 What are nueés ardents? (1)

9 Why do 20% of Sicilians live on the side of the active volcano Mount Etna? (1)

10 Name an area which uses geothermal power as a source of energy. (1)

11 Why is there a series of volcanic islands down the centre of the Atlantic Ocean? (3)

12 Why are LEDCs likely to suffer a greater loss of life than MEDCs if an earthquake hits? (2)

13 What is the difference between lava and magma? (2)

14 Explain why there is a 'Pacific Ring of Fire'. (3)

SCORE

1 Convectional activity. (1) This is caused by magma moving through the mantle.
2 Apart. (1) As the plates move apart magma can reach the earth's surface, cool and form new land.
3 Destructive plate margin. (1) This is where one plate is being destroyed as it is forced beneath a neighbouring plate.
4 Epicentre. (1) This is the closest point on the earth's surface to the seismic focus of the earthquake.
5 100. (1) Remember that a rise of one point on the Richter Scale means the earthquake is ten times more powerful.
6 Crater. (1) Remember technical terms.

7 Mouna Loa, Hawaii. (1)

8 Superheated clouds of gas and dust. (1)

9 The soils there are very fertile. (1) Lava breaks down very readily into a workable soil. The soil is very rich in minerals.
10 Iceland. (1)
11 Sea floor spreading. (1) The Eurasian and the North American plates are moving apart. (1) This allows magma to reach the surface. (1) This question refers to a specific place so you need to state the names of the plates.
12 Buildings in LEDCs are less earthquake proof and so collapse more easily. (1) Emergency aid systems are not as efficient. (1) In a MEDC the value of the damage to the infrastructure will be much higher than in a LEDC.
13 Magma is molten rock beneath the earth's surface. (1) Lava is solidified magma on the earth's surface. (1) Magma can solidify before it reaches the earth's surface to form dykes and sills. These can be found in a composite volcano.
14 There are volcanoes dotted all around the Pacific Ocean. (1) The Pacific plate is being subducted beneath the neighbouring plates. (1) Magma is forced to the surface to form volcanoes. (1)

TOTAL