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Discusssion / Activity 1 Suggested Answers

Earth Structure

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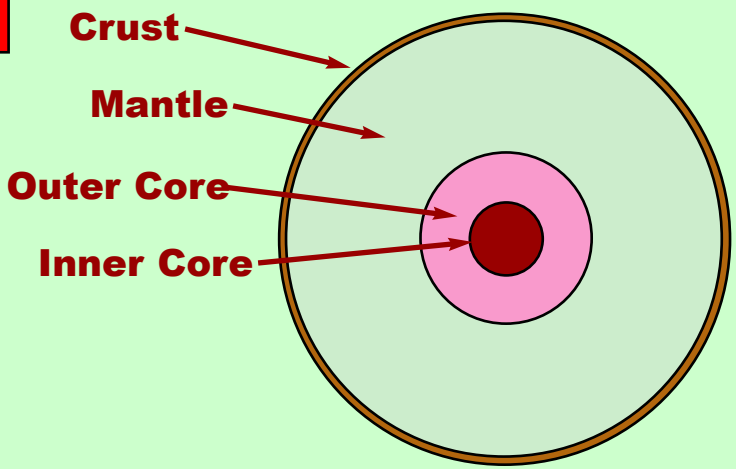

1. Clearly label the diagram to show the main layers of the Earth.

2. What is the "lithosphere"?

The lithosphere is the crust, plus a thin part of the upper mantle which has attached to the crust.

3.

a) What is seismology?

The study of earthquake shock waves.

b) Give an outline how seismology has revealed the Earth's structure as shown in the diagram.

The shock waves travel at different speeds in different layers and also reflect and refract as they pass through the Earth. Study of their behaviour has led to the model of the Earth shown by the diagram.

c) Give an outline of how seismology data can pin-point the location of an Earthquake.

The speed of earthquake shock waves is known. The time gap between arrival of "P" waves and "S" waves allows calculation of the distance to the earthquake focus. Triangulation from 3 or more seismometer stations can find the exact location of the 'quake.

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Discusssion / Activity 2 Suggested Answers

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Plate Tectonics

1.

a) Who proposed the theory of "Continental Drift" in 1915? Alfred Wegener.

b) Why was the theory not accepted by other scientists?

Although Wegener found evidence that continents had moved, he could not suggest any mechanism for HOW they could move.

2.

a) List the technologies that discovered new, important data in the 1950-70's.

Sonar, magnetometers and deep-sea drilling all allowed data to be gathered from the deep oceans.

b) Outline the theory of Plate Tectonics.

The Earth's lithosphere is broken into a number of pieces (plates) which move around due to huge convection currents in the mantle.

3. Summarise what happens at places where 2 plates move apart.

Where plates move apart, molten rock wells up to fill the gap and creates new crust, mainly under the oceans. Many small, shallow earthquakes occur.

4. Summarise what happens at places where 2 plates collide.

One plate may be forced down under the other (subduction). Volcanic islands and/or mountain ranges are pushed up. There are powerful, deep earthquakes and deep-ocean trenches along subduction zones.

5. Give an outline of the main force which pushes the plates around.

The rocks of the mantle can flow and move under the huge pressure down there. Heat moves outwards from the core in enormous convection currents. As these reach the top of the mantle, they push sideways on the base of the lithosphere and slowly push the plates around.

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Discusssion / Activity 3 Suggested Answers

Evidence of Plate Tectonics

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Outline the evidence for moving continents which comes from:

a) the shape of the continents.

The continents fit together like jig-saw pieces, especially along the continental shelf rather than modern coastline. This suggests they were once joined and later split apart.

b) the locations of certain fossils and mineral deposits.

Identical fossils and mineral deposits can be found on different continents, in places that match the "jig-saw" fit.

c) studies of the ocean floor.

The mid-ocean ridges are composed of new crust rocks, while the rocks are older as you move further away. There are also matching patterns of magnetism in the rocks on either side of the central ridge. Both show that new crust is being made in the middle as the plates move apart.

d) the distribution of earthquakes & volcanoes.

The vast majority of earthquakes & volcanoes occur along the edges of the plates. This is totally consistent with the idea of moving plates and what happens at the plate boundaries.

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Discusssion / Activity 4 Suggested Answers

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The Changing Continents

1. Outline how a map of the world 200 million years ago was different to that of today.
200 mya, all the world's continents were joined into one super-continent called "Pangaea".

2. What was "Gondwana" and which modern continents did it contain? (list 5 items)
Pangaea split into 2 large parts. The southern continent, Gondwana, contained the modern Africa, India, Australia, Antarctica & Sth America.

3. What is meant by a "supercycle" of the continents?
Over time frames of about 400 my, the continents collide and join together, then split and move apart again.

4.

a) What is a "craton"?
An ancient piece of lithosphere which is thick & stable and is never broken up by plate rifting.

b) Where in modern Australia are the oldest cratons located?
Western Australia, such as the Pilbara region.

c) Outline the formation of eastern Australia.
During the break-up of an earlier super-continent, a collision & subduction zone formed which created mountain ranges and upthrust the crust. Erosion formed vast sedimentary deposits. These areas eventually became eastern Australia.

5.

a) Why is Australia the flattest continent in the world?
For 200 my there has been little tectonic activity. Erosion has worn the continent flat.

b) Australia is surrounded by areas of frequent earthquakes and active volcanoes, yet has no volcanoes and very few earthquakes. Why is this?
Most earthquakes & volcanoes occur along plate boundaries. Australia is in the middle of its plate, well away from the active edges.

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Discusssion / Activity 5 Suggested Answers

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Tectonic Impacts

1.

a) How can volcanic eruptions cause cooling of Earth's climates?

Fine dust & ash can be thrown into the upper atmosphere where it can reflect a lot of radiation from the Sun. Less reaches the surface, so the Earth becomes cooler.

b) How can volcanic eruptions cause later warming of Earth's climates?

Volcanoes release huge amounts of CO_2 gas. This increases the "greenhouse effect" and causes global warming.

c) What are the main dangers to people from a volcanic eruption?

Pyroclastic flows and Lahars.

2.

What are the main dangers to people during an earthquake?

Falling buildings, fires, landslides and tsunamis.

3.

What is a "tsunami" and in which tectonic areas are they most likely to begin?

A tsunami is a huge, destructive water wave caused by an undersea earthquake, usually along a subduction zone.

4.

Outline one positive benefit (to living things) of the Earth's tectonic activity.

Plate tectonics recycles vital chemicals such as carbon & phosphorus. It creates landscapes & new habitats for living things.

5.

Describe the general connection between the Earth's climate and the distribution of continents over a complete "supercycle".

When there is one super-continent there is little rifting and volcanic activity, so CO_2 level is low. Reduced greenhouse results in cooling, so the global climate is cold & dry. When there are many, separate continents there is more tectonic activity. Volcanoes increase CO_2, so the climate becomes warmer and wetter.