COSMOS LESSONS

Earth and Space Sciences

Tectonic Plates: The moving earth

This lesson will investigate the movement of the Earth's tectonic plates.

We will look at questions such as:

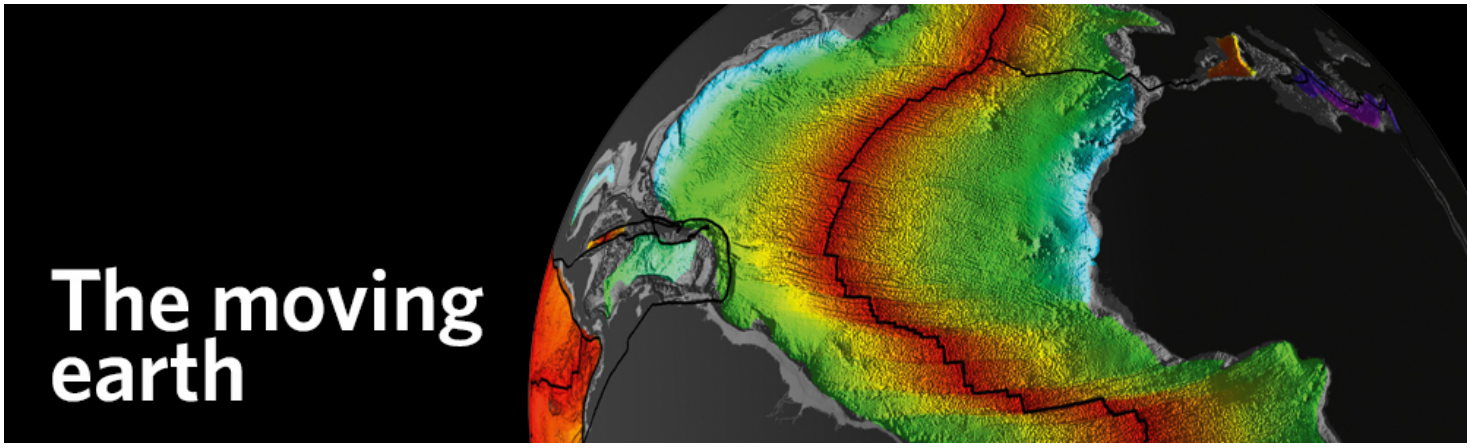
- What is the evidence that supports the theory of continental drift?
- Where are the major tectonic plates located?
- How does a tectonic plate move?
- How fast are tectonic plates moving?
- What are convection currents?

Watch the videos, conduct an experiment and contemplate the future appearance of our world.

This is a print version of an interactive online lesson. To sign up for the real thing or for curriculum details about the lesson go to **www.cosmosforschools.com**

Introduction: Plate tectonics (P1)

COSMOS LESSONS



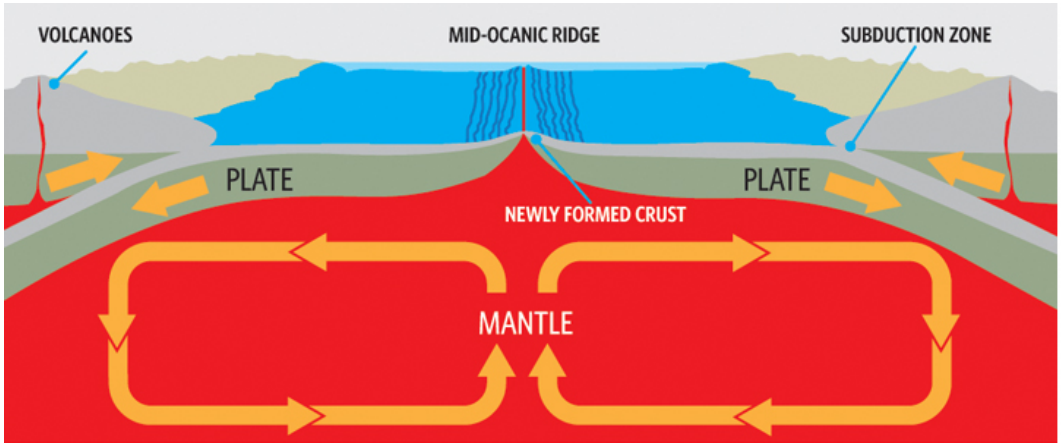
Our knowledge of science and how the world works is changing all the time. Only 40 years ago, scientists thought that the Earth's crust was fixed in place like the skin of an orange, but all that changed in 1963 with a paper written by Fred Vine. His findings were nothing less than a revolution in thinking about the structure of our planet.

Instead of being a solid skin, Vine said that the Earth's surface was broken up like a jigsaw puzzle into large rigid slabs, called plates, that floated on the molten rocks and minerals that lay underneath. The incredible heat inside the planet made these plates constantly move, crash together, tear apart or grind past each other, Vine said. His theory is known as "plate tectonics". For the first time, this explained how great mountain ranges were formed and what caused earthquakes and created volcanoes.

After lots of investigations and experiments, scientists worked out that the magma - the molten rock inside the Earth - rises up from cracks underneath the deep ocean. When it hits the cold water, it hardens and adds new material to the ocean floor. That then spreads away from the ridge on either side in a constant conveyer belt, always on the move.

The discovery also made scientists look again at the work of Alfred Wegener, a brilliant meteorologist and intrepid polar explorer. Back in 1915, he suggested that all the Earth's continents had once been joined together in a massive area of land called Pangaea. Because of plate tectonics, it broke apart with the pieces of the puzzle drifting to their current positions. But they didn't stop there and we now know that all the continents are still on the move.

Read the full *Cosmos* Magazine article here



Left: New ocean floor is continually being created from molten magma and moving away from the ridges like a slow-motion conveyer belt. Right: Meteorologist Alfred Wegener.

Question 1

Think: Do you have a mobile phone that uses GPS (Global Positioning System) to locate a specific location? How will continental drift affect the accuracy of the GPS?

Type your ideas here about how GPS technology may be useful to, or be challenged by, continental drift. Suggest possible solutions to overcome any challenges identified.

Gather: Plate tectonics (P1)

COSMOS LESSONS

Source: YouTube.

Question 1

Identify: What is the name of the supercontinent that Alfred Wegener thought existed hundreds of millions of years ago?

Question 2

Describe: List three different types of evidence that Wegener used to support his theory of continental drift and give a specific example for each.

Evidence	Specific example

Source: YouTube.

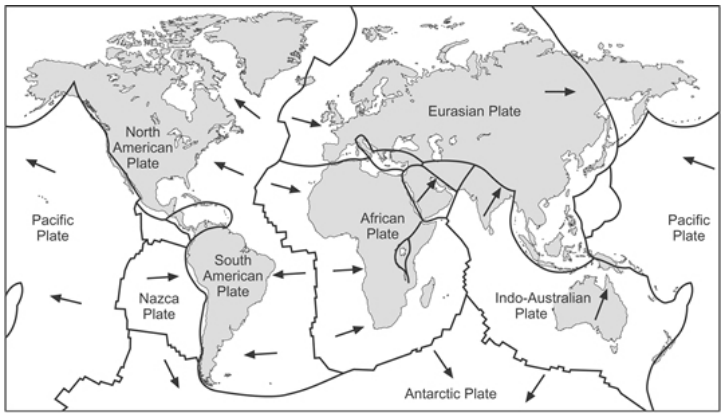
Question 3

Define: Write a definition of plate tectonics.

Question 4

Identify: Which type of land formation is created when two land masses collide?

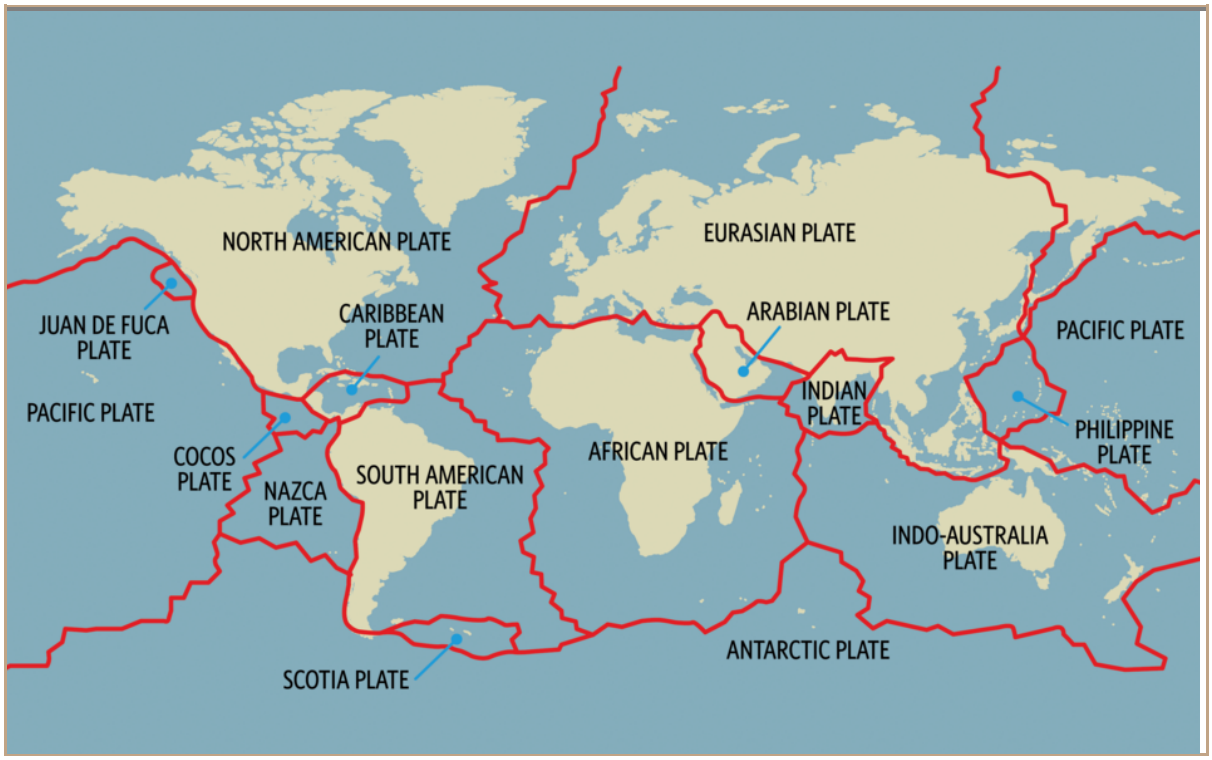
Study the image on the right before answering question 5. The image illustrates the Earth's tectonic plates and their directions of movement.



Source: The Royal Society of Chemistry.

Question 5

Complete: Draw arrows on the image below to indicate the direction in which the Earth's tectonic plates are moving.



Source: YouTube.

Question 6

Describe: Write a step by step process to describe how tectonic plates move.

Process: Plate tectonics (P1)

The Himalayan mountains were formed as a result of the Indian Plate colliding with the Eurasian Plate. Source: iStock.

Question 1

Calculate: If the Australian plate is moving at 7 cm per annum, how long will it take to move 50 m?

- [ ] 714 days
- [ ] 714 months
- [ ] 714 years
- [ ] 714 decades

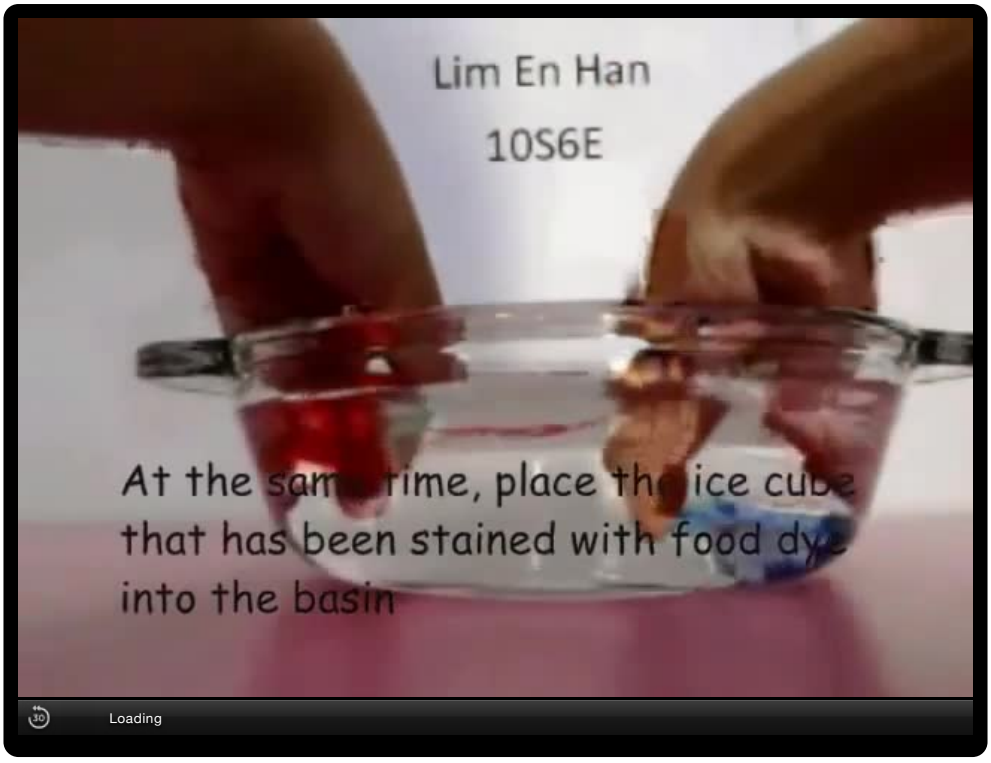
Question 2

Analyse: Watch the following silent animation of continental drift. Choose a country and write a 26-second commentary for this video to describe the movement of your chosen country. In your commentary describe the rate of movement and the position of your chosen country relative to other countries and continents.

Tip: A 26-second commentary is roughly equivalent to 60 words.

Question 3

Predict: Below is a video of an experiment that shows how convection currents work in a liquid. The experimenter has added icy cold blue dye and hot red dye to a bowl of water. Using your understanding of convection currents, predict what will happen to the blue dye and the red dye when they are placed in the water.



Question 4

Explain: Was your prediction correct?

Question 5

Compare: How is this experiment like the convection currents that cause the Earth's plates to move?

Apply: Plate tectonics (P2)

The dinosaurs were the dominant species 100 million years ago. What will the dominant species be 100 million years from now? Source: iStock.

Question 1

Predict: What will a map of the world look like in 100 million years? Where will Australia be? Where will the Americas be? Will there be any new major mountain ranges? How much bigger are the Himalayas going to be?

Use the data table below to collect information on several major continents and then use this information to sketch over the current map of the world to predict the future shape of the Earth's landmasses.

Country/continent	Which direction is it currently moving in?	How fast is it moving?	Which countries might it collide with?	Which countries might it move away from?
India				
Australia				
Africa				
North America				
South America				

Question 2

Apply: Draw your future map of the world 100 million years from now on the map below.

Career: Plate tectonics (P2)

Brought to you by Edith Cowan University

Sonya Pemberton is a Melbourne-based film-maker who combines a passion for science communication with a talent for film-making. Her documentaries tackle complex, controversial scientific issues, but the main inspiration for her work is that facts can be beautiful.

Sonya grew up in a family filled with curious minds and medical researchers. Her grandfather was an epidemiologist, her father specialised in providing medical care to newborn babies (neonatology), and her mother was a vivacious woman with a questing nature. When Sonya was growing up, her family encouraged her to think critically and it is perhaps this background that gives Sonya her talent for sniffing out the facts.

Sonya has hundreds of hours of experience writing, directing and producing content for TV. These days she works for a company called Genepool Productions, which specialises in creating interesting science television programs. Some of the issues that Sonya has explored include cervical cancer, immunisation, DNA and mental illness. She is currently hard at work on new shows about autism, breast cancer, and nuclear power.

But making shows about science is not as straightforward as it may seem. Just imagine trying to make a film about an organism that you can only see using a microscope!

Sonya says that to be a documentary film-maker you need to be able to convey complicated information and controversial ideas in a way that engages people.

“My films and I are both about the fact that being emotional and rational can co-exist; in a nutshell, that’s what everything I do is about.”

Question 1

Research: Sonya Pemberton is contributing to the field of science without working as a scientist. Your task is to, through your own research, find two other people that are contributing to the field of science, but who do not work as scientists.

List the names of the people that you find along with their job descriptions in the table below.

Person contributing to the field of science	Job description

Cosmos Lessons team

Education Editor: Bill Condie
Art director: Robyn Adderly
Lesson authors: Sally Parker and Daniel Pikler