

Physics: Structure of the Earth

Name:

Read through the content and then answer the question(s) at the end. When you have finished don't forget to save the document to your device or computer.

Structure of the Earth

JSH Learning's Presenting Physics



10-15 minutes



An oblate spheroid

The Earth is spherical, but it is not a perfect sphere - it is an oblate spheroid.

An oblate spheroid is similar in shape to a perfect sphere, except it has been squashed at two ends - so it is thicker in the middle.

The Earth's equatorial diameter is slightly greater than its pole-to-pole diameter.

This 'bulging' in the Earth's equatorial region is caused by the rotation of the Earth. Though slight, this bulging is enough to cause the Earth's gravitational attraction to vary across its surface.

Diameter being measured	Measurement (kilometres)
Equatorial	12 756
Pole-to-pole	12 714
Average (mean)	12 742

The Earth's varying diameter¹.

The blue-green planet

The Earth is surrounded by a layer of gases: the atmosphere.

The conditions are also just right for there to be liquid water. Liquid water is essential to life on Earth. This water lies on top of the Earth's crust.

The Earth is known as the blue-green planet as it is 70% covered by water (30% land).

The land we stand on is called the crust which is just one of four distinct layers that the Earth is comprised of. The other three layers are the mantle, the outer core and the inner core.



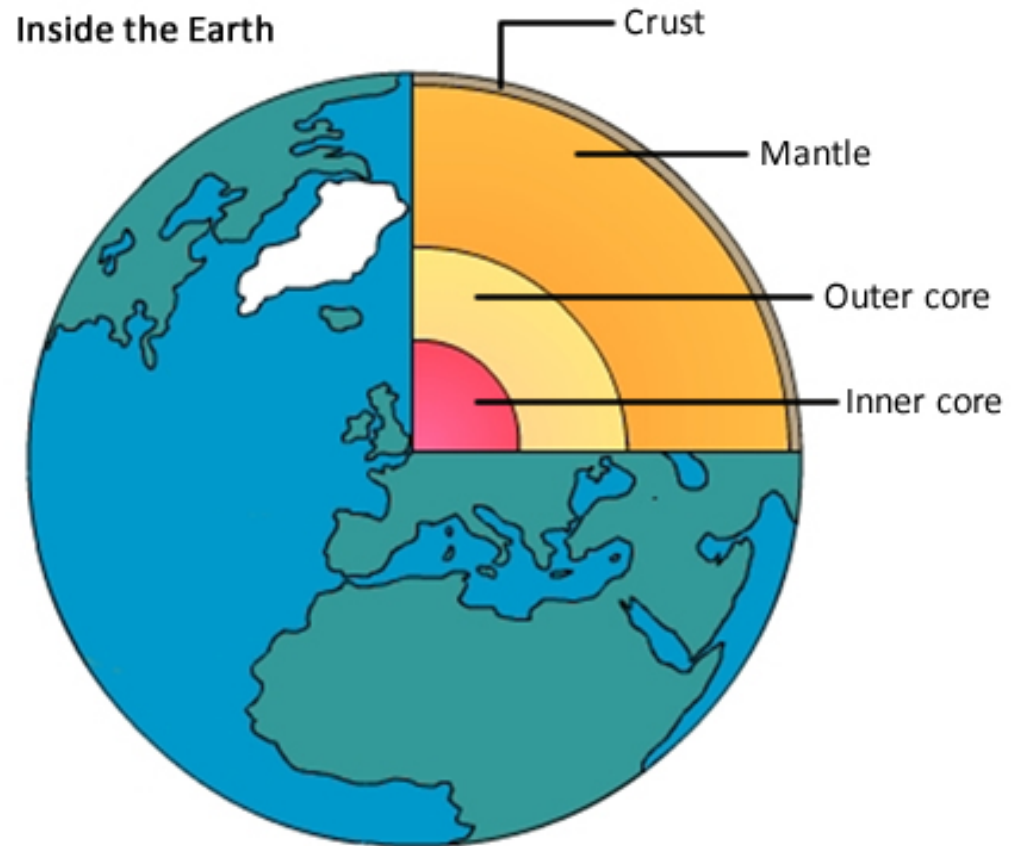
Image courtesy of NASA/JPL.

The crust

The crust is the hard outer layer of the Earth. The crust ranges in thickness:

- ✓ Under continents it ranges from around 25-70 km²
- ✓ Under oceans it ranges from 5-10 km²
- ✓ It is thicker under the continents and thinner under the oceans

The Earth's crust provides us with metal ores such as haematite and bauxite; and, fossil fuels such as coal, crude oil and natural gas.



Structure of the Earth. *Not to scale.*

Crust composition

The Earth's crust contains elements that usually are found in compounds.

The metal compounds are called ores.

The abundance of the ores at any point on the Earth varies by location.

In one country there might be more haematite (an ore of iron) and in another country there might be more bauxite (an ore of aluminium).

The table on the right shows the relative abundance by weight of the most common elements.

Element	% abundance by weight
Oxygen	46.6
Silicon	27.7
Aluminium	8.1
Iron	5.0
Calcium	3.6
Sodium	2.8
Potassium	2.6
Magnesium	1.5

The relative abundance by weight of the most common elements.

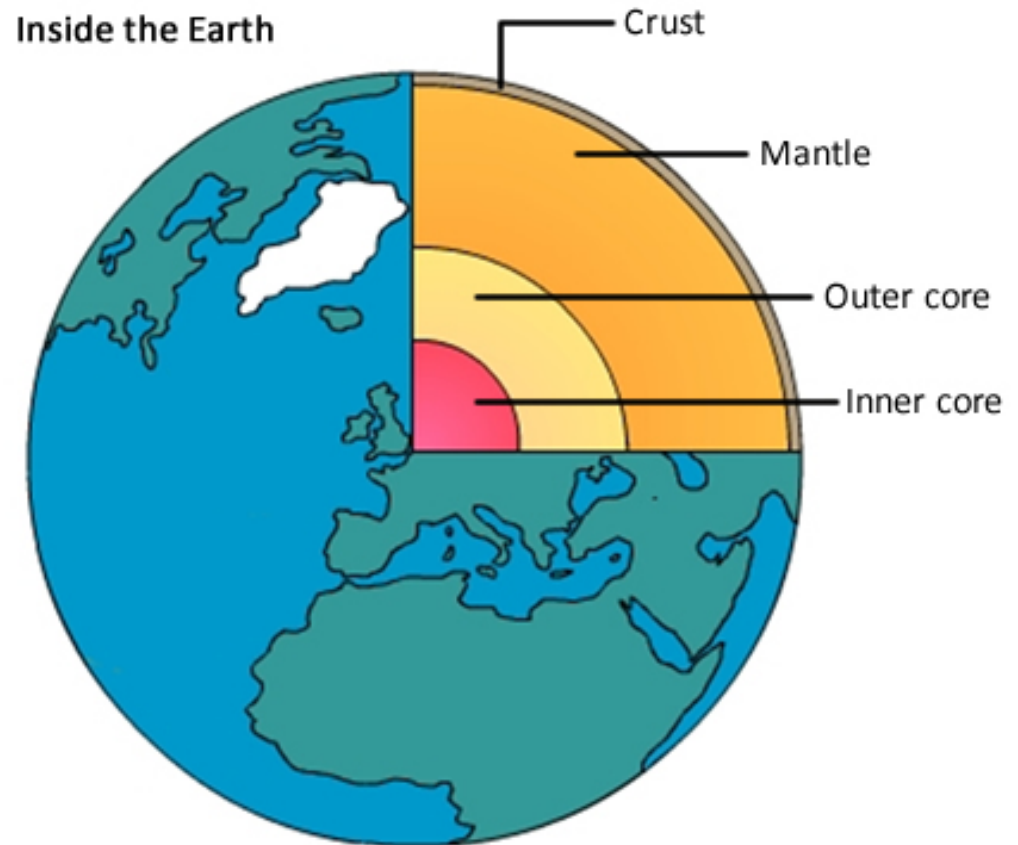
The mantle

Studying seismic waves provides us with information regarding the Earth's internal structure. The study of seismic waves is known as seismology.

Beneath the crust is the molten (but solid) mantle, ranging in depth from 35-2890 km. The mantle is comprised of dense silicate rocks².

Scientists believe convection currents in the mantle power the movement of tectonic plates*. Convection currents only occur in fluids, so the mantle must exhibit fluid-like behaviour for this to occur².

*Tectonic plates are the inter-locking plates that comprise the Earth's crust.



Structure of the Earth. *Not to scale.*

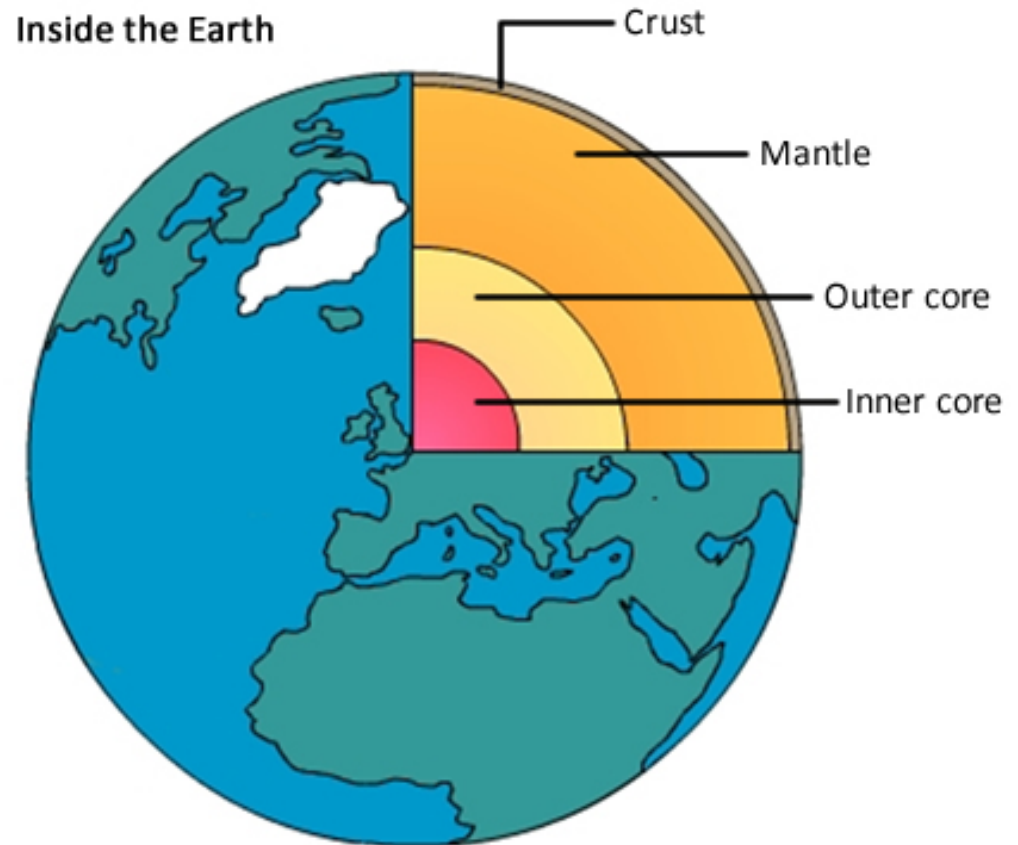
The Earth's core

The Earth's core is split into two distinct layers: a liquid outer core (2900-5150 km) and a solid inner core (5150-6360 km)³.

The liquid outer core is comprised of the elements iron and nickel. The temperature of the outer core varies (but can reach as high as 5500°C)³.

The solid inner core is mostly iron. Its temperature is slightly cooler than the outer core (5200°C)³.

The Earth's magnetic field is caused by its rotating core.



Structure of the Earth. *Not to scale.*

The Earth's magnetic field

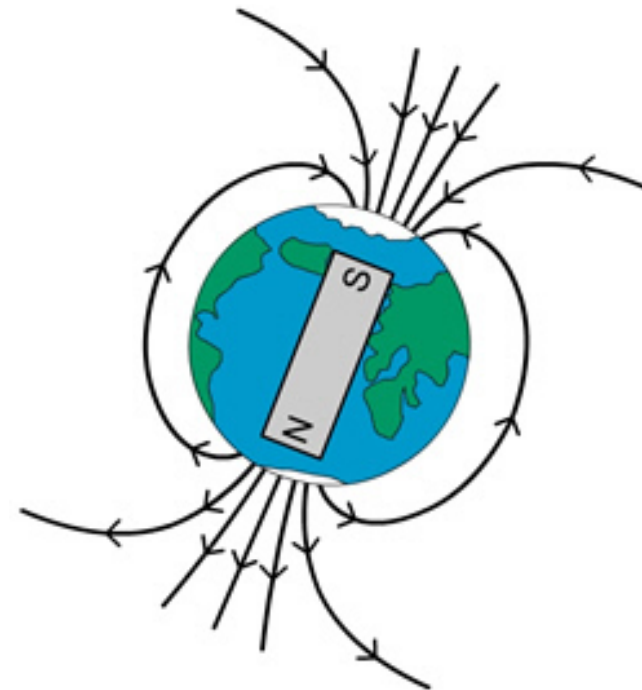
The Earth has a magnetic field. The Earth's magnetic field is caused by its rotating core.

The Earth's magnetic field behaves as if there was a huge bar magnet inside the Earth. As shown in the diagram: the south pole of this bar magnet is located in the Earth's northern hemisphere. The north pole of this bar magnet is located in the Earth's southern hemisphere.

A compass uses the Earth's magnetic field to find direction.

Some animals use the Earth's magnetic field to navigate.

The Earth's magnetic field protects us from harmful solar radiation.



The Earth has a magnetic field.

Summary

- ✓ The Earth is an oblate spheroid
- ✓ The equatorial diameter of the Earth is slightly greater than its pole-to-pole diameter
- ✓ The Earth is surrounded by a layer of gases called the atmosphere
- ✓ The Earth has four distinct layers: the crust, the mantle, the outer core and the inner core
- ✓ The rotating Earth's core generates a magnetic field

End notes

JSH EducAtion Ltd are not responsible for the content on third party websites:

¹ Anon. (2017). Earth. [Wikipedia](#).

² British Geological Survey (2017). [The Structure of the Earth](#).

³ National Geographic (2017). [Core](#).

Image on slide 3 is a NASA/JPL image.

Site of interest:

Kevin McSpadden, TIME (2015). [New Google Doodle Honors Pioneering Seismologist Inge Lehmann](#). *[article about Inge Lehmann, a pioneering female Danish seismologist]*

NASA History (unknown). [The Magnetosphere: Our Shield in Space](#).

NASA History (unknown). [Table of Contents](#).

ESA (2017). [Video of Auroras Captured in Kiruna](#).

Knowledge Check

Enter your answers below.

KC1 What are the four layers found within the Earth?

KC2 Where is the crust thickest? Where is it thinnest?

KC3 What powers the movement of the tectonic plates?

KC4 What does the Earth's magnetic field protect us from?

Enter text below as needed.

Feedback/Notes

