

Unit 2 - The Lithosphere and the Atmosphere

Key concept - Systems - How do different environmental systems interact with each other on Earth?

Related concepts - Models and environment - How can we use scientific models to explain changes in our environment?

Global concept - Orientations in time and space - Why is the position of Earth in the solar system essential for our survival?

Unit 2

KEYWORDS:

Lithosphere
Inner core
Outer core
Mantle
Crust

Periodic table

- Elements
- Minerals
- Gems
- Mining
- Diamond

- Global warming
- Carbon dioxide
- Fossil fuels
- Energy
- Rising sea levels
- Climate change

- Nitrogen
- Atmosphere
- Greenhouse effect
- Climate

Our planet

The photo to the right is called "**The Pale Blue Dot**". It is a photo taken on the 14th February, 1990 by the *Voyager 1* Space probe from 6 billion km away.

It shows the Earth in a scattered ray of light from the Sun as the space probe was leaving our solar system. *Click* on the photo to hear a famous quote by Carl Sagan.

What is the Earth made of?

To fully understand how our Earth works, it is important to know the chemicals that make up the different **systems**. In science, we organise all of the chemicals into the **periodic table** (below). Each type of chemical has a **name** and a **symbol**.

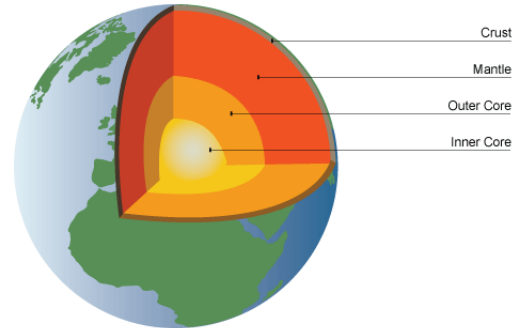
This table contains all of the chemical elements that we know. You will need to learn some of these names and symbols. The documents below contain the names and symbol that you need to learn.

The lithosphere

Definition: The lithosphere is the rocky part of the Earth

The hard, rocky part of the Earth consists of 4 layers as shown in the diagram.

The inner and outer core are formed mainly from the chemical elements **iron (Fe)** and **nickel (Ni)** and can have a temperature of up to 5,500 °C. The mantle and the crust are solid and contain a large mixture of elements, including: **Si, Al, Ca, Na, K** and **Mg**.



(Bbc.co.uk, 2015)

Task 2b:

1. **State** which chemical elements have the symbols above?

Silicon, Aluminium, Calcium, Sodium, Potassium, Magnesium

2. **Find out** which are the 2 most abundant (*common*) elements in the Earth's crust?

Oxygen and Silicon

3. **Although** the mantle and crust are both solid, the mantle has a property that is more like a liquid. Which property is it?

The rocks in the mantle are under high pressure and temperatures and so can flow like a liquid.

Extension: This property is responsible for earthquakes. Explain how?

The solid crust is divided into different “plates” that move on the liquid-like mantle. When they rub together an earthquake can happen.

What are minerals?

Definition: Minerals are naturally occurring substances with a definite chemical composition and a regular internal structure. Note: Most minerals are crystals, like salt and diamonds.

Many **minerals** are very hard so have been used

throughout human history for things such as building. Rare and beautiful minerals such as emeralds and diamonds are called **gems**.

The piece of art to the right is a skull made with over 8,000 gems and was sold in 2007 for €75,000,000!

You will need to be able to describe certain properties of minerals:

- **Colour**
- **Hardness** - This is measured on Mohs scale from 1 - 10. Diamond is the hardest mineral on the scale -->
- **Transparency** - We can describe a mineral as:

Transparent - Light can pass through it and you can see through it.

Translucent - Light can pass through it but you cannot see objects through it.

Opaque - No light can pass through it.

Task 2c:

1. **Make** a table in your NSD with 8 rows and 3 columns. Label each column - Mineral letter, Colour and Transparency. Complete the table using the photo to the left.
2. **How do we compare the hardness of different minerals?**

Minerals are ranked by their hardness between 1 and 10 on the Mohs Hardness scale. 1 is soft like talc and 10 is hard like diamond.

3. **Can you identify** any of the minerals shown? How did you work it out?

(Fivestarstoneinc.com, 2014)

	Mineral Name	Scale Number	Common Object
Increasing Hardness ↑	Diamond	10	
	Corundum	9	Masonry Drill Bit (8.5)
	Topaz	8	
	Quartz	7	Steel Nail (6.5)
	Orthoclase	6	
	Apatite	5	Knife/Glass Plate (5.5)
	Fluorite	4	
	Calcite	3	Copper Penny (3.5)
	Gypsum	2	
	Talc	1	Fingernail (2.5)



Image - (Thehappyscientist.com, 2015)



(Stuffpoint.com, 2015)

Rocks

Definition: A rock is a naturally occurring solid material containing 1 or more minerals.

There is a huge range of uses for rock that depend on their properties. You should be able to suggest uses according to the properties of a rock.

You will see the rock cycle in Unit 8.

Task 2d:

1. Use the following [interactive link](#) to **suggest** which rock would be the best to make a: kitchen surface; make tiles for a roof; and use to mark distances on a road.

kitchen surface: **marble**

make tiles for a roof: **slate**

use to mark distances on a road: **chalk**

2. A new type of rock has the following properties: is multi-coloured, shiny, easy to shape, resistant to rain. **Suggest** a use for this rock and **explain** your choice.
3. The photo below shows the Bingham mine in America. It is the largest open mine in the world and is used to extract rocks containing **copper (Cu)**. Evaluate the advantages and disadvantages of mining for rocks and minerals?

Hints: *Think about environmental, economic and human issues.*



(Wired UK, 2015)

The atmosphere

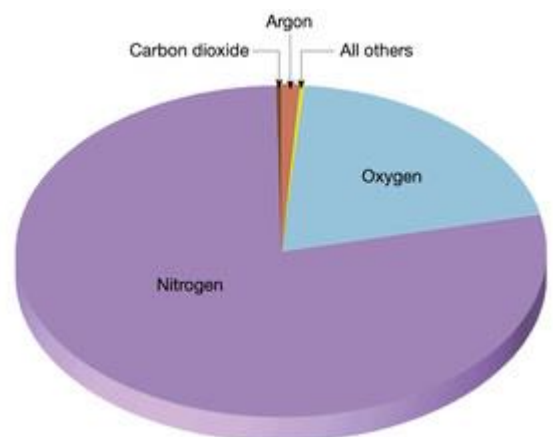
Definition: The atmosphere is the gaseous part of the Earth

The Earth's atmosphere is essential in providing the conditions for **life** on our planet. Without it, the average surface temperature would be -20°C and the amount of dangerous **radiation** from the Sun would cause large amounts of damage to living things. We would also have no **oxygen** to breathe!

Task 2e: Read the text below and make a bar graph using the information in it:

It is clear from the pie chart that the main gas is nitrogen at 78 percent. Oxygen is the next most abundant gas at 21 percent. This is the gas that allows animals and plants to respire, and fuels to burn.

All the other gases make up only 1 percent. These include carbon dioxide, water vapour and argon.
(Bbc.co.uk, 2015)



All the gases in the atmosphere are made from chemical elements. **Oxygen** for example, has the chemical symbol **O** and **nitrogen** has the symbol **N**. **Carbon dioxide** actually contains one **carbon** (C) and two **oxygens**.

As the composition of the atmosphere is different in different places, scientists have named different layers. There are many layers that have been named, but the most common are the ones in this diagram.

You might also hear of other layers such as the ionosphere and the exosphere.

Task 2b:

1. Find a different diagram of these 4 layers and copy it to your NSD.
2. In which layer do we find most meteorological phenomena (*weather*)?

Most of our weather happens in the troposphere.

3. In which layer can we find the ozone layer?

The ozone layer is found in the stratosphere.

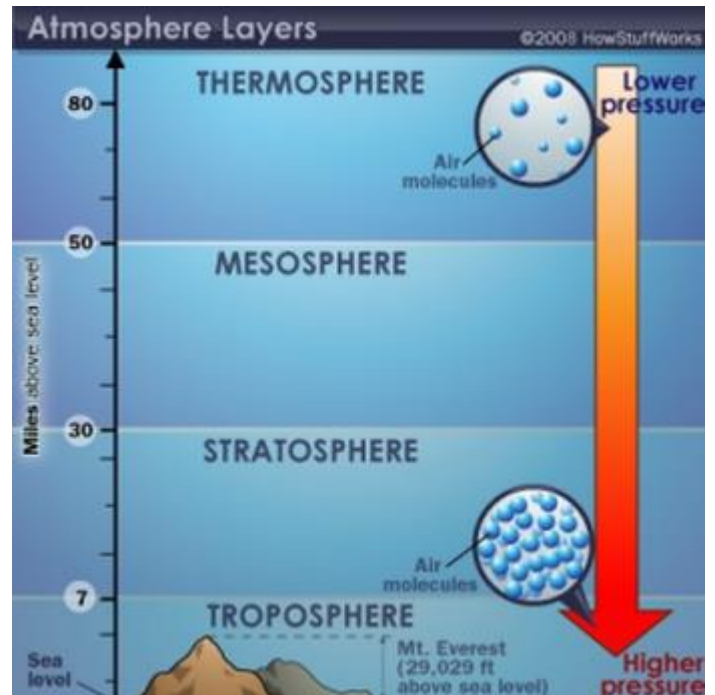
4. What important role does the ozone layer have in our safety?

The ozone layer protects us from harmful radiation from the sun. It absorbs the UV radiation which can damage our DNA.

(Lamb, 2015)

Extension: Copy this map to your NSD and **explain** where you think the ozone layer has been destroyed the most in the world.

The most damage is along the equator, that is why Australia is red on the map.





(HubPages, 2015)

The Greenhouse Effect



The most important role of the atmosphere is something called the **greenhouse effect**.

A greenhouse works by letting in the heat and light energy from the Sun but then preventing it from leaving again so that the temperature remains warm. The Earth's atmosphere works in a similar way. It allows the Sun's energy to pass through but then prevents most of it from escaping. Without the atmosphere, the energy would be lost back into space immediately.

(Climatekids.nasa.gov, 2015)

Certain gases are very good at absorbing the heat energy from the Sun so we call them **greenhouse gases**. The most important greenhouse gases are:

- Water (H_2O)
- Carbon dioxide (CO_2)
- Methane (CH_4)

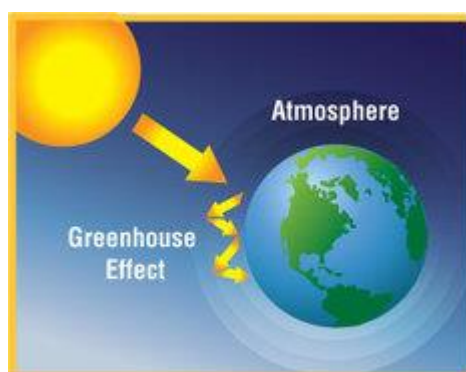
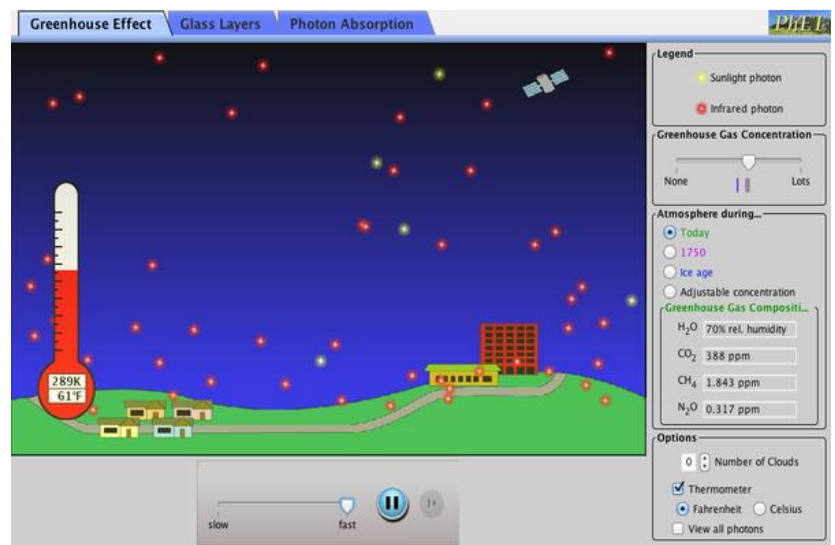


Image - (Qyuhouse.website, 2015) [Click the link to see the video.](#)

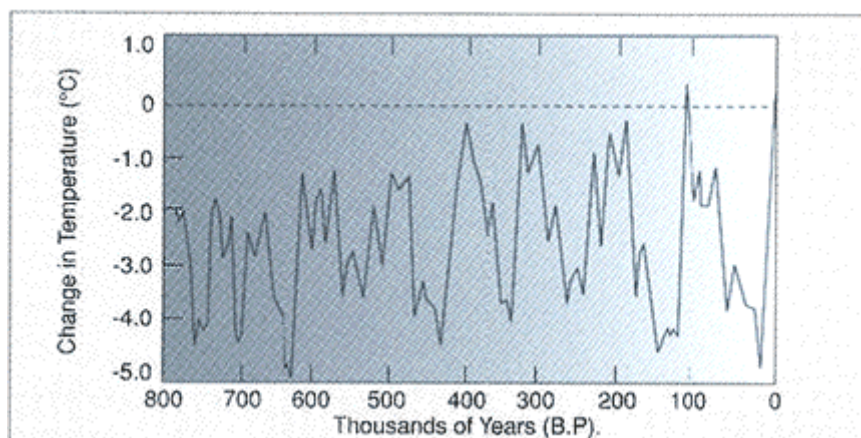
Try the simulation to the right. Investigate the effect on temperature of:

- The amount of greenhouse gases
- The number of clouds
- The number of glass slides (on the second tab)



Global warming

Over the million years, the average temperature of the Earth's atmosphere has fluctuated (*moved up and down*) between cold periods and warm periods (*right*). Recently, however, human activities have started causing a particularly fast increase in the temperature of the Earth's atmosphere (*below*). This increase in temperature is called. **global warming**.



(Geocraft.com, 2015)

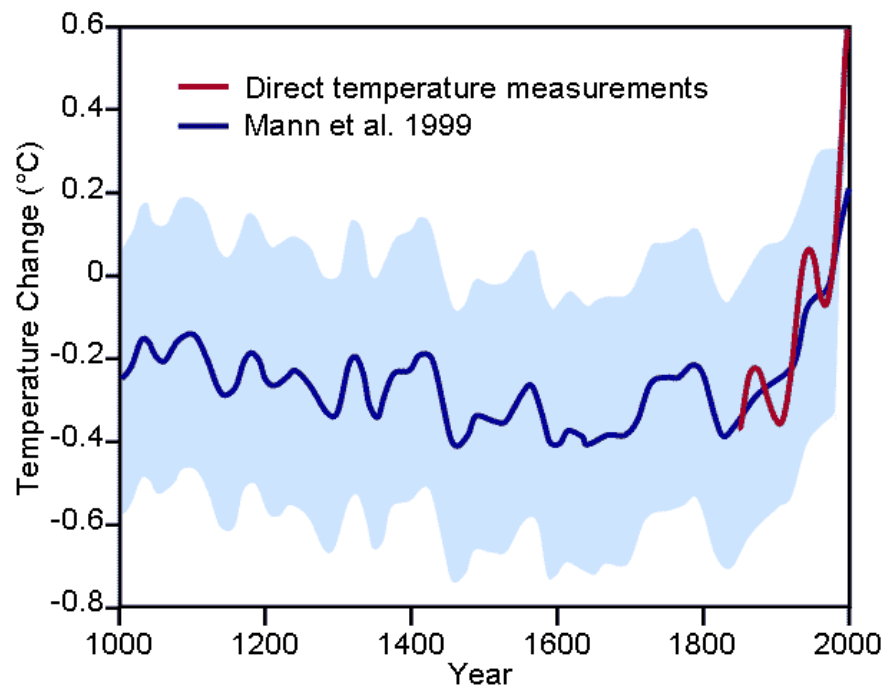
Which human activities do you know that have been causing these changes?

Three of the most important human activities that are causing global warming are:

- Burning fossil fuels
- Deforestation
- Livestock (breeding animals)

We will focus on the burning of fossil fuels to provide energy. This releases large amounts of greenhouse gases, especially carbon dioxide, into the atmosphere.

(Savage, 2009)



The more greenhouse gases that we release into the atmosphere, the more heat energy is trapped and this causes global warming.

The problems with global warming

The increasing temperature of the Earth's atmosphere is already having a range of negative effects on the **environment** and **systems** that function in it. The video below explains global warming and the problems that it is causing.



(Qyuhouse.website, 2015)

Video and activities, see web page to finish and complete the notes.

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