1 The early atmosphere of the Earth

Watch the video and answer the questions.

http://www.bbc.co.uk/science/earth/earth_timeline/earth_formed#p00fzslq

When was the Earth formed? _____

Describe what it was like _____

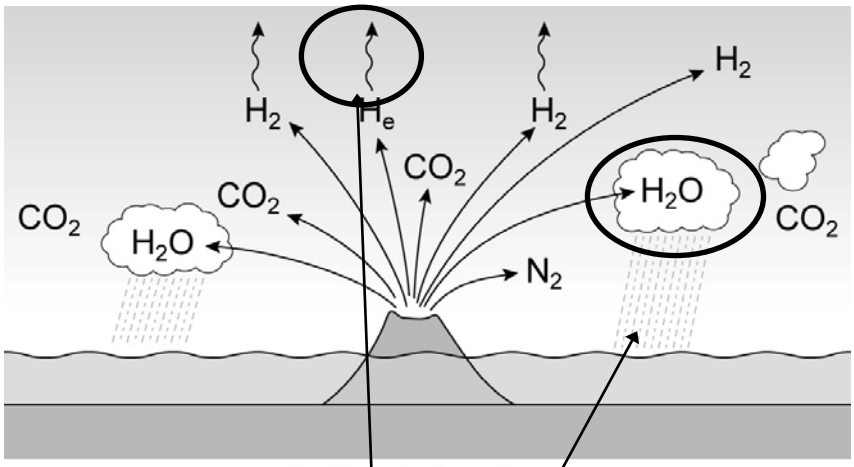
_____

The Atmosphere at this time is called Atmosphere#1

Which gases were around then? _____

_____

As the Earth cooled down, many gases were released from volcanoes and the early atmosphere was formed.



Earth's early atmosphere

Write down the names of the gases given off by the volcano.

CO_2 _____

H_2O _____

H_2 _____

He _____

N_2 _____

Explain what this squiggle means _____

Suggest what the white area around the H_2O means _____

Suggest what the dots here mean _____

What do the arrows coming from the volcano mean? _____

Explain how the water was formed _____

The volcanoes also released important gases called methane, ammonia and sulphur dioxide. The pools of water were also important.

Watch these videos and answer the questions.

http://www.bbc.co.uk/science/earth/earth_timeline/first_life#p00g5snq
http://www.bbc.co.uk/science/earth/earth_timeline/first_life#p00fztnc
http://www.bbc.co.uk/science/earth/earth_timeline/first_life#p00gczg5

Why were the pools of water and the volcanoes important?

_____

What was earliest form of life? _____

We breathe out carbon dioxide. What gas did this early form of life release?

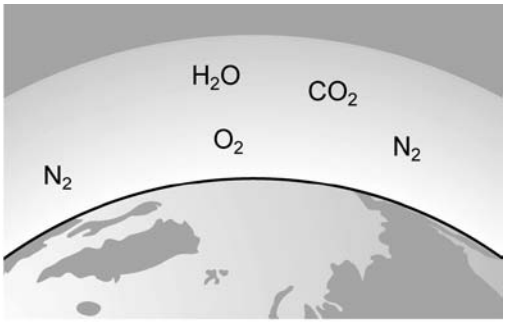
_____

What living things today release the same gas? _____

What happened to this gas at first? _____

What happened to this gas after a while? _____

Over time, the early atmosphere slowly changed to that of today.



Earth's atmosphere today

Which gases are in both the early atmosphere and today's atmosphere?

_____

Complete this table comparing atmospheres.

gas	was it in the early atmosphere?	is it in the atmosphere today?	has its amount increased or decreased?
oxygen			
carbon dioxide			
water vapour			
nitrogen			
methane			

Note to teachers:

There is a lot of material for this section… e.g. from the BBC and others, but a lot is at quite a high level and in too much detail for the students.

These links do have some value

- http://scijinks.nasa.gov/atmosphere-formation Simple page from NASA that students should find the right level.
- http://www.ux1.eiu.edu/~cfjps/1400/atmos_origin.html
- http://www.youtube.com/watch?v=OaiAh-V0C2c nice short video of a power point
- History of the earth video…long, slow but does the job….this could be watched in short sequences at the end of lessons.
- http://www.youtube.com/watch?NR=1&feature=fvwp&v=RQm6N60bneo, This will give you a useful overview

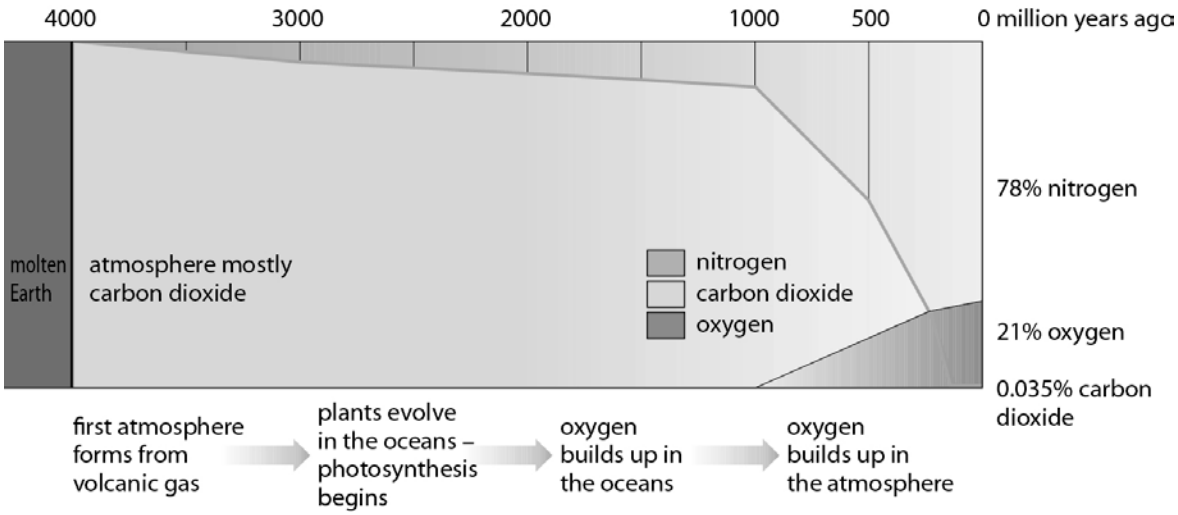
Images can also be found at

http://ircamera.as.arizona.edu/NatSci102/NatSci/images/primeva2.jpg

http://www.columbia.edu/~vjd1/early_Earth_ocean.gif

2 Gases in the Atmosphere

This chart shows how the concentration of gases in the atmosphere has changed during the Earth's history.



Where did methane, carbon dioxide and the other gases of the early atmosphere come from? _____

_____

How did the water in the seas and oceans form? _____

What has happened to the percentage of carbon dioxide (CO_2) since the early atmosphere?

_____

When did the percentage of oxygen (O_2) start to increase?

_____

What process caused the percentage of O_2 to increase and the percentage of CO_2 to decrease?

_____

Plants take in carbon dioxide and release oxygen. What is this called?

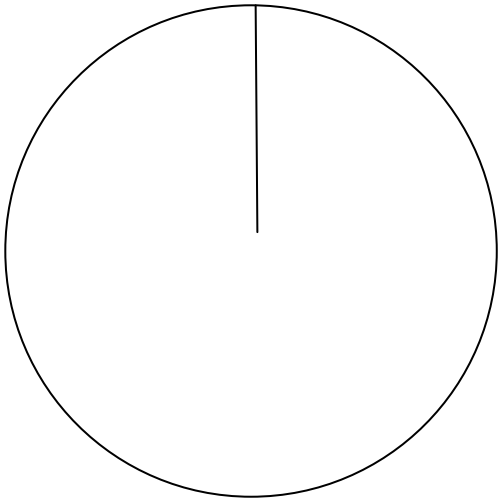
_____

Which gas occurs most in the atmosphere? _____

_____

Use the internet to help you complete this pie-chart showing which gases are in today's atmosphere.

Use colours or shading to make it clear



nitrogen
oxygen
carbon dioxide
other gases

Today, people are responsible for changes in the atmosphere.

Give the names of three things that people do which change the amounts of gases in the atmosphere.

_____

_____

_____

Other changes are caused naturally.

Write down one natural event that causes changes to our atmosphere.

_____

What can happen if we keep putting carbon dioxide into our atmosphere?

_____

3 Testing for gases

1 Oxygen

Watch the video http://www.youtube.com/watch?v=lohKLYbZp6Q about testing for oxygen.

Make a list of the equipment the students use _____

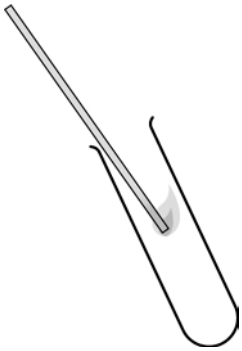
_____

Describe some safety problems with this experiment.

_____

_____

_____



The test to see if a gas is oxygen is: a glowing splint of wood will re-light.

How do you get a glowing splint?

_____

_____

_____

Describe what the three test tubes of gas look like.

Do they have any smell? _____

Try the glowing splint test on the three test tubes of gas.

Fill in the results table for these gases.

gas	does the glowing splint relight?	other observations
air		
carbon dioxide		
oxygen		

2 carbon dioxide

Watch this video http://www.youtube.com/watch?v=sfAbVX6UXRs about testing for oxygen and testing for carbon dioxide.

Carbon dioxide is a heavy gas: it will stay at the bottom of a beaker and it can be poured! We breathe it out.

Complete the sentences below about testing for carbon dioxide. Use words from the box to help you.

There are _____ easy tests for carbon dioxide.

You can _____ through a _____ into a test tube of _____ (calcium hydroxide).

The _____ goes a _____ colour which is called cloudy.

The other test is that it will _____ a lit splint or _____

You can pour the _____ onto a _____ and it will _____

blow	**candle**	**flame**	**gas**	**go out**	**lime water**
liquid	**milky-white**	**put out**	**straw**	**two**	

Now test the other three test tubes of gas with a lit splint.

Fill in the results table for these gases.

gas	what happens to the lit splint?	other observations
air		
carbon dioxide		
oxygen		

Use the internet or a text book to answer these questions.

Which gas is used in a fire extinguisher? _____

Explain why _____

Why is oxygen gas used in hospitals? _____

_____

Note to teachers:

Each student or group of students will need access to

2 × labelled test-tubes of air

2 × labelled test-tubes of oxygen

2 × labelled test-tubes of carbon dioxide

Bunsen burner, lit on luminous flame

safety mat

labelled test-tube partly filled with limewater

drinking straw

[It is useful to keep plenty of spares!]

The gases are best obtained from cylinders but can be made by technicians.

Depending on the sensitivity of you class you may want to avoid the title on the second video.

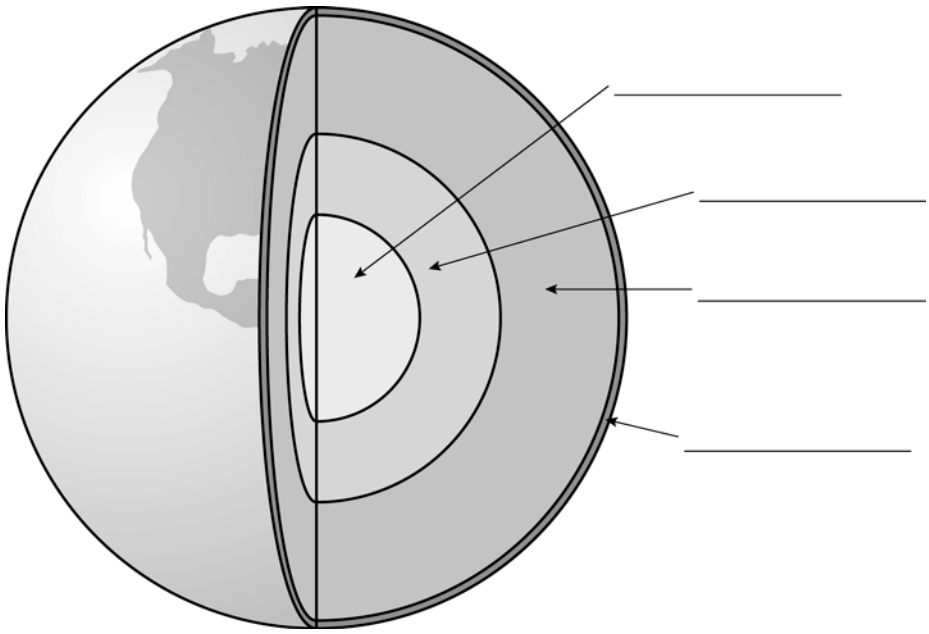
Extension work: suggest you replicate the experiment in this video

http://www.youtube.com/watch?v=Es-flbAIpms

4 Hot rocks

Inside the Earth, there are three main layers.

Write labels for these layers.



Use the internet or a text book to help you complete this table.

name	solid?	liquid?	gas?	temperature?	thickness?
atmosphere	X				
core					3,300 km
crust				mostly cool	
mantle			X		

The word box for the last two columns is:

2,900 km	**about 50 km**	**hot**	**mostly cold**
	up to 100km	**very hot**	

Sometimes, rocks from underneath the surface, can escape.

This is called a volcano.

Describe what a volcano looks like _____

_____

Which gases come out of a volcano? _____

_____

Notes to Teacher:

The structure of the Earth is not required by the spec…… but unless the students know that the centre of the earth is hot, then they will find igneous and metamorphic rocks hard to understand.

This worksheet is used to link atmosphere and earth together.

For a nice diagram of a volcano, ready to colour and label, (with answers too!) use this link

http://www.teachervision.fen.com/tv/printables/dk/instantexpert/VolcanoParts_Worksheet.pdf

This one is a bit too detailed unless you have sufficient time

http://www.enchantedlearning.com/subjects/volcano/labelvolcano.shtml

nice short bitesize clip…use as a plenary?

http://www.bbc.co.uk/schools/gcsebitesize/science/ocr_gateway/chemical_resources/earth_structureact.shtml

5 Fire rocks: igneous rocks

Watch the demonstration about igneous rocks and complete the following sentences.

Igneous rocks start their life deep down in the Earth, in a layer called the

_____ . This layer is very _____

The rocks are molten which means _____ and they can flow.

When _____ erupt, the molten rocks come out of the Earth, often with

lots of _____, _____ and _____.

Follow the instructions on the worksheet.

1. What do you notice about the sizes of the crystals in these two types of rock?

   _____

2. Which type of rock, granite or basalt, has the larger crystals?

   _____

3. Which tube cooled faster?

   _____

4. What do you see about the crystal sizes in the tubes?

   In the boiling tube that cooled faster, the crystals are

   _____

   In the boiling tube that cooled slower, the crystals are

   _____

5. Which rock, granite or basalt, cooled faster when it was formed?

   I think that _____ cooled faster when it was formed because

   the crystal size is _____

6. When igneous rocks form underneath the ground, they cool much more slowly. Which rock, granite or basalt, was formed under the ground?

   I think that _____ formed under the ground, because

   the crystal size is _____.

Note to teachers:

clip for starter or plenary

http://www.youtube.com/watch?v=mxbmvG5gpAs

This link has good details of the demo (and the ideas that go with it!)

http://www.rsc.org/Education/Teachers/Resources/jesei/volcano/teachers.pdf

but you might prefer to do this similar one (figures 4 & 5)

http://www.rsc.org/Education/Teachers/Resources/jesei/sequenc/index.htm

For ease of printing, the word box is placed here

fire	**gases**	**hot**	**mantle**	**melted**
	smoke	**volcanoes**		

For ease of printing, the practical instructions are on a separate sheet.

If you have rock samples, then any pair of intrusive and extrusive igneous rocks can be used instead of the photographs these are the links to the original site if you prefer to use a data projector

https://en.wikipedia.org/wiki/File:BasaltUSGOV.jpg

https://en.wikipedia.org/wiki/Rhyolite

or from RSC site: this also has instructions for the salol experiment.
http://www.rsc.org/Education/Teachers/Resources/jesei/cooling/index.htm

5A Crystal size and cooling rate: fast and slow cooling of lead iodide

What you will need:

● eye protection ● 2 boiling tubes ● boiling-tube rack ● Bunsen burner ● heatproof mat ● spatula	● boiling-tube holder ● spatula ● thermometer (0-100 °C) ● salol ● samples of granite and basalt

Safety notes:

- Wear eye protection.

What to do:

1. Look at the samples of two igneous rocks – granite and basalt.

2. Half fill a boiling-tube with salol.

   Heat over a small blue Bunsen flame until the salol is melted. Continue to heat for a further minute.

3. Then **quickly** tip half of the salol into another clean boiling tube. Immediately cool this tube under a stream of cold water from the tap.

   Put the other tube in a rack to cool down slowly.

4. Leave both boiling tubes and contents for about 15 minutes until they are both the same temperature.

   Look carefully at the contents.

Note to teachers:

You will need to collect samples of granite and basalt for this activity.

These can be obtained from schools suppliers, such as http://www.ukge.co.uk/, or http://www.geologysuperstore.com

6 Sedimentary rocks

Sedimentary rocks are formed from broken down bits of rock.

The breaking down of rocks is called _____ and _____

The bits are carried or _____ along by ice, _____ or _____.

The small particles settle as sediments or _____ on the bottom of a river bed or sea.

Over millions of years these _____ change into rock.

Often the name of the rock tells you what it is made from; if

the particles are _____ then the rock is called ‘sandstone’.

erosion	**layers**	**sand**	**sediments**
transportation	**water**	**weathering**	**wind**

Use the instruction sheet to make different mixes of ‘sandstone’.

What can you do to find out which of your mixes is the most ‘rock-like’?

_____

Why is it unfair if one mix is not fully dry? _____

_____

How can you test the strength of each one? (Hint - look at the list of apparatus you need)

_____

_____

_____

Which mix is the strongest and which is the weakest?

strongest = _____ weakest = _____

What does the clay (or plaster of Paris) do to the pellet of sand?

_____

_____

What is the sedimentary rock formed when mud is compressed?

_____

Mud layers have up to 80% water, which is much more water than sand layers. Mud layers become more compacted than sand layers. Explain why.

_____

A scientist tests two rocks, sandstone A and sandstone B, with some dilute acid.

This is what she finds out

rock	**what cements the sand particles together**	**reaction with acid**
sandstone A	calcium carbonate	it fizzes and then becomes crumbly
sandstone B	silica	nothing seen

Which sandstone is best for use as building stone in a big city? (hint many cities have acid rain)

_____

Explain why you chose this rock _____

_____

Use the internet to find out how fossils are formed. You can draw diagrams if this helps.

_____

_____

_____

How long does it take to make fossils? _____ years

Note to teachers:

This clip makes a suitable plenary or starter

http://www.youtube.com/watch?v=eOuPsJwYu9I

The table for the mixes has 2 columns for your own use….. if you don't want to use salt, then you could use a carbonate and then test this pellet for acid erosion.

If you have time to do some of these demos, http://www.rsc.org/Education/Teachers/Resources/jesei/weather/index.htm

then you can look at erosion/weathering in detail.

if time you may want to show folding of rocks, but that is beyond the scope of the spec.

http://www.rsc.org/Education/Teachers/Resources/jesei/folding/index.htm

Activity 3, on this site, shows you how to make simple 'fossils'

http://www.rsc.org/Education/Teachers/Resources/jesei/weather/index.htm

also shown here http://www.homegrownfun.com/how-to-make-homemade-fossils-classroom/

6A Sedimentary rock from sand

What you will need

● eye protection ● 20 cm^3 plastic syringe with end cut off ● plastic cup ● spatula ● stirring rod ● file ● variety of masses	● dry sand ● powdered clay ● powdered chalk ● Plaster of Paris ● petroleum jelly ● sandstone samples ● salt and sugar

Safety notes

- Wear eye protection
- Avoid getting Plaster of Paris on your hands.
- Do not pour the Plaster of Paris down the sink

What to do

1. Use your finger to coat the petroleum jelly on the inside of the syringe
2. Mix five spatulas-full of damp sand with a little water in a plastic cup and load it into the syringe.
3. Put your finger over the end of the syringe and push down on the plunger as hard as possible,

4. Then carefully push out the pellet of sand and leave it on a piece of paper to dry. Label it ‘sand and water only’.
5. Repeat the steps 1-4 using different mixes as in the table.
6. You can make your own mixes with salt or sugar.
7. Remember to label each one.
8. Leave the ‘rocks’ to dry overnight.

Table to show the mixes that can be used.

	mix 1	mix 2	mix 3	mix 4	mix 5	mix 6
sand	**5**	**4**	**4**	**4**		
clay	0	**1**	0	0		
plaster of Paris	0	0	**1**	0		
powdered chalk	0	0	0	**1**		
salt	0	0	0	0		
sugar	0	0	0	0		
total amount	**5**	**5**	**5**	**5**	**5**	**5**

7 Changed rocks: metamorphic rocks

Watch the clip on how rocks change and complete the sentence below.
http://www.learner.org/interactives/rockcycle/change.html

Metamorphic (which is pronounced as 'meta- mor-fic') rocks are rocks which

have been changed because of _____ or _____

Carry out the investigation on metamorphic rocks and complete these sentences.

The beaker of water represents the underground _____

The unchanged egg white represents the original _____

The cooked egg white represents the new _____

magma	metamorphic rock	sedimentary rock

Explain why the egg has changed _____

_____

Metamorphic rocks often have curvy layers because they were made from rocks with crystals. The enormous pressure inside the earth caused some of the rocks to melt and some crystals to line up.

Watch the demonstration about metamorphic rocks.

Draw the before and after pictures.

before	**after**

Notes to teacher:

the demo mentioned is activity 2 on

http://www.rsc.org/Education/Teachers/Resources/jesei/meta/index.htm

However, it can also be done with laydough and uncooked long grain rice, Possibly as a class practical. (How to make playdough http://www.instructables.com/id/How-to-Make-Playdough-Play-doh/#step1)

If you can't face this demo then the link from the geology kitchen is fun

http://www.youtube.com/watch?feature=endscreen&v=e15n7-zq0mA&NR=1

Activity 3 on this page which could be done…..showing the distortion of shape of fossils in metamorphic rocks……but be careful that students don't associate fossils with metamorphic rocks.

7A Investigating metamorphic rocks

What you need

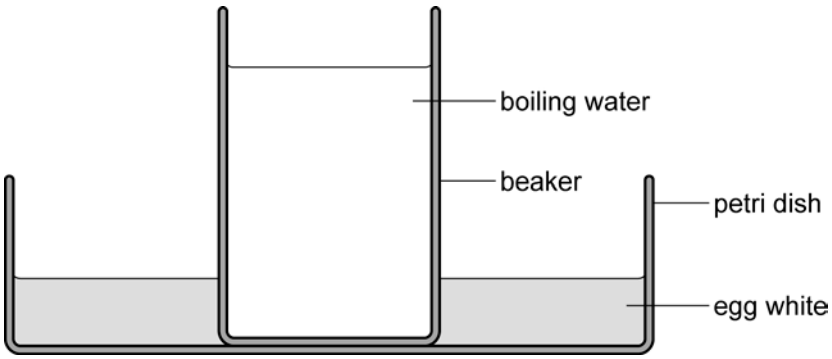
● shallow transparent dish (a Petri dish) ● small beaker, 50 ml or 100 ml ● Bunsen burner, tripod, gauze and heatproof mat ● cloth for handling the hot beaker	● 1 raw egg white ● salt (sodium chloride)

Safety notes

- Be careful when handling boiling water
- Do not eat the cooked egg
- Wash your hands after the experiment

What you do

- Place the white of an egg in a Petri dish.
- Half fill the beaker with water and two or three spatulas-full of salt (this will make the water boil at a temperature above 100 °C)
- Boil the water in the beaker.
- Then, carefully take the beaker off the tripod and place it in the middle of the egg white on the Petri dish as shown. Ask your teacher for help if you are not sure.
- Leave for it set up for about 10 minutes
- Draw and label what you see has happened on the diagram.



8 Sorting rocks-revision

Watch one of the interactive videos and try the questions with a partner.

http://www.learner.org/interactives/rockcycle/index.html
http://www.bbc.co.uk/bitesize/ks3/science/environment_earth_universe/rock_cycle/revision/1/
http://www.classzone.com/books/earth_science/terc/content/investigations/es0602/es0602page01.cfm

Use the internet to find out which sort of rock each of these are. Draw a sketch in the space provided.

conglomerate	**gneiss**	**granite**
limestone	**marble**	**obsidian**
pumice	**sandstone**	**slate**

9 Limestone chemistry

Use the internet or a text-book to find answers to these questions/

- Limestone is a sedimentary rock with a chemical name of calcium carbonate.

What are the 3 elements in calcium carbonate? One has been done for you.

1 = oxygen 2 = _____ 3 = _____

- There are 2 other rocks made from calcium carbonate.

What are the names of the 3 rocks made of the calcium carbonate? State what sort of rock they are.

1 = limestone which is sedimentary 2 = _____ which is _____

3 = _____ which is _____

- Limestone is important because it has so many uses in building and farming.

What are the main 5 uses for limestone?

1 _____ 2 _____

3 _____ 4 _____

5 _____

- Fill in the table to compare heated limestone and unheated limestone

What happens when	unheated limestone	heated limestone
you try to crush it (#7)		
you add a few drops of water (#8)		
indicator is added to the water (#10)		
you blow gently through the water (#11)		

- What did you see as you heated the limestone?

  Was it a different colour when hot?

  _____

  _____

  _____

- Match the beginnings and ends of these sentences. Use a straight line to join them.

Beginnings of sentences	ends of sentences
When limestone is heated it reacts and becomes	**calcium carbonate**
This sort of reaction is called a	**calcium hydroxide** (also known as lime water).
When water is added to calcium oxide it reacts and becomes a solution known as	**calcium oxide** (also known as quick lime).
Limewater can be used as a test for	**carbon dioxide**.
When carbon dioxide is bubbled through the limewater, the limewater goes	**cloudy** with tiny white particles which settle down to the bottom.

The tiny white particles are made of	**thermal decomposition**.

Notes to teacher:

The worksheet and instruction sheet are designed to work as a pair so that you have the option of reusing the instruction sheet if required.

The last part of the worksheet will form coherent notes if correctly completed, as the beginnings are in the correct order for the limestone cycle. You may wish to cut out the ends and paste them into the correct space.

Useful links:

limestone cycle http://www.youtube.com/watch?v=0jBWEGwejPg rather dry for the students but, if you are unfamiliar with the content, it will be useful for your own revision.

chemistry in action on industrial production of quick lime http://www.youtube.com/watch?v=Tok0LWjIGqE

uses of limestone http://www.youtube.com/watch?v=Cn3lJEnV_H0

scientific eye http://www.youtube.com/watch?v=mt5Ik0f2fXE

http://www.bbc.co.uk/schools/gcsebitesize/science/aqa_pre_2011/rocks/limestoneact.shtml

download a pdf on limestone uses

http://www.longcliffe.co.uk/pdf/The%20Processing%20and%20Major%20Uses%20of%20Limestone.pdf

nice chart of limestone uses

http://4.bp.blogspot.com/-aMi52GkPg0A/UIANlYcfREI/AAAAAAAAAEg/LQYgoT5GIMU/s1600/usesoflimestone.png

http://1.bp.blogspot.com/-gcZcSyn0bDA/UIANEPEg2TI/AAAAAAAAAEY/2ochlfxFZbo/s1600/limestone+reaction+cycle.jpg

9A Investigating limestone

What you will need

● eye protection ● Bunsen burner, tripod and gauze ● heatproof mat ● tongs ● 3 boiling tubes ● test-tube rack ● dropping pipette ● drinking straw	● a few small lumps of limestone (each about 1 cm^3) ● deionised / distilled water ● Universal Indicator solution and colour chart ● wire loop (optional) to support limestone

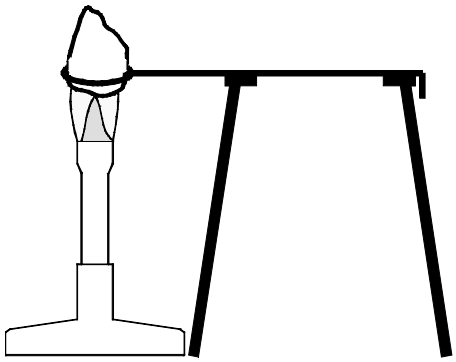
Safety notes

- You MUST wear goggles, the limestone can spit when it is heated and when you add water afterwards
- Take care with the stone after heating: it will be hot and it can react with your fingers and burn them.

What to do

1. Every test you do with the heated limestone you should do with a lump of unheated limestone.
2. Put 3 lumps of limestone on a tripod and gauze and heat with a hot Bunsen flame for 15 minutes.

   You can heat the limestone in a loop of wire supported by a tripod.



3. **Observation** = Watch the limestone as it heats and write down any changes that you see.
4. If it is possible make the room dark and watch what happens when the flame is pointed directly on the lumps.
5. Take the Bunsen away and let the lumps of rock cool down.
6. When it is cold, pick up one lump with your tongs and put it on a heatproof mat.
7. **TEST** = Try to crush it with your tongs.

Try the same with a lump of limestone that has not been heated.

Write down what you find.

8. **TEST** = Use your tongs to pick up a second lump and put it into a boiling tube.

   Then gently add a few drops of water with the dropping pipette.

   Carefully feel the bottom of the boiling tube.

   Write down what you see and feel.

9. Now put some more water into the same test tube until it is about half full.

   Put a stopper in and shake the boiling tube.

10. **TEST** = Pour off the clear liquid, half into one boiling tube and half into another.

    Put a few drops of Universal Indicator in one of the boiling tubes.

    Write down the colour and the pH of the liquid.

11. **TEST** = Put a drinking straw into the clear liquid in the second tube.
    Gently blow into the liquid through the straw.

    Write down what you see.

10 Iron and sulfur: elements and compounds.

Every **element** is made up of tiny particles called atoms.

All the atoms in any element are the same.

Iron and sulfur are two important elements.

How many different elements are there? _____

We can't create **atoms** --- all we can do is jumble them up or rearrange the atoms into new patterns.

When we **mix** pure substances together randomly, we get a _____

If we **react** pure substances together we get a _____

This is a completely new substance and nothing like the pure substances it was made from.

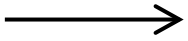
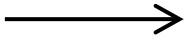
- Use the instruction sheet to make a new substance iron sulfide.
- Use the second instruction sheet to test the iron, sulfur, the mixture and iron sulfide. Write your results in the table.

To make iron sulfide we had to heat the iron and sulfur mixture. This is called a chemical reaction.

Chemical reactions are written down in a special way called an equation.

Sometimes this is in words, but sometimes it uses chemical shorthand.

Look at the equation below for our reaction.

reactants	**goes to**	**products**
iron + sulfur		iron sulfide
Fe + S		FeS

On the left are the substances we start with = **reactants**

On the right are the substances we end up with = **products**

The arrow points in the direction of the reaction and is read as 'goes to'

We can't destroy atoms --- at the end of the reaction there are always the same total number of atoms……just rearranged!

This means that if we start with 56 g of iron and produce 88g of iron sulfide at the end of the reaction, the mass of sulfur needed is _____ g

Questions:

1. What do iron and sulfur look like?

   iron = _____

   sulfur = _____

2. What does a mixture of iron and sulfur look like?

   _____

3. Explain how to get iron out of the mixture.

   _____

4. What does a mixture of iron and sulfur look like?

   _____

5. Can you get iron out of the iron sulfide compound?

   _____

6. Explain how you know that iron sulfide is a new substance.

   _____

   _____

   _____

10 Iron and sulfur question sheet

Part 1…. Mixtures and compounds

Use the words in the box to complete the sentences below.

Words can be used more than once.

chemical	**compound**	**different**
elements	**mixture**	

A compound is made up of two or more _____.

A compound has _____ properties from the properties of its elements.

A compound is made by a _____ reaction.

The elements in a _____ cannot be separated by physical means for example by using a magnet or by filtering.

A _____ can contain different elements and/or compounds mixed together.

A mixture is not made by a _____ reaction.

A mixture can be separated into _____ parts by physical means.

Part 2…. Iron and sulfur

Use the words in the box to complete the sentences below.

can	**compound**	**different**	**elements**
mixture	**not**		

Iron and sulfur are _____.

Iron sulphide is a _____.

The properties of iron sulphide are _____ from the properties of iron and sulfur.

It is easy to separate iron and sulfur from a _____ of iron and sulfur.

It is _____ easy to separate iron and sulfur from the compound iron sulphide.

A mixture of iron and sulfur _____ be separated by physical means.

Notes to teacher:

Although placed at #10, this is a stand-alone lesson. If you choose to do topic 5 or 6 before topic 4, it is advised that you do this lesson first.

It is quite demanding and could be taken in stages, which is allowed by the layout into parts.

The practicals are the standard ones for this topic.

Provide a iron powder / sufur powder mixture (ration 7:4 by mass) in a labelled container

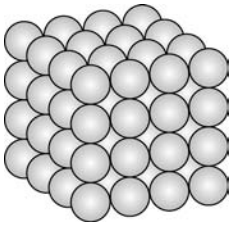
Other resources can be found from the RSC site at

http://www.rsc.org/learn-chemistry/resource/listing?searchtext=iron%20and%20sulfur&filter=all&fLevel=LEV00000003

10A Information I: atoms and elements

- Everything in the universe is made up of very small particles.
- These small particles are called **atoms**.
- Atoms are the building blocks of the universe.

Substances that contain only one type of atom are called **elements**.



Each circle represents one type of atom.

There are more than 100 different elements.

Elements cannot be separated into simpler substances.

All the elements are numbered,starting with 1.

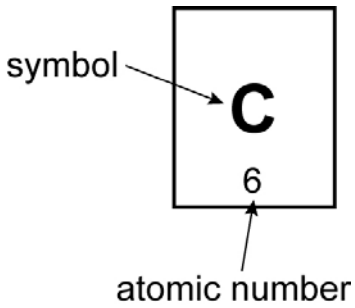
This number is called the **atomic number**.

Every element also has a shorthand symbol (or letter code).

The symbol is made of one or two letters.

So every atom of every element can be identified by their symbol and their atomic number.

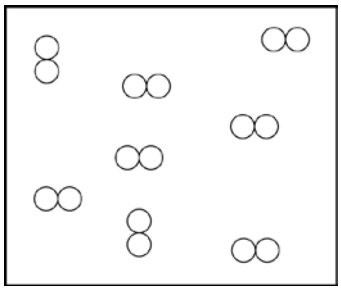
The diagram shows how to represent an atom of carbon.



When we write equations we only use the symbol.

10A Information II: molecules, compounds and mixtures

When only one of the ***same*** type of atom joins together they form groups called **molecules**.



Often they group in pairs.

We write the pairs such as O_2 or H_2.

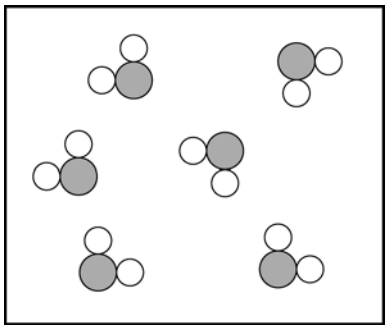
Note that the number is at the bottom right.

If they join together in eights we would write S_8.

Two or more ***different*** types of atom can chemically join together.

This forms the molecules of a **compound**. One they are joined it is difficult to split them up.

In this case:



the white circles represent one type of atom (oxygen)

the grey circles represent a different type of atom (carbon)

We can write this as carbon dioxide or CO_2

Different types of atoms may be mixed together to form a **mixture**.

In a mixture, the different types of atoms are not joined together.

It is quite easy to separate out the different elements in a mixture.

10A Information III

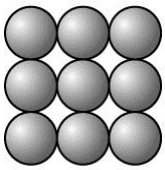
Particle pictures of elements, mixtures and compounds

Particle pictures can help you to understand the differences between elements, mixtures and compounds.

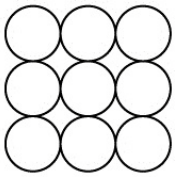
Elements are made up of very small particles called atoms.

Atoms of one element are different to atoms of another element.

Elements



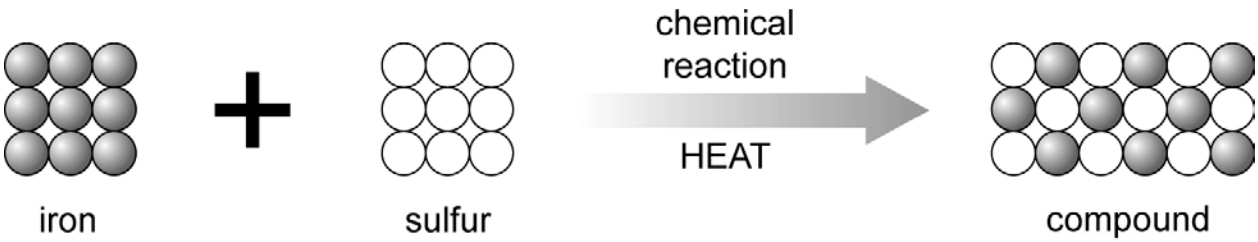
Particles (atoms) of iron



Particles (atoms) of sulfur

Mixtures

Compounds



10B Making a compound of Iron and Sulfur

What you need

● stand and clamp ● Pyrex / borosilicate glass test tube ● Bunsen burner ● heat proof mat ● safety goggles ● access to a fume cupboard	● A mixture containing fine iron filings and powdered sulfur (prepared by technician) ● mineral wool

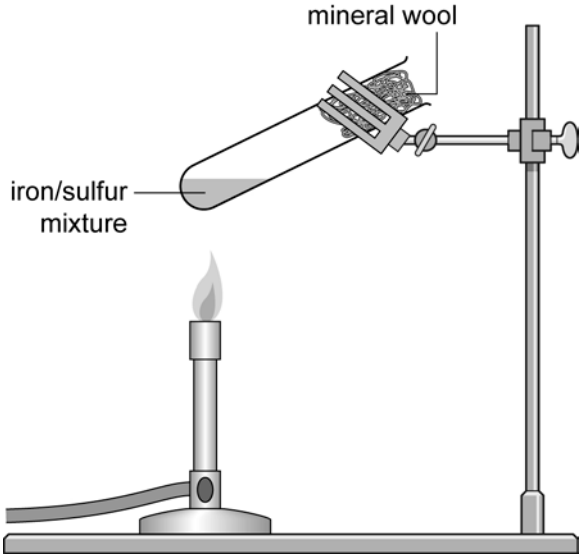
SAFETY PRECAUTIONS

- wear safety goggles
- carry out the reaction in a fume cupboard as a dangerous gas is produced.

What you do

1. Put 2 spatula measures of the iron / sulfur mixture into a hard glass test tube.

Put a loose plug of mineral wool into the mouth of the test tube.Half fill the test tube with the mixture.
Make sure there is an air space above the mixture.



2. Clamp the tube at the top at an angle.
   Heat the tube strongly near the middle as shown.
3. Stop heating when you see a red glow.
4. If there is any of the mixture left, reheat the tube to complete the reaction.
5. Let the tube and its contents cool before doing any tests with it.

10B Investigating the elements iron and sulfur

What you need

● beaker 100 ml ● bar magnet (wrapped in plastic) ● hand lens ● sheet of paper ● safety goggles	● iron filings ● sulfur powder ● mixture of iron and sulfur ● water ● dilute hydrochloric acid, 0.5 mol dm^{-3} ● iron sulfide compound

SAFETY PRECAUTIONS

- wear safety goggles
- carry out the reaction in a fume cupboard

What you do

Every time you do a test, write your results in the results table

1. **Test** - Put a small amount of **iron** filings on the sheet of paper.
   Write down what it looks like. Use the hand lens to help you.
2. **Test** - Move the magnet around underneath the paper.
   Write down what happens.
3. **Test** - Add a small amount of iron to water in a beaker.
   Write down whether the filings float or sink.
4. **Test** - Pour off the water leaving the iron behind.
   Carefully add a small amount of dilute hydrochloric acid to the iron.
   Write down what happens.
5. Repeat the steps1, 2, 3 and 4 with **sulfur** in place of the iron.
   Write down what happens in each case.
6. Repeat the steps1, 2, 3 and 4 with the **mixture of iron and sulfur**.
   Write down what happens.
7. Repeat the steps1, 2, 3 and 4 with the **compound of iron and sulfur**.
   Write down what happens.

10B Investigating the elements iron and sulfur — 2

Results Table

substance	appearance (what it looks like)	effect of magnet	float / sink in water	reaction with dilute acid
iron				
sulfur				
iron and sulfur mixture				
compound of iron and sulfur				