Knowledge Organiser: Year 9 Chemical Reactions Part 2

Chemical & Physical Reaction

Chemical changes happen when chemical reactions occur. They involve the formation of new chemical elements or compounds.
E.g. Iron will react with oxygen to form Iron Oxide (rust).

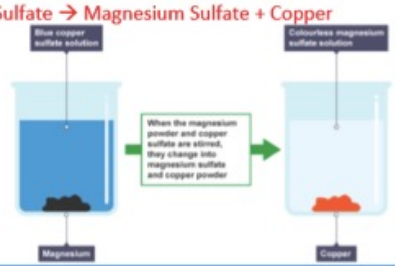
Physical changes do not lead to new chemical substances forming. In a physical change, a substance simply changes physical state. E.g. A solid to a liquid.

Displacement Reactions

Displacement reactions involve a metal and a compound of a different metal. In displacement reactions, a more reactive metal will displace a less reactive metal from its compound.

Magnesium + Copper Sulfate → Magnesium Sulfate + Copper

Magnesium is more reactive than copper, so it displaces (pushes out) the copper within the compound.

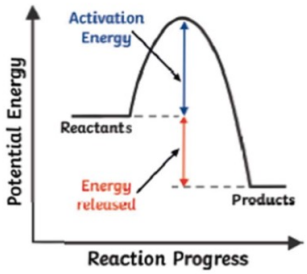


Reaction Profiles – Exothermic

Energy level diagrams show us what is happening in a particular chemical reaction. The diagram shows us the **difference in energy** between the reactants and the products.

In an exothermic reaction, the **reactants** are at a **higher** energy level than the products.

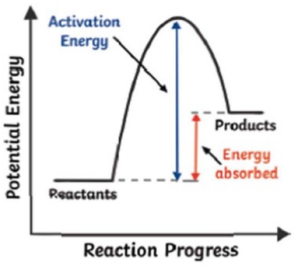
In an **exothermic** reaction, the difference in energy is **released** to the surroundings and so the **temperature** of the surroundings **increases**.



Reaction Profiles – Endothermic

In an **endothermic** reaction, the **reactants** are at a **lower** energy level than the products.

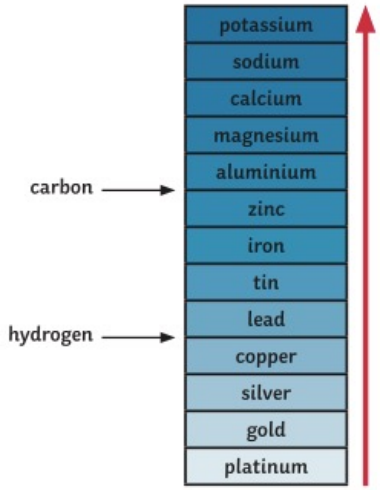
In an **endothermic** reaction, the difference in energy is **absorbed** from the surroundings and so the **temperature** of the surroundings **decreases**.



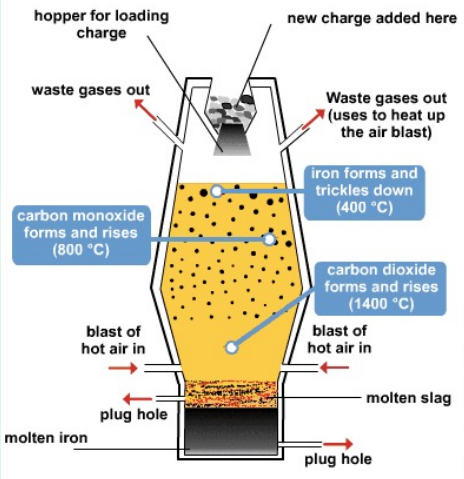
The Reactivity Series

Here's a mnemonic to help you learn the order:

purple (potassium)
slime (sodium)
can (calcium)
make (magnesium)
a (aluminium)
careless (carbon)
zebra (zinc)
insane (iron)
try (tin)
learning (lead)
how (hydrogen)
camels (copper)
surprise (silver)
gorillas (gold)



The reactivity series is a league table for metals. The more reactive metals are near the top of the table with the least reactive near the bottom. In chemical reactions, a more reactive metal will displace a less reactive metal.

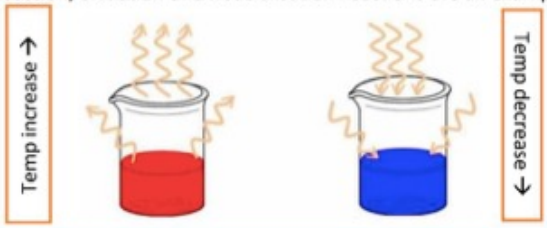


Endothermic Reactions

In an endothermic reaction, thermal energy is taken in from the surroundings, therefore there is a temperature decrease. Thermal decomposition is an example.

Exothermic Reactions

In an exothermic reaction, thermal energy is given out to the surroundings, therefore there is a temperature increase.
Combustion, oxidation and neutralisation reactions are all examples.



Activation Energy – the minimum amount of energy required for a chemical reaction to take place.

Catalysts – increase the rate of a reaction. Catalysts provide an alternative pathway for a chemical reaction to take place by **lowering** the activation energy.

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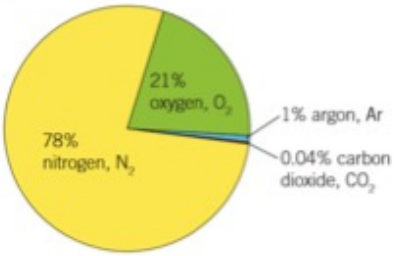
Term	Topic/s	Year group
1	Chemical Reactions Part II	9

Tier 2 'unlocking' language	Tier 3 subject relevant language
Compound	Catalyst
Mass	Displacement
Chemical	Endothermic
Ore	Exothermic
Investigating	Activation energy
Reactivity	Oxidation
Energy	Reduction
Collisions	Neutralisation

Knowledge Organiser: Year 9 Earth and Atmosphere

What is the atmosphere?

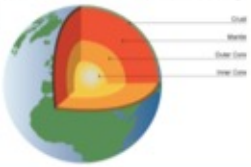
The air around us is called the **atmosphere**. The atmosphere is a mixture of gases that surrounds the Earth. It is mainly two elements, nitrogen and oxygen. There are smaller amounts of other substances, including carbon dioxide and argon.

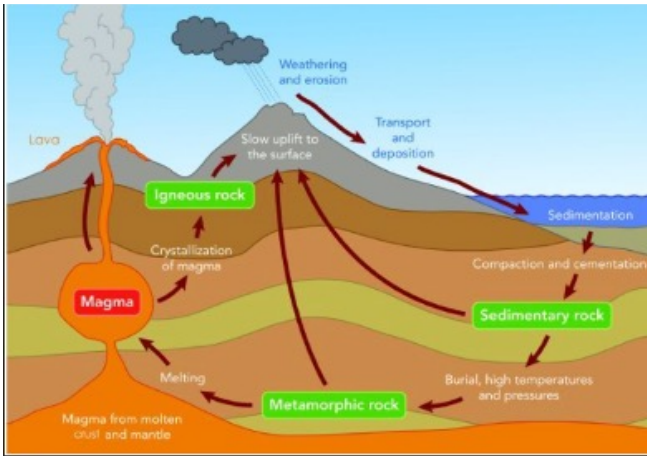


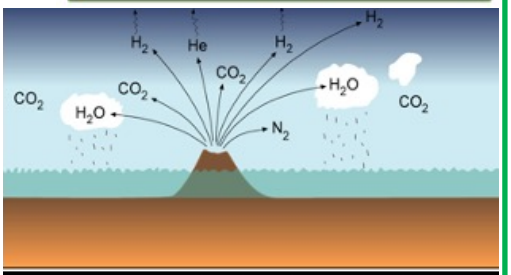
▲ The most common substances in the Earth's atmosphere, by volume.

Earth Structure

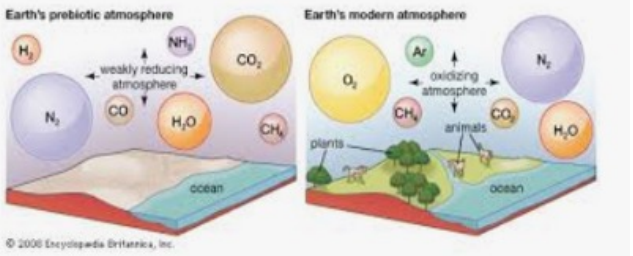
Inner Core: **Solid iron and nickel**
Outer core: **Liquid layer of iron and nickel**
Mantle: **classed as a liquid.**
Crust: **Land is made of continental crust, made mostly from *granite*. The layer beneath the ocean bed is made of oceanic crust, which is made mainly from *basalt*.**







There are two competing theories. 1. that Earth's water might have been captured from asteroids and comets that collided with the planet. 2.Tthat water was always present in the rocks of the Earth's mantle and was gradually released to the surface through volcanoes.



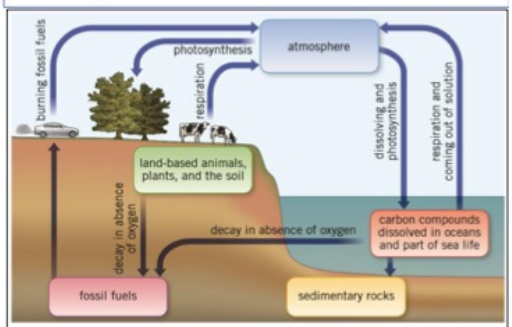
Comparison of Earth's prebiotic and modern atmospheres. Before life began on the planet, Earth's atmosphere was largely made up of nitrogen and carbon dioxide gases. After photosynthesizing organisms multiplied on Earth's surface and in the oceans, much of the carbon dioxide was replaced with oxygen.

Fossil fuels

Coal, oil, and gas are **energy resources** that were formed millions of years ago. That is why they are called **fossil fuels**. Oil and gas are made from the fossilised remains of sea creatures. Coal is the fossilised remains of trees.

Coal, oil, and gas are **non-renewable**. That doesn't mean that you can't use them again. It means that you cannot easily get more of them when we have used them up.

Carbon Cycle



▲ The carbon cycle.

Causes and Effects of Climate Change

Causes

- Rapid industrialization
- Energy use
- Agricultural practices
- Deforestation
- Consumer practices
- Livestock
- Transport
- Resource extraction
- Pollution

Effects

- Rising temperatures
- Rising sea levels
- Unpredictable weather patterns
- Increase in extreme weather events
- Land degradation
- Loss of wildlife and biodiversity

What are the social impacts of climate change?

Displaced people. Poverty. Loss of livelihood. Hunger. Malnutrition. Increased risk of diseases. Global food and water shortages.

Elements - only one type of atom in the particle

78% nitrogen N_2 molecules (about 80% or $^4/_5$ths) N_2 important to plants if not of direct use to us!

21% oxygen O_2 molecules (about 20% or $^1/_5$th)  , rather important for respiration!

1% argon **Ar** atoms ($^1/_{100}$th), plus traces of other Group 0 Noble Gases (He, Ne, Kr, Xe atoms)

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2	The Earth and Atmosphere	9

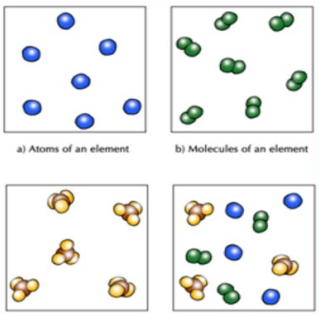
Tier 2 'unlocking' language	Tier 3 subject relevant language
Sedimentary	Photosynthesis
Igneous	Biodegradable
Metamorphic	Decomposition
Precipitation	Greenhouse effect
Atmosphere	Infrared
Water vapour	Radiation
Respiration	Combustion
Climate change	Condensation

Knowledge Organiser: Year 9
C1 Atomic structure

All substances are made of **atoms** that cannot be chemically broken down. It is the smallest part of an **element**.

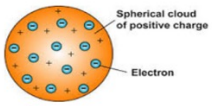
Elements are made of only one type of atom. Each element has its own **symbol.**
e.g. Na is sodium.

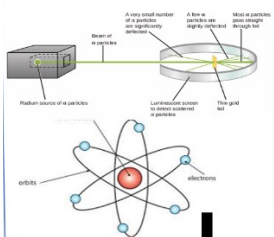
Compounds contain more than one type of atom.
Naming compounds-
Two elements = **ide**
e.g. Na_2S Sodium sulphide
Two or more including oxygen = **ate**
e.g. Na_2SO_4 = sodium sulphate



Dalton – atoms can't be divided

JJ Thompson discovered electrons – Plum pudding model

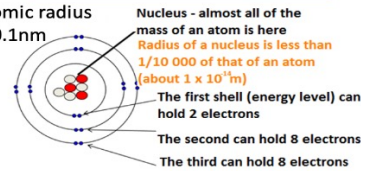




Geiger-Marsden The Nuclear Model of the Atom

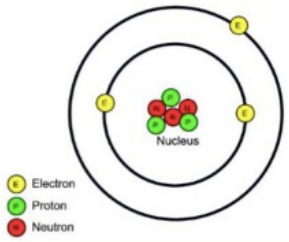
Bohr – electrons in shells

Chadwick – the neutron



Atomic structure

An atom is made up of three particles: protons, neutrons and electrons. Protons and neutrons are found together in the nucleus, electrons are found in electron shells. Atoms come in different types, each 'type' has a different number of protons. For example all atoms with 1 proton are hydrogen, all with 2 are helium etc.



Subatomic particle	Charge
Proton	+1
Neutron	0
Electron	-1

c) Molecules of a compound

d) Mixture of elements and a compound

There are two elements here – Magnesium and chlorine

magnesium ← $MgCl_2$ → 2 x chlorine

Magnesium chloride

There are 3 atoms. 1 x Mg and 2 x Cl

Small numbers (subscripts) after symbols tell you how many of the element BEFORE the number.

Electron shells

Shell	Maximum number of electrons
1	2
2	8
3	8

Electrons go in shells which are around the nucleus of the atom (where the protons and neutrons are). The electrons fill the shells from the closest to the nucleus outwards. A maximum of 2 can fit in the first shell, a maximum of 8 in the second shell and a maximum of 8 in the third. This can be written as 2, 8, 1.

Having a full outer shell of electrons makes an atom more stable. Atoms will lose or gain electrons in order to get a full outer shell. This happens during chemical reactions.

Elements
Elements are substances made up of only one type of atom.

Molecules
A collection of two or more atoms held together by chemical bonds.

Compounds
Substance that contains atoms of two or more *different* elements held together by chemical bonds.

Mixtures
Two or more different substances that are not joined together.

Mass number = Number of **protons** and **neutrons**

Atomic number = Number of protons

$^{7}_{3}Li$

Number of protons(+) = Number of electrons (-)

Number of neutrons =
mass number – atomic number

$^{7}_{3}Li$

Protons = 3
Electrons = 3
Neutrons = 4

Isotopes — Different mass numbers

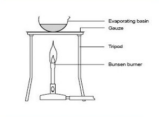
$^{12}_{6}C$ $^{13}_{6}C$ $^{14}_{6}C$

Same atomic number

Filtration
This technique separates substances that are insoluble in a solvent from those that are soluble

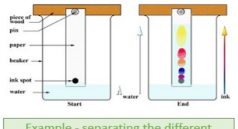
Example - filtering a mixture of sand, salt and water to collect the sand

Crystallisation
This technique separates a soluble substance from a solvent by heating



Example - crystallisation of sodium chloride from salt solution

Chromatography
This technique separates small amounts of dissolved substances by running a solvent along absorbent paper



Example - separating the different colours in ink

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3	C1/ C2	9

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Periods	Proton
Groups	Electron
Elements	Neutron
Atom	Ion
Negative	Isotope
Positive	Abundance
Neutral	Molecule
Charged	Compound