

**REVISION: CHEMISTRY**

**17 JUNE 2014**

 **Lesson Description**

In this lesson we revise:

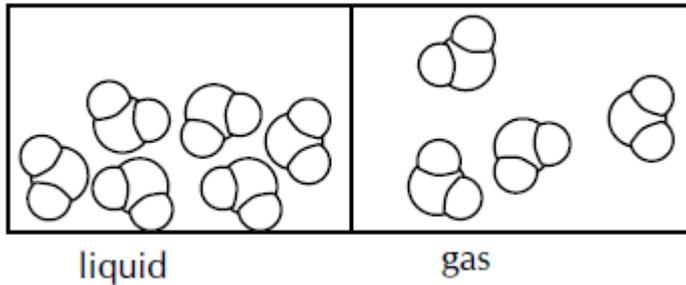
- the differences between physical and chemical changes
- how to represent chemical changes as balanced chemical equations

 **Summary**

**Physical Change**

A physical change can be seen or felt, but that doesn't involve the break-up of the particles in the reaction. During a physical change, the form of matter may change, but not its identity.

E.g. phase changes of water H<sub>2</sub>O



**Chemical Change**

When a chemical reaction takes place new substances are formed – with different properties.

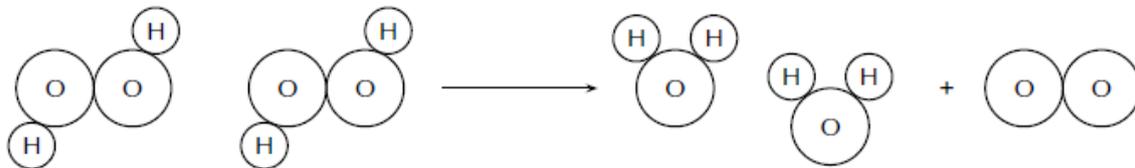
PHet simulation: Chemical reactions

- <http://phet.colorado.edu/en/simulation/reactants-products-and-leftovers>

Examples of chemical change:

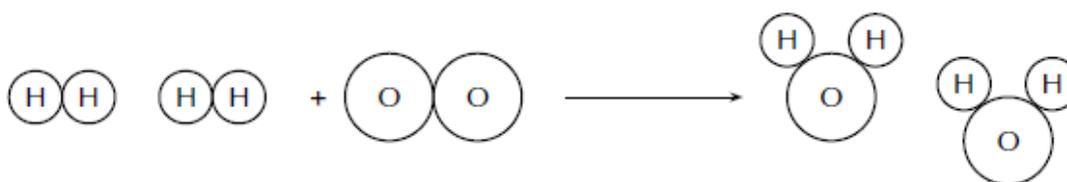
- Decomposition (breaking down) of hydrogen peroxide
- Synthesis (forming) of water.

**Decomposition**



Picture taken from: [www.everythingscience.co.za](http://www.everythingscience.co.za)

## Synthesis



Picture taken from: [www.everythingscience.co.za](http://www.everythingscience.co.za)

	Physical Change	Chemical Change
<b>Arrangement of particles</b>	Compounds may spread apart or come closer together - but the bonds in between the atoms will not break.	New compounds are formed.
<b>Conservation of mass</b>	Total mass, the number of atoms and the number of molecules will always stay the same.	Mass is conserved during a chemical change, but the number of molecules may change.
<b>Energy changes</b>	Energy changes are normally small.	The energy changes are much larger. Energy needed to break bonds and then energy is released when the new product is formed
<b>Reversibility</b>	Physical changes in matter are usually easier to reverse than chemical changes. i.e. Filtration, Distillation, Temperature changes	More difficult to reverse than physical changes.

## Representing Chemical Change

When a chemical change takes place, **new substances** are formed in a chemical reaction. This chemical change must be described and represented on paper:

- Words
- Symbol equation
- Balanced symbol equation

Reactants are on the left hand side of the equation and the products on the right. Arrow shows the direction of the reaction.

E.g. Magnesium burns in oxygen to produce a white substance, magnesium oxide.

Words: magnesium + oxygen → magnesium oxide

Symbols: Mg + O<sub>2</sub> → MgO (Not balanced)

Each substance is written with the correct formula.

NB – some elements exist as diatomic molecules: H<sub>2</sub>; N<sub>2</sub>; O<sub>2</sub>; F<sub>2</sub>; Cl<sub>2</sub>; Br<sub>2</sub>; I<sub>2</sub>

## Writing Formulae

Consider the group number to find the **valency** of each substance in the compound.

### Covalent Compounds

Valency represents the number of bonds the substance can make. For each substance, draw out the bonds as little “arms” and link each.

Ammonia

Nitrogen: Group 15 – can make 3 bonds

Hydrogen: Group 1 – can make 1 bond

Formula:  $\text{NH}_3$

### Ionic Compounds

The valency represents the **charge on the ion**. Metals have a positive charge as they have given away their valence electrons. Non-metals will gain electrons when forming ions – so form negative ions. This is done in order to obtain a filled outer energy level.

group 1	group 2	group 3	group 16	group 17	group 18
$\text{H}^+$	$\text{Mg}^{2+}$	$\text{Al}^{3+}$	$\text{O}^{2-}$	$\text{Cl}^-$	He

Simply **balance the charges** to make a neutral compound.

Magnesium oxide:  $\text{Mg}^{2+}$   $\text{Cl}^-$

Lithium oxide:  $\text{Li}^+$   $\text{O}^{2-}$

Calcium chloride:  $\text{Ca}^{2+}$   $\text{F}^-$

Roman numerals behind the name of an element in a compound indicate the charge on that element.

E.g. iron(III) oxide:  $\text{Fe}^{3+}$   $\text{O}^{2-}$

**Polyatomic ions** are ions (charged particles) made up of many atoms. They are useful to know

Ammonium:  $\text{NH}_4^+$

Hydroxide:  $\text{OH}^-$

Nitrate:  $\text{NO}_3^-$

Carbonate:  $\text{CO}_3^{2-}$

Sulphate:  $\text{SO}_4^{2-}$

Phosphate:  $\text{PO}_4^{3-}$



## Improve your Skills

### Physical & Chemical Change

#### Question 1

A child has been playing in the kitchen and mixes table salt, pepper corns and water together.

To try and separate these substances a number of processes could be done:

- Suggest a way to separate the peppercorns from the salt water.
- Suggest a way to separate the salt from the water
- Identify each process as undergoing physical or a chemical change.

#### Question 2

Given the following equation:  $(\text{NH}_4)_2\text{CO}_3 \rightarrow 2\text{NH}_3 + \text{CO}_2 + \text{H}_2\text{O}$

- Identify this as a physical or a chemical change.
- Identify this reaction as a synthesis or a decomposition reaction.
- Show that the law of conservation of mass applies.

### Representing Chemical Change

#### Question 1

Write formula for each of the following:

- magnesium iodide
- copper (II) fluoride
- calcium sulphate
- potassium chloride
- lithium nitrate
- ammonium carbonate
- sodium hydroxide

#### Question 2

Balance the following equations:

- $(\text{NH}_4)_2\text{CO}_3 \rightarrow \text{NH}_3 + \text{CO}_2 + \text{H}_2\text{O}$
- Lead (II) nitrate solution reacts with potassium iodide solution to form a precipitate (solid) of lead iodide while potassium nitrate remains in solution.
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## Challenge Question

Write a balanced symbol equation from the following word equation:

Aluminium reacts with solid copper (II) oxide to produce copper metal and aluminium oxide.