REVISION: CHEMICAL CHANGE 11 JUNE 2013

Lesson Description

In this lesson we revise:

- the characteristics of physical and chemical change
- how to represent a chemical reaction as a balanced equation

Key Concepts

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.

Chemical Change

When a chemical change takes place, **new** substances are formed in a chemical reaction. These new products may have very **different properties** from the substances that were there at the start of the reaction.

	PHYSICAL CHANGE	CHEMICAL CHANGE
Arrangement of particles	Compounds may re-arrange themselves, but the bonds in between the atoms will not break.	During a chemical change, the particles themselves are changed in some way.
Conservation of mass	Total mass, the number of atoms and the number of molecules will always stay the same. Always have the same number of molecules or atoms at the end of the change as you had at the beginning.	Mass is conserved during a chemical change, but the number of molecules may change. In the example of the decomposition of hydrogen peroxide, for every two molecules of hydrogen peroxide that decomposes, three molecules are formed (two water and one oxygen).
Energy changes	Energy changes are normally smaller than the energy changes that take place during a chemical change.	The energy changes are much greater than those that take place during a physical change in matter. During a chemical reaction, energy is used up in order to break bonds and then energy is released when the new product is formed
Reversibility	Physical changes in matter are usually easier to reverse than chemical changes. i.e. Filtration, Distillation, Temperature	More difficult to reverse than physical changes.

Law of Conservation of Mass

In a chemical reaction, the total mass of all the substances taking part in the reaction remains the same. Also, the number of atoms in a reaction remains the same. Mass cannot be created or destroyed in a chemical reaction.

Law of Constant Composition

In any given chemical compound, the elements always combine in the same proportion with each other. For example, any water molecule is always made up of two hydrogen atoms and one oxygen atom in a 2:1 ratio.

Gay-Lussac's Law

In a chemical reaction between gases, the relative volumes of the gases in the reaction are present in a ratio of small whole numbers if all the gases are at the same temperature and pressure.

Chemical Reactions

When a chemical change takes place, **new** substances are formed in a chemical reaction. These new products may have very **different properties** from the substances that were there at the start of the reaction.

This chemical change must be described and represented on paper:

- Word equation
- Symbol equation
- Balanced symbol equation

In a chemical equation, **reactants** are written on the left hand side of the equation and the **products** on the right. The arrow is used to show the direction of the reaction.

Writing chemical formulae

Consider the group number to find the **valency** of each substance in the compound.
(Revise notes on Chemical Bonding)

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: 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. This is done in order to obtain a filled outer energy level.

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

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

There are some important **polyatomic ions** which will be useful for you to know: These are ions (charged particles) made up of many atoms.

Ammonium: NH_4^+

Hydroxide: OH^-
Nitrate: NO_3^-

Carbonate: CO_3^{2-}
Sulphate: SO_4^{2-}

Phosphate: PO_4^{3-}

Questions

Question 1

Complete the following table by identifying each of the descriptions as an example of a physical or chemical change.

Description	**Physical or chemical**
hot and cold water mix together	
a car starts to rust	
food digests in the stomach	
alcohol disappears when it is placed on your skin	
fireworks exploding	

Question 2

For the following equation: $CaCO_{3\,(s)} \longrightarrow CaO + CO_2$ show that the law of conservation of mass applies.

Question 3

Write formula for each of the following:

a.) Magnesium iodide
b.) Zinc (II) fluoride
c.) Copper sulphate
d.) Potassium chloride
e.) Sodium nitrate
f.) Ammonium carbonate
g.) Calcium hydroxide

Question 4

Write a balanced chemical reaction for the following.

a.) Calcium reacts with water to produce calcium hydroxide and hydrogen gas.
b.) Lead (II) nitrate solution reacts with potassium iodide solution to form a precipitate (solid) of lead iodide while potassium nitrate remains in solution.
c.) When heated, aluminium metal reacts with solid copper oxide to produce copper metal and aluminium oxide (Al_2O_3).