**S3 BGE Chemistry: Rates, Reactions & Atomic Structure**

**Structure of the Atom**

* Atoms are made up of protons, neutrons and electrons.
* Protons are located in the nucleus, and electrons orbiting around the nucleus.
* Protons have a positive charge, electrons have a negative charge and neutrons have no charge.
* The number of protons in an element is equal to the atomic number and the number of electrons is the same as the number of protons.
* The number of neutrons can be calculated using:

**Mass number = no. protons + no. neutrons**

**The Periodic Table**

* The Periodic Table is split into metals and non-metals by a solid line.
* Metals are on the left and non-metals on the right
* The elements are found in vertical columns called groups
* Some of the Groups are named:
  + Group 1 = The Alkali Metals (these are VERY REACTIVE)
  + Group 7 = Halogens (VERY REACTIVE)
  + Group 0 = Noble Gases (these don’t react at all – UNREACTIVE)
* The large Group between Groups 2 and 3 are called the Transition Metals
* All the elements in the Periodic Table have a symbol. This is either a ­­­­­­­­­­­­­­Capital letter or a CAPITAL and a lower case letter.
* What elements have these symbols?

Li Lithium Fe Iron

C Carbon Cl Chlorine

He Helium U Uranium

**Elements, Compounds & Chemical Reactions**

* Elements only contain 1 type of atom.
* A mixture is 2 or more elements mixed together that can be separated
* Compounds contain 2 or more types of atom.
* Compounds are made when elements chemically bond together
* The difference between a mixture and a compound is that mixtures can be easily separated, compounds cannot
* Are the following an element, mixture or compound?

Water C Iron E

Magnesium chloride C Air M

Salt C Iron sulfide C

* When chemical reactions happen a new substance is made.
* Signs of a chemical reaction happening are:
  + Bubbles of gas
  + Temperature change
  + Colour Change
  + Solid Formed
* There are two main rules for NAMING COMPOUNDS:
  + Ending in –IDE = 2 elements are present
  + Ending in –ITE or –ATE = 2 elements plus oxygen
* What elements have reacted to make these compounds?
  + Sodium chloride: Sodium and chlorine
  + Copper sulfate: Copper, sulfur and oxygen
  + Magnesium nitrite: Magnesium, nitrogen and oxygen
  + Carbon hydride: Carbon and hydrogen
* It is very difficult to turn compounds back into elements, but it can be done by Electrolysis.
* This uses electricity to break up the chemical bonds.
* Some gas elements can be tested to identify them:
  + Hydrogen burns with a ‘POP’
  + Oxygen relights a glowing splint

**Solutions**

* A **SOLUTION** is a **MIXTURE** formed when a solute dissolves in a solvent.
* The **SOLUTE** is the substance that dissolves
* The **SOLVENT** is the liquid it dissolves in
* If something **CAN DISSOLVE** it is said to be soluble
* If something **CANNOT DISSOLVE** it is said to be insoluble

In this example, label each substance below as SOLUTE, SOLVENT and SOLUTION:

**Copper sulfate solid + Water** 🡪 **Copper sulfate solution**

Solute Solvent Solution

* When the MAXIMUM amount of solute has dissolved in the solvent, we say that the solution is saturated.

**Rates of Reaction**

* Reactions can be slow or fast. An example of a slow reaction is oil forming and an example of a fast reaction is fireworks
* The rate of reaction can be measured by measuring volume and mass
* The rate of reaction can be increased by:
  + Increasing temperature
  + Adding a catalyst
  + Increasing concentration
  + Decreasing particle size
* Explain why smaller logs will burn faster than larger logs.

Smaller logs have a larger surface area so will burn faster than larger logs

* Explain why plants grow faster in a greenhouse.

Greenhouses are hotter so the increased temperature makes the plants grow faster

* Explain how concentration affects the rate of a reaction.

Increasing concentration means there are more particles present, therefore there are more collisions so the reaction rate increases

* A catalyst a substance that speeds up a reaction but remains unchanged
* An enzyme is a biological catalyst

**Electrolysis**

* Electrolysis uses electrical energy to break up compounds
* The compound must either be in a solution (dissolved in water) or a liquid (been melted) to go through electrolysis
* The metal is always found at the NEGATIVE electrode
* The NON-METAL is always found at the POSITIVE electrode.