National 4/5 Chemistry Learning Outcomes

(what you need to know…)

Unit 1 – Chemical Changes and Structure

**Ah!**

**123**

**(280)**

**The Element of Surprise!**

Topic A: Reaction Rates

* A chemical reaction always results in a new substance being formed
* A chemical reaction can be shown by a change in appearance of a substance
* A chemical reaction can be shown by a detectable energy change
* A chemical reaction can be shown by precipitation (a solid forming in a solution)
* A chemical reaction can be shown by effervescence (a gas bubbling form a solution)
* An exothermic reaction gives out heat energy
* An endothermic reaction takes in heat energy
* I can give examples of everyday chemical reactions
* I know what happens to the rate of a reaction if particle size is decreased
* I know what happens to the rate of a reaction if concentration is increased
* I know what happens to the rate of a reaction if temperature is increased
* I can give examples of everyday chemical reactions affected by changing particle size or concentration or temperature
* I can explain why these factors affect the rate of a reaction
* I know what a catalyst can do to the rate of some reactions
* I know that catalysts are not used up in chemical reactions and can be recovered chemically unchanged
* I can give some everyday examples of the names and uses of catalysts.
* I can describe how the progress of a reaction could be accurately followed in an experiment
* I can draw a graph to show how a reaction progresses over time
* I can sketch graphs of reaction progress for different reaction conditions
* I can use graphs or experimental data to calculate the average rate of a reaction over a time period

Notes:

Topic B: Atomic Structure

* Everything in the world is made up of about 100 elements
* Each element has a name and symbol
* I can classify elements as either naturally occurring/man-made or solid/liquid/gas or metal/non-metal
* Elements are classified by chemists by arranging them in the periodic table
* I understand what a group is in the periodic table
* I can identify Group 1 elements (the alkali metals), Group 7 (the halogens) and Group 0 (the noble gases) in the periodic table
* I know that elements in the same group of the periodic table have similar chemical properties
* I can identify the position of the transition metals in the periodic table
* I understand that the noble gases are a family of unreactive elements
* I understand that every element is made up of tiny particles called atoms
* I know each atom has a very small positively charged nucleus with negatively charged electrons moving around outside the nucleus.
* I know the location and charge of the proton, neutron and electron
* I know the relative masses of the proton, neutron and electron
* I know an atom is neutral because the positive charge of the nucleus is equal to the sum of the negative charges of the electrons
* I know an atom is neutral because the numbers of protons and electrons are equal.
* I know each element is different and has a different number called the Atomic Number
* I know atoms of different elements have a different number of protons and this number is the atomic number
* I know the meaning of Mass Number
* I can calculate the number of protons (p), neutrons (n) and electrons (e) from mass number and atomic number and vice versa
* I can calculate the number of protons (p), neutrons (n) and electrons (e) from nuclide notation of atoms
* I know what is meant by the term isotope and how isotopes of an element are different
* I know that most elements exists as a mixture of isotopes
* I know atoms of different elements are different in mass and size
* I know that the relative atomic mass is the average mass of the isotopes of an element and why the average mass is rarely a whole number
* I know the electrons are arranged in energy levels
* I can state the electron arrangement for the first 20 elements (use data book)
* I can explain the structure of the Periodic Table in terms of the atomic number and chemical properties of the elements
* I know that elements with the same number of outer electrons (same group) have similar chemical properties
* I know why atoms form ions and can work out what the charge on an ion will be from the electron arrangement of the atom
* I can calculate the number of protons (p), neutrons (n) and electrons (e) from nuclide notation of ions

Notes:

Topic C: Formula and Equations

* I can write the formula of elements including the 7 diatomic elements (I2, Br2, Cl2, F2, O2, N2, H2)
* When two or more elements join together a compound is formed
* I can explain why some compounds have names which end in -IDE, some end in -ATE while others end in –ITE
* I can write the formula of compounds that have prefixes in their names (e.g. carbon monoxide, silicon tetrachloride)
* I can write the formula of two element compounds using valency
* I can write the formula of compounds with Roman numerals in their name
* I can write the formula of compounds ending in –ATE, -ITE or containing other group ions
* I can write word equations to describe chemical reactions
* I can write formula equations to describe chemical reactions
* I can use state symbols in formula equations
* I can balance formula equations

Notes:

Topic D: Bonding and Properties

* I know that atoms form bonds to achieve a stable full outer shell of electrons
* I know that compounds containing metals are classified as ionic
* I know the typical properties of an ionic compound
* I know when ionic compounds can conduct electricity and when they cannot conduct electricity
* I know how positive and how negative ions are formed from atoms
* Ionic solids exist as lattices of oppositely charged ions
* I know that the formula of an ionic compound gives the ratio of the different ions in the lattice
* I can write ionic formula
* I understand what happens to the lattice when an ionic compound dissolves in water or is melted
* I know what an electric current is
* I know the name of the particles which move through the solution when an ionic compound conducts electricity
* I can work out the elements formed at each electrode when an ionic solution is changed by an electric current
* I can explain the movement of the oppositely charged ions when an electric current passes through an ionic solution is changed by electrical energy
* I can explain the changing of ions into atoms/molecules in terms of electron loss or gain when an electric current passes through an ionic solution
* I know what happens to a molten ionic compound when it is changed by an electric current
* I know why molten ionic compounds conduct electricity but solid ionic compounds do not
* I know the meaning of the terms 'electrolyte' and 'electrolysis'
* I know that electrolysis applies only to ionic compounds
* I can relate the colour of ionic compounds to the colour of the positive or negative ions present in it
* I can explain the results of the migration of coloured ions in an electric field
* I know why a d.c. supply must be used to identify the products when an electric current is passed through an ionic solution
* I know that non-metal elements and compounds containing only non-metals are classified as covalent
* I know that covalent substances (solid, liquid and gas) do not conduct electricity
* A covalent bond involves the sharing of pairs of electrons
* When two positive nuclei are held together by their common attraction for the shared pair of electrons, a covalent bond results
* A molecule is a group of atoms joined held together by covalent bonds
* The chemical formula of a covalent substance gives the numbers of atoms of each element in the molecule
* I can draw diagrams to show what happens to the outer electrons when covalent bonds are formed
* I can draw or describe the shape of some simple molecules such as H2O, CO2 and CH4
* I know that covalent molecular compounds have only weak forces if attraction between their molecules and so are low melting point solids, liquids and gases
* I know that covalent network substances (e.g. diamond and glass) have strong covalent bonds all through their structure and so are high melting point solids
* I understand that to find out the type of bonding present in a substance you need to test its properties

Notes:

Topic E: Mole Calculations

* I can calculate the formula mass of a substance
* I know that a mole of a substance is its formula mass in grams (GFM)
* I can covert moles to mass and mass to moles
* I understand what the concentration of a solution is and know that it is measured in mol/l
* I can carry out calculations involving concentration, moles and volume
* I can carry out calculations involving concentration of solutions in mol/l and mass in g

Notes:

Topic F: Acids and Alkalis

* The pH scale measures how acidic or alkaline a solution is
* The pH scale is a number scale running from below 1 to above 14
* Acids have a pH of less than 7, alkalis have a pH of more than 7, pure water and neutral solutions have a pH equal to 7
* Know the names and formula of common acids and alkalis used in the laboratory
* Know the names of some household acids and alkalis
* Acid solutions are produced when non-metal oxides dissolve in water
* I know that metal oxides or hydroxides which dissolve in water produce alkaline solutions
* I am aware of the environmental impact of various non-metal oxides
* I am aware of the uses of various acids in foods
* I know that acids and alkalis are ionic solutions and know the names of the ions present in them
* I know the gas produced at the negative electrode when acids are electrolysed
* I know the concentration of ions in water is small
* I know that in water and neutral solutions, the concentration of H+(aq) and OH-(aq) ions is the same
* I know that an acidic solution contains more H+(aq) ions than does pure water
* I know that an alkaline solution contains more OH-(aq) ions than does pure water
* I know what effect diluting an acid or an alkali has on concentration of ions and on its pH

Notes:

Topic G: Neutralisation

* I know that a base is a chemical that will neutralise an acid
* I know that alkalis are formed when soluble bases dissolve in water
* I understand that neutralisation is the reaction of acids with bases
* I know some everyday examples of bases
* I know that neutralisation moves the pH of an acid/alkali towards 7
* I know that H+ ions are always used up in neutralisation reactions
* I know that water is formed in all neutralisation reactions
* I know that hydrogen ions and hydroxide ions react to form water
* I can name the products formed in the reaction of a base with dilute hydrochloric, nitric and sulphuric acid
* I know the definition of the term ‘salt’
* I know the reaction of an acid with a metal carbonate gives off carbon dioxide
* I know the reaction of hydrogen ions and carbonate ions forms water and carbon dioxide
* I can explain why, in the preparation of a salt, it is often easier to use an insoluble metal carbonate or metal oxide as the neutraliser
* I can explain the effect of acid rain on buildings and carbonate rocks
* I can describe some ways in which neutralisation is used to control pH (e.g. in soil, lakes, human body)
* I can write ionic formula equations for neutralisation reactions and remove spectator ions
* I can carry out calculations to find the concentration of acids/alkalis from volumetric titration

Notes: