Science Year 10 – Chemistry Rotation

	What? **When?** **Why?**			
	Biology (DUE TO TIMINGS) Health and Disease	**Chemistry** Acids and Alkalis	**Chemistry** Bonding and Substances	**Chemistry** Calculations and Chemical Change
Lesson 1 Learning intentions	**Health** Describe health as a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity, as defined by the World Health Organisation (WHO) Describe the difference between communicable and non-communicable diseases. Explain why the presence of one disease can lead to a higher susceptibility to other diseases	**Acids, Indicators and pH** Describe the use of hazard symbols on containers. Recall that a neutral solution has a pH of 7 and that acidic solutions have lower pH values and alkaline solutions higher pH values. Recall the effect of acids and alkalis on indicators, including litmus, methyl orange and phenolphthalein. **Recall that the higher the concentration of hydrogen ions in an acidic solution, the lower the pH; and the higher the concentration of hydroxide ions in an alkaline solution, the higher the pH.**	**Ionic Bonds** Explain how ionic bonds are formed by the transfer of electrons between atoms to produce cations and anions, including the use of dot and cross diagrams. Recall that an ion is an atom or group of atoms with a positive or negative charge. Calculate the numbers of protons, neutrons and electrons in simple ions given the atomic number and mass number Explain the formation of ions in ionic compounds from their atoms, limited to compounds of elements in groups 1, 2, 6 and 7.	**Relative Formula Mass** Calculate relative formula mass given relative atomic masses.
Lesson 2 Learning intentions	**Non-Communicable Diseases** Describe that many non-communicable human diseases are caused by the interaction of a number of factors including cardiovascular diseases, many forms of cancer, some lung and liver diseases and diseases influenced by nutrition. Explain the effect of lifestyle factors on non-communicable diseases at local, national and global levels, including:	**Looking at Acids** **Recall that as hydrogen ion concentration in a solution increases by a factor of 10, the pH of the solution decreases by 1.** **Explain the terms dilute and concentrated, with respect to amount of substances in solution.** **Explain the terms weak and strong acids, with respect to the degree of dissociation into ions.**	**Ionic Lattices** Explain the use of the endings –ide and –ate in the names of compounds. Recall the formulae of elements, simple compounds and ions. Deduce the formulae of ionic compounds (including oxides, hydroxides, halides, nitrates, carbonates and sulfates) given the formulae of the constituent ions. Explain the structure of an ionic compound as a lattice structure a) consisting of a regular	**Empirical Formula** Calculate the formulae of simple compounds from reacting masses and understand that these are empirical formulae. Deduce: a) the empirical formula of a compound from the formula of its molecule b) the molecular formula of a compound from its empirical formula and its relative molecular mass.

	a) … diet on … malnutrition… b) alcohol on liver diseases		arrangement of ions b) held together by strong electrostatic forces (ionic bonds) between oppositely-charged ions.	
Lesson 3 Learning intentions	**Cardiovascular Disease** Explain the effect of lifestyle factors on non-communicable diseases at local, national and global levels, including: a) exercise and diet on obesity and malnutrition, including BMI and waist:hip calculations using the BMI equation. c) smoking on cardiovascular diseases Evaluate some different treatments for cardiovascular disease including: a) life-long medication b) surgical procedures c) lifestyle changes	**Bases and Salts** Recall that a base is any substance that reacts with an acid to form salt and water only. Explain the general reactions of aqueous solutions of acids with b) metal oxides to produce salts Describe a neutralisation reaction as a reaction between an acid and a base. Explain why, if soluble salts are prepared from an acid and an insoluble reactant: a) excess of the reactant is added b) the excess reactant is removed c) the solution remaining is only salt and water.	**Properties of Ionic Compounds** Explain the properties of ionic compounds limited to: a) high melting points and boiling points, in terms of forces between ions b) whether or not they conduct electricity as solids, when molten and in aqueous solution.	**Empirical Formula Experiment** Describe an experiment to determine the empirical formula of a simple compound such as magnesium oxide
Lesson 4 Learning intentions	**Pathogens** Describe a pathogen as a disease-causing organism including viruses, bacteria, fungi and protists. Describe some common infections, including: a) cholera (bacteria) causes diarrhoea b) tuberculosis (bacteria) causes lung damage c) chalara ash dieback (fungi) causes leaf loss and bark lesions d) malaria (protists) causes damage to blood and liver e) HIV (virus) destroys white blood cells, leading to the onset of AIDS	**Core Practical** Investigate the preparation of pure, dry hydrated copper sulfate crystals starting from copper oxide including the use of a water bath.	**Covalent Bonding** Explain how a covalent bond is formed when a pair of electrons is shared between two atoms. Recall that covalent bonding results in the formation of molecules. Recall the typical size (order of magnitude) of atoms and small molecules. Explain the formation of simple molecular, covalent substances, using dot and cross diagrams, including: a) hydrogen b) hydrogen chloride c) water d) methane	**Conservation of Mass** Explain the law of conservation of mass applied to a) a closed system including a precipitation reaction in a closed flask b) a non-enclosed system including a reaction in an open flask that takes in or gives out a gas

	f) stomach ulcers caused by Helicobacter (bacteria) g) Ebola (virus) causes haemorrhagic fever		e) oxygen f) carbon dioxide	
Lesson 5 Learning intentions	**Spreading Pathogens** Explain how pathogens are spread and how this spread can be reduced or prevented, including: a) cholera (bacteria) – water b) tuberculosis (bacteria) – airborne c) chalara ash dieback (fungi) – airborne d) malaria (protists) – animal vectors e) stomach ulcers caused by Helicobacter (bacteria) – oral transmission f) Ebola (virus) – body fluids	**Alkalis and Balancing Equations** Explain the general reactions of aqueous solutions of acids with c) metal hydroxides to produce salts Recall the formulae of elements, simple compounds and ions. Write word equations. Write balanced chemical equations, including the use of the state symbols (s), (l), (g) and (aq) Recall that alkalis are soluble bases	**Molecular Compounds** Explain the properties of typical covalent, simple molecular compounds limited to a) low melting points and boiling points, in terms of forces between molecules (intermolecular forces) b) poor conduction of electricity Describe, using poly(ethene) as the example, that simple polymers consist of large molecules containing chains of carbon atoms	**Calculating the Mass of Reactants and Products** Calculate masses of reactants and products from balanced equations, given the mass of one substance.
Lesson 6 Learning intentions	**Physical and Chemical Defences** Describe how the physical barriers and chemical defences of the human body provide protection from pathogens, including: a) physical barriers including mucus, cilia and skin b) chemical defence including lysozymes and hydrochloric acid.	**Core Practical** Investigate the change in pH on adding powdered calcium hydroxide or calcium oxide to a fixed volume of dilute hydrochloric acid	**Allotropes of Carbon** Recall that graphite and diamond are different forms of carbon and that they are examples of covalent giant molecular substances. Describe the structures of graphite and diamond. Explain, in terms of structure and bonding, why graphite is used to make electrodes and as a lubricant, whereas diamond is used in cutting tools. Explain the properties of fullerenes (e.g. C_{60}) and graphene in terms of their structures and bonding.	**Concentration** Calculate the concentration of solutions in g dm^{-3}
Lesson 7 Learning intentions	**Immune System** Explain the role of the specific immune system of the human body in defence against disease including:	**Alkalis and Neutralisation** Explain an acid-alkali neutralisation as a reaction in which hydrogen ions (H^+) from the acid react with	**Properties of Metals** Explain the properties of metals, including malleability and the ability to conduct electricity.	**Moles** **Recall that one mole of particles of a substance is defined as:**

	a) exposure to pathogen b) the antigens trigger an immune response which causes the production of antibodies c) the antigens also trigger production of memory lymphocytes d) the role of memory lymphocytes in the secondary response to the antigen	hydroxide ions (OH^-) from the alkali to form water. Explain why, if soluble salts are prepared from an acid and a soluble reactant: a) titration must be used b) the acid and the soluble reactant are then mixed in the correct proportions c) the solution remaining, after reaction, is only salt and water. Describe how to carry out simple acid-alkali titrations, using burette, pipette and a suitable indicator, to prepare a pure, dry salt.	Describe most metals as shiny solids which have high melting points, high density and are good conductors of electricity whereas most non-metals have low boiling points and are poor conductors.	**a) the Avogadro constant number of particles (6.02×10^{23} atoms, molecules, formulae or ions) of that substance** **b) a mass of 'relative particle mass' g** **Calculate the number of:** **a) moles of particles of a substance in a given mass of that substance and vice versa** **b) particles of a substance in a given number of moles of that substance and vice versa** **c) particles of a substance in a given mass of that substance and vice versa**
Lesson 8 Learning intentions	**<u>Immunisation</u>** Explain the body's response to immunisation using an inactive form of a pathogen.	**<u>Reactions of acids with metals and carbonates</u>** Explain the general reactions of aqueous solutions of acids with: a) metals d) metal carbonates to produce salts Describe the chemical test for: a) hydrogen b) carbon dioxide (using limewater) **Write balanced ionic equations for these reactions.**	**<u>Bonding Models</u>** Explain why elements and compounds can be classified as: a) ionic b) simple molecular (covalent) c) giant covalent d) metallic and how the structure and bonding of these types of substances results in different physical properties, including relative melting point and boiling point, relative solubility in water and ability to conduct electricity (as solids and in solution) Describe the limitations of particular representations and models to include dot and cross, ball and stick models and two- and three-dimensional representations	**<u>Limiting Reactants and Chemical Equations</u>** **Explain why, in a reaction, the mass of product formed is controlled by the mass of the reactant which is not in excess** **Deduce the stoichiometry of a reaction from the masses of the reactants and products.**

Lesson 9 Learning intentions	**Antibiotics** Explain that antibiotics can only be used to treat bacterial infections because they inhibit cell processes in the bacterium but not the host organism.	**Solubility** Recall the general rules which describe the solubility of common types of substances in water: a) all common sodium, potassium and ammonium salts are soluble b) all nitrates are soluble c) common chlorides are soluble except those of silver and lead d) common sulfates are soluble except those of lead, barium and calcium e) common carbonates and hydroxides are insoluble except those of sodium, potassium and ammonium Predict, using solubility rules, whether or not a precipitate will be formed when named solutions are mixed together, naming the precipitate if any.		**Electrolysis** Recall that electrolytes are ionic compounds in the molten state or dissolved in water Describe electrolysis as a process in which electrical energy, from a direct current supply, decomposes electrolytes. Explain the movement of ions during electrolysis, in which: a) positively charged cations migrate to the negatively charged cathode b) negatively charged anions migrate to the positively charged anode. **Write half equations for reactions occurring at the anode and cathode in electrolysis** **Explain oxidation and reduction in terms of loss or gain of electrons** **Recall that reduction occurs at the cathode and that oxidation occurs at the anode in electrolysis reactions**
Lesson 10 Learning intentions	**New Medicines and Drug Trials** Describe that the process of developing new medicines, including antibiotics, has many stages including discovery, development, preclinical and clinical testing.			**Core Practical** Investigate the electrolysis of copper sulfate solution with inert electrodes and copper electrodes
Lesson 11 Learning intentions	**STIs** Explain how sexually transmitted infections (STIs) are spread and how this spread can be reduced or prevented, including:			**Products of Electrolysis** Explain the formation of the products in the electrolysis, using inert electrodes, of some electrolytes.

	a) Chlamydia (bacteria) b) HIV (virus)			Predict the products of electrolysis of other binary, ionic compounds in the molten state. Explain formation of the products in the electrolysis of copper sulfate solution, using copper electrodes, and how this electrolysis can be used to purify copper
Lesson 12 Learning intentions				**<u>Reactivity</u>** Deduce the relative reactivity of some metals, by their reactions with water, acids and salt solutions. **Explain displacement reactions as redox reactions, in terms of gain or loss of electrons.** Explain the reactivity series of metals (potassium, sodium, calcium, magnesium, aluminium, (carbon), zinc, iron, (hydrogen), copper, silver, gold) in terms of the reactivity of the metals with water and dilute acids and that these reactions show the relative tendency of metal atoms to form cations
Lesson 13 Learning intentions				**<u>Ores</u>** Recall that: a) most metals are extracted from ores found in the Earth's crust b) unreactive metals are found in the Earth's crust as the uncombined elements. Explain why the method used to extract a metal from its ore is related to its position in the reactivity series and the cost of the extraction process,

				illustrated by a) heating with carbon (including iron) b) electrolysis (including aluminium) (knowledge of the blast furnace is not required) **Evaluate alternative biological methods of metal extraction (bacterial and phytoextraction)**
Lesson 14 Learning intentions				**<u>Oxidation and Reduction</u>** **Explain displacement reactions as redox reactions, in terms of gain or loss of electrons.** Explain oxidation as the gain of oxygen and reduction as the loss of oxygen. Recall that the extraction of metals involves reduction of ores. Explain how a metal's relative resistance to oxidation is related to its position in the reactivity series
Lesson 15 Learning intentions				**<u>Recycling</u>** Evaluate the advantages of recycling metals, including economic implications and how recycling can preserve both the environment and the supply of valuable raw materials. Describe that a life time assessment for a product involves consideration of the effect on the environment of obtaining the raw materials, manufacturing the product, using the product and disposing of the product when it is no longer useful. Evaluate data from a life cycle assessment of a product.
Lesson 16 Learning intentions				**<u>Dynamic Equilibria</u>**

				Recall that chemical reactions are reversible and the use of the symbol ⇌ in equations and that the direction of some reversible reactions can be altered by changing the reaction conditions. Explain what is meant by dynamic equilibrium Describe the formation of ammonia as a reversible reaction between nitrogen (extracted from the air) and hydrogen (obtained from natural gas) and that it can reach a dynamic equilibrium. Recall the conditions for the Haber process as: a) temperature 450°C b) pressure 200 atmospheres c) iron catalyst **Predict how the position of a dynamic equilibrium is affected by changes in:** **a) temperature** **b) pressure** **c) concentration**