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**Knowledge Rich Curriculum Plan**

Science – Chemistry

Year 12



| **Science** **Year 12 Chemistry**  | **Unit: Atomic Structure** |  |  |
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| **Lesson/Learning Sequence**  | **Intended Knowledge:***Students will know that…* | **Tiered Vocabulary**  | **Prior Knowledge:***In order to know this students, need to already know that…* |
| **Lesson:** **Atomic Structure: GCSE Review** | * Students will know that atoms are made up of protons, neutrons and electrons
* Students will know that neutrons have no electrical charge and have a relative mass of 1
* Students will know that protons have an electrical charge of +1 and a relative mass of 1
* Students will know that electrons have an electrical charge of -1 and negligible relative mass
* Students will know that protons, electrons and neutrons are known as "fundamental particles"
* Students will know that the symbol A means Mass number
* Students will know that the symbol Z means atomic number
* Students will know that isotopes are atoms with the same number of protons but different number of neutrons
* Students will know how to determine the number of fundamental particles in atoms and ions
* Students will know how to calculate relative atomic mass from isotopic abundance
 |  | * ***Students need to already know that an atom is made up of 3 subatomic particles; protons, neutrons and electrons.***
* ***Students need to already know that the atomic number is the same as the number of protons***
* ***Students need to already know that the mass number is the same as the total number of protons and neutrons***
* ***Students need to already know that ions are formed when atoms either lose or gain electrons***
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| **Lesson:** **Electron Configuration** | * Students will know that electrons are arranged in energy levels surrounding the nucleus of the atom
* Students will know that each energy level can be split into sub-shells (s, p and d)
* Students will know that each sub-shell can hold 2 electrons
* Students will know that the first energy level contains only one sub-shell, s (1s)
* Students will know that the second energy level contains 1 s sub-shell, and 3 p sub-shells (2s, 2p)
* Students will know that the third energy level contains 1 s sub-shell, 3 p sub-shells and 5 d sub-shells (3s, 3p, 3d)
* Students will know that the 4s sub-shell fills before the 3d sub-shell
* Students will know that chromium and iron are exceptions to the 4s sub-shell filling first rule
* Students will know that when transition metals form ions, they lose their 4s electrons first
* Students will know that 4s fills before 3d as it is a lower energy level
* Students will know that, for stability, atoms will fill the sub-shells one electron at a time
* Students will know how to write the electron configurations of atoms and ions up until Z = 36
 |  | * ***Students need to already know that electrons are arranged around the nucleus of an atom***
* ***Students need to already know that ions are formed when atoms lose or gain electrons***
 |
| **Lesson:** **Ionisation Energies** | * Students will know that first ionisation energy is defined as the energy required to remove one mole of electrons from one mole of atoms in the gaseous state
* Students will know that nuclear charge is the size of the positive charge in the nucleus of an atom
* Students will know that electron shielding refers to the number of electron shells an atom as.
* Students will know that first ionisation energies gave evidence for the configuration of electrons
* Students will know how to write equations for first and successive ionisation energies
* Students will know how to explain the pattern of first ionisation energies in Period 3 give evidence for electron configuration in sub-shells
* Students will know how to explain how first and successive ionisation energies in Group 2 give evidence for electron configuration in shells
* Students will know how to use ionisation energies to determine which group an atom is in
 | Ionisation energy: energy required to remove one mole of electrons from one mole of atoms in the gaseous state | * ***Students need to already know that electrons are arranged in sub-shells around the nucleus***
 |
| **Lesson:** **Time of Flight Mass Spectrometry** | * Students will know that the stages of time of flight mass spectrometry are ionisation, acceleration, ion drift, ion detection
* Students will know that ionisation can happen through either electron impact or electrospray ionisation
* Students will know that during electron impact the sample being analysed is vaporised and then high energy electrons are fired at it. This results in one electron being knocked off from the particle.
* Students will know that electrospray ionisation involves the sample being dissolved in a volatile solvent and injected through a needle. The needle is attached to a high voltage power supply.
* Students will know that during electrospray ionisation the particles are ionised by gaining a proton
* Students will know how to represent electron impact ionisation or electrospray ionisation using equations
* Students will know that during the acceleration stage, the ions are accelerated using an electric field, giving all the ions the same kinetic energy.
* Students will know that as all particles are given the same kinetic energy, the velocity (and therefore time taken for detection) depends on the mass. The lighter particles will have a higher velocity, whilst heavier particles will have a slower velocity
* Students will know that during detection the positive ions hit a negatively charged electric plate. When this happens, the positive ions are discharged (gaining electrons from the plate), resulting in an electric current that can be measured
* Students will know that the size of the current gives a measure of the number of ions hitting the plate.
* Students will know that the product of mass spectrometry is called a mass spectrum. This shows the mass to charge ratio (m/z) plotted against the abundance of each ion at the detector.
* Students will know how to predict the mass spectrum produced by a sample
* Students will know how to interpret mass spectra
* Students will know how to use mass spectra to calculate relative atomic masses.
 |  | * ***Students need to already know that isotopes are atoms with the same number of protons but different number of neutrons***
 |
| **Lesson:** **Time of Flight Calculations** | * Students will know that kinetic energy can be determined using the equation:
* KE = 1/2 x m x v2
* Students will know how to rearrange the kinetic energy equation to determine the velocity of particles
* Students will know that the mass of a particle in grams can be determined by dividing the relative atomic mass of the particle by Avogadro's constant
* Students will know that mass needs to be in kg for the kinetic energy equation
* Students will know that the time of flight along the flight tube can be determined using t = d/v
* Students will know how to use the equations above to determine mass, velocity, kinetic energy, distance or time.
 |  | * ***Students need to already know that one mole of atoms contains Avogadro's constant number of particles***
* ***Students need to already know that one mole of atoms has its relative atomic mass in grams***
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| **Science** **Year 12 Chemistry**  | **Unit: Bonding** |  |  |
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| **Lesson/Learning Sequence**  | **Intended Knowledge:***Students will know that…* | **Tiered Vocabulary**  | **Prior Knowledge:***In order to know this students, need to already know that…* |
| **Lesson:****GCSE Bonding Review** | * Students will know that ionic bonding involves electrostatic attraction between oppositely charged ions in a lattice
* Students will know the following compound ions:

SO4 2-OH -NO3 -CO3 2-NH4 +* Students will know that a single covalent bond contains a shared pair of electrons
* Students will know that multiple bonds contain multiple pairs of electrons
* Students will know that metallic bonding involves attraction between delocalised electrons and positive ions arranged in a lattice
* Students will know how to represent covalent bonds using lines and dot and cross diagrams
* Students will know how to construct formulae for ionic compounds
 |  | * ***Students need to already know that metals generally form positive ions, and non-metals form negative ions***
* ***Students need to already know that the properties of ionic compounds include high melting and boiling points and electrical conductivity when molten or aqueous.***
 |
| **Lesson:****Dative Covalent Bonds** | * Students will know that a dative covalent bond (also known as a co-ordinate bond) is a covalent bond in which both electrons come from the same atom
* Students will know that dative covalent bonds are represented with an arrow, which points from the atom donating the pair of electrons to the atom accepting it
* Students will know that a lone pair is a pair of electrons that aren't involved in bonding
* Students will know that examples of molecules that contain dative covalent bonds are NH4+, H3O+, Al2Cl6
* Students will know how to represent dative covalent bonds using diagrams
 | Dative covalent bond: covalent bond where both the electrons are provided by one of the bonding atoms | * ***Students need to already know that a covalent bond involves the sharing of a pair of electrons***
 |
| **Lesson:****Bonding and Physical Properties** | * Students will know that the four types of crystal structure are ionic, metallic, macromolecular and molecular
* Students will know that macromolecular is also known as giant covalent
* Students will know that an example of a substance that displays ionic crystal structure is sodium chloride
* Students will know that an example of a substance that displays metallic crystal structure is magnesium
* Students will know that examples of substances that displays macromolecular crystal structure are diamond and graphite
* Students will know that examples of substances that displays molecular crystal structure are ice and iodine
* Students will know how to explain the energy changes associated with changes of state
* Students will know how to draw diagrams to represent these structures involving specified number of particles
* Students will know how to relate the melting point and conductivity of materials to the type of structure and the bonding present
 | Macromolecular: molecules containing a large number of atoms | * ***Students need to already know that ionic substances have high melting points and can conduct electricity when molten or aqueous***
* ***Students need to already know that molecular substances have low melting points and are electrical insulators***
* ***Students need to already know metallic substances have high melting points and are electrical conductors***
 |
| **Lesson:****Shapes of Molecules** | * Students will know that bonding pairs and lone pairs of electrons repel each other
* Students will know that Valence Shell Electron Pair Repulsion (VSEPR) Theory states that pairs of electrons in the outer shell of atoms arrange themselves as far apart as possible to minimise repulsion
* Students will know that lone pair-lone pair repulsion is greater than lone pair-bond pair repulsion, which is in turn greater than bond pair-bond pair repulsion
* Students will know that electron pair repulsion affects bond angles.
* Students will know how to determine the shapes of, and bond angles in, simple molecules and ions with up to 6 electron pairs surrounding the central atom.
* Students will know how to represent the shapes of molecules using diagrams
* Students will know how to explain the effect of electron pair repulsion on bonding angles within molecules
 | Valence: outer electron shell | * ***Students need to already know that electrons have a negative electrical charge***
* ***Students need to already know that like charges repel***
 |
| **Lesson:** **Bond Polarity** | * Students will know that electronegativity is the power of an atom to attract the pair of electrons in a covalent bond
* Students will know that the most electronegative atoms are found in the top right of the periodic table (excluding the noble gases, which don't form covalent bonds)
* Students will know that the electron distribution in a covalent bond between elements with different electronegativities will be unsymmetrical.
* Students will know that the electronegativity of an atom is linked to its nuclear charge and electron shielding.
* Students will know that unsymmetrical electron distribution within a bond causes a polar covalent bond
* Students will know how to represent polar bonds, using delta to represent partial charges
* Students will know how to predict whether a bond with be polar or not.
 | Electronegativity: the power of an atom to attract the pair of electrons in a covalent bond | * ***Students need to already know that a covalent bond is a shared pair of electrons***
* ***Students already need to know that nuclear charge refers to the size of the positive charge in the nucleus of an atom***
* ***Students already need to know that shielding refers to the number of electron shells a substance has.***
 |
| **Lesson:** **London Forces** | * Students will know that London forces can also be known as dispersion forces (and occasionally van der Waals)
* Students will know that within a bond electrons are mobile within a bond
* Students will know that as electrons are mobile, at one instant they might be more towards one end of a molecule, causing that end to have a slight negative charge (and the other end slightly positive)
* Students will know that when two molecules are together, a slight positive charge on one could attract the electrons from the bond in the other. This induces a dipole.
* Students will know that the polarity of both molecules can reverse, but they will still be attracted.
* Students will know that the strength of the London forces depends on the size of the atoms involved. As larger atoms have more electrons there is more distance in which the temporary dipoles can develop.
* Students will know that the strength of the London forces also depends on the shape of the molecule. Long thin molecules can develop bigger temporary dipoles due to electron movement than short fat ones. Long thin molecules can also lie closer together, increasing the effectiveness of the London forces.
* Students will know that all molecules experience London forces, and that they are the weakest intermolecular force.
* Students will know how to link melting and boiling points with the size of the London forces exhibited by molecules
 |  | * ***Students need to already know that covalent bonds involve the shared pair of electrons***
 |
| **Lesson:** **Permanent dipole-dipole forces** | * Students will know that a substance that contains polar covalent bonds could become polar itself.
* Students will know that not all substances that contain polar covalent bonds are polar molecules themselves
* Students will know that molecules are polar if they are unsymmetrical and contain polar covalent bonds
* Students will know that permanent dipole-dipole forces are stronger than induced dipole forces, but weaker than hydrogen bonding
* Students will know that in permanent dipole-dipole interactions, the slightly charge positive end of a molecule is attracted to the slightly negative end of another molecule
* Students will know how to test whether molecules have a permanent dipole
* Students will know how to represent permanent dipoles
* Students will know how to explain the melting and boiling points of molecules with a permanent dipole
 |  | * ***Students need to already know that some molecules will contain polar bonds.***
 |
| **Lesson:** **Hydrogen Bonding** | * Students will know that the boiling points of H2O, HF and NH3 are much higher than anticipated, and so there must be another intermolecular force causing this to happen.
* Students will know that hydrogen bonding is the strongest of the 3 intermolecular forces (full order, from weakest to strongest, is London forces, permanent dipole-dipole forces, Hydrogen bonds)
* Students will know that for hydrogen bonding to take place a hydrogen atom must be directly attached to one of the most electronegative elements (Fluorine, Oxygen, Nitrogen), giving the hydrogen atom a significant amount of partial positive charge
* Students will know that for hydrogen bonding to occur the atom the hydrogen is attached to must have a lone pair of electrons, along with a partial negative charge
* Students will know that hydrogen bonds are the intermolecular attraction between the hydrogen's significant partial positive charge and the lone pair of electrons on the atom bonded to the hydrogen.
* Students will know that hydrogen bonding is responsible for the comparative low density of ice, as the hydrogen bonds space the water molecules further apart than they would be in liquid water
* Students will know how to represent hydrogen bonds using diagrams.
 |  | * ***Students need to already know that a lone pair is a non-bonding pair of electrons on an atom***
* ***Students need to already know that electronegativity is a measure of how much an atom pulls a bonding pair of electrons towards it.***
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| **Science** **Year 12 Chemistry**  | **Unit: Amount of Substance** |  |  |
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| **Lesson/Learning Sequence**  | **Intended Knowledge:***Students will know that…* | **Tiered Vocabulary**  | **Prior Knowledge:***In order to know this students, need to already know that…* |
| **Lesson:** **GCSE Review: Formulae and Masses** | * Students will know that chemical equations must be balanced
* Students will know how to determine the formulae for ionic compounds
* Students will know that relative atomic mass (Ar) is defined as the average mass of an atom relative to Carbon-12
* Students will know that the relative molecular mass (Mr) is the combined mass of all of the atoms within a molecule, relative to Carbon-12
* Students will know how to calculate the Ar of an atom, using relative abundance of isotopes
* Students will know how to calculate the Mr of a molecule
* Students will know that the appropriate accuracy to give Ar and Mr values to is one decimal place
 |  | * ***Students need to already know that relative atomic masses are found in the periodic table***
* ***Students need to already know that isotopes are atoms with the same number of protons but different number of neutrons***
 |
| **Lesson:** **The Mole and Avogadro's Constant** | * Students will know that the Avogadro constant is the number of particles in a mole
* Students will know that one mole of an atom will have a mass equal to its relative atomic mass in grams
* Students will know that moles (mol) are used as a chemical quantity
* Students will know that to calculate number of moles you use the equation:
* moles = mass ÷ atomic mass (or molecular mass)
* Students will know that concentration is measured in mol dm-3
* Students will know that concentration is calculated using the equation:

concentration = moles ÷ volume* Students will know how to complete calculations using:

Avogadro's constantMoles, Mr and massConcentration, volume and moles* Students will know that to find the number of moles of a fundamental particle in a substance you first need to calculate the number of moles of the substance, and then multiply by the number of fundamental particles in one atom of the substance
 |  | * ***Students need to already know how to determine the number of fundamental particles within a substance***
* ***Students need to already know how to determine the Ar and Mr of a substance***
* ***Students need to already know how to convert volume from cm3 to dm3***
 |
| **Lesson:** **Ideal Gas Equation** | * Students will know that the following assumptions are made about gases in calculations:

-Gases are made of molecules which are in constant random motion in straight lines-The molecules behave as rigid spheres-Pressure is due to collisions between the molecules and the walls of the container-All collisions between molecules are elastic-The temperature of the gas is proportional to the average kinetic energy of the molecules-There are no intermolecular forces between as molecules-The volume occupied by the molecules themselves is negligible relative to the volume of the container* Students will know that the ideal gas equation is:

pV = nRT* Students will know that pressure, p, is measured in Pascals (Pa).
* Students will know that 1 atmosphere pressure is equal to 101325 Pa
* Students will know that volume, V, is measured in m3 (for the ideal gas equation only)
* Students will know that the symbol n stands for number of moles
* Students will know that R is the ideal gas constant
* Students will know that temperature, T, is measured in Kelvin (K)
* Students will know that to convert degrees Celsius into Kelvin you add 273
* Students will know how to use the ideal gas equation to calculate pressure, volume, number of moles or temperature.
 |  | * ***Students need to already know how to do the following conversions:***
* ***1) kPa --> Pa: x 1000***
* ***2) dm3 --> m3: ÷ 1000***
* ***3) cm3 --> m3: ÷ 1 000 000***
 |
| **Lesson:** **Empirical and Molecular Formula** | * Students will know that empirical formula is defined as the simplest whole number ratio of atoms of each element in a compound
* Students will know that molecular formula is defined by the actual number of atoms of each element in a compound
* Students will know how to calculate empirical formula from data giving composition by mass or percentage by mass
* Students will know how to calculate molecular formula from the empirical formula and relative molecular mass
 |  | * ***Students need to already know how to calculate Mr***
 |
| **Lesson:** **Balanced Equations and Calculations** | * Students will know how to write balanced equations for reactions
* Students will know how to write ionic equations for reactions
* Students will know that atom economy is calculated using:
* (Molecular mass of desired product) ÷ (Sum of molecular masses of all reactants) x 100
* Students will know that there are economic, ethical and environmental advantages for society and for industry of developing chemical processes with a high atom economy.
* Students will know how to use balanced equations to calculate masses, volumes of gases, percentage yields and percentage atom economies
 |  | * ***Students need to already know that:***
* ***Percentage yield = (actual yield) / (theoretical yield) x 100***
 |
| **Lesson:** **Titrations** | * Students will know that titrations are used to determine unknown concentrations of solutions
* Students will know how to carry out a titration
* Students will know how to use data collected from titration to complete calculations related to concentration
* Students will know how to identify potential sources of error in titrations
 |  | * ***Students need to already know that concentration is calculated by using:***
* ***concentration = moles / volume***
 |
| **Lesson:** **Required Practical 1 (2 lessons)** | * Students will know how to make up a volumetric solution using a balance, a volumetric flask, a beaker and a funnel
* Students will know how to carry out a simple acid-base titration
* Students will know how to calculate unknown concentrations using a titration
 |  |  |

| **Science****Year 12 Chemistry**  | **Unit: Energetics** |  |  |  |
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| **Lesson/Learning Sequence**  | **Intended Knowledge:***Students will know that…* | **Tiered Vocabulary**  | **Prior Knowledge:***In order to know this students, need to already know that…* | **Practical Opportunities** |
| **Lesson:** **Enthalpy Change** | * Students will know that enthalpy is a measure of the heat content of a substance
* Students will know that enthalpy change is the change in heat content at constant pressure
* Students will know that standard conditions are 100 kPa and 298 K
* Students will know that enthalpy change of exothermic reactions is negative
* Students will know that enthalpy change of endothermic reactions is positive
* Students will know that enthalpy change of formation is the enthalpy change when 1 mole of a substance is formed from its constituent elements with all reactants and products in standard states
* Students will know that standard enthalpy of combustion is the enthalpy change when 1 mole of a substance is completely burned in oxygen with all reactants and products in standard states under standard conditions
* Students will know that standard enthalpy of neutralisation is the enthalpy change when 1 mole of water is formed from a reaction between an acid and an alkali under standard conditions
* Students will know how to represent standard enthalpy change of formation using equations
* Students will know how to represent standard enthalpy change of combustion using equations
* Students will know how to represent standard enthalpy change of neutralisation using equations
 | Enthalpy change: change in heat energyEnthalpy change of combustion: enthalpy change when 1 mole of a substance is completely burned in oxygen with all reactants and products in standard states under standard conditions.Enthalpy change of formation: enthalpy change when 1 mole of a substance is formed from its constituent elements with all reactants and products in standard statesEnthalpy change of neutralisation: enthalpy change when 1 mole of water is formed from a reaction between an acid and an alkali under standard conditions | * ***Students need to already know that exothermic reactions release energy to the surroundings***
* ***Students need to already know that endothermic reactions absorb energy from the surroundings***
* ***Students need to know how to represent exothermic and endothermic reactions using reaction profiles***
 | Measuring heat changes |
| **Lesson:** **Calorimetry** | * Students will know that enthalpy change for a reaction can be found by measuring the temperature change in a reaction
* Students will know that when practically determining enthalpy change of a reaction the heat energy is used to heat a known mass of water
* Students will know that the energy needed to raise 1 g of a substance by 1 K is called the specific heat capacity
* Students will know that heat energy can be calculated using the equation:

q = mcΔTq = heat energym = mass (g)c = specific heat capacity (J g-1 K-1)ΔT = change in temperature (K)* Students will know that enthalpy change is calculated by using:

q ÷ number of moles* Students will know that heat loss is a problem when practically determining enthalpy change, and techniques used in calorimetry are used to reduce heat loss.
* Students will know how to use practical data to determine enthalpy change
* Students will know that reactions taking place in solution are carried out in an insulated beaker to reduce heat loss
* Students will know that flame calorimeters are used to find the enthalpy of combustion of a substance
 |  | * ***Students need to already know that Kelvin and degrees celsius use the same divisions within the scale***
 | Calorimetry |
| **Lesson:** **Calorimetry Required Practical (2 lessons)** | * Students will know how to complete a practical to determine enthalpy change
 |  |  |  |
| **Lesson:** **Application of Hess's Law** | * Students will know how that Hess's law states that the total enthalpy change of a reaction is independent of the route taken
* Students will know how to apply Hess's law to solve problems involving standard enthalpy change of formation and standard enthalpy change of combustion
 |  | * ***Students need to already know that enthalpy change of formation is the enthalpy change when 1 mole of a substance is formed from its constituent elements with all reactants and products in standard states***
* ***Students need to already know that standard enthalpy of combustion is the enthalpy change when 1 mole of a substance is completely burned in oxygen with all reactants and products in standard states under standard conditions***
 | Using Hess’s Law |
| **Lesson:** **Bond Enthalpies** | * Students will know that bond enthalpy is the enthalpy change to break one mole of covalent bonds in the gas phase
* Students will know that enthalpies of reaction can be calculated using mean bond enthalpies
* Students will know that enthalpies of reaction that have been calculated using mean bond enthalpies are not as accurate as they might be because the values used are averages and not the specific ones for that compound
* Students will know how to apply Hess's law to complete calculations involving bond enthalpies
 | Bond enthalpy: enthalpy change to break one mole of covalent bonds in the gas phase | * ***Students need to already know that enthalpy change of a reaction is independent of the route taken***
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| **Science** **Year 12 Chemistry**  | **Unit: Kinetics** |  |  |  |
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| **Lesson/Learning Sequence**  | **Intended Knowledge:***Students will know that…* | **Tiered Vocabulary**  | **Prior Knowledge:***In order to know this students, need to already know that…* | **Practical Opportunities** |
| **Lesson:** **GCSE Review - Collision Theory** | * Students will know that reactions can only occur when collisions take place between particles having sufficient energy
* Students will know that the sufficient energy needed for a reaction to take place is the activation energy
* Students will know how to apply collision theory to explain different circumstances
 |  | * ***Students need to already know that reaction rates can be increased through increasing the temperature, increasing the concentration, increasing the pressure and using catalysts***
 |  |
| **Lesson:** **Maxwell-Boltzmann Distribution** | * Students will know that Maxwell-Boltzmann distribution curves show the distribution of molecular energies in gases
* Students will know how to draw and interpret distribution curves for different temperatures
 |  |  |  |
| **Lesson:** **Temperature and Reaction Rate** | * Students will know that the rate of reaction is a measure of how fast a chemical reaction takes place
* Students will know that the rate of reaction is increased with an increase in temperature
* Students will know how to use the Maxwell-Boltzmann distribution to explain why a small temperature increase can lead to a large increase in rate
 |  | * ***Students need to already know the effect of temperature on the rate of reaction***
 | Investigating Effect of temperature on the rate of reaction |
| **Lesson:** **Required Practical 3 - Temperature and rates of reaction** | * Students will know how to practically determine the effect of rate of reaction with temperature
 |  |  |  |
| **Lesson:** **Concentration and Pressure** | * Students will know that changes in concentration has an effect on collision frequency
* Students will know that an increase in pressure causes more particle collisions to take place
* Students will know how to explain how a change in concentration or pressure influences the rate of reaction
 |  |  | Investigating the effect of concentration and pressure |
| **Lesson:** **Catalysts** | * Students will know that a catalyst is a substance that increases the rate of a chemical reaction without being changed in chemical composition or amount
* Students will know that catalysts work by providing an alternative reaction route of lower activation energy
* Students will know how to use a Maxwell-Boltzmann distribution to help explain how a catalyst increases the rate of a reaction involving a gas
 |  | * ***Students need to already know that catalysts speed up a chemical reaction.***
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| **Science** **Year 12 Chemistry**  | **Unit: Chemical Equilibria and Le Chatelier’s Principle** |  |  |  |
| **Lesson/Learning Sequence**  | **Intended Knowledge:***Students will know that…* | **Tiered Vocabulary**  | **Prior Knowledge:***In order to know this students, need to already know that…* | **Practical Opportunities** |
| **Lesson:** **Dynamic Equilibria** | * Students will know that a reversible reaction is at equilibrium when the forward and reverse reactions proceed at equal rates.
* Students will know that when a reaction has reached equilibrium the concentrations of the reactants and products remain constant
* Students will know that Le Chatelier’s principle states that when the conditions of an equilibria are changed, the equilibrium will shift to reverse those changes.
* Students will know that an increase in temperature will shift the equilibrium to favour the endothermic direction
* Students will know that an increase in concentration of a reactant will cause the equilibrium to shift in the direction to favour the side without that substance.
* Students will know that an increase in pressure will cause the equilibrium to shift to favour the side of the reaction with the fewest gas particles.
* Students will know how to use Le Chatelier’s principle to make predictions
* Students will know that a compromise will need to be met in industrial processes when implementing Le Chatelier’s principle.
 |  | * ***Students need to already know that many chemical reactions are reversible***
 | Test tube equilibrium reactions |
| **Lesson:** **Equilibrium Constant** | * Students will know that the equilibrium constant is represented with the symbol Kc
* Students will know that the concentration of a substance is represented using square brackets, e.g. [X]
* Students will know that when writing an expression for Kc, the products are over the reactants.
* Students will know that if, in a balanced symbol equation, there are numbers in front of the molecules, then the concentration of these is raised to the power of this number
* Students will know how to construct an expression for Kc for a homogeneous system
* Students will know that a homogeneous system is one where the reactants and products are in the same state
* Students will know how to calculate Kc
* Students will know that the value of equilibrium constant is not affected by either changes in concentration or addition of a catalyst (only affected by temperature)
* Students will know how to use ICE (initial, change, equilibrium) to determine the number of moles of substances at equilibrium.
 |  | * ***Students need to already know that a reaction at equilibrium will have a constant concentration of reactants and products***
 | Practically determining Kc for reaction of ethanol with ethanoic acid |

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| **Science** **Year 12 Chemistry**  | **Unit: Oxidation, Reduction and Redox Equations** |  |  |  |
| **Lesson/Learning Sequence**  | **Intended Knowledge:***Students will know that…* | **Tiered Vocabulary**  | **Prior Knowledge:***In order to know this students, need to already know that…* | **Assessment**  |
| **Lesson:** **Oxidation, Reduction and oxidation states** | * Students will know that oxidising agents are electron acceptors
* Students will know that reducing agents are electron donors
* Students will know that the oxidation state shows the total number of electrons that have been lost or gained by an atom.
* Students will know that if an atom has lost electrons, the oxidation state will be “+<insert number of electrons lost>”
* Students will know that if an atom has gained electrons, the oxidation state will be “-<Insert number of electrons gained>”
* Students will know that a substance has been oxidised if its oxidation state increases
* Students will know that a substance has been reduced if its oxidation state decreases.
* Students will know that group 1 metals will always have an oxidation state of +1
* Students will know that group 2 metals will always have an oxidation state of +2
* Students will know that oxygen usually has an oxidation state of –2, apart from peroxides (-1), and when bonded to F (F2O, oxidation state is +2)
* Students will know that fluorine always has an oxidation state of –1
* Students will know that hydrogen usually has an oxidation state of +1, apart from in metal hydrides (-1)
* Students will know that chlorine usually has an oxidation state of –1, apart from when bonded to oxygen or fluorine.
* Students will know how to determine oxidation states of atoms in a compound
 |  | * ***Students need to already know that oxidation is the loss of electrons***
* ***Students need to already know that reduction is the gaining of electrons***
 |  |
| **Lesson:** **Redox Equations** | * Students will know that when writing half equations, the following steps need to be taken:
	+ Balance oxygens by adding the correct number of waters to the other side of the equation
	+ Balance hydrogens by adding the correct number of H+ ions to the other side of the equation
	+ Balance charge by adding electrons to the side needed
* Students will know how to construct half equations to represent reduction and oxidation
* Students will know how to combine half equations to give an overall redox equation
* Students will know that a disproportionation reaction is a reaction where a substance is both oxidised and reduced.
 | Disproportionation: where a species is both oxidised and reduced in a reaction. | * ***Students need to already know how to determine the oxidation state of a substance***
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