10 Things to Do to Prepare for...

A Level Chemistry

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Activities

1. Atomic structure

- Learn the definitions of atoms, elements, molecules and compounds and be able to explain the differences. Make sure that you are comfortable in representing elements and compounds with symbols. Practise writing word and balanced chemical equations for common reactions that involve metals and acids, acids and alkalis and acids and carbonates. You should be able to write balanced half equations and ionic equations.
- Can you describe what is meant by a mixture and the physical processes used to separate them? You should be able to suggest suitable techniques given basic information.
- Can you describe how the model of the atom has changed over time and the evidence that led scientists to developing the model?
- Can you describe the structure of the atom and the relative charges and masses of protons, neutrons and electrons? Can you calculate the numbers of protons, neutrons and electrons when given its atomic number and mass number? You should practise doing this.
- Can you define isotope and calculate the relative atomic mass of an element given the percentage abundance of its isotopes?
- Can you describe electron arrangement in different elements and represent the electron structure of elements using diagrams and numbers? You should practise doing this.

2. Amount of substance

This section will test and develop your maths skills.

- Can you state the law of conservation of mass and describe balanced chemical equations in these terms? Can you explain the use of multipliers in equations before a formula and in subscript within a formula?
- Can you describe what is meant by relative formula mass (Mr) and calculate the relative formula masses of compounds given their formulae? Practise doing this for common compounds that you have encountered. Can you explain observed changes in mass in non-enclosed systems?
- Can you explain what a mole is with reference to relative formula mass and Avogadro's constant? Can you calculate the number of moles in a given mass of a substance and calculate the masses of reactants and products when given a balanced chemical equation?
- Can you calculate the mass of solute in a given volume of solution of known concentration? Can you describe the experimental technique of titration of strong acids and alkalis? Are you able to carry out the associated calculations such as the concentration of a solute when it reacts completely with another

solution of known concentration? Can you explain how concentration is related to the mass of solute and the volume of solution?

- Can you explain what the volume of one mole of a gas at room temperature is? Can you calculate the volume of a gas at room temperature and pressure from its mass and relative formula mass?

3. Balanced equations and calculations

- Can you explain why it is not always possible to obtain the calculated or expected amount of product? Can you calculate the theoretical amount of product and percentage yield using the equation:

  % yield = mass of product made/theoretical mass of product x 100%

- Can you calculate theoretical mass of a product from a given mass of reactant and the balanced equation?
- Can you define atom economy and describe some of the environmental, ethical and economic reasons for developing processes with high atom economy? Can you calculate the percentage atom economy using the equation:

  % atom economy = Mr of desired product/sum of Mr of all reactants x 100%

4. Bonding

- Learn the definitions for the three types of bonding; ionic, covalent and metallic, in terms of electrostatic forces and the transfer or sharing of electrons.
- Can you describe how the ions formed by the elements in the same group have the electron structure of a noble gas and relate the charge to group number? Practise drawing ionic compounds using dot and cross diagrams. Can you work out empirical formulae of compounds from a diagram that shows the ions in the structure?
- Can you identify different types of covalently bonded structures such as small molecules, large molecules and giant covalent structures? Can you represent the bonds in covalent structures using diagrams? Practise drawing dot and cross diagrams to represent the sharing of electrons in molecules of hydrogen, chlorine, oxygen, nitrogen, hydrogen chloride, water, ammonia and methane.
- Can you describe the arrangement of atoms and electrons in metallic bonds and draw diagrams to show the bonding in metals?
- You should be able to name the three states of matter, identify them from simple diagrams and describe changes of state in terms of the behaviour of particles. You should be comfortable with the use of the state symbols (s), (l), (g) and (aq).
- Can you explain how structure affects the properties for each of ionic compounds, small molecules, polymers, giant covalent structures, metals and alloys?
- Can you explain the properties of graphite, diamond and graphene in terms of their structure and bonding? Can you describe the structure of Fullerenes and their uses?

5. Energetics and kinetics

- Can you explain how energy is transferred to or from the surroundings in a chemical reaction? Can you define exothermic and endothermic reactions and give everyday examples? Can you describe an investigation that you have carried out into the effect of variables on temperature changes in reacting solutions?
- Can you interpret and draw reaction profiles for exothermic and endothermic reactions and identify relative energies of reactants and products, activation energy and overall energy change? Can you explain energy changes in making and breaking bonds and calculate overall energy changes using (given) bond energies?
- Can you draw and interpret graphs showing the quantity of product formed (or reactant used up) over time? You should be able to explain the patterns seen. Can you calculate the rate of a chemical reaction over time, including using a tangent to a graph as a measure of the rate of reaction?
- Can you describe how different factors affect rate of reaction, including temperature, concentration, pressure, surface area and the presence of a catalyst? Practise sketching graphs that show reactions under different conditions. You should be able to describe an investigation into the effect of concentration in a reaction on either the volume of gas produced, a colour change or turbidity (cloudiness, caused by a precipitate forming).
- Can you explain collision theory and the effect of catalysts in lowering activation energy? Can you use collision theory to explain the effect of changing conditions of temperature, concentration, pressure and surface area in a reaction?
- Can you explain what a reversible reaction is and represent it using symbols? Can you explain and predict the effect of a change in concentration, temperature or pressure on the equilibrium position of a reaction?

6. The periodic table

- Can you describe the early attempts to classify the elements and explain the creation and features of Mendeleev's periodic table?
- Can you describe how the elements are arranged in the periodic table and identify metals and non-metals and compare their properties? Can you explain how the atomic structure of metals and non-metals relates to their position on the periodic table?
- Can you describe the atomic structure of the noble gases and explain their (lack of) reactivity? Can you describe the properties of the noble gases, predict trends in the group and relate that to the outer shell of electrons?
- Can you describe the reactivity and properties of the group 1 alkali metals and the group 7 halogens with reference to their electron arrangement? Can you describe the reactions of the group 7 halogens with metals and non-metals, including what you would observe? You should be able to write word and balanced equations.

7. The alkanes and alkenes

- Can you describe what crude oil is and where it comes from? Can you define the term hydrocarbon?
- Can you write the general formula of the alkanes, name the first four members of the alkane family (methane, ethane, propane, butane) and recognise them from their formulas? Practise drawing the alkanes, showing the C-H covalent bonds as sticks. Can you describe the trends in the properties of the alkanes and relate this to their molecular size? Practise writing balanced equations to show the complete combustion of different hydrocarbons up to octane.
- Can you write the general formula of the alkenes, name the first four members of the alkene family (ethene, propene, butene, pentene) and recognise them from their formulas? Practise drawing the alkenes, showing the covalent bonds as sticks. Can you explain what unsaturated means? Make sure that you recognise the C=C double bond as the functional group of the alkenes. Can you describe the trends in the properties of the alkenes and relate this to their molecular size? Practise writing balanced equations to show the complete combustion of different hydrocarbons up to octene.
- Can you describe the process of fractional distillation? Practise drawing and labelling a fractionating column to show the temperature profile, the products and their uses.
- Can you describe the process of (and reason for) cracking? Learn the test for alkenes. Practise balancing chemical equations for cracking when given the formula of the reactants and products.

8. Making use of the alkenes

- Can you describe the reactions of the alkenes with hydrogen, water and the halogens (chlorine, bromine and iodine)? Practise drawing the structural formulae of the first four members of the alkenes and the products from those addition reactions.
- Are you able to identify -OH as the functional group of the alcohols and can you state the first four members of this homologous series, representing the alcohols using diagrams and formulae? Can you describe the uses, properties and reactions of the first four alcohols, including dissolving in water, the reaction with sodium, and burning in air?
- Are you able to identify -COOH as the functional group of the carboxylic acids and can you state the first four members of this homologous series, representing them using diagrams and formulae? Can you describe the properties and reactions of carboxylic acids, including dissolving in water, reacting with carbonates and alcohols?

9. Polymers

- Can you describe how alkenes can be used to make polymers by addition polymerisation? Can you identify addition polymers and monomers from

diagrams and the presence of functional groups? Can you draw diagrams to represent their formation? Practise drawing these diagrams.

- Can you describe the process of condensation polymerisation and the production of polypeptides by the condensation polymerisation of amino acids? Are you able to recognise an amino acid from its two functional groups -NH2 (the amino group) and -COOH (the carboxyl group) and explain that the side chain (-R) determines the amino acid type? Can you explain that different amino acids combine in a chain to produce polypeptides and then proteins?
- Can you describe the structure of DNA as two polymer chains made up of four monomers called nucleotides (adenine, guanine, cytosine and thymine)? These form a double helix. You should be able to name and describe other naturally occurring polymers such as proteins, starch and cellulose.

10. Apparatus, techniques and practical skills

- Make sure that you are familiar with all of the apparatus that you have used in GCSE Chemistry and are clear on how to make accurate readings; this includes basic laboratory equipment and more specialised chemical equipment such as burettes and volumetric flasks. Measurements include mass, time, temperature and the volumes of liquids and gases. Can you describe colour changes seen in indicators in different conditions of pH?
- Can you select and describe appropriate techniques, including equipment, for the purification of substances such as evaporation, crystallisation, filtration, chromatography and distillation? Can you explain the steps taken where necessary? Can you calculate Rf values (for chromatography)?
- Can you name the qualitative tests to identify samples of unknown substances such as gas tests, flames tests, and precipitation? Can you describe the technique used to determine the concentration of unknown strong acids and alkalis and carry out the calculations required to do so?
- Are you able to safely use a range of equipment, including that for heating, identify hazards and suggest ways in which risks can be controlled?
- Practise looking at a range of different graphs and tables showing data derived from chemical experiments. Use your science book or revision guide or look online. Practise writing descriptions of the trends shown, writing explanations, and carrying out calculations where appropriate.
- Can you confidently evaluate methods and suggest improvements to experimental technique for further testing?
- Are you confident with the mathematical techniques needed to find means from sets of data? Are you confident in expressing to appropriate numbers of significant figures? Can you plot graphs from data involving two variables and draw an appropriate line of best fit? This is often not a straight line in Chemistry.