

Subject	Y10 Chemistry Threshold Concepts – Autumn Term	How to support students' learning
Structure and bonding	Chemical bonds Explain chemical bonding in terms of electrostatic forces and the transfer or sharing of electrons Ionic bonding • Draw dot and cross diagrams for ionic compounds formed by metals in Groups 1 and 2 with non-metals in Groups 6 and 7 • The charge on the ions produced by metals in Groups 1 and 2 and by non-metals in Groups 6 and 7 relates to the group number of the element in the periodic table • Work out the charge on the ions of metals and non-metals from the group number of the element, limited to the metals in Groups 1 and 2, and non-metals in Groups 6 and 7 Ionic compounds • Deduce that a compound is ionic from a diagram of its structure in one of the specified forms • Describe the limitations of using dot and cross, ball and stick, two and three-dimensional diagrams to represent a giant ionic structure • Work out the empirical formula of an ionic compound from a given model or diagram that shows the ions in the structure	Encourage your child to watch this video on ionic bonding GCSE Chemistry - What is Ionic Bonding? How Does Ionic Bonding Work? Ionic Bonds Explained #14 - YouTube

	• Predict the states of substances at different temperatures given appropriate data • Explain the different temperatures at which changes of state occur in terms of energy transfers and types of bonding • Recognise that atoms themselves do not have the bulk properties of materials • (HT only) explain the limitations of the particle theory in relation to changes of state when particles are represented by solid inelastic spheres which have no forces between them. • (HT only) Limitations of the simple model above include that in the model there are no forces, that all particles are represented as spheres and that the spheres are solid State symbols • Include appropriate state symbols in chemical equations for the reactions in this specification. Properties of ionic compounds • State that ionic compounds have regular structures (giant ionic lattices) in which there are strong electrostatic forces of attraction in all directions between oppositely charged ions. • State that these compounds have high melting points and high boiling points because of the large amounts of energy needed to break the many	Encourage your child to visit BBC bitesize to read about the limitations of the particle model Limitations of the particle model - Higher - States of matter - Eduqas - GCSE Chemistry (Single Science) Revision - Eduqas - BBC Bitesize
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	strong bonds • Explain that when melted or dissolved in water, ionic compounds conduct electricity because the ions are free to move and so charge can flow Properties of small molecules • Use the idea that intermolecular forces are weak compared with covalent bonds to explain the bulk properties of molecular substances Polymers • Recognise polymers from diagrams showing their bonding and structure Giant covalent structures • Recognise giant covalent structures from diagrams showing their bonding and structure Properties of metals and alloys • Explain why alloys are harder than pure metals in terms of distortion of the layers of atoms in the structure of a pure metal Metals and conductors • State that metals are good conductors of electricity because the delocalised electrons in the metal carry electrical charge through the metal. Metals are	Encourage your child to watch this video on giant covalent structures GCSE Chemistry Giant covalent structures (Edexcel 9-1) - YouTube
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	good conductors of thermal energy because energy is transferred by the delocalised electrons Structure and bonding of carbon Diamond • Explain the properties of diamond in terms of its structure and bonding Graphite • Explain the properties of graphite in terms of its structure and bonding. • Students should know that graphite is similar to metals in that it has delocalised electrons Graphene and fullerenes • Recognise graphene and fullerenes from diagrams and descriptions of their bonding and structure • Give examples of the uses of fullerenes, including carbon nanotubes Triple only <i>Bulk and surface properties of matter including nanoparticles</i> <i>Sizes of particles and their properties</i>	Encourage your child to visit BBC bitesize and read about the structure and bonding in carbon Diamond and graphite - Giant covalent molecules - AQA - GCSE Chemistry (Single Science) Revision - AQA - BBC Bitesize Encourage your child to Visit this website to read about nanoscience and watch the video showing some uses Nanoscience National Geographic Society
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	• <i>Compare 'nano' dimensions to typical dimensions of atoms and molecules</i>	
Hydrocarbons	Crude oil, hydrocarbons and alkanes • Recognise substances as alkanes given their formulae • Know the names and structure methane, ethane, propane and butane Fractional distillation and petrochemicals • Explain how fractional distillation works in terms of evaporation and condensation Properties of hydrocarbons • Write balanced equations for the complete combustion of hydrocarbons with a given formula. • Knowledge of trends in properties of hydrocarbons is limited to boiling points, viscosity and flammability. Cracking and alkenes • Describe in general terms the conditions used for catalytic cracking and steam cracking. • Recall the colour change when bromine water reacts with an alkene.	Encourage your child to watch this video on crude oil and fractional distillation GCSE Chemistry - Crude Oil and Fractional Distillation #53 - YouTube Encourage your child to visit BBC bitesize to read about the process of cracking Cracking and alkenes - Crude oil, hydrocarbons and alkanes - AQA - GCSE Chemistry (Single Science) Revision - AQA - BBC Bitesize

	•Balance chemical equations as examples of cracking given the formulae of the reactants and products. •Give examples to illustrate the usefulness of cracking. •Explain how modern life depends on the uses of hydrocarbons. <u>Triple only topic</u> Reactions of alkenes • Describe the reactions and conditions for the addition of hydrogen, water and halogens to alkenes • Draw fully displayed structural formulae of the first four members of the alkenes and the products of their addition reactions with hydrogen, water, chlorine, bromine and iodine. Alcohols • Alcohols contain the functional group –OH. Methanol, ethanol and propanol are the first three members of a homologous series of alcohols. Candidates should be able to recognise alcohols from their names or formulae, but do not need to know the names of individual alcohols, other than methanol, ethanol and propanol.	Encourage your child to watch this video on the reactions of alkenes GCSE Chemistry - Addition Reactions of Alkenes #55 - YouTube
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- Methanol, ethanol and propanol dissolve in water to form a neutral solution, react with sodium to produce hydrogen, burn in air, are used as fuels and solvents, and ethanol is the main alcohol in alcoholic drinks.

Candidates are not expected to write balanced chemical equations for the reactions of alcohols other than combustion reactions.

- Ethanol can be oxidised to ethanoic acid, either by chemical oxidising agents or by microbial action. Ethanoic acid is the main acid in vinegar.
- Candidates should be aware that vinegar is an aqueous solution that contains ethanoic acid.

Carboxylic acids

- Ethanoic acid is a member of the carboxylic acids, which have the functional group -COOH .

Candidates should be able to recognise carboxylic acids from their names or formulae, but do not need to know the names of individual carboxylic acids, other than methanoic acid, ethanoic acid and propanoic acid.

- Carboxylic acids dissolve in water to produce acidic solutions react with carbonates to produce carbon dioxide react with alcohols in the presence of an acid catalyst to produce esters

	- do not ionise completely when dissolved in water and so are weak acids (HT only) - aqueous solutions of weak acids have a higher pH value than aqueous solutions of strong acids with the same concentration. (HT only) Addition Polymers - recognise addition polymers and monomers from diagrams in the forms shown and from the presence of the functional group C=C in the monomers - draw diagrams to represent the formation of a polymer from a given alkene monomer - relate the repeating unit to the monomer. Condensation Polymers (HT only) - explain the basic principles of condensation polymerisation that requires two different functional groups in the monomers and the repeating units in the polymers. - When these types of monomers react they join together, usually losing small molecules such as water Amino Acids (HT only)	Encourage your child to watch this video on addition polymers GCSE Chemistry - Addition Polymers & Polymerisation #56 - YouTube Encourage your child to watch this video on condensation polymers GCSE Chemistry - Condensation Polymers (Polyesters) #60 - YouTube
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	• Amino acids have two different functional groups in a molecule. Amino acids react by condensation polymerisation to produce polypeptides • Different amino acids can be combined in the same chain to produce proteins. DNA (deoxyribonucleic acid) and other naturally occurring polymers • DNA (deoxyribonucleic acid) is a large molecule essential for life. • DNA encodes genetic instructions for the development and functioning of living organisms and viruses. • Most DNA molecules are two polymer chains, made from four different monomers called nucleotides, in the form of a double helix. Other naturally occurring polymers important for life include proteins, starch and cellulose.	Encourage your child to read the information on this website on amino acids Amino Acids (GCSE Chemistry) - Study Mind Encourage your child to watch this video on naturally occurring polymers GCSE Chemistry - Naturally Occurring Polymers - Polypeptides, DNA, and Carbohydrates #61 - YouTube
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