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VCE Chemistry 3&4

Exam Revision Planner

My Goals:

1) Complete …….. by ……..
2) Complete …….. by ……..
3) Complete …….. by ……..

My Ideal Study Score: ……..

U3 Area of Study 1: Current and Future Options for Supplying Energy	Finish Summary Notes by:	Completed ☑	Reviewed ☑	My Notes
Carbon-based fuels: • the definition of a fuel, including the distinction between fossil fuels (coal, natural gas, petrol) and biofuels (biogas, bioethanol, biodiesel) with reference to their renewability (ability of a resource to be replaced by natural processes within a relatively short period of time) • fuel sources for the body measured in kJ g^{-1}: carbohydrates, proteins and lipids (fats and oils) • photosynthesis as the process that converts light energy into chemical energy and as a source of glucose and oxygen for respiration in living things: $6CO_2(g) + 6H_2O(l) \rightarrow C_6H_{12}O_6(aq) + 6O_2(g)$ • oxidation of glucose as the primary carbohydrate energy source, including the balanced equation for cellular respiration: $C_6H_{12}O_6(aq) + 6O_2(g) \rightarrow 6CO_2(g) + 6H_2O(l)$ • production of bioethanol by the fermentation of glucose, $C_6H_{12}O_6(aq) \rightarrow 2C_2H_5OH(l) + 2CO_2(g)$, and subsequent distillation to produce a more sustainable transport fuel • comparison of exothermic and endothermic reactions, with reference to bond making and bond breaking, including enthalpy changes (ΔH) measured in kJ, molar enthalpy changes measured in kJ mol^{-1} and enthalpy changes for mixtures measured in kJ g^{-1}, and their representations in energy profile diagrams • determination of limiting reactants or reagents in chemical reactions • combustion (complete and incomplete) reactions of fuels as exothermic reactions: the writing of balanced thermochemical equations, including states, for the complete and incomplete combustion of organic molecules using experimental data and data tables		☐	☐	

U3 Area of Study 1: Current and Future Options for Supplying Energy (cont)	Finish Summary Notes by:	Completed ☑	Reviewed ☑	My Notes
Measuring changes in chemical reactions: • calculations related to the application of stoichiometry to reactions involving the combustion of fuels, including mass-mass, mass-volume and volume-volume stoichiometry, to determine heat energy released, reactant and product amounts and net volume or mass of major greenhouse gases (CO_2, CH_4 and H_2O), limited to standard laboratory conditions (SLC) • the use of specific heat capacity of water to approximate the quantity of heat energy released during the combustion of a known mass of fuel and food • the principles of solution calorimetry, including determination of calibration factor and consideration of the effects of heat loss; analysis of temperature-time graphs obtained from solution calorimetry • energy from fuels and food: calculation of energy transformation efficiency during combustion as a percentage of chemical energy converted to useful energy, and comparison and calculations of energy values of foods containing carbohydrates, proteins and fats and oils		☐	☐	

U3 Area of Study 1: Current and Future Options for Supplying Energy (cont)	Finish Summary Notes by:	Completed ☑	Reviewed ☑	My Notes
Primary galvanic cells and fuel cells as sources of energy: • The redox reactions as simultaneous oxidation and reduction processes, and the use of oxidation numbers to identify the reducing agent, oxidising agent and conjugate redox pairs • the writing of balanced half-equations (including states) for oxidation and reduction reactions, and the overall redox cell reaction in both acidic and basic conditions • the common design features and general operating principles of non-rechargeable (primary) galvanic cells converting chemical energy into electrical energy, including electrode polarities and the role of the electrodes (inert and reactive) and electrolyte solutions • the use and limitations of the electrochemical series in designing galvanic cells and as a tool for predicting the products of redox reactions, for deducing overall equations from redox half-equations and for determining maximum cell voltage under standard conditions • the common design features and general operating principles of fuel cells, including the use of porous electrodes for gaseous reactants to increase cell efficiency • the application of Faraday's Laws and stoichiometry to determine the quantity of galvanic or fuel cell reactant and product, and the current or time required to either use a particular quantity of reactant or produce a particular quantity of product • contemporary responses to challenges and the role of innovation in the design of fuel cells to meet society's energy needs, with reference to green chemistry principles: design for energy efficiency, and use of renewable feedstocks		☐	☐	

U3 Area of Study 2: Optimising the rate and yield of chemical reactions	Finish Summary Notes by:	Completed ☑	Reviewed ☑	My Notes
Rate of chemical reactions: • factors affecting the frequency and success of reactant particle collisions and the rate of a chemical reaction in open and closed systems, including temperature, surface area, concentration, gas pressures, presence of a catalyst, activation energy and orientation • the role of catalysts in increasing the rate of specific reactions, with reference to alternative reaction pathways of lower activation energies and represented using energy profile diagrams		☐	☐	
Extent of chemical reactions: • the distinction between reversible and irreversible reactions, and between rate and extent of a reaction • the dynamic nature of homogenous equilibria involving aqueous solutions or gases, and their representation by balanced chemical equations (including states) • the change in position of equilibrium that can occur when changes in temperature or species or volume (concentration or pressure) are applied to a system at equilibrium, and representation of these changes using concentration-time graphs • the application of Le Chatelier's principle to identify factors that increase the yield • calculations involving equilibrium expressions (including units) for a closed homogeneous equilibrium system and the dependence of the equilibrium constant (K) value on the system temperature and the equation used • the reaction quotient (Q) as a quantitative measure of the extent of a chemical reaction: the relative amounts of products and reactants present at a given time • responses to the conflict between optimal rate and temperature considerations in producing equilibrium reaction products, with reference to the green chemistry principles of catalysis and designing for energy efficiency		☐	☐	

U3 Area of Study 2: Optimising the rate and yield of chemical reactions (cont)	Finish Summary Notes by:	Completed ☑	Reviewed ☑	My Notes
Production of chemicals by electrolysis: • the use and limitations of the electrochemical series to explain or predict the products of the electrolysis of particular chemicals, given their state (molten liquid or in aqueous solution) and the electrode materials used, including the writing of balanced equations (with states) for the reactions occurring at the anode and cathode and the overall redox reaction for the cell • the common design features and general operating principles of commercial electrolytic cells (including, where practicable, the removal of products as they form), and the selection of suitable electrode materials, the electrolyte (including its state) and any chemical additives that result in a desired electrolysis product (no specific cell is required) • the role of innovation in designing cells to meet society's energy needs in terms of producing 'green' hydrogen (including equations in acidic conditions) using the following methods: polymer electrolyte membrane electrolysis powered by either photovoltaic (solar) or wind energy and artificial photosynthesis using a water oxidation and proton reduction catalyst system • the application of Faraday's Laws and stoichiometry to determine the quantity of electrolytic reactant and product, and the current or time required to either use a particular quantity of reactant or produce a particular quantity of product		☐	☐	

U4 Area of Study 1: Categorising and synthesising organic compounds	Finish Summary Notes by:	Completed ☑	Reviewed ☑	My Notes
Structure, nomenclature and properties of organic compounds: • characteristics of the carbon atom that contribute to the diversity of organic compounds formed, with reference to valence electron number, relative bond strength, relative stability of carbon bonds with other elements, degree of unsaturation, and the formation of structural isomers • molecular, structural and semi-structural (condensed) formulas and skeletal structures of alkanes (including cyclohexane), alkenes, benzene, haloalkanes, primary amines, primary amides, alcohols (primary, secondary and tertiary), aldehydes, ketones, carboxylic acids and non-branched esters • the International Union of Pure and Applied Chemistry (IUPAC) systematic naming of organic compounds up to C8, with no more than two functional groups for a molecule, limited to non-cyclic hydrocarbons, haloalkanes, primary amines, alcohols (primary, secondary and tertiary), aldehydes, ketones, carboxylic acids and non-branched esters • trends in physical properties within homologous series (boiling point and melting point, viscosity), with reference to structure and bonding		☐	☐	

U4 Area of Study 1: Categorising and synthesising organic compounds (cont)	Finish Summary Notes by:	Completed ☑	Reviewed ☑	My Notes
Reactions of organic compounds: • organic reactions and pathways, including equations, reactants, products, reaction conditions and catalysts (specific enzymes not required): – synthesis of primary haloalkanes and primary alcohols by substitution – addition reactions of alkenes – the esterification between an alcohol and a carboxylic acid – hydrolysis of esters – pathways for the synthesis of primary amines and carboxylic acids – transesterification of plant triglycerides using alcohols to produce biodiesel – hydrolytic reactions of proteins, carbohydrates and fats and oils to break down large biomolecules in food to produce smaller molecules – condensation polymerisation reactions to synthesise large biologically important molecules for storage as proteins, starch, glycogen and lipids (fats and oils) • calculations of percentage yield and atom economy of single-step or overall reaction pathways, and the advantages for society and for industry of developing chemical processes with a high atom economy • the sustainability of the production of chemicals, with reference to the green chemistry principles of use of renewable feedstocks, catalysis and designing safer chemicals		☐	☐	

U4 Area of Study 2: How are organic compounds analysed and used?	Finish Summary Notes by:	Completed ☑	Reviewed ☑	My Notes
Laboratory analysis of organic compounds: • qualitative tests for the presence of carbon-carbon double bonds, hydroxyl and carboxyl functional groups • applications and principles of laboratory analysis techniques in verifying components and purity of consumer products, including melting point determination and distillation (simple and fractional) • measurement of the degree of unsaturation of compounds using iodine • volumetric analysis, including calculations of excess and limiting reactants using redox titrations (excluding back titrations)		☐	☐	

U4 Area of Study 2: How are organic compounds analysed and used? (cont)	Finish Summary Notes by:	Completed ☑	Reviewed ☑	My Notes
Instrumental analysis of organic compounds: • applications of mass spectrometry and interpretation of qualitative and quantitative data, including identification of molecular ion peak, determination of molecular mass and identification of simple fragments • identification of bond types by qualitative infrared spectroscopy (IR) data analysis using characteristic absorption bands • structural determination of organic compounds by low resolution ^{13}C-NMR spectral analysis, using chemical shift values to deduce the number and nature of different carbon environments • structural determination of organic compounds by low and high resolution ^{1}H-NMR spectral analysis, using chemical shift values, integration curves (where the height is proportional to the area underneath a peak) and peak splitting patterns, and application of the n+1 rule (where n is the number of neighbouring protons) to deduce the number and nature of different proton environments • the principles of chromatography, including HPLC and the use of retention times and the construction of a calibration curve to determine the concentration of an organic compound in a solution • deduction of the structures of simple organic compounds using a combination of mass spectrometry (MS), infrared spectroscopy (IR), ^{1}H-NMR and ^{13}C-NMR • the roles and applications of laboratory and instrumental analysis, with reference to product purity and the identification of organic compounds or functional groups in isolation or within a mixture		☐	☐	

U4 Area of Study 2: How are organic compounds analysed and used? (cont)	Finish Summary Notes by:	Completed ☑	Reviewed ☑	My Notes
Medicinal chemistry: • extraction and purification of natural plant compounds as possible active ingredients for medicines, using solvent extraction and distillation • identification of the structure and functional groups of organic molecules that are medicines • significance of isomers and the identification of chiral centres (carbon atom surrounded by four different groups) in the effectiveness of medicines • enzymes as protein-based catalysts in living systems: primary, secondary, tertiary and quaternary structures and changes in enzyme function in terms of structure and bonding as a result of increased temperature (denaturation), decreased temperature (lowered activity), or changes in pH (formation of zwitterions and denaturation) • medicines that function as competitive enzyme inhibitors: organic molecules that bind through lock-and-key mechanism to an active site preventing binding of the actual substrate		☐	☐	

U4 Area of Study 3: Scientific inquiry	Finish Summary Notes by:	Completed ☑	Reviewed ☑	My Notes
• independent, dependent and controlled variables • the accuracy, precision, repeatability, reproducibility, resolution and validity of measurements • the health, safety and ethical guidelines relevant to the selected scientific investigation • ways of organising, analysing and evaluating primary data to identify patterns and relationships, including sources of error and uncertainty • assumptions and limitations of investigation methodology and/or data generation and/or analysis methods		☐	☐	

Exam Date: _____

Practice Exam Schedule		Complete by	Completed ☑	Score	Notes
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2			☐		
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