

Higher Chemistry

Unit 1 - Chemical Changes and Structure

1. Controlling the rate

- Collision theory explaining rates of reaction and activation energy.
- Calculating relative rate of reaction - $\text{rate} = 1/\text{time}$
- Reaction profiles - Potential energy diagrams, energy pathways, activated complex, activation energy and enthalpy changes.
- Catalysts - how they affect reaction pathway and activation energy.
- Temperature and kinetic energy - Energy distribution diagrams showing effect of temperature changes on successful collisions. The effect of temperature on the reaction rate

2. Periodicity

- The first 20 elements in the Periodic Table are categorised according to bonding and structure.
- Periodic trends and underlying patterns and principles.
- Covalent radius, ionisation energy, electronegativity and trends in groups and periods, related to atomic structure.

3. Structure and bonding

- Bonding continuum
- Polar covalent bonds and their position on the bonding continuum, dipole formation and notation. $\delta^+ \delta^-$, eg $\text{H}^{\delta+} \text{Cl}^{\delta-}$
- Intermolecular forces called van der Waals forces. London dispersion forces, permanent dipole-dipole, hydrogen bonding and the resulting physical properties including solubility.

Unit 2 - Nature's Chemistry

1. Esters, fats and oils

- Esters – naming, structural formulae and uses.
- Fats and oils, esters condensation and hydrolysis reactions.
- Saturated and unsaturated fats and oils.
- Melting points of oils and fats, through intermolecular bonding.

2. Proteins

- Enzymes as biological catalysts, amino acids, dietary proteins, condensation reactions to make proteins and amide link, peptide link.
- Digestion, enzyme hydrolysis of dietary proteins.

3. Chemistry of cooking

- Flavours in foods. Influence of functional groups on solubility, boiling points and volatility. Aldehydes as sources of flavour and aroma.
- For aldehydes and ketones:
Naming compounds with no more than eight carbon atoms in their longest chain.
For straight and branch chained aldehydes and ketones systematic names, structural formulae and isomers.
- Oxidation reactions of aldehydes and ketones.
- Effect of heat on proteins, denature of proteins.

4. Oxidation of food

- For branch chained alcohols with no more than eight carbon atoms in their longest chain - systematic names, structural formulae and isomers.
- Hydrogen bonding in alcohols
- Diol, triols and the effect of hydrogen bonding on properties of these molecules.
- Primary, secondary and tertiary alcohols, oxidation reactions and products, oxidising agents.
- For branch chained carboxylic acids - systematic names, structural formulae and isomers.
- Reactions of carboxylic acids to include reduction and reactions with bases to form salts.
- Reaction of oxygen with edible oils.
- Antioxidants. Ion-electron equations for the oxidation of antioxidants.

5. Soaps, detergents and emulsions

- Hydrolysis of esters.
- Structure of soap ions including covalent tail, (hydrophobic), and an ionic head (hydrophilic)
- Cleansing action of soaps.
- Production, action and use of detergents.
- Emulsion and emulsifiers and their formation and use in food.

6. Fragrances

- Essential oils from plants: properties, uses and products.
- Terpenes: functional group, structure and use. Oxidation of terpenes within plants.

7. Skin care

- The damaging effect of ultraviolet radiation (UV) in sunlight on skin and the action of sun-block.
- Formation of free radicals in UV light. Structure, reactivity and reactions of free radicals.
- Initiation, propagation and termination stages of free radical reactions
- Free radical scavengers in cosmetic products, food products and plastics. Reaction of free radical scavengers with free radicals to prevent chain reactions.

Unit 3 - Chemistry in Society

1. Getting the most from reactants

- availability, sustainability and cost of feedstock(s); opportunities for recycling; energy requirements; marketability of by-products; product yield.
- Balanced equations, mole ratio(s) of reactants and products.
- Determination of quantities of reactants and/or products using balanced equation, the gram formula masses (GFM), mass and moles.
- Determination of quantities of reactants and/or products using balanced equations, concentrations and volumes of solutions and/or masses of solutes.
- Calculations of mass or volume (for gases) of products, assuming complete conversion of reactants.
- percentage yield and atom economy.
- Limiting reactants and excesses identified.

2. Equilibria

- Reversible reactions, dynamic equilibrium, altering equilibrium position.
- Effect of catalyst on equilibrium and the most favourable reaction conditions.

3. Chemical energy

- Enthalpy calculations used for industrial processes. The specific heat capacity, mass temperature and moles used to calculate the enthalpy change for a reaction. Enthalpies of combustion.
- Hess's law. Calculation of enthalpy changes by application of Hess's law.
- Bond enthalpies for a diatomic molecule
- The molar bond enthalpy and mean molar bond enthalpies. Enthalpy changes for gas phase reactions can be calculated using bond enthalpies.

4. Oxidising or reducing agents

- Elements, molecules, group ions and compounds as oxidising and reducing agents,
- electrochemical series as reduction reactions.
- Uses of oxidising agents.
- Ion-electron for redox, oxidation and reduction equations.

5. Chemical analysis

- Chromatography
- Differences in the polarity and/or size of molecules
- Volumetric titration
- Volumetric analysis for quantitative reactions. Standard solutions, acid base and redox titrations.

CfE Higher Chemistry

Register online with the Royal Society of Chemistry for help with study, careers advice, resources
<http://rsc.li/chemnet>

<http://www.bbc.co.uk/education/subjects/zjmtsbk>

<http://www.edubuzz.org/nbscience/>

Doc Brown - aimed at A levels rather than Highers but some good quizzes found here.

<http://www.docbrown.info/page14/page14.htm>

<http://www.docbrown.info/page13/page13a.htm>

<http://www.docbrown.info/page13/page13b.htm>

<http://www.docbrown.info/page13/page13c.htm>

Revision notes- not all are relevant

<http://www.hsn.uk.net/resources/Higher-Chemistry/>

<http://www.educationscotland.gov.uk/highersciences/chemistry/>

SCHOLAR - Login required

<http://courses.scholar.hw.ac.uk/vle/scholar/>

Evan2chemweb - Login required (Username: farr Password: chemistry)

<http://evans2chemweb.co.uk/index.php>

Specimen Paper

Section 1 Questions 1-13

Section 2 Questions 1, 2 (not biii), 3, 4, 5 (not c), 6 (not ciii) , 8, 9, 11, 12ab

Answers at http://www.sqa.org.uk/files_ccc/ChemistrySQPH.pdf

Past Papers

Question papers with spreadsheet telling you which questions are relevant.

Exam question booklets