

## UNIT 2 REVISION CHECKLIST

### Topic 2.1 Energetics

Can you:

- understand that reactions are either exothermic or endothermic and apply the sign convention
- define the term “enthalpy change”, recall what standard conditions are and understand that conditions affect enthalpy changes
- define activation energy and relate it to bond breaking
- recall and use  $q = mc\Delta T$  and  $\Delta H = q/n$  and explain how simple enthalpy changes are measured
- use bond dissociation enthalpy data to calculate approximate enthalpy changes and vice versa
- Define Hess' Law, standard enthalpy of formation and standard enthalpy of combustion
- Calculate enthalpy changes from enthalpy of formation data using Hess' Law and vice versa
- Calculate enthalpy changes from enthalpy of combustion data using Hess' Law and vice versa

### Topic 2.2 Kinetics

Can you:

- Explain collision theory in terms of collision frequency, collision energy, activation energy and the fraction of successful collisions
- Outline an experimental procedure for measuring the rate of a reaction which involves a gas being evolved
- Sketch graphs to show how the concentration of a reactant varies with time in a chemical reaction and know that the gradient of the graph is the rate of the reaction
- Sketch the Maxwell-Boltzmann distribution of molecular energies at two temperatures

- e) Explain the large effect on rate of reaction of a small increase in temperature by reference to Maxwell-Boltzman, collision energy, fraction of successful collisions and collision frequency
- f) Define the term "catalyst" and explain that the catalyst lowers the activation energy by providing an alternative reaction pathway
- g) Explain by reference to Maxwell-Boltzmann how a catalyst increases the rate of a reaction
- h) Explain how concentration, pressure and particle size affect the rate of a reaction

### **Topic 2.3 Equilibria**

Can you:

- a) Explain the term "dynamic equilibrium" and recall that all equilibria are dynamic
- b) Use Le Chatelier's Principle to explain the effect of changes in temperature, pressure, concentration and catalysts on the position of equilibrium, and select suitable conditions to maximise the yield of a certain product
- c) Explain that reaction conditions used in industry sometimes differ from those which would maximise the yield due to the importance of rate of reaction and cost of energy, equipment and maintenance

### **Topic 2.4 Redox Reactions**

Can you:

- a) Define oxidation and reduction in terms of electron transfer
- b) deduce half-equations for oxidation and reduction processes and hence derive ionic equations for redox reactions
- c) define the terms oxidising and reducing agent and recognise them in chemical reactions

### **Topic 2.5 Group VII, The Halogens**

Can you:

- a) describe the trends in physical appearance, boiling point, electronegativity and oxidising power of the halogens, and know the different colours of iodine in vapour, solid and aqueous form

- b) write equations and observations for the displacement reactions of halogens with halide ions
- c) describe and explain the trend in reducing power of the halides, and write equations and give observations for the reactions of solid halides with concentrated sulphuric acid
- d) describe how nitric acid and silver nitrate can be used to distinguish between aqueous halide ions, and know the solubility of the silver halides in ammonia
- e) write equations for the reactions of chlorine with water and dilute NaOH and know the uses of the solutions formed

### **Topic 2.6 Group 2, the Alkaline Earth Metals**

Can you:

- a) describe and explain the trends in electronegativity and melting point of the elements in group 2
- b) describe the reactions of Mg with steam and of Ca, Sr and Ba with water and write appropriate equations
- c) describe the trends in the solubility of hydroxides and sulphates write ionic precipitation equations where appropriate
- d) know that acidified barium chloride can be used as a test for sulphate ions
- e) know the uses of magnesium hydroxide, calcium hydroxide and barium sulphate

### **Topic 2.7 Extraction of Metals**

Can you:

- a) know that the most important methods of extracting metals from ores are reaction of the oxide with carbon (eg iron), reaction of the halide with a metal (eg titanium), electrolysis (eg aluminium) and reaction of the oxide with hydrogen (eg tungsten)
- b) explain why different methods are appropriate for different metals
- c) describe the reactions taking place in the blast furnace and explain how the furnace is heated, how the CO is produced, how the iron ore is reduced and how the silicon dioxide is removed
- d) know how slag is removed from the furnace and know its uses

- e) know that this process is also used to extract other metals which exist as sulphides, know that the sulphides have to be converted into the oxides by roasting in air and know why this causes pollution
- f) know that aluminium is extracted by electrolysis of its purified oxide, know the electrode reactions, know what the electrodes are made of, understand the role of the molten cryolite and explain why the anodes need to be regularly replaced
- g) know that titanium dioxide is converted into its chloride by reaction with carbon and chlorine, and that the chloride is reduced by sodium or magnesium, and know the equations and conditions for both reactions
- h) explain why the aluminium and titanium extractions are expensive and why titanium cannot be extracted by any other method
- i) explain how tungsten is extracted from its oxide by hydrogen
- j) explain the main barriers to recycling, explain why recycling is economically and environmentally desirable and explain how iron and aluminium are recycled

## 2.8 Haloalkanes

Can you:

- a) give the mechanism for the reaction between methane and chlorine, give the name of each step and know how termination and further propagation steps can give a number of different products
- b) know that chloroalkanes and chlorofluoroalkanes are used as solvents
- c) explain with aid of equations how chlorine radicals can destroy the ozone layer
- d) describe the structure and bonding in haloalkanes, use it to explain why they react with nucleophiles and explain how  $\text{CN}^-$ ,  $\text{OH}^-$  and  $\text{NH}_3$  can behave as nucleophiles
- e) Give the mechanisms for the nucleophilic substitution reactions of  $\text{NH}_3$ ,  $\text{CN}^-$  and  $\text{OH}^-$  with haloalkanes (including the role of ammonia as both base and nucleophile) and know the conditions for the reactions
- f) recall that haloalkanes can undergo elimination in the presence of hydroxide ions, know the conditions which favour elimination over substitution, understand that the two reactions compete and know the different roles of the hydroxide ion in both reactions

- g) Predict and explain whether one or two alkenes will be obtained from the elimination reaction
- h) Recall that the rate of reaction of haloalkanes depends on the C-X bond enthalpy

## 2.9 Alkenes

Can you:

- a) Explain and recognise geometrical isomerism in alkenes and name geometrical isomers
- b) Describe the structure and bonding in alkenes, use it to explain why they react with electrophiles and explain how HBr, Br<sub>2</sub> and H<sub>2</sub>SO<sub>4</sub> can behave as electrophiles
- c) Give the mechanism for the reaction of HBr, Br<sub>2</sub> and H<sub>2</sub>SO<sub>4</sub> with alkenes
- d) Classify carbocation intermediates as primary, secondary or tertiary, recall that HBr and H<sub>2</sub>SO<sub>4</sub> give two products with unsymmetrical alkenes, predict which of these products will be the major one and explain this on the basis of the stability of the carbocation intermediate
- e) recall that the reaction between bromine and alkenes is used as a test for alkenes
- f) recall the reagents, conditions and type of reaction involved in the hydration of alkenes to form alcohols
- g) recall that alkylhydrogensulphates can be hydrolysed to form alcohols.
- h) recall that alkenes can undergo addition polymerisation, deduce the monomer from the structure of a polymer and vice versa and know some uses of common polymers

## 2.10 Alcohols

Can you:

- a) Recall the conditions for the fermentation of glucose to produce ethanol and understand the advantages and disadvantages of this method compared to the hydration of ethane, including the classification of ethanol as a biofuel
- b) Give the reagents and conditions for the dehydration of alcohols to form alkenes and predict and explain when two different alkenes will be formed
- c) Give the reagents and conditions for the oxidation of primary alcohols to aldehydes and then to carboxylic acids, of secondary alcohols to ketones

- d) Describe and explain the simple chemical basis for the tests to distinguish between aldehydes and ketones

## 2.11 Analytical Techniques

Can you:

- a) deduce the molecular formula of a molecule from the accurate mass of the molecular ion
- b) explain how fingerprinting of infra-red spectra allows molecules to be identified
- c) use infra-red spectra to identify functional groups and impurities
- d) explain how infra-red spectroscopy works and understand how it can be used to explain global warming

**If you can do all these things, you'll get an A!**