Chemistry Exam Practice Book Additional Question Answers

Atomic structure and the periodic table

Group 7 - the halogens

1 a Melting point increases further down the group/with increasing RMM.

b Fluorine and chlorine.

c 1 mark for attempt at extrapolation, 1 mark for interpreting the value correctly and in the region of 200–220 – actual value is higher but the rest of the values are on a straight line.

d 420

Bonding, structure and the properties of matter

Bonding and structure

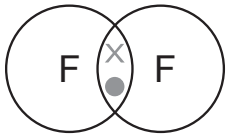
1 a $CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$

b $Ca(s) + H_2O(l) \rightarrow Ca(OH)_2(aq) + H_2(g)$

c $CuO(s) + H_2SO_4(aq) \rightarrow CuSO_4(aq) + H_2O(l)$

Covalent bonds and simple molecules

1 a



b Formula: F_2

Quantitative chemistry

Moles in solution

H **1 a** 0.0022 moles

b 0.0011 moles

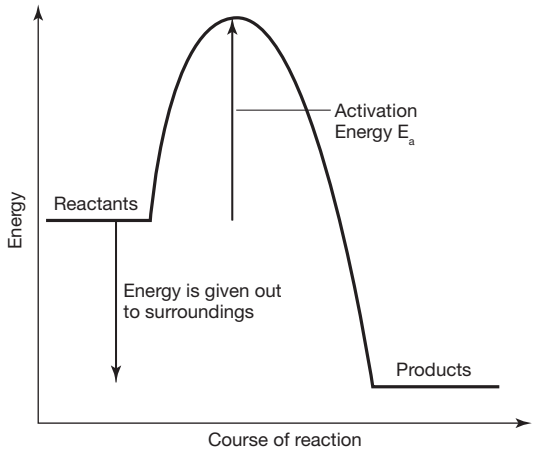
c 0.0625 mol/dm^3

Energy changes

Reaction profiles

1 a $C_{20}H_{42} + 31½\ O_2 \rightarrow 20CO_2 + 21H_2O$ (Remember: multiples are accepted in the exam!)

b



c Energy is needed; to overcome the activation energy.

The energy changes of reactions

H **1 a** Bond breaking: Requires energy

b Bond making: Releases energy

c Endothermic reactions: Require more energy to break bonds than is released in making them.

Chemical cells and fuel cells

a Rechargeable batteries can be reused.

b The reaction is reversed; electrons return to the more reactive metal.

c The difference in reactivity between lithium and zinc is more than the difference between zinc and copper; producing a great voltage.

d Possible steps to include: Pick electrolyte (e.g. hydrochloric acid); Use same volume of electrolyte; Use same electrolyte throughout; Cut same size strips; Connect wire to each metal; Connect to voltmeter; Change sequential so all metals are tested with each other; Record in a table.

e Lithium-zinc 5; lithium-copper 4; lithium-aluminium 3; zinc-copper 2; zinc-aluminium lowest.

Rates of reaction and equilibrium

Calculating the rate of reaction

1 Increasing temperature increases the rate of reaction in two ways. When the temperature is raised particles have more **kinetic energy** so they move more **quickly**. This means that the particles collide more **frequently**. These collisions are more likely to be effective because they are more likely to collide with enough energy to overcome the **activation energy**.

2 Catalysts increase the rate of reaction by providing an alternative reaction route; Catalysts are chemically unchanged during the reaction

The effect of changing conditions on equilibrium

H **1 a** $CO(g) + 2H_2\ CH_3OH(g)$

b

Change	What happens	Explanation
Increase the concentration of CO gas	Equilibrium shifts to Right →	The equilibrium moves to lower the concentration of CO gas by reacting it with hydrogen to make more methanol
Increase the pressure	Equilibrium Shifts to the **right** →	**If you increase the pressure the system tries to lower it by making fewer gas molecules and this means more methanol is produced.**
Decrease the temperature	Equilibrium shifts to Right →	**If you decrease the temperature the system tries to raise it and this favours the exothermic reaction so making more methanol.**

Organics chemistry

Alkenes

1 a C_2H_4

b C_6H_{12}

2 a and **b**

$C_3H_6 + 4½\ O_2 \rightarrow 3CO_2 + 3H_2O$; propene;

$C_5H_{10} + 7½\ O_2 \rightarrow 5CO_2 + 5H_2O$; pentene.

Cracking and alkenes

1 Cracking is the process used to break down alkanes into **smaller** more useful molecules.

During catalytic cracking, an alkane is heated until it turns into a **vapour** and is passed over a hot catalyst.

The products of cracking are always an alkane and at least one **alkene**.

Chemical analysis

Chromatography

1 Draw a baseline with a ruler on a sheet of paper; put spots of sugar, caffeine, capsaicin and the drink mixture on the baseline; put the paper in a beaker containing a volume of solvent that is below the baseline; compare the Rf values for each substance and the mixture.

Identifying metal ions using flame tests, flame emission spectroscopy and sodium hydroxide

1 a Yellow/purple flame; because the low sodium salt contains potassium/sodium.

b The low sodium salt contains sodium chloride; which turned the flame yellow so that the purple flame is masked.

c A safety flame is bright and yellow; which would make it difficult to see other colours.

2 Any four from: It is more sensitive; It can be used to measure the concentration of the ion in the sample; It can look at distinctive areas of the colour spectrum emitted by a heated element and not by others, this overcomes the problem of some colours being masked by others; It can be used to analyse the composition of mixtures; It can be automated.

3 Magnesium Mg^{2+} – White

Calcium Ca^{2+} – White

Aluminium Al^{3+} – White

Copper(II) Cu^{2+} – Blue

Iron(II) Fe^{2+} – Green

Iron(III) Fe^{3+} – Brown

4 The metal ion is calcium, aluminium or magnesium; add more sodium hydroxide – if it dissolves it is aluminium; Otherwise, use a flame test – if no colour it is magnesium, if the flame is red the metal ion is calcium.

Chemistry of the atmosphere

The composition and evolution of the Earth's atmosphere

1 a Nitrogen – 78%; Oxygen – 21%; Argon – 0.9%; Water, carbon dioxide and other gases – < 0.1%.

b Nitrogen

2 a It reduced; More rapidly for the first ~1 million years; Reduced more slowly between 2-3 million years ago; Was relatively constant over the last million years.

b Two from: Photosynthesis; $6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$; Formation of carbonate rocks/dissolves in water; $2CO_2 + 2H_2O \rightarrow 2H_2CO_3 \rightarrow CO_3^{2-}$

Global warming

1 **Short wavelength** UV rays from the sun pass through the atmosphere. Some of this energy is reflected back by Earth as UV rays, but some is reflected back as **infrared radiation**.

Some of this is **absorbed** by **greenhouse gases**, which **emit** this energy in all directions, but most of it goes back to the Earth, keeping **temperatures** on Earth high enough to support life.

2 a Any four from: Increased temperatures; More extreme weather; Drought; Increase weathering and erosion of coasts; Melting of polar ice caps; Sea level rise; Flooding.

b Any two from: Gases in the atmosphere move around the Earth; The consequences are global; The actions of one country have consequences for others; Global agreement is required to reduce emissions.

c Any two from: Alternatives are expensive; Economic growth relies on cheap energy; Lack of international co-operation; Rejection of the idea that human activity causes climate change.

The carbon footprint and its reduction

1 Carbon footprint is the amount of carbon dioxide and other greenhouse gases emitted over the lifetime of a product, service or event.

2 a Solar panels – 1300.5 kg of carbon dioxide reduction.

b Some of the products require energy to create; All require energy to transport; This may release carbon dioxide.

H **c** 1300.5/44 = 29.56 moles

d Terraced houses have internal walls between homes which emit less heat; reducing the reduction seen by cavity-wall insulation.

Using resources

Alternative methods of copper extraction

1 $Fe + CuSO_4 \rightarrow FeSO_4 + Cu$

Rusting

1 a Iron

b A barrier OR specific example of a barrier, e.g. painting, greasing or coating with tin.

2 a Barrier – stops oxygen or water coming into contact with iron.

b Aluminium forms an aluminium oxide layer on the surface; Stops oxygen or water coming into contact with aluminium.

c Tin is less reactive than iron; It will not oxidise/react but iron will OR zinc is more reactive than iron; It will oxidise/react instead of iron.