CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Ordinary Level

MARK SCHEME for the May/June 2013 series

5070 CHEMISTRY

5070/21 Paper 2 (Theory), maximum raw mark 75

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A1 **(a)** Iron(II) hydroxide (1) [1]

(b) Butane (1) [1]

(c) Propene (1) [1]

(d) Calcium carbonate (1) [1]

(e) Sulfur dioxide (1) [1]

(f) Sulfuric acid / sodium chloride (1) [1]

[Total: 6]

A2 **(a)** Any value in range 20–22 (1) [1]

(b) $6H_2O + 6CO_2 \rightarrow C_6H_{12}O_6 + 6O_2$ (1) [1]

(c) **ANY TWO FROM**
Use of enzymes (1)

Chlorophyll / presence of chloroplasts (1)

Sunlight (1) **IGNORE** just light / sun / sunshine

(Ideally) 20–40 ^oC (1) [2]

(d) **(i)** Bond breaking absorbs energy **and** bond making releases energy / bond breaking is endothermic **and** bond making is exothermic (1)

More energy absorbed than released / less energy released than absorbed / endothermic energy change is greater than exothermic energy change / exothermic energy change is less than endothermic energy change (1) [2]

(ii) Products level above and to the right of the reactants level (1)

Correct energy hump drawn and near vertical arrow labelled activation energy (or E_a) from reactant level to energy maximum (1)

Correct labelled enthalpy change with near vertical arrow pointing upwards (1) [3]

[Total: 9]

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A3 (a) (i) $2KOH + H_2SO_4 \rightarrow K_2SO_4 + 2H_2O$ (1) [1]

(ii) 24 cm^3 (of potassium hydroxide neutralises acid) (1) [1]

(iii) Moles of KOH = $\frac{24}{1000} \times 0.150 / 0.0036$ (1)

Moles of H_2SO_4 = $\frac{0.0036}{2} / 0.0018$ (1)

Concentration = $\frac{0.0018}{0.025} = 0.072$ (mol dm^{-3}) (1) [3]

(b) Use of nitric acid (1)
Add **excess** base to acid (and warm) (1)

Filter (to remove excess base) (1)

Evaporate to point of crystallisation / leave in warm place / heat then allow solution to cool (1) [4]

[Total: 9]

A4 (a) 40 (1) [1]

(b) Same number of protons and electrons / because it has 12 protons and 12 electrons (1)

Protons are positive and electrons are negative / protons are +1 and electrons are –1 (1) [2]

(c) **C** and **D** [1]

(d) 2– / –2 (1) [1]

(e) **F** and **G** (1) [1]

[Total: 6]

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A5 (a)

	N	H	Cr	O
Mole ratio	$\frac{11.1}{14}$ / 0.793	$\frac{3.2}{1}$ / 3.2	$\frac{41.3}{52}$ / 0.794	$\frac{44.4}{16}$ / 2.78
Simplified ratio	$\frac{0.793}{0.793}$ / 1	$\frac{3.2}{0.793}$ / 4	$\frac{0.794}{0.793}$ / 1	$\frac{2.78}{0.793}$ / 3.5
×2	2	8	2	7

Mole ratio line (1) Simplified ratio line (1)
Idea of the × 2 (1) [3]

(b) Chromium (1) [1]

(c) **X** is an oxidising agent (1)

because oxidation number of iodine increases / iodide loses electrons / **X** gains electrons / oxidation number of Cr decreases (1) [2]

(d) **(i)** NH_4^+ (1) [1]

(ii) $Cr_2O_7^{2-}$ (1) [1]

(e) Nitrogen (1) [1]

[Total: 9]

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A6 (a) (i) Correct 'dot-and-cross' diagram with one pair of bonding electrons between O and C*l*, four non-bonding electrons on O and six non-bonding electrons on each C*l* (1) [1]

(ii) ANY TWO FROM
Simple molecular structure / small molecule (1)

Weak intermolecular forces have to be broken (1)

Little energy needed to break intermolecular force / intermolecular force is easy to overcome (1) [2]

(b) K^+ 2,8,8 (1)

O^{2-} 2,8 (1)

Alternatively

ALLOW correct charge on ion (1) and correct electronic structure (1) [2]

(c) $H_2O + Cl_2O_7 \rightarrow 2HClO_4$ (1) [1]

[Total: 6]

B7 (a) ANY TWO FROM
Dissolves (1)

Blue / green solution (1)

Fizzes / bubbles / effervescence (1) [2]

(b) $CuCO_3.Cu(OH)_2 + 4HCl \rightarrow 2CuCl_2 + CO_2 + 3H_2O$ (1)

Correct formulae (1)

Balancing (1) [2]

(c) Moles of CO_2 / moles of CO_3^{2-} = 0.004 (1)

M_r of CO_3^{2-} = 60 (1)

Mass of CO_3^{2-} = 0.24 g (1) [3]

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(d) (i) $CuCO_3.Cu(OH)_2 + C \rightarrow 2Cu + 2CO_2 + H_2O$

Correct formulae (1)

Balancing (1) [2]

(ii) **ANY ONE FROM:**
less energy used (in recycling than in extracting from the ore) (1)

reduces pollution / reduces waste / reduces trash / less of an eyesore / not an eyesore / less landfill / no landfill (1)

(less mining) saves more land for other uses / (less mining) saves land for more agriculture (1) [1]

[Total: 10]

B8 (a) Group of substances with a general formula / formulae vary by CH_2 (1)

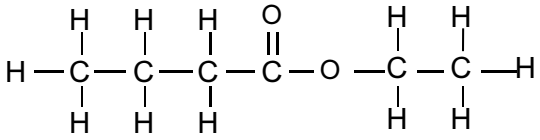
Have similar reactions / have similar chemical properties / have the same functional group (1) [2]

(b) Propanoic acid (1) [1]

(c) $C_nH_{2n+1}CO_2H$ / $C_nH_{2n+1}COOH$ (1) [1]

(d) Melting point does not have a trend but boiling point does / melting point increase and decreases but boiling point only increases (1) [1]

(e) Ethyl butanoate (1)



(1)

[2]

(f) (i) $C_{15}H_{31}COOH \rightleftharpoons C_{15}H_{31}COO^- + H^+$ (1)

Only partially dissociates / forms an equilibrium mixture / does not completely ionise (1) [2]

(ii) $C_{15}H_{31}COONa$ (1) [1]

[Total: 10]

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B9 (a) (i) Reaction is faster because particles are moving faster / rate increases because particles have more energy (1)

There are more successful collisions / more particles have energy above the activation energy / more effective collisions / more fruitful collisions / more energetic collisions more chance of successful collisions (1) [2]

(ii) Position of equilibrium shifts to the left (1)

Because the reaction is exothermic (1) [2]

(b) (i) Reaction is slower because the particles are further apart / rate decreases because the particles are less crowded (1)

Fewer collisions per second / particles collide less often / lower collision frequency (1) [2]

(ii) Position of equilibrium shifts to the left (1)

More moles on the reactant side / fewer moles on the product side (1) [2]

(c) 450 kJ (1) [1]

(d) Lowers the activation energy / gives (alternative) route with lower energy (1) [1]

[Total: 10]

B10 (a) (i) $Ag^+ + e^- \rightarrow Ag$ (1) [1]

(ii) Electrons are gained (1) [1]

(b) Temperature does not change the mass (1)

Mass is proportional to the time / doubling time doubles mass (1)

Mass is proportional to the current / doubling current doubles mass (1)

Concentration does not change the mass (1) [4]

(c) Ions cannot move in a solid / ions are in a fixed position in a solid (1)

Ions can move in a solution (1) [2]

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(d) $Ag^{+}(aq) + Cl^{-}(aq) \rightarrow AgCl(s)$
Correct formulae and balancing (1)
Correct state symbols – dependent on correct formulae (1) [2]

[Total: 10]

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