CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Ordinary Level

MARK SCHEME for the May/June 2014 series

5070 CHEMISTRY

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

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A1 (a) **J** / $NH_4^+(aq) + OH^-(aq) \rightarrow H_2O(l) + NH_3(g)$ [1]

(b) **B** / $Ba^{2+}(aq) + SO_4^{2-}(aq) \rightarrow BaSO_4(s)$ [1]

(c) **E** / $Cu^{2+}(aq) + 2e^- \rightarrow Cu(s)$ [1]

(d) **H** / $H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$ [1]

(e) **K** / $4OH^-(aq) \rightarrow O_2(g) + 2H_2O(l) + 4e^-$ [1]

[Total: 5]

A2 (a) $2H_2S + 3O_2 \rightarrow 2H_2O + 2SO_2$ (1) [1]

(b) Sulfur dioxide causes acid rain / sulfur dioxide linked to effects of acid rain (1)
Carbon dioxide is a greenhouse gas / carbon dioxide linked to global warming (1) [2]

(c) (i) 999 (1) [1]

(ii) 1 (1) [1]

(iii) $\frac{1}{1000} \times 100$ (1)
= 0.1 (1) [2]

(d) (i) Volume decreases (1)
Smaller space between the particles / particles are closer together (1) [2]

(ii) Volume increases (1)
Idea that particles have more energy **and** spread out (1) [2]

[Total: 11]

A3 (a) Initially zinc carbonate is cold so a low speed of reaction / at start zinc carbonate is not hot enough to decompose (1) [1]

(b) First time when the line is horizontal (1)
ALLOW explanation written on the graph [1]

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(c) Graph starts at the origin and ends at the same volume (1)
Graph has same shape as original but always to the left and does not go above the final volume (1)
Reaction is faster (1)
Particles have more energy / more successful collisions / more energetic collisions / more fruitful collisions / more effective collisions / more particles have energy above the activation energy (1) [4]

(d) $MgCO_3$ any time greater than 70 and less than 360 **and** $PbCO_3$ any time less than 60 (1)
Idea that the time is linked to position of metal in the reactivity series e.g. the more reactive the metal the longer the time (1) [2]

[Total: 8]

A4 (a) Positive electrode: $2O^{2-} \rightarrow O_2 + 4e^-$ (1)
Negative electrode: $Al^{3+} + 3e^- \rightarrow Al$ (1) [2]

(b) Has a layer of aluminium oxide on the surface (1)
The layer stops water getting to the surface / layer will not let oxygen reach the surface / the layer will not flake off / layer is non-porous / layer is impermeable (1) [2]

(c) Magnesium is more reactive (than iron) / magnesium is oxidised more easily / magnesium is above iron in the reactivity series (1)
Magnesium reacts instead of iron (1) [2]

(d) Use of excess aluminium oxide (1)
Use of sulfuric acid (1)
Filter mixture (to get filtrate) (1)
Evaporate some of solution and allow to crystallise / leave in warm place to crystallise (1) [4]

[Total: 10]

A5 (a) Correct 'dot-and-cross' diagram (2)
Award 1 mark for two shared pairs of electrons between carbon atoms / each carbon-hydrogen bond shown as a shared pair of electrons [2]

(b) $C_2H_4 + H_2O \rightarrow C_2H_5OH$ (1)

Any two from:
High temperature / 200–400 °C / heat (1)
High pressure / 30–100 atmospheres (1)
Catalyst / (concentrated) phosphoric acid (1) [3]

[Total: 5]

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A6 **A** copper(II) carbonate (1)

B carbon dioxide (1)

C copper(II) sulfate (1)

D copper(II) hydroxide (1)

E magnesium sulfate (1)

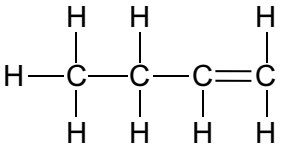
F copper (1) [6]

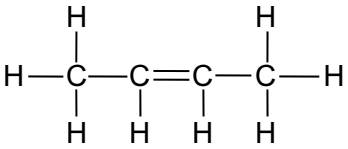
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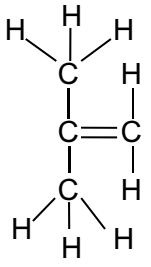
B7 **(a)** Has only single bonds / has no double bonds (1) [1]

(b) CH_2 (1) [1]

(c) Any one of







(1) [1]

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(d) (i) $C_4H_8 + 6O_2 \rightarrow 4CO_2 + 4H_2O$
Correct reactants and products (1)
Balancing (1) [2]

(ii) Moles of $C_4H_8 = \frac{600}{24} = 25$ (1) (mark for working or correct answer)
Energy = 67 550 (1) [2]

(iii) Bond breaking absorbs energy / bond breaking is endothermic (1)
Bond making releases energy / bond making is exothermic (1)
More energy is released than absorbed (1) [3]

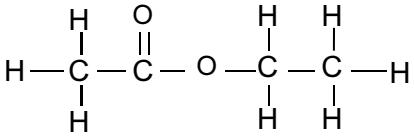
[Total: 10]

B8 (a) Does not completely dissociate / partially ionises / ionises to form an equilibrium mixture (1)
$CH_3CO_2H \rightleftharpoons CH_3CO_2^- + H^+$ / $CH_3CH_2CH_2CO_2H \rightleftharpoons CH_3CH_2CH_2CO_2^- + H^+$ (1) [2]

(b) Hydrogen (1)
Pops with a lighted splint (1) [2]

(c) $Mg(CH_3CH_2CH_2CO_2)_2$ / $(CH_3CH_2CH_2CO_2)_2Mg$ (1) [1]

(d)



(1)

[1]

(e) Moles of NaOH = $0.0232 \times 0.1 = 0.00232$ (1) (mark for working or correct answer)
Moles of acid = moles of alkali = 0.00232 (1)
$M_r = 74.1$ (1)
$CH_3CH_2CO_2H$ / propanoic acid / propionic acid (1) [4]

[Total: 10]

B9 (a) Reaction is faster
because the particles are closer together / because the particles are more crowded / more particles per unit volume (1)
more collisions per second / collisions more often / higher collision frequency (1) [2]

(b) Position of equilibrium shifts to the left (1)
Because the reaction is exothermic / because heat is released (in the forward reaction) (1) [2]

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(c) (i) Moles of CO_2 = $\frac{220}{44}$ = 5 (1) (mark for working or correct answer)
Mass of methane = 80 (1) [2]

(ii) 57.5 (1) [1]

(d) (i) No effect / does not change (1) [1]

(ii) Speed increases (1)
Activation energy is lowered / reaction follows a different pathway (1) [2]

[Total: 10]

B10 (a) (i)

symbol	number of protons	number of electrons	number of neutrons
$^{223}_{87}Fr$	87	**87**	136
$^{225}_{87}$**Fr**	87	**87**	138

Correct symbol (1)
Correct numbers of electrons (1) [2]

(ii) $2Fr + 2H_2O \rightarrow 2FrOH + H_2$ (1) [1]

(c) (i) Francium atom loses one electron to make a francium ion (1)
Oxygen atom gains two electrons to make an oxide ion (1) [2]

(ii) **Any two from**
High melting point (1)
Does not conduct electricity as a solid (1)
Conducts electricity as a molten liquid (1)
Soluble in water (1) [2]

(d) Positive ions in regular layers (2 layers is the minimum required in a diagram) (1)
Electrons shown interspersed between the particles shown (1)

Note: Marks can be awarded from correct description in writing or from a labelled diagram.
Electrons can move / delocalised electrons / free electrons (1) [3]

[Total: 10]

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