UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Ordinary Level

MARK SCHEME for the October/November 2011 question paper for the guidance of teachers

5070 CHEMISTRY

5070/22 Paper 2 (Theory), maximum raw mark 75

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International Examinations

A1 **(a)** zinc
ALLOW: vanadium [1]

(b) nickel [1]

(c) chlorine [1]

(d) chlorine [1]

(e) hydrogen [1]

(f) zinc [1]

[Total: 6]

A2 **(a)** **(i)** 20% [1]

(ii) lower temperature of (purified) air so below boiling points of gases/liquefy air/air compressed and expanded so cools to liquid; [1]

idea of distillation/temperature raised gradually oxygen remains liquid whilst nitrogen (or other gases) distil off; [1]
ACCEPT: ideas about separation according to boiling points
ACCEPT: ideas about heavier molecules having higher boiling points

(b) welding/joining metals; [1]

(c) correct dot and cross diagram for acetylene; [1]

(d) charges correct either on diagram or written as Mg^{2+} and O^{2-} [1]
correct electronic structures for both (2,8); [1]

(e) **(i)** $3O_2 \rightarrow 2O_3$; [1]
(ignore + uv)

(ii) absorbs ultraviolet radiation which is harmful/absorbs uv which causes skin cancer; [1]
ALLOW: blocks uv which is harmful

[Total: 9]

A3 **(a)** substance containing only carbon and hydrogen; [1]

(b) C_7H_{16} [1]

(c) isomers; [1]

(d) 45 cm^3 [1]
25 cm^3 [1]

(e) carbon monoxide formed; [1]
which is poisonous/toxic/kills you; [1]

[Total: 7]

A4 **(a)** **(i)** reactants on left and products on right and reactants above products; [1]
enthalpy change shown correctly; [1]
activation energy shown correctly; [1]

(ii) limewater; [1]
turns milky/cloudy/white precipitate; [1]

(b) **(i)** any 3 of: [3]
sulfur burns to form sulfur dioxide/correct equation;
sulfur dioxide dissolves in rainwater/correct equation;
further oxidation to sulfur trioxide in the atmosphere/correct equation; sulfur dioxide/ trioxide is an acidic oxide;

(ii) breathing difficulties/lung or throat irritant; [1]

(c) **(i)** lightning/high voltage/electric spark; [1]

(ii) $2HNO_3 + CaCO_3 \rightarrow Ca(NO_3)_2 + CO_2 + H_2O$ [2]
1 mark for correct formulae
1 mark for balance

[Total: 12]

A5 (a) **atoms** of same element/with same number of protons but different numbers of neutrons/ atoms with the same proton (atomic) number but different nucleon number; [1]

(b) electrons = 35 and protons = 35; [1]
neutrons = 46; [1]

(c) (i) molecules very close together; [1]
molecules random/irregularly arranged; [1]

(ii) any 3 of: [3]
faster moving/more energetic molecules escape from liquid/
diffusion/
random movement of molecules/
molecules get mixed up with molecules in the air/
molecules of bromine collide with molecules in the air

(d) (i) $Br_2 + F_2 \rightarrow 2BrF$ [1]

(ii) correct molar masses for Br and BrF_5 (80 and 175); [1]
100 × 80/175 = 45.7/46% [1]

[Total: 11]

B6 (a) (i) $N_2 + 3H_2 \rightleftharpoons 2NH_3$ [1]

(ii) iron catalyst; [1]
temperature 450°C (allow between 420 and 450); [1]
pressure of 200 atmospheres (allow between 150 and 500 atmospheres [1]

(b) to increase crop yield/make plants grow better/replace N (or K or P) lost from soil; [1]

(c) calcium hydroxide reacts with ammonium salts to form ammonia; [1]
ammonia is a gas/gas escapes from the soil; [1]

(d) (i) fertilisers dissolve in the (ground)water; [1]
idea of leaching/movement of dissolved salts through soil to lakes; [1]

(ii) eutrophication; [1]

[Total: 10]

B7 (a) strong acid is completely ionised in water/solution and weak acid is only partially ionised/ strong acid is completely dissociated weak acid is partly dissociated/no (or few) molecules in strong acid but weak acid is largely molecules; [1]

(b) strong acid has better conductivity BECAUSE strong acid has greater concentration of hydrogen ions/weak acid has lower conductivity
BECAUSE has lower concentration of hydrogen ions [1]

(c) (i) hydrogen ions are positive so move to negative electrode/hydrogen ions gain electrons at cathode; [1]

(ii) $4OH^- \rightarrow O_2 + 2H_2O + 4e^-$ [2]
1 mark for correct reactants and products (including electron)
1 mark for balance

(d) (i) gas syringe attached to flask/flask with cotton wool in mouth on top pan balance; [1]
measure volume of gas/mass of flask and contents over time; [1]
rate = change in volume of gas/time or change in mass/ time; [1]

(ii) 3g Mg = 3/24 = 0.125 mol; [1]
volume = 1000 × 0.125/2.5 = 50 cm^3/0.05 dm^3 (unit needed) [1]

[Total: 10]

B8 (a) (i) ALLOW: 175–191 (actual = 187°C) [1]

(ii) correct structure of butanoic acid showing all atoms and bonds; [1]

(iii) $2CH_3CO_2H + 2Na \rightarrow 2CH_3CO_2Na + H_2$ [1]

(b) (i) ethyl ethanoate [1]

(ii) correct structure of ethenyl ethanoate i.e. $CH_2{=}CHO_2CCH_3$ [1]

(c) (i) divide by atomic masses: C = 55.8/12 H = 7/1 O = 37.2/16
C = 4.65 H = 7 O = 2.325 [1]
divide by smallest number: C = 4.65/2.325 = 2
H = 7/2.325 = 3
O = 1
Correct formula C_2H_3O [1]

(ii) $C_4H_6O_2$ [1]
ALLOW: ecf from part **(i)** if 1 or 2 carbon atoms but H and/or O incorrect.

(iii) aqueous bromine/(acidified) potassium(VII) manganate; [1]
goes colourless [1]

[Total: 10]

B9 (a) (i) $Ba(s) + 2H_2O(l) \rightarrow Ba(OH)_2(aq) + H_2(g)$ [3]
1 mark for formulae
1 mark for balance
1 mark for state symbols

(ii) $H^+ + OH^- \rightarrow H_2O$ [1]

(b) valence electrons in metallic structure are free to move [1]

(c) aluminium removes oxygen from barium oxide/oxidation number of decreases/oxidation number of aluminium increases [1]

(d) add named soluble sulfate/sulfuric acid; [1]
filter off ppt [1]
wash ppt with water; [1]
dry ppt in oven/leave ppt to dry/dry ppt in dessicator [1]

[Total: 10]