CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Ordinary Level

MARK SCHEME for the October/November 2012 series

5070 CHEMISTRY

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

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A1 **(a)** (substance containing) two or more elements bonded / joined [1]

(b) **(i)** carbon dioxide / CO_2 [1]

(ii) zinc oxide / ZnO [1]

(iii) calcium carbonate / $CaCO_3$ [1]

(iv) carbon dioxide / CO_2 [1]

(v) methane / CH_4 [1]

(vi) carbon monoxide / CO [1]

(c) one pair of electrons between each H and O; (1)

rest of structure is correct; (1) [2]

[Total: 9]

A2 **(a)** **(i)** lead < iron < zinc < magnesium [1]

(ii) $Fe_2O_3 + 3Zn \rightarrow 3ZnO + 2Fe$ [1]

(b) **(i)** (forms an) oxide layer / has a coat of oxide; (1)

which is strongly fixed to the surface / which is not easily removed / which is unreactive; (1) [2]

(ii) low density [1]

(iii) protons = 13 and neutrons = 14 [1]

[Total: 6]

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A3 NOTE: for parts **A3a(i)** and **A3a(ii)** answers must be comparative

(a) (i) speed increases with increase in bromine concentration (no mark alone)
because
(bromine) molecules closer together / more (bromine) molecules (in a given volume) / more (bromine) particles (in a given volume) / more crowded molecules; (1)

therefore frequency of collisions greater /more particles collide per second / greater chance of collisions / collide more often; (1) [2]

(ii) increasing temperature increases rate (no mark alone)
because
particles move more rapidly / particles have more energy ; (1)

therefore more energetic collisions / more effective collisions / more successful collisions / more vigorous collisions; (1)

NOTE: more particles have energy greater than activation energy = 2 marks [2]

(iii) measure colour of the solution / bromine (over time) / use a colorimeter / measure absorbance / measure how much light goes through the solution / measure (electrical) conductivity [1]

(b) (i) $Fe \rightarrow Fe^{2+} + 2e^{-}$ (1)

$Br_2 + 2e^{-} \rightarrow 2Br^{-}$ (1) [2]

(ii) reactants on the left and products on the right and reactant level above product level; (1)

ΔH correctly labelled with arrow going downwards; (1)

activation energy correctly labelled with arrow / line going upwards or double-headed arrow; (1) [3]

[Total: 10]

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A4 (a) carbon dioxide and water (required); (1)

(in presence of) sunlight / chlorophyll; (1)

to form glucose / $C_6H_{12}O_6$ / sugars / carbohydrate; (1) [3]

(b) (i) calcium ethanoate [1]

(ii) boiling point [1]

(iii) C = 54.5/12 H = 9.1/1 O = 36.4/ 16
or
4.54 9.1 2.275 / 2.28 (1)

ratio = 2 4 1 (1) [2]

(c) (i) formula completed correctly e.g. – OCH_2CH_3 [1]

(ii) solvent / flavouring / perfumes / making polyesters / making terylene / plasticisers / making fuels (transesterification) / nail varnish remover [1]

[Total: 9]

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A5 (a) (i) evaporates easily / easily form a gas [1]

(ii) by heating / high temperature [1]

(iii) impurities remain as solids / impurities do not evaporate / only the nickel carbonyl evaporates / nickel reacts and leaves impurities behind [1]

(b) 4 [1]

(c) two electrodes dipping into liquid and power pack or battery; (1)

(pure) nickel and impure nickel electrodes labelled; (1)

impure nickel is the anode / + electrode and pure nickel is the cathode / - electrode; (1)

electrolyte labelled as nickel salt / named nickel salt / aqueous nickel compound; (1) [4]

(d) any **three** from:
conducts heat / conducts electricity (1)

malleable / can be hammered into shape / can be bent into shapes (1)

ductile / can be stretched (1)

shiny / lustrous (1) **IGNORE:** silvery [3]

[Total: 11]

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B6 (a) (i) chlorine gains electrons, so is reduction; (1)

bromide loses electrons, so is oxidation; (1) [2]

(ii) use of universal indicator / pH paper **and** comparison with colour chart / use of pH meter / use of pH electrode [1]

(iii) iodine is less reactive (than bromine) ORA iodine is lower in the reactivity series (than bromine) [1]

(b) C and D because they have low boiling points/
C and D because they do not conduct (when molten) [1]

(c) $Cl_2 + 2NaOH \rightarrow NaClO + NaCl + H_2O$ [1]

(d) (i) 0.05 (mol dm^{-3}) [1]

(ii) mol thiosulfate = 0.05 x 23.6/1000 / 1.18×10^{-3} (mol); (1)

mol iodine = 5.9×10^{-4} (mol) ; (1)

concentration of iodine = ($5.9 \times 10^{-4} \times 1000 / 12.5$) = 0.0472 (mol dm^{-3}) (1)
(mark is for correct answer) [3]

[Total: 10]

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B7 (a) (i) (both have) tetrahedral arrangement of atoms / (both have) hexagonal arrangement of atoms; (1)

(both are) giant structures / giant molecular (structures) / macromolecules / covalent lattices; (1) [2]

(ii) many (covalent) bonds / giant structure / macromolecule / all atoms joined together / network of bonds / lattice; (1)

takes a lot of energy to break bonds / hard to break bonds / high temperature needed to break bonds / bonds are strong; (1) [2]

(iii) no free electrons / no delocalised electrons / no sea of electrons / all electrons in covalent bonds / electrons can't move / electrons in fixed positions; [1]

(b) (i) idea of random movement of molecules or particles / movement of molecules or particles in any direction;
NOTE: answer must refer to particles, of any kind [1]

(ii) they have different masses / they have different sizes / hydrogen (ion) is lighter / hydrogen (ion) is smaller [1]

(c) 8 valency electrons in both sodium and oxide ions; (1)

charges correct Na^{+} and O^{2-} ; (1)

2 sodium ions and 1 oxide ion / Na_2O / ratio of 2 Na to 1 O from diagram of covalent structure; (1) [3]

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B8 **(a)** improve (crop) growth / improve (crop) yield / increase crop (growth) / increase crop (yield) / bigger crop (growth) / better crop (yield) [1]

(b) so that the roots can absorb them / so the plant can absorb them [1]

(c) **(i)** 2N = 28; (1)

RFM of ammonium nitrate = 80; (1)

% by mass = 35%; (1) [3]

(c) **(ii)** add sulfuric acid (to aqueous ammonia); (1)

titration; (1)

use of indicator then repeat without indicator; (1)

heat (solution obtained) to crystallisation point / evaporate some of the water (from the solution) / heat (solution) then leave (solution) to cool / leave (solution) to crystallise / solution concentrated by heating (1) [4]

(d) 3- [1]

[Total: 10]

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B9 (a) (i) sulfur dioxide / hydrogen peroxide [1]

(ii) kills bacteria [1]

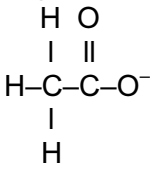
(b) (i) correct structure with
two or more units and single bonds between carbon atoms; (1)

continuation bonds present; (1) [2]

(ii) bromine water / (aqueous) bromine / bromine; (1)

turns colourless / decolourised; (1) [2]

(c) (i) correct formula for ethanoate ion showing all atoms and bonds including negative charge on the single bonded oxygen



[1]

(ii) $CH_3COOH + OH^- \rightarrow CH_3COO^- + H_2O$ [1]

(d) (i) (hydroxide reacts with ammonium salts) to form ammonia [1]

(ii) $OH^- + NH_4^+ \rightarrow NH_3 + H_2O$ [1]

[Total: 10]

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