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

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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

(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]

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]

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]

A5 (a) (i) evaporates easily / easily form a gas

(ii) by heating / high temperature

(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]

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

bromide loses electrons, so is oxidation; (1)

(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 x 10^{-3} (mol); (1)

mol iodine = 5.9 x 10^{-4} (mol) ; (1)

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

[Total: 10]

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 <u>bonds</u> / hard to break <u>bonds</u> / high temperature needed to break <u>bonds</u> / <u>bonds</u> 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]

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

(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]

B9 (a) (i) sulfur dioxide / hydrogen peroxide

(ii) kills bacteria

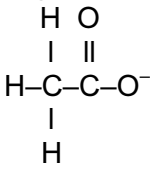
(b) (i) correct structure with
two or more units and single bonds between carbon atoms; (1)

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]