CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Ordinary Level

MARK SCHEME for the October/November 2013 series

5070 CHEMISTRY

5070/21 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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International Examinations

A1 **(a)** iron(II) chloride (1) [1]

(b) carbon dioxide (1) [1]

(c) nitrogen dioxide (1) [1]

(d) calcium oxide (1) [1]

(e) carbon dioxide (1) [1]

(f) silver chloride (1) [1]

[Total: 6]

A2 **(a)** C_nH_{2n} (1) [1]

(b) **ANY TWO FROM:**
have same functional group (1)

physical properties change gradually (down the series) (1)

have similar chemical properties (1)

chain increases by CH_2 for each successive member (1) [2]

(c) **(i)** **ANY ONE FROM:**
catalyst/aluminium oxide/zeolites/silicon dioxide (1)

high temperature/values between and including 400–500 °C (1) [1]

(ii) $C_{14}H_{30} \rightarrow C_8H_{16} + C_6H_{14}$ (1) [1]

(d) addition (1) [1]

(e) **ANY TWO FROM:**
does not conduct electricity/does not conduct heat (1)

it is a gas/low melting point/low boiling point (1)

insoluble in water/soluble in organic solvents (1) [2]

(f) absorbs ultra violet/UV light (1)

(too much) UV light harmful/(too much) UV causes skin cancer (1) [2]

[Total: 10]

A3 **(a)** 2, 8, 8, 2 (1) [1]

(b) **(i)** atoms of same element with different number of neutrons (1) [1]

(ii)

isotope	number of protons	number of electrons	number of neutrons
^{42}Ca	**20**	**20**	**22**
^{48}Ca	**20**	**20**	**28**

proton column (1)

electrons column (1)

neutrons column (1) [3]

(c) **(i)** $CaCO_3 + 2HCl \rightarrow CaCl_2 + CO_2 + H_2O$ (1) [1]

(ii) calcium ion = 2, 8, 8 and charge is + 2 (1)

chloride ion = 2, 8, 8 and charge is –1 (1) [2]

(d) **(i)** anode: chlorine
AND
cathode: calcium (1) [1]

(ii) hydrogen (1) [1]

(iii) ions cannot move/no free ions (1) [1]

[Total: 11]

A4 **(a)** nitrogen; 78 to 79% (1)
oxygen; 20 to 21% (1) [2]

(b) fractional distillation (1) [1]

(c) **ANY ONE FROM:**
acid rain/effect of acid rain e.g. chemical weathering of carbonate rocks/buildings/ killing aquatic life (1)

smog (1)

(worsens) asthma/breathing difficulties (1)

depletion of ozone layer (1) [1]

(d) $C_8H_{18} + 8½O_2 \rightarrow 8CO + 9H_2O$

correct reactants and products (1)

balancing – dependent on correct formulae (1) [2]

(e) speeds up chemical reaction/lowers activation energy (1) [1]

(f) **(i)** reaction in which oxidation and reduction occur at the same time (1)

(ii) carbon monoxide oxidised to carbon dioxide (1)

nitrogen dioxide reduced to nitrogen (1) [2]

[Total: 10]

A5 **(a)** M_r of H_2O_2 as 34 (1)

$\left(\frac{32}{34} \times 100 = \right)$ 94% (1) [2]

(b) measure volume of gas or oxygen (1)

at various times (1) [2]

(c) rate of reaction increases/reaction is faster (1)

particles of H_2O_2 closer together/more particles per unit volume/more crowded particles (1)

greater frequency of collisions (1) [3]

(d) yeast dies (at higher temperatures)/enzymes denatured (1) [1]

[Total: 8]

B6 (a) (i) ANY FOUR FROM:
carbon converted to carbon dioxide (from air blast) (1)

carbon monoxide formed from reaction of carbon with carbon dioxide (1)

carbon monoxide converts iron oxide, iron ore or haematite to iron (1)

(in hotter parts of furnace) carbon converts iron oxide, iron ore or haematite to iron (1)

idea of reduction of iron oxide (1)

calcium carbonate/limestone decomposes to calcium oxide (1)

calcium oxide reacts with silicon dioxide/sand to form slag (1)

balanced equation for iron oxide reduction (1) [4]

(b) in 'pure' iron the layers can slide (when force applied) (1)

in alloy the (larger) Mn atoms stop the layers from sliding (1) [2]

(c) (i) 0.0375 / 0.038 mol (1) [1]

(ii) 0.005 / 5×10^{-3} mol (1) [1]

(iii) mol $H_2 = 5 \times 10^{-3}/2 = 2.5 \times 10^{-3}$ mol (1)

60 (cm^3) / 0.06 dm^3 (1) [2]

[Total: 10]

B7 (a) (i) (C = 0.48/12 H = 0.08/1 C*l* = 1.42/35.5)
C = 0.04 H = 0.08 C*l* = 0.04 (1)

CH_2Cl (1) [2]

(ii) $C_2H_4Cl_2$ (1) [1]

(b) two or more units shown polymerised with single bonds only/single unit with single bonds only and brackets (1)

extension bonds shown (1) [2]

(c) ANY ONE FROM:
in condensation polymer a small molecule is released (on polymerisation) whereas in addition polymer no other substance is formed (1)

addition polymers formed by double bonds breaking (when monomers combine) whereas condensation polymers formed by reaction of (specific groups) in each monomer (1) [1]

(d) (i) $C_2H_4 + HCl + ½\ O_2 \rightarrow C_2H_3Cl + H_2O$ / $2C_2H_4 + 2HCl + O_2 \rightarrow 2C_2H_3Cl + 2H_2O$ (1) [1]

(ii) $CuO + 2HCl \rightarrow CuCl_2 + H_2O$ (1) [1]

(iii) ANY TWO FROM:
high melting point/high boiling point (1)

high density (1)

hard (1) [2]

[Total: 10]

B8 (a) ANY TWO FROM
mixture has no fixed composition but compound has fixed composition (1)

(components of) mixture can be separated (by physical means) but compound cannot (1)

when mixture formed no heat change/energy change but when compound formed there is an energy change (1)

the properties of a compound are different from those of the reactants (1) [2]

(b) zinc sulfide/labelled products on right and below the reactants (1)

labelled enthalpy change shown correctly with downward pointing arrow (1) [2]

(c) ZnS (1) [1]

(d) (acid which is) incompletely ionised (in water)/(acid which is) partially ionised (in water)/ (acid which is) incompletely dissociated (in water) (1) [1]

(e) (i) $Zn + 2H^+ \rightarrow Zn^{2+} + H_2$ (1) [1]

(ii) **ANY THREE FROM**
add excess Zn to sulfuric acid (1)

filter (off excess zinc) (1)

heat filtrate to crystallisation point/partially evaporate filtrate (1)

filter off crystals or pick out crystals and dry on filter paper (1) [3]

[Total: 10]

B9 (a) CH_3CO_2Na (1) [1]

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

(c) (i) goes to the right + reason (1)
e.g. reaction goes in direction to oppose direction of change/reaction goes in direction to reduce concentration of methanol [1]

(ii) goes to the left + reason (1)
e.g. for endothermic reaction decrease in temperature shifts reaction to the left **ORA**/reaction goes in direction so as to oppose the decrease in temperature [1]

(d) $C_8H_8O_2$ (1) [1]

(e) OH^- (1) [1]

(f) (i) $0.0025 / 2.5 \times 10^{-3}$ mol (1) [1]

(ii) $0.00125 / 1.25 \times 10^{-3}$ mol (1) [1]

(iii) $\mathbf{M}(OH)_2 + 2HCl \rightarrow \mathbf{M}Cl_2 + H_2O$ (1) [1]

(g) calcium (hydroxide) (1) [1]

[Total: 10]