CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge Ordinary Level

MARK SCHEME for the October/November 2015 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.

Cambridge will not enter into discussions about these mark schemes.

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

(b) iodine (1) **[1]**

(c) sulfur (1) **[1]**

(d) lead (1) **[1]**

(e) argon (1) **[1]**

(f) aluminium / magnesium (1) **[1]**

[Total: 6]

A2 **(a)** $6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$ (2) **[3]**
1 mark for correct reactants and products
1 mark for correct balancing (dependent on correct reactants and products)

conditions: chlorophyll **and** light (1)

(b) **(i)** glucose / sugars (1) **[1]**

(ii) **EITHER** **[2]**
acid (1)

heat / reflux (1)

OR

enzymes / amylase (1)
REJECT: other named enzymes which do not hydrolyse starch

at room temperature / temperature any value between 1 °C and 40 °C / pH 7 (1)

(c) **(i)** calcium ethanoate (1) **[2]**
$(CH_3COO)_2Ca$ / correct displayed formula (1)

(ii) $CH_3COOC_2H_5$ shown as displayed formula (1) **[1]**
or
$C_2H_5COOCH_3$ shown as displayed formula (1)
or
$HCOOC_3H_7$ shown as displayed formula (1)
or
$HCOOCH(CH_3)_2$ shown as displayed formula (1)

(iii) 1 mark for
C = 37.5 / 12 H = 12.5 / 1 O = 50 / 16 **[2]**
or
= 3.125 = 12.5 = 3.125

1 mark for
$\frac{3.125}{3.125}$ $\frac{12.5}{3.125}$ $\frac{3.125}{3.125}$
or
1 4 1
or
CH_4O

[Total: 11]

A3 **(a)** carbon for removing smells / removing odours / for removing tastes / so it tastes better (1) **[2]**

chlorine to kill bacteria / to kill microbes / to kill micro-organisms (1)

(b) removal of salt / removal of minerals from (sea) water (1) **[1]**

(c) nitrate **and** phosphate (1) **[1]**

(d) $Ba^{2+}(aq) + SO_4^{2-}(aq) \rightarrow BaSO_4(s)$ (2) **[2]**
1 mark for correct formulae
1 mark for correct state symbols (dependent on correct formulae)

[Total: 6]

A4 **(a)** **(i)** $CO_2 + C \rightarrow 2CO$ (1) **[1]**

(ii) $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$ (1) **[1]**

(b) to form calcium oxide / to make calcium oxide (1) **[1]**

(c) ($\frac{56 \times 3}{232} \times 100$ =) 72.4 % **or** 72% (2) **[2]**

2 marks for correct percentage
OR 1 mark for 232 **or** **(**(56 × 3) + (16 × 4)) as denominator, **or** (56 × 3) **or** 168 as numerator

(d) anode reaction is oxidation as loss of electrons (1) **[2]**
OR
anode reaction is oxidation as oxidation number of oxygen increases (1)

cathode reaction is reduction as gain of electrons (1)
OR
cathode reaction is reduction as oxidation number (of iron) decreases (1)

(e) 1 mark each for any two of: **[2]**
- magnesium more reactive than iron / magnesium higher in the reactivity series
- magnesium reacts instead of iron / magnesium corrodes instead of iron / magnesium corrodes preferentially
- magnesium loses electrons instead of iron

(f) $Fe + 2HCl \rightarrow FeCl_2 + H_2$ (1) **[1]**

[Total: 10]

A5 (a) (i) 1 mark each for any two of: **[2]**
- diffusion
- molecules move randomly / molecules spread out / molecules get mixed up
- (bulk movement of molecules) from high to low <u>concentration</u> / with the <u>concentration</u> gradient

(ii) they have different relative molecular masses / they have different molar masses (1) **[1]**

(b) molecules **or** particles move faster at higher temperature (or reverse argument) / molecules **or** particles have more (kinetic) energy at higher temperature (1) **[2]**

molecules spread out / molecules move further away from each other (on average) / space between molecules increases (1)

[Total: 5]

A6 **(a)** 9.60 / 32 **or** 0.3(0) mol S (1) **[2]**
(247 × 0.30) = 74.1 (kJ) **or** 74 (kJ) (1)

(b) $SO_2 + OH^- \rightarrow HSO_3^-$ (1) **[1]**

(c) higher concentration of H^+ ions in ethanoic acid / more crowded H^+ ions in ethanoic acid (or reverse argument) (1) **[2]**

collision frequency greater in ethanoic acid (or reverse argument) (1)

(d) 3.2 g NaOH = $\frac{3.2}{40}$ **or** 0.08 mol (1) **[2]**

(0.08 / 0.1) = 0.8 dm^3 **or** 800 (cm^3) (1)

[Total: 7]

B7 **(a)** (atoms) arranged tetrahedrally / tetrahedral (structure) / (bent) hexagonal (structure) / four atoms round carbon and four atoms round silicon / both giant (structures) / both lattices / both macromolecules / each has one atoms surrounded by four others (1) **[1]**

(b) giant structure / lattice (1) **[2]**

(all) bonds are strong / takes a lot of energy to break bonds / needs high temperature to break the bonds (1)

(c) SiO_3^{2-} (1) **[1]**

(d) no mobile electrons / does not have delocalised electrons / does not have free electrons / all electrons are used in bonding (1) **[1]**

(e) breakdown / decomposition of substance using electric current (1) **[1]**

(f) **(i)** $2O^{2-} \rightarrow O_2 + 4e^-$ (1) **[1]**

(ii) $Al^{3+} + 3e^- \rightarrow Al$ (1) **[1]**

(g) protons 14 **and** neutrons 15 (1) **[1]**

(h) (weighted) mass of atom on scale where carbon-12 atom weighs 12 units / idea of mass of an atom comparison with C-12 atom (1) **[1]**

[Total: 10]

B8 **(a)** 6×10^{-3} mol Cl_2 (1) **[3]**

9.5×10^{-3} mol NaOH (1)

mol NaOH required to react with all chlorine = 12×10^{-3} **or** mol Cl needed to react with NaOH = $4.7(5) \times 10^{-3}$
AND
Cl_2 in excess (1)

(b) **(i)** $Cl_2 + 2KBr \rightarrow Br_2 + 2KCl$ (2) **[2]**
1 mark for correct formulae
1 mark for balancing (dependent on correct formulae)

(ii) chlorine more reactive than bromine / chlorine above bromine in reactivity series (or reverse argument) **[1]**

(iii) –1 **or** Cl^- **or** – (1) **[2]**

2,8,8 (1)

(c) in solid, the ions are in fixed positions / ions do not move (1) **[2]**
when molten, the ions can move (1)

[Total: 10]

B9 **(a)** bromine water / aqueous bromine / bromine (1) **[2]**
decolourises / goes colourless (1)

(b) arrangement: not ordered / disordered / no fixed arrangement / no fixed position / random / irregular (shape) (1) **[2]**

motion: slide over each other / move over each other (1)

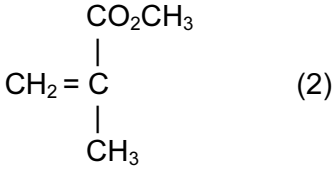
(c) correct molar masses of isoprene and methylsulfolene: 68 **AND** 132 **or** 68 + 64 (1) **[3]**

100/68 or 1.47 mol isoprene (1)

(× 132) = 194.1 g methylsulfolene (1)

(d) **(i)** double bond / C=C (bond) (1) **[1]**

(ii) **[2]**



(2)

1 mark for CH_2=C correct; 1 mark for rest of molecule correct

[Total: 10]

B10 (a) position of equilibrium moves to the right / moves in forward direction / moves to the product side / moves to make more PCl_3 / moves to make more Cl_2 (1) **[2]**

(if pressure decreases) reaction goes in direction of increasing number of moles (in stoichiometric) equation) / goes in direction of more moles of products / products have larger (gas) volume than reactants (1)

(b) position of equilibrium moves to left moves in backward direction (1) **[2]**

to reduce the concentration of added substance / to reduce the concentration of chlorine (1)

(c) (i) increasing temperature increases the % of PCl_3 (or reverse argument) (1) **[1]**

(ii) reaction is endothermic (because as temperature increases the amount of product increases) (1) **[1]**

(d) no effect / position of equilibrium remains the same (1) **[1]**

(e) molecules move faster / molecules have more energy (1) **[2]**

more molecules have energy greater than activation energy (1)

(f) $PCl_5 + 4H_2O \rightarrow H_3PO_4 + 5HCl$ **[1]**

[Total: 10]