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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Ordinary Level

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

5070 CHEMISTRY

5070/21 Paper 2 (Theory), maximum raw mark 75

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UNIVERSITY of CAMBRIDGE
International Examinations

Section A

A1 **(a)** sulfur dioxide (1) [1]

(b) potassium manganate(VII) (1) [1]

(c) silver nitrate (1) [1]

(d) nitrogen dioxide (1) [1]

(e) Methane (1) [1]

[Total: 5]

A2 **(a)** C_2H_4O (1) [1]

(b) structure shown or written as 2,8,2 (1) [1]

(c) **(i)** **any two of:**
floats/moves over surface (1)
bubbles/effervescence (1)
goes into a ball/melts (1)
gets smaller/eventually forms a colourless solution (1)
yellow/orange flame (1)
IGNORE dissolves [2]

(ii) $2Na(s) + 2H_2O(l) \rightarrow 2NaOH(aq) + H_2(g)$
correct formulae for reactants and products (1)
balancing (dependent on correct formulae) (1)
correct state symbols (dependent on correct products and reactants) (1)

(d) **(i)** iron has higher melting point/sodium has lower melting point/iron has high melting point and sodium low (1) [1]

(ii) iron has higher density/sodium has lower density/iron has high density and sodium low (1) [1]

[Total: 9]

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A3 (a) (i) losing electrons (to from iodine)/oxidation number goes from –1 to 0/increasing their oxidation number/removing oxygen from hydrogen peroxide (1)
ALLOW incorrect decreases or increases in oxidation number providing the change is the correct direction
ALLOW H_2O_2 is reduced/H_2O_2 gains electrons
IGNORE statements repeating what is in the equation e.g. iodide ions goes to iodine [1]

(ii) colourless to brown (1)
ALLOW yellow/orange-brown/straw coloured [1]

(b) potassium iodide: increase in concentration increases rate (1)
sulfuric acid: no effect (1) [2]

(c) any two of:
particles moving slower at lower temperature or have less energy/ORA (1)
collisions less effective at lower temperature/collisions less successful at lower temperature/ORA (1)
collisions less frequent at lower temperature/ORA (1)
fewer particles have energy greater than activation energy (1) [2]

(d) protons = 53
electrons = 54
neutrons = 74

all 3 correct (2)
1 or **2** correct (1) [2]

[Total: 8]

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A4 (a) (i) chromatography <u>paper</u> dipping in <u>labelled</u> solvent (1)
ALLOW named solvents e.g. propanone/alcohol/water
origin line marked <u>above the solvent level</u> (1)
pigment spot on origin line at start and then separates into more than one (coloured) spots (1)
All marks can be obtained by writing or from a diagram [3]

(ii) run chromatogram with known sample <u>and</u> the brown solution/mixture (1)
if chlorophyll present it will go up the paper same distance as the known sample/ has same R_f value (1) [2]

(b) (i) **carbon dioxide** (+ water $\rightarrow$) **glucose** (+ oxygen) (1) [1]

(ii) $2H_2O - 2e^- \rightarrow 2H^+ + O_2 / 2H_2O \rightarrow 2H^+ + O_2 + 2e^-$
correct formulae (including electron) (1)
balancing (1) [2]

(c) (i) contains (C=C) double bonds/can add more hydrogen (1) [1]

(ii) bromine decolourises/goes colourless (1)
IGNORE: goes clear/colour fades/discolourises [1]

(d) (i) C_nH_{2n} (1) [1]

(ii) full structure of but-1-ene or but-2-ene drawn (1)
Must show all the atoms and all the bonds
ALLOW structure of 2 -methylpropene [1]

(iii) add steam/water above 100°C (1)
ALLOW hydrated above 100°C
NOT reference to hydrolysis

catalyst/phosphoric acid (1)
ALLOW $H_3PO_4/H_2SO_4/H^+$ [2]

[Total: 14]

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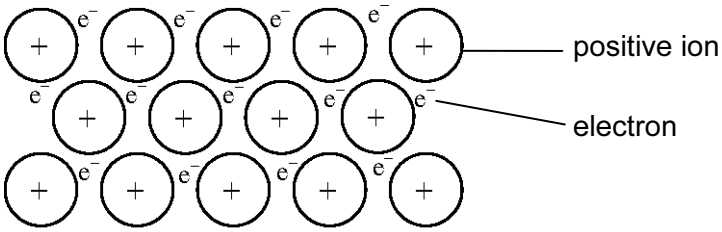
A5 (a) (i) Positive ions in regular layers (1) positive ions can be shown as circles with + or labelled as ions NOT atoms
electrons shown interspersed between the ions (1) electrons can be shown in diagram as e^-/e or – or dots labelled electron [2]



(ii) malleable: idea of layers sliding when force applied (1)
conducts: electrons can move/the sea of electrons/the delocalised electrons/free electrons (1) [2]

(b) no free electrons/no mobile electrons/all electrons involved in bonding/no delocalised electrons/no sea of electrons (1)
strong bonding throughout the whole structure/covalent bonding throughout the whole structure/idea of many strong bonds (1)
NOT ionic bonds [2]

(c) $PdCl_2$ (1) [1]

(d) in solid ions not free to move (1)
when molten ions free to move (1)
ALLOW ions only free to move when molten (2) [2]

[Total: 9]

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Section B

B6 (a) do titration with (indicator) to find end point/do titration (with indicator) to find volume of acid or alkali needed to neutralise (1)
titrate again **without indicator** using same volume as before (1)
evaporate solution to crystallisation point/leave to form crystals (1)
filter off crystals/pick out crystals and dry with filter paper (1) [4]

(b) moles NaOH = $1.6 \times \frac{25}{1000}$ /0.04 mol (1)

moles hydrates sodium sulfate = $\frac{0.04}{2}$ /0.02 (1)

molar mass of sodium sulfate calculated = 322 (1)
mass sodium sulfate = 0.02 × 322 = 6.44g (1) [4]

(c) Anhydrous copper sulfate/white copper sulfate (1)
turns (from white) to blue (1)
OR
Anhydrous cobalt chloride/blue cobalt chloride (1)
turns (from blue) to pink (1) [2]

[Total: 10]

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B7 **(a)** alcohol **and** carboxylic acid (1) [1]

(b) products: $HOCH_2COONa + CO_2 + H_2O$ (1)
balancing $2HOCH_2COOH$ and $2HOCH_2COONa$ (1) [2]

(c) oxygen has been removed from oxalic acid/hydrogen has been added to oxalic acid (1)
ALLOW oxidation number of carbon decreases [1]

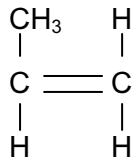
(d) **(i)** condensation polymer because water has been removed (when it is made)/monomer does not have a carbon-carbon double bond/has ester linkage (formed by condensation)/can be hydrolysed (1) [1]

(ii) Polyester/named polyester (1) [1]

(e) **(i)** **any two of:**
less litter (1)
small mammals or birds not trapped or harmed (1)
less landfill (1) ALLOW less or no land pollution
fewer poisonous fumes since not burnt (1) [2]

(ii) any suitable e.g. plastic bags (1) [1]

(iii)



(1)
ALLOW $CH_3CH=CH_2$ [1]

[Total: 10]

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B8 (a) (i) amphoteric oxide because it react both with acids and bases/amphoteric because it reacts as both an acid and a base (1) [1]

(ii) $Al_2O_3 + 2NaOH \rightarrow 2NaAlO_2 + H_2O$ (1)
ALLOW other equations making $NaAl(OH)_4$ or $NaAl(OH)_6$ [1]

(iii) Filtration (1) [1]

(b) (i) cathode: $Al^{3+} + 3e^- \rightarrow Al$ (1)
anode: $2O^{2-} \rightarrow O_2 + 4e^-$
correct symbols and formulae including electron (1)
balancing (1) [3]

(ii) to dissolve the aluminium oxide/to lower the melting point of the mixture (1) [1]

(c) (i) **Any two from:**
aluminium (apparently) unreactive/does not corrode (1)
IGNORE aluminium does not rust
because of oxide layer (1)
acid in drink could react with iron/acid in drink doesn't react with aluminium (1) [2]

(ii) mixture of metals or a metal with a non-metal (1) [1]

[Total: 10]

B9 (a) (i) $0.2 \times 24 = 4.8\ dm^3/4800\ cm^3$ (unit needed) (1) [1]

(ii) correct 'dot-and-cross' diagram for HCl (1) [1]

(b) $CaF_2 + H_2SO_4 \rightarrow CaSO_4 + 2HF$
correct formulae (1)
balancing (1) [2]

(c) HCl is strong and HF is weak(ish)/HCl is stronger than HF (1) ALLOW ORA
pH HCl = 1 (allow 0-2) and HF = 3–6/HCl has a lower pH than HF (1)
or
reference to greater concentration of **hydrogen** ions in HCl than in HF (1) [2]

(d) (i) increasing temperature: reaction goes to left/more reactants (1)
decreasing conc of HI: reaction to the right/more HI formed (1) [2]

(ii) masses: H_2 = 0.8 (2 × 0.4), I_2 = 19.2 (254 × 0.0756) and HI = 172.0 (128 × 1.344) (1)
% I_2 = 19.2/(0.8 + 19.2 + 172) = 10 % (1) [2]

[Total: 10]

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