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Mark Scheme (Results)
January 2011

GCE

GCE Chemistry (6CH02/01)

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January 2011

Publications Code US026197

Section A (multiple choice)

Question Number	Correct Answer	Mark
1	D	**1**

Question Number	Correct Answer	Mark
2	C	**1**

Question Number	Correct Answer	Mark
3	A	**1**

Question Number	Correct Answer	Mark
4	B	**1**

Question Number	Correct Answer	Mark
5	D	**1**

Question Number	Correct Answer	Mark
6 (a)	B	**1**

Question Number	Correct Answer	Mark
6 (b)	A	**1**

Question Number	Correct Answer	Mark
7 (a)	C	**1**

Question Number	Correct Answer	Mark
7 (b)	B	**1**

Question Number	Correct Answer	Mark
7 (c)	C	**1**

Question Number	Correct Answer	Mark
7 (d)	B	**1**

Question Number	Correct Answer	Mark
8	D	**1**

Question Number	Correct Answer	Mark
9	D	**1**

Question Number	Correct Answer	Mark
10 (a)	C	**1**

Question Number	Correct Answer	Mark
10 (b)	D	**1**

Question Number	Correct Answer	Mark
11 (a)	D	**1**

Question Number	Correct Answer	Mark
11 (b)	C	**1**

Question Number	Correct Answer	Mark
11 (c)	D	**1**

Question Number	Correct Answer	Mark
11 (d)	B	**1**

Question Number	Correct Answer	Mark
12	A	**1**

TOTAL FOR SECTION A = 20 MARKS

Section B

Question Number	Acceptable Answers	Reject	Mark
13 (a) (i)	Each mark is independent Diagram of separating funnel with tap. Sides can be straight or bulbous. Top can be stoppered or unstoppered, but not sealed (eg inverted test-tube with tap at bottom). **(1)** Allow straight sides with an open top Two layers. Upper layer is hydrocarbon layer **(1)** Colour – pink/purple/mauve. Allow violet **(1)**	 Filter funnel with tap Three layers Mention of any other colours on their own (e.g. grey, brown, red) or in combination with those accepted.	**3**

Question Number	Acceptable Answers	Reject	Mark
13 (a) (ii)	$2Fe^{3+} + 2I^- \rightarrow 2Fe^{2+} + I_2$ Ignore state symbols Allow multiples/half amounts shown Accept answers involving I_3^-	Formation of Fe^+	**1**

Question Number	Acceptable Answers	Reject	Mark
13 (b)(i)	Answers must refer to oxidation/reduction Sulfuric acid oxidizes (hydrogen/potassium) iodide (to iodine) OR (hydrogen) iodide reduces sulfuric acid OR Phosphoric((V)) acid does not oxidize (hydrogen) iodide (to iodine) (as well as sulfuric acid does) Allow sulfuric acid is a strong(er)/good oxidizing agent/phosphoric(V) acid is a weaker oxidizing agent	 Sulfuric acid oxidizes iodine/oxidizes iodide to iodide Phosphoric acid is a better reducing agent Comments about hazards or strength of sulfuric acid alone Stability of phosphoric(V) acid alone	**1**

Question Number	Acceptable Answers	Reject	Mark
13 (b) (ii)	Water rises in the test tube Allow the gas /HI is soluble / dissolves	Steamy fumes Any coloured solutions forming even if with the acceptable/allowed answer Water would displace the gas	**1**

Question Number	Acceptable Answers	Reject	Mark
13 (b) (iii)	$NH_3(g)/(aq) + HI(g) \rightarrow NH_4I(s)$ Species and balanced equation **(1)** Allow $NH_4^+ + I^-$ for product All state symbols present (dependent on the entities above) **(1)**	NH_3I NH_3HI NIH_4	**2**

Question Number	Acceptable Answers	Reject	Mark
13 (c) (i)	$PI_3 + 3C_4H_9OH \rightarrow 3C_4H_9I + H_3PO_3$ Accept multiples Allow $P(OH)_3$, PH_3O_3, $H_2O + HPO_2$, as product/s		**1**

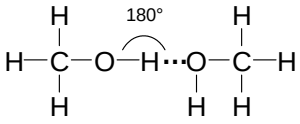
Question Number	Acceptable Answers	Reject	Mark
13 (c) (ii)	**Both points required** Van der Waals'/ London / dispersion / induced dipole / temporary dipole (forces) in 1-iodobutane Allow recognisable spelling of van der Waals' **and** (permanent) dipole dipole/permanent dipole (forces) Allow dipolar-dipolar	Any mention of hydrogen bonding (0)	**1**

Question Number	Acceptable Answers	Reject	Mark
13 (c) (iii)	Yellow precipitate /ppt /ppte / solid The answer may appear with additional words and phrases: e.g. two clear colourless solutions form a yellow precipitate which is insoluble in concentrated ammonia solution Allow bright yellow, sunshine yellow Allow recognisable spelling eg yello percipitate	Off-white Cream Any other colours and combinations of yellow with any other colours Any other qualifications of yellow eg pale/light Any answers which include bubbles, fizzing, effervescence	**1**

Question Number	Acceptable Answers	Reject	Mark
13 (c) (iv)	$CH_3CH_2CH_2CH_2NH_2$ /$CH_3(CH_2)_3NH_2$ /$CH_2(NH_2)CH_2CH_2CH_3$ / $NH_2CH_2CH_2CH_2CH_3$ / $H_2NCH_2CH_2CH_2CH_3$ /$(CH_3CH_2CH_2CH_2)_2NH$ /$(CH_3CH_2CH_2CH_2)_3N$ Allow displayed and skeletal formulae, $C_4H_9NH_2$ Salts of amines which must include a positively charged ion and I^-	NH_4I NH_3 instead of NH_2 Three carbon chains Missing hydrogens $C_4H_{11}N$	**1**

Question Number	Acceptable Answers	Reject	Mark
14 (a) (i)	H .x xx H.x C.x O .xH .x xx H Allow all dots / crosses, combinations of dots, crosses and other symbols like triangles Allow extra inner electrons around carbon and /or oxygen	Missing symbols Missing non-bonding electrons	**1**

Question Number	Acceptable Answers	Reject	Mark
14 (a) (ii)	Each mark is independent of the next unless the bond angle is greater than 119 ^{o} 109 ^{o} / 109.5^{o} **(1)** **Minimum repulsion** / **maximum separation** (between four bond pairs of electrons / bonds) **(1)** 104^{o} – 105^{o} **(1)** (Two) lone pairs / non-bonding pairs (of electrons) repel more (than bonding pairs)/repel a lot **(1)**	Four bond pairs give tetrahedral shape	**4**

Question Number	Acceptable Answers	Reject	Mark
14 (a) (iii)	 Correct atoms in the hydrogen bond (O—H···O) **(1)** Allow CH_3 groups not displayed, correct ethanol formulae. Hydrogen bond can be shown as dots horizontal or vertical dashes. If it is a bond-like line it must be labelled. Second mark dependent on correct atoms involved. O-H...O in straight line (within small tolerance) and 180^{o} bond angle given in the correct place **(1)**	Hydrogen bond between methanol and water does not score	**2**

Question Number	Acceptable Answers	Reject	Mark
14 (b) (i)	Any two from: Bubbles/ fizzing / effervescence (of gas) forming **(1)** Sodium /solid disappearing /dissolving (to form a clear colourless solution) **(1)** White solid /precipitate forming **(1)**	 Vigorous reaction White solution/fumes form Clear colourless solution forms alone	**2**

Question Number	Acceptable Answers	Reject	Mark
14 (b) (ii)	$CH_3OH + Na \rightarrow CH_3O^{(-)}Na^{(+)} + ½H_2$ Allow multiples, $NaOCH_3$ as product, ethanol as CH_3CH_2OH/C_2H_5OH with sodium ethoxide as product, Ignore state symbols and charges	Na^+ as reactant $CH_3O—Na$ CH_3NaO or $NaCH_3O$	**1**

Question Number	Acceptable Answers	Reject	Mark
14 (c) (i)	$Na_2Cr_2O_7$ / $K_2Cr_2O_7$ / Sodium / potassium dichromate((VI)) **(1)** Allow recognisable spelling of potassium and dichromate If name and formula given, both must be correct. H_2SO_4 / (Dilute / concentrated) sulfuric acid **(1)** Second mark dependent on recognisably correct oxidizing agent Allow acidified / H^+ and dichromate((VI)) / $Cr_2O_7^{2-}$ for 1 mark Allow potassium manganate((VII)) and **dilute** sulfuric acid for 1 mark	 Other oxidation numbers Potassium/sodium dichromate(VI) **ions** Other acids e.g. hydrochloric, nitric, phosphoric Other oxidation numbers	**2**

Question Number	Acceptable Answers	Reject	Mark
14 (c) (ii)	Round-bottomed/pear shaped flask with **heat** Still head **(1)** Delivery tube and exit above/in (cooled) collection vessel **(1)** A condenser may be included Sealed apparatus (max. 1)	Reflux apparatus or reflux followed by distillation scores 0 Conical flask Open still head	**2**

Question Number	Acceptable Answers	Reject	Mark
14 (c) (iii)	**Mark independently** (Permanent) dipole dipole/permanent dipole (forces) in ethanal **(1)** **Ethanal higher** because both compounds have (similar) London /van der Waals'/etc forces OR no (permanent) dipole dipole /permanent dipole (forces) in propane OR propane (only) has London /van der Waals' /etc forces **(1)**	Ethanal has hydrogen bonds loses **first mark only**	**2**

Question Number	Acceptable Answers	Reject	Mark
15 (a) (i)	Pestle (and mortar) / mortar and pestle Allow any recognisable spelling eg pessl, morta	Anything else, including hammer, mallet, heavy metal object, spatula, glass rod, crusher, grinder	**1**

Question Number	Acceptable Answers	Reject	Mark
15 (a) (ii)	Methyl /methly orange **(1)** Red to orange / peach (allow yellow) **(1)** Accept other acid–base indicators eg phenolphthalein **(1)** Accept recognisable spelling for all acid-base indicators Correct colour change, the correct way round, to end point or beyond **(1)**	Litmus, Universal Indicator score 0/2	**2**

Question Number	Acceptable Answers	Reject	Mark
15 (b) (i)	(11.20 and 11.40 give) 11.3(0) (cm^3)		**1**

Question Number	Acceptable Answers	Reject	Mark
15 (b) (ii)	$\frac{11.3 \times 0.300}{1000}$ = 3.39×10^{-3} / 0.00339 (mol) If mean titre value is 11.47 then 3.44×10^{-3}	Ignore SF unless only one, in which case penalise this only once.	**1**

Question Number	Acceptable Answers	Reject	Mark
15 (b) (iii)	3.39×10^{-3} (mol) Or answer to (ii)		**1**

Question Number	Acceptable Answers	Reject	Mark
15 (b) (iv)	3.39×10^{-2} (mol) answer (iii) x 10		**1**

Question Number	Acceptable Answers	Reject	Mark
15 (b) (v)	0.05 – 0.0339 = 0.0161 (mol) Or 0.05 – (answer to (iv)) If mean titre value is 11.47 then 0.0156		**1**

Question Number	Acceptable Answers	Reject	Mark
15 (b) (vi)	0.00805 (mol) Or answer to (v) divided by 2 If mean titre value is 11.47 then 0.0078		**1**

Question Number	Acceptable Answers	Reject	Mark
15 (b) (vii)	0.00805 x 100 = 0.805 (g) / 805 **mg** Or answer to (vi) x 100 If mean titre value is 11.47 then 0.780		**1**

Question Number	Acceptable Answers	Reject	Mark
15 (b) (viii)	Reason – there must be some other ant acid present / substance/chemical which reacts with acid	Experimental / calculation error	**1**

TOTAL FOR SECTION B = 39 MARKS

Section C

Question Number	Acceptable Answers	Reject	Mark
16 (a)	**1** Reaction 1: C goes from —4 to +2, **(1)** **2** H from +1 to 0 (redox reaction) **(1)** **3** Reaction 2: C goes from +2 to +4 **(1)** **4** H from +1 to 0 (redox reaction) **(1)** Allow from 2(+1) to 0 For each mark **both** correct oxidation states are needed Additional incorrect oxidation numbers of oxygen lose 1 mark per reaction Allow number followed by charge Penalise missing plus signs only once Penalise wrong use of the terms reduced and oxidized only once Penalise correct oxidation states and **not** a redox reaction only once **5** Reaction 3 **no** (elements) **change** (oxidation number)/**details for carbon / hydrogen calculated** **AND** so this is **not a redox reaction** **OR** Redox mentioned in reactions 1 and 2 but 'not redox' omitted in reaction 3 **(1)**	 H from +2 to 0 H from +2 to 0	**5**

Question Number	Acceptable Answers	Reject	Mark
***16 (b) (i)**	Any seven from: **1** A higher temperature would increase the yield /favour the forward reaction /produce more hydrogen… **(1)** **2** …(as) the reaction is endothermic **(1)** **3** Increased temperature would increase the rate/speed of reaction /make the reaction go faster… **(1)** **4 …**(as) a greater proportion of /more molecules have sufficient /higher/activation energy (to react) **(1)** **5** Decreased pressure increases the yield /favour the forward reaction /produce more hydrogen… **(1)** **6**…(as) the forward reaction is favoured with more (gaseous) molecules /mole **(1)** **7** Decreased pressure would decrease the rate of reaction… **(1)** **8** …(as) collision frequency decreases/less collisions **(1)** Points may muddle into one another **Reverse statements allowed** e.g. 'lower temperature decreases yield because reaction is endothermic'. **Contradictory statements** in each pair lose both marks e.g. 'lower temperature increases yield because reaction is endothermic'.	'More (successful) collisions' alone	**7**

Question Number	Acceptable Answers	Reject	Mark
16 (b) (ii)	An excess is used to drive the equilibrium to the right / to ensure all the methane reacts (as the reaction responds to remove steam by Le Chatelier's principle) **(1)** Methane is more expensive (so it is better to increase the amount of steam) / steam is cheaper /readily available /renewable OR Methane is not renewable **(1)**	…to get a better yield of hydrogen /to allow reaction to happen fully / so all the reactants react / to make the reaction go to completion Methane is a greenhouse gas / dangers associated with methane e.g. flammable	**2**

Question Number	Acceptable Answers	Reject	Mark
16 (c)	The catalyst provides an alternative route for the reaction **(1)** (with) a lower activation energy **(1)** Allow 'catalyst lowers activation energy' alone for one mark		**2**

Question Number	Acceptable Answers	Reject	Mark
16 (d) (i)	It regenerates /reforms potassium carbonate /reactant(s) (which reduces the cost of the process) OR potassium carbonate can be re-used Allow recycles potassium carbonate	Regenerates some of the other reactants. Chemicals are regenerated	**1**

Question Number	Acceptable Answers	Reject	Mark
***16 (d) (ii)**	**1** Carbon dioxide / CO_2 Allow both water and carbon dioxide **(1)** **2** Traps longer wavelength radiation / traps radiation / IR emitted (from the earth) OR Absorbs/traps heat /IR OR Prevents loss of IR / heat **(1)** **3,4 Any two from:** Rising sea levels / flooding Polar ice / ice caps /glacier(s) / glacial / habitat **ice melting** Changing (sea /air) currents Changing weather patterns /more extreme weather / climate change **(2)** Other acceptable alternatives only if well justified e.g. more malaria because more breeding areas for mosquitoes But more malaria /desertification /forest fires alone is insufficient Three or more correct answers get 2 marks Three or more answers, where some are wrong, are marked 1 mark for each correct answer and –1 mark for each incorrect answer e.g. Two correct and one wrong award 1 mark Three correct and two wrong award 1 mark etc One on list and one wrong award 1. Ignore neutral statements	Water alone Mark is lost if any mention of UV / ozone layer depletion Absorbs IR / heat from the sun Increased UV Increased skin cancer/melanoma	**4**

TOTAL FOR SECTION C = 21 MARKS

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Order Code US026197 January 2011

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