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Mark Scheme (Results)

June 2011

GCE Chemistry (6CH08) Paper 01
Chemistry Laboratory Skills (WA)

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.
- Mark schemes will indicate within the table where, and which strands of QWC, are being assessed. Questions labelled with an **asterix (*)** are ones where the quality of your written communication will be assessed.

Using the Mark Scheme

Examiners should look for qualities to reward rather than faults to penalise. This does NOT mean giving credit for incorrect or inadequate answers, but it does mean allowing candidates to be rewarded for answers showing correct application of principles and knowledge. Examiners should therefore read carefully and consider every response: even if it is not what is expected it may be worthy of credit.

The mark scheme gives examiners:
- an idea of the types of response expected
- how individual marks are to be awarded
- the total mark for each question
- examples of responses that should NOT receive credit.

/ means that the responses are alternatives and either answer should receive full credit.
( ) means that a phrase/word is not essential for the award of the mark, but helps the examiner to get the sense of the expected answer.
Phrases/words in **bold** indicate that the meaning of the phrase or the actual word is **essential** to the answer.
ecf/TE/cq (error carried forward) means that a wrong answer given in an earlier part of a question is used correctly in answer to a later part of the same question.

Candidates must make their meaning clear to the examiner to gain the mark. Make sure that the answer makes sense. Do not give credit for correct words/phrases which are put together in a meaningless manner. Answers must be in the correct context.

Quality of Written Communication
Questions which involve the writing of continuous prose will expect candidates to:
- write legibly, with accurate use of spelling, grammar and punctuation in order to make the meaning clear
- select and use a form and style of writing appropriate to purpose and to complex subject matter
- organise information clearly and coherently, using specialist vocabulary when appropriate.

Full marks will be awarded if the candidate has demonstrated the above abilities.
Questions where QWC is likely to be particularly important are indicated (QWC) in the mark scheme, but this does not preclude others.

Question Number	Acceptable Answers	Reject	Mark
1 (a)	**Two** of Cu^{2+},Cr^{2+}, Co^{2+}, Ni^{2+} **(2)** ALLOW $[Cr(H_2O)_6]^{2+}$; $[Cu(H_2O)_6]^{2+}$; $[Cu(H_2O)_4]^{2+}$, $[Cu(NH_3)_4]^{2+}$, $[Cu(H_2O)_2(NH_3)_4]^{2+}$ $[Ni(NH_3)_6]^{2+}$, $[Ni(NH_3)_4]^{2+}$, $[Co(H_2O)_6]^{2+}$ any other blue **complex** ion e.g. VO^{2+}. If **two** correct names are given award **(1)** Two different ammines (different number of ammonia ligands) of the same metal ion **(1)** only Ignore any names	Any blue **compound** containing these ions.	**2**

Question Number	Acceptable Answers	Reject	Mark
1 (b)(i)	Steam / water vapour / colourless liquid on (cool parts of) test tube	Any test for water vapour, e.g. $CoCl_2$	**1**

Question Number	Acceptable Answers	Reject	Mark
1 (b)(ii)	Ammonia / **contains** ammonium (ion)/ammonium salt/ammonia ligand/ethylenediamine (ligand) ALLOW correct formulae		**1**

Question Number	Acceptable Answers	Reject	Mark
1 (b)(iii)	Water evolved could come from hydration / water of crystallization **(1)** or from ligand water **(1)** which could be shown in a formula	The crystals are damp	**2**

Question Number	Acceptable Answers	Reject	Mark
1 (c)(i)	(Any) blue **(1)** $CuCl_4^{\ 2-}$ / $CuCl_3^{\ -}$ **(1)**	$CuCl_2$; names	**2**

Question Number	Acceptable Answers	Reject	Mark
1 (c)(ii)	$BaSO_4$	Barium sulphate, $SO_4^{\ 2-}$	**1**

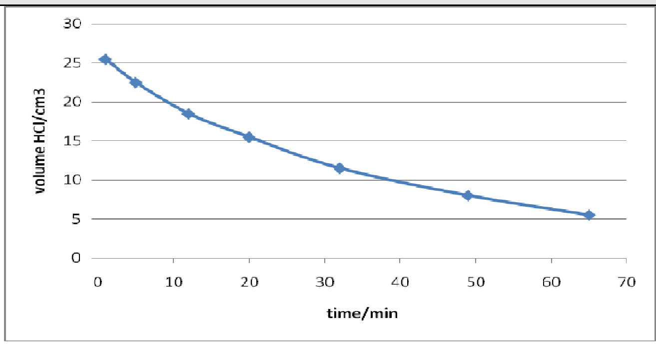
Question Number	Acceptable Answers	Reject	Mark
1 (c)(iii)	CuI / Cu_2I_2 **(1)** I_2 / I_3^- **(1)** If names correctly given allow **(1)**	Copper(I) iodide, CuI_2 Iodine	**2**

Question Number	Acceptable Answers	Reject	Mark
1 (d)	$[Cu(NH_3)_x(H_2O)_{6-x}]^{2+}$, x = 1 – 4 ALLOW the following: x = 5 or 6 $[Cu(NH_3)_4]^{2+}$ $[Cu(H_2O)_2(NH_3)_4]^{2+}[SO_4^{2-}]$ but **both** charges must be present	 $[Cu(H_2O)_2(NH_3)_4]SO_4$	**1**

Question Number	Acceptable Answers	Reject	Mark
2 (a)(i)	Yellow to orange **(1)** must have colour change	Red as final colour	**1**

Question Number	Acceptable Answers	Reject	Mark
2 (a)(ii)	(Propanone) slows (but does not stop) reaction **(1)**; there must be an implication of the rate falling (so if flask is left,) titre would be too low **(1)** as stand-alone mark	Reaction stops; reaction keeps on going	**2**

Question Number	Acceptable Answers	Reject	Mark
2 (b)	**Halogenoalkane/organic compound:** immiscible with / insoluble in water OR form two layers with water OR more soluble in ethanol than in water	Ethanol a better solvent	**1**

Question Number	Acceptable Answers	Mark
2 (c)(i)	 Sensible scale and points correct **(1)** Smooth / best fit line **(1)**	**2**

Question Number	Acceptable Answers	Reject	Mark
2 (c)(ii)	27 (min) **(1)** 29 (min) **(1)** Consequential on the graph. Sum of half-lives for second value award first mark only		**2**

Question Number	Acceptable Answers	Reject	Mark
2 (c)(iii)	(reaction is first order because) half-life is constant/half-lives are the same/half-lives are similar. **Stand-alone** independent of (c)(ii)		**1**

Question Number	Acceptable Answers	Reject	Mark
2 (c)(iv)	min $^{-1}$ ALLOW s $^{-1}$		**1**

Question Number	Acceptable Answers	Reject	Mark
2 (c)(v)	Increase concentration of halogenoalkane (keeping all other conditions the same) **(1)** show that the rate increases **proportionally (1)** OR increase concentration of hydroxide ions (keeping all other conditions the same) **(1)** show that the rate is the same **(1)**		**2**

Question Number	Acceptable Answers	Reject	Mark
2 (d)(i)	**pH 7** because no acid is present **ALLOW:** water **only** is present pH value must be present for credit	Neutral	**1**

Question Number	Acceptable Answers	Reject	Mark
2 (d)(ii)	Hydrolysis is rapid in the absence of (added) hydroxide ions/in very low concentration of hydroxide ions/in water alone **(1)** **thus** $[OH^-]$ does not affect the rate **(1) conditional** on the first mark		**2**

Question Number	Acceptable Answers	Reject	Mark
2 (d)(iii)	$(CH_3)_3C\text{-}Cl \rightarrow (CH_3)_3C^+ + Cl^-$ correct carbocation **(1)** remainder of the equation correctly balanced **(1)** If the whole of the mechanism is given mark the first step only and ignore all else.		**2**

Question Number	Acceptable Answers	Reject	Mark
3 (a)(i)	Prevents splashing (of acid) / prevents mixture getting hot/prevents loss of volatile compounds OR Reaction exothermic / vigorous		**1**

Question Number	Acceptable Answers	Reject	Mark
3 (a)(ii)	Under reflux: Prevents **loss of** reactants / products / reaction mixture / volatile substances / flask contents **(1)** For about 30 minutes: Reaction is slow / has high E_a / to allow **equilibrium** to be reached / to allow maximum yield **(1)**	Goes to completion	**2**

Question Number	Acceptable Answers	Reject	Mark
3 (a)(iii)	Catalyst / lowers activation energy ALLOW references to removing water	Solvent	**1**

Question Number	Acceptable Answers	Reject	Mark
3 (a)(iv)	Any **two** from: water propan(-1-)ol / alcohol ethanoic acid sulphuric acid **(2)**	Ethanol or other incorrect alcohol	**2**

Question Number	Acceptable Answers	Reject	Mark
3 (a)(v)	Density		**1**

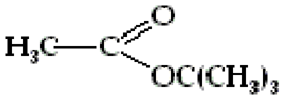
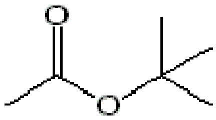
Question Number	Acceptable Answers	Reject	Mark
3 (a)(vi)	**Acid/**sulphuric acid/ethanoic acid reacts with sodium carbonate **(1)** giving carbon dioxide gas **(1)**		**2**

Question Number	Acceptable Answers	Reject	Mark
3 (a)(vii)	Removes water/drying agent **(1)** becomes clear **(1)**	dehydrating agent becomes colourless	**2**

Question Number	Acceptable Answers	Reject	Mark
3 (a)(viii)	Ensures smooth boiling / even boiling / even heating (of liquid)	Prevents bumping alone; safe boiling	**1**

Question Number	Acceptable Answers	Reject	Mark
3 (b)(i)	Mass of ethanoic acid = 50 x 1.05 = 52.5(g) Moles of ethanoic acid = 52.5 / 60.1 = 0.874 **(1)** Mass of propan-1-ol = 50 x 0.804 = 40.2(g) Moles of propan-1-ol = 40.2 / 60.1 = 0.669 **(1)** Ignore sig fig except 1, penalize once. ALLOW (1) if one correct mass calculated. If a statement is made that propan-1-ol is in excess give **(1)** if there are words to show that the moles of each substance have been calculated correctly. If there are numbers but no words then **(0)**		**2**

Question Number	Acceptable Answers	Reject	Mark
3 (b) (ii)	Max. mass of ester is 0.669 x 102 = 68.2(g) **(1)** % yield 100 x 35 / 68.2 = 51.3(%) **(1)** ALLOW 51.2 or 51.0 or 51 depending on their rounding if the working is correct ALLOW max. 1 if the moles of ethanoic acid are used giving: 0.874 x 102 = 89.1(g), 100 x 35 / 89.1 = 39.3(%)		**2**

Question Number	Acceptable Answers	Reject	Mark
3 (c) (i)	 **(1)** Accept CH_3- etc **OR**  **OR** $CH_3COOC(CH_3)_3$ **OR** $CH_3CO_2C(CH_3)_3$		**1**

Question Number	Acceptable Answers	Reject	Mark
3 (c) (ii)	EITHER: Add alcohol to **acidified** potassium dichromate((VI)) solution (and heat) **(1)** propan-1-ol gives colour change orange to green **(1)** (both colours needed) 2-methylpropan-2-ol shows no colour change/ stays orange **(1)** primary alcohols can be oxidized OR tertiary alcohols cannot **(1)** Second mark could be awarded for the use of Tollens'/Benedict's on the reaction **product** with the correct result. OR: Add alcohol to **acidified** potassium manganate((VII)) solution (and heat) **(1)** propan-1-ol gives colour change purple to colourless **(1)** (both colours needed) 2-methylpropan-2-ol shows no colour change/ stays purple **(1)** primary alcohols can be oxidized whereas tertiary alcohols cannot **(1)** OR: Add alcohol to conc HCl solution **(1)** and zinc chloride **(1)** propan-1-ol shows no change / turns milky very slowly **(1)** 2-methylpropan-2-ol turns milky quickly **(1)** Allow the 'milky' mark in the answer for either alcohol. Can be milky/turbid/forms two phases.	Iodoform reaction gives no reaction gives no reaction Precipitate for milky	**4**

TOTAL FOR PAPER = 50 MARKS

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