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Mark Scheme (Results)

January 2013

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.

General Guidance on Marking

All candidates must receive the same treatment.

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.

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.

Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the Team Leader must be consulted.

Using the mark scheme

The mark scheme gives:
- 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.

1 / means that the responses are alternatives and either answer should receive full credit.
2 ( ) 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.
3 [ ] words inside square brackets are instructions or guidance for examiners.
4 Phrases/words in **bold** indicate that the meaning of the phrase or the actual word is **essential** to the answer.
5 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.

Quality of Written Communication

Questions which involve the writing of continuous prose will expect candidates to:

- show clarity of expression
- construct and present coherent arguments
- demonstrate an effective use of grammar, punctuation and spelling.

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)	A transition metal (compound/ion) / d block compound/ion (allow element) / Fe^{2+} (compound)/iron(II) salt Ignore: Cr^{3+} Cu^{2+} Ni^{2+} V^{3+}		**1**

Question Number	Acceptable answers	Reject	Mark
1(b)	Hydrolysis / water has removed a proton (from the aqua ion) / Deprotonation / acid base	Ligand exchange Neutralisation Forms a complex ion Hydration	**1**

Question Number	Acceptable answers	Reject	Mark
1(c)	Base / alkali /proton acceptor **(1)** $Fe(OH)_2$ / $Fe(H_2O)_4(OH)_2$ **(1)** ALLOW $Ni(OH)_2$ / $Ni(H_2O)_4(OH)_2$ / $Cr(OH)_3$ / $Cr(H_2O)_3(OH)_3$	Names Cu^{2+}, V^{3+} hydroxides	**2**

Question Number	Acceptable answers	Reject	Mark
1(d)	oxidation **(1)** Allow redox $Fe(OH)_3$ / $Fe(H_2O)_3(OH)_3$ **(1)** Allow $Fe_2O_3.x\ H_2O$	 Fe_2O_3	**2**

Question Number	Acceptable answers	Reject	Mark
1(e)	($Fe(OH)_2$) not amphoteric / no further deprotonation occurs / no ligand substitution occurs Allow (Confirms) compound contains Fe^{2+}		**1**

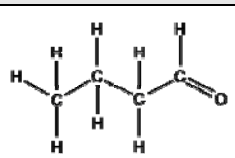
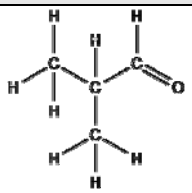
Question Number	Acceptable answers	Reject	Mark
1(f)	Barium sulfate/$BaSO_4$		**1**

Question Number	Acceptable answers	Reject	Mark
1(g)	A is $FeSO_4$ ($.7H_2O$) / iron(II) sulfate Ignore numbers of water.	Iron sulfate	**1**

Total for Q1 = 9 marks

Question Number	Acceptable answers	Reject	Mark
2 (a)(i)	(X) is an aldehyde or ketone / carbonyl compound allow contains a carbonyl group / C=O bond	Just an aldehyde or just a ketone	**1**

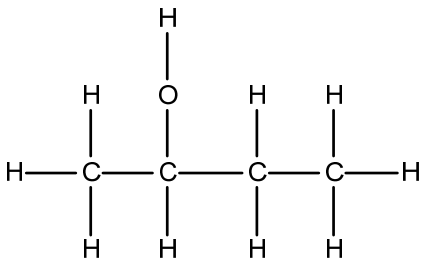
Question Number	Acceptable answers	Reject	Mark
2 (a)(ii)	X is an aldehyde / butanal / (2-)methylpropanal Allow X is not a ketone	Any other named aldehyde	**1**

Question Number	Acceptable answers	Reject	Mark
2(b)	 (1)  (1) Accept skeletal formulae Allow CH_3 and C_2H_5 not displayed	Displayed formulae with missing hydrogen atoms C_3H_7 not displayed	**2**

Question Number	Acceptable answers	Reject	Mark
2 (c)(i)	(Y likely to be an) alcohol or (carboxylic) acid / contains an OH group /contains hydroxyl group	Just an alcohol or just a carboxylic acid Contains hydrox**ide** group	**1**

Question Number	Acceptable answers	Reject	Mark
2(c)(ii)	(Y is) an alcohol / not a carboxylic acid	Contains OH group	**1**

Question Number	Acceptable answers	Reject	Mark
2 (c)(iii)	(Y has) a chiral centre / has a chiral carbon atom / is chiral / non-superimposable mirror images / has optical isomers / is an optical isomer / is an enantiomer Allow asymmetric carbon atom / a carbon atom with four different groups attached	Just optically active Just secondary alcohol	**1**

Question Number	Acceptable answers	Reject	Mark
2 (c)(iv)	 Allow CH_3 and C_2H_5 and OH not displayed Allow structural formula or skeletal formula $CH_3CH(OH)CH_2CH_3$ / $CH_3CH(OH)C_2H_5$		**1**

Question Number	Acceptable answers	Reject	Mark
2 (c)(v)	(Pale) yellow precipitate / solid Both colour and state required. Ignore references to smell.	White precipitate Just triiodomethane will form	**1**

Total for Q2 = 9 marks

Question Number	Acceptable answers	Reject	Mark
3 (a)(i)	Moles of 2-aminobenzoic acid = 4 ÷ 137 / 0.029197 / 0.0292 **(1)** Mass of ethanoic anhydride needed =0.029197 x102 = 2.9781 g **(1)** allow TE from first step Volume of ethanoic anhydride = 2.9781 / 1.082 = 2.7524 cm^3 **(1)** Allow TE from 2nd step Allow any answer that rounds to 2.7 or 2.8 to 2 sf Correct answer alone scores 3 marks **NOTE** The use of 1sf in the moles of 2-aminobenzoic acid loses the first mark even though it gives an answer which rounds to 2.8	**0.03**	**3**

Question Number	Acceptable answers	Reject	Mark
3 (a)(ii)	M_r 2-aminoethanoylbenzoic acid = 179 **(1)** Theoretical yield = 0.029197 mol / = 0.029197 x 179 = 5.2263 g **(1)** % yield = 2.97 ÷ 5.23 x 100/ 0.016592 ÷ 0.029197x100 = 56.828 % = 57 (%) **(1)** correct answer to **2sf** (with no working) scores 3 marks ALLOW TE from 3ai of moles of 2-aminobenzoic acid		**3**

Question Number	Acceptable answers	Reject	Mark
3 (b)(i)	To (try to) make sure all the 2-aminobenzoic acid reacts Comment: allow discussion of small volume measurement	To ensure ethanoic anhydride is in excess To completely dissolve the reactant Ethanoic anhydride is volatile	**1**

Question Number	Acceptable answers	Reject	Mark
3 (b)(ii)	**large** bubbles / liquid rising up condenser / shooting out of the top /uneven boiling / liquids will splash out of flask / liquid will boil up suddenly	Just breaks flask Just "bubbles" Strong bubbling Liquid spills over Liquid sprinkles over Uneven heating Air pockets No smooth boiling Boil vigorously	**1**

Question Number	Acceptable answers	Reject	Mark
3 (b)(iii)	Wear gloves **(1)** (Measure out in) fume cupboard / hood **(1)** Ignore: Wear a mask Allow for second mark In a well ventilated laboratory		**2**

Question Number	Acceptable answers	Reject	Mark
3 (b)(iv)	Dissolve solid in **minimum** (volume) **(1)** Allow: Small volume Ignore: To make a saturated solution of **hot** / **boiling** ethanoic acid / solvent **(1)** (filter hot solution) leave to cool (and recrystallize) **(1)** Filter (wash with ice cold solvent) **and** dry **(1)**	Melt instead of dissolve water Filter and dry with no solid formed in previous steps	**4**

Question Number	Acceptable answers	Reject	Mark
3 (b)(v)	Small amount of product remains in solution (when cool) / after recrystallization) / solid remaining on filter paper / solid remaining in funnel / solution absorbed on filter paper /solid lost during washing with cold solvent.	Just transfer errors Side reactions or incomplete reaction	**1**

Question Number	Acceptable answers	Reject	Mark
3 (b)(vi)	Thermometer with capillary near to bulb **(1)** Allow: Thermometer dipping into solid sample **(max 1)** In a container of **oil** Or In a sand bath Or (Electrically) heated block Or (horizontal) test tube inside boiling tube / double skinned test tube **(1)**	Thermometer above solid sample In water bath	**2**

Question Number	Acceptable answers	Reject	Mark
3(b)(vii)	Compare experimental value to literature / data book value **(1)** Sharp melting temperature / narrow melting temperature range **(1)**		**2**

Total for Q3 = 19 marks

Question Number	Acceptable answers	Reject	Mark
4 (a)	To find the approximate end point / Rough guide to end point / Estimate of end point / as a 'range finder'	To check the method works First titration is inaccurate	**1**

Question Number	Acceptable answers	Reject	Mark
4 (b)(i)	<table><tr><td>Titration number</td><td>1(Trial)</td><td>2</td><td>3</td><td>4</td></tr><tr><td>Burette reading (final)/ cm^3</td><td>21.45</td><td>41.35</td><td>21.95</td><td>**41.75**</td></tr><tr><td>Burette reading (start)/ cm^3</td><td>1.20</td><td>21.45</td><td>**1.95**</td><td>21.95</td></tr><tr><td>Volume of Fe^{2+} (aq) used / cm^3</td><td>**20.25**</td><td>**19.90**</td><td>20.00</td><td>19.80</td></tr><tr><td>Titre used to calculate mean (✓)</td><td></td><td>✓</td><td>✓</td><td>✓</td></tr></table> All data correct **(2)** 2 or 3 pieces of data correct **(1)** 0 or 1 piece of data correct **(0)** Ticks, consistent with concordant values **(1)** Mean = 19.9(0) (cm^3) **(1)** Allow transferred error from incorrect ticks Allow correct mean titre even if the ticks are incorrect	19.9 First column ticked	**4**

Question Number	Acceptable answers	Reject	Mark
4 (b)(ii)	Moles of Fe^{2+} = (19.90 ÷ 1000) x 0.05 **(1)** = 9.95×10^{-4} (mol) Moles of $Cr_2O_7^{2-}$ = (9.95×10^{-4}) ÷ 6 **(1)** = 1.6583×10^{-4} (mol in 20 cm^3) Allow TE from moles of Fe^{2+} $[Cr_2O_7^{2-}]$ = $1.6583 \times 10^{-4} \times 1000 / 20$ =8.2917×10^{-3} (mol dm^{-3}) **(1)** Allow TE from moles of $Cr_2O_7^{2-}$ Allow any answer that rounds to 8.3×10^{-3} to 2 sf Ignore sf except 1		**3**

Question Number	Acceptable answers	Reject	Mark
4 (c)	(0.05 x 2) ÷ 20.00 x 100 = 0.5(%)		**1**

Question Number	Acceptable answers	Reject	Mark
4 (d)	(indicator makes) the end point more obvious/easier to see OR (indicator makes) the end point sharper	To find the exact end point	**1**

Question Number	Acceptable answers	Reject	Mark
4 (e)	Titre would appear to be greater **(1)** Because (extra solution needed to fill) the air gap **(1)** (More Fe^{2+} ≡ more $Cr_2O_7^{2-}$), so calculated concentration would be greater (than actual value) **(1)** ALLOW (for third mark only): Increased titre would not be concordant so would not be used to calculate mean. Titre would make no difference to the calculated concentration. **(1)** ALLOW (for third mark only): TE from smaller titre to smaller concentration		**3**

Total for Q4 = 13 marks

PAPER TOTAL= 50 MARKS

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