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Mark Scheme (Results)

Summer 2012

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	Correct Answer	Reject	Mark
1(a)	Green ACCEPT any green eg blue-green		**1**

Question Number	Correct Answer	Reject	Mark
1 (b)(i)	Chromium((III)) hydroxide/ $Cr(OH)_3$ /([])$Cr(OH)_3(H_2O)_3$([])/([])$Cr(H_2O)_3(OH)_3$ ([]) If oxidation number is given must be correct	Correct name with incorrect formula and vice versa	**1**

Question Number	Correct Answer	Reject	Mark
1 (b)(ii)	The precipitate dissolves ALLOW the precipitate redissolves/ disappears OR A solution (forms) IGNORE colours of solutions		**1**

Question Number	Correct Answer	Reject	Mark
1(b)(iii)	(green) precipitate forms Allow same precipitate forms **(1)** IGNORE other colours Chromium((III)) hydroxide/$Cr(OH)_3$/ ([])$Cr(OH)_3(H_2O)_3$([]),/([])$Cr(H_2O)_3(OH)_3$] **(1)**		**2**

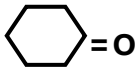
Question Number	Correct Answer	Reject	Mark
1(b)(iv)	([])$Cr(NH_3)_6^{3+}$([]) Allow other numbers of NH_3 with H_2O provided correct charge and 6 ligands	Mixture of NH_3 and OH^- in ligands	**1**

Question Number	Correct Answer	Reject	Mark
1(b)(v)	CrO_4^{2-}	Chromate ((VI))	**1**

Question Number	Correct Answer	Reject	Mark
1(c)	Nickel hydroxide/precipitate doesn't dissolve in excess (sodium hydroxide) ALLOW "Ppt with nickel chloride is insoluble in excess NaOH" "Nickel chloride will not form a solution in excess NaOH" "The precipitate does not redissolve"	Nickel/nickel ion doesn't dissolve in excess "Nickel chloride is insoluble in excess NaOH"	**1**

Question Number	Correct Answer	Reject	Mark
2(a)	**First mark:** Goes (from brown/red-brown/ orange/orange-brown/yellow to) colourless OR (the bromine) is decolorised **(1)** **Second mark:** (White) precipitate forms OR misty/steamy fumes form **(1)** IGNORE Medicinal/antiseptic smell Names of products even if incorrect	Clear for colourless Effervescence White smoke Layers formed	**2**

Question Number	Correct Answer	Reject	Mark
2(b)(i)	(orange to) green/blue/brown IGNORE Initial colour even if incorrect		**1**

Question Number	Correct Answer	Reject	Mark
2(b)(ii)	 Accept displayed / structural formula	$C_6H_{10}O$	**1**

Question Number	Correct Answer	Reject	Mark
2(b)(iii)	(2,4-dinitrophenylhydrazine:) yellow/ orange/red precipitate or yellow/orange/red solid **(1)** both colour and state needed ALLOW Combinations of above colours "Crystals" for solid (Tollens':) no change/no reaction Allow "nothing" (1) If aldehyde in b(ii) –allow TE for 2,4-dnp mark as above and silver mirror with Tollens If carboxylic acid in b(ii) – allow TE for no reaction in either case	Brown	**2**

Question Number	Correct Answer	Reject	Mark
2(c)(i)	React with ammonia (fumes) **(1)** White smoke /white solid **(1)** OR React with silver nitrate (solution) **(1)** (White/cream /yellow) precipitate forms **(1)** IGNORE use of acid-base indicators (litmus, universal indicator)	React with a solution of ammonia White fumes/ white gas Just "silver chloride test"	**2**

Question Number	Correct Answer	Reject	Mark
2(c)(ii)	(X) C=O ester **(1)** (Y) C–O ethanoate **(1)** Two correct bonds with incorrect/no groups **(1)** Two correct groups with incorrect/no bonds **(1)**	 C-O benzoate	**2**

Question Number	Correct Answer	Reject	Mark
2(c)(iii)	CH_3-C=O | O-C_6H_5 ALLOW skeletal, displayed, $CH_3COOC_6H_5$ and $C_6H_5OCOCH_3$ ALLOW C_6H_5 as benzene ring	$C_6H_5COOCH_3$ $C_6H_5OOCCH_3$ Hexagon with no circle for benzene ring	**1**

Question Number	Correct Answer	Reject	Mark
3(a)	(white/yellow) precipitate (of sulfur) /goes cloudy/solid forms ALLOW choking/pungent smell (of sulfur dioxide) IGNORE effervescence/bubbles/gas forms/Gas turns blue litmus red /Heat evolved	Yellow solution Colours other than white or yellow e.g. black solid Smell of bad eggs/ bad smell	**1**

Question Number	Correct Answer	Reject	Mark
3(b)(i)	Blue ACCEPT any blue eg blue-green		**1**

Question Number	Correct Answer	Reject	Mark
3(b)(ii)	Effervescence /fizzing /bubbling IGNORE identity of gas	Just "Gas given off" Effervescence with brown fumes	**1**

Question Number	Correct Answer	Reject	Mark
3(c)(i)	Copper**(I)** iodide Oxidation number is essential	Just "Copper iodide" Oxidation number **after** iodide	**1**

Question Number	Correct Answer	Reject	Mark
3(c)(ii)	(In CuI) the copper (ion) has a full d (sub) shell/does not have an incomplete d (sub) shell/has configuration (3)d^{10} ALLOW Cu^+ has full d orbital(s)	Configuration of element Just "d-d transitions cannot occur" Just "all the shells are full"	**1**

Question Number	Correct Answer	Reject	Mark
3(d)(i)	((24.40 x 0.125) / 1000) = 3.05 x 10^{-3} / 0.00305 (mol) ALLOW 3.1 x 10^{-3} (mol)	 3.00 x 10^{-3} 3.10 x 10^{-3}	**1**

Question Number	Correct Answer	Reject	Mark
3(d)(ii)	Mol I_2 = half answer to (i) **(1)** =1.525 x 10^{-3} Mol Cu^{2+} = 2 x mol I_2 **(1)** =3.05 x 10^{-3} IGNORE sf unless 1 sf Correct final answer without working **(2)**		**2**

Question Number	Correct Answer	Reject	Mark
3(d)(iii)	mass Cu in 25 cm^3 = (63.5 x 3.05 x 10^{-3} = 1.93675 x 10^{-1}) = 1.94 x 10^{-1} / 0.194 (g) **(1)** Mass in original = (1.93675) = 1.94 (g) **(1)** TE for 10x mass in 25 cm^3 Ignore sf except 1 sf ALLOW use of Cu = 64 which gives 1.95 (g) Correct final answer without working **(2)**		**2**

Question Number	Correct Answer	Reject	Mark
3(d)(iv)	% Cu = (1.93675 x 100 / 2.10 = 92.2261) = 92.2 % OR (1.94 x 100) / 2.10 = 92.38095) =92.4% ALLOW TE from use of Cu = 64 which gives 92.9% ALLOW TE from mass of Cu provided less than 100% IGNORE sf except 1 sf		**1**

Question Number	Correct Answer	Reject	Mark
3(e)(i)	(0.01 / 2.10 x 100 = ± 0.4761904) = (±) 0.48 (%) / (±)0.5 (%) IGNORE sf		**1**

Question Number	Correct Answer	Reject	Mark
3(e)(ii)	(0.10 / 24.40 x 100 = 0.4098) = (±) 0.41 (%) / (± 0).4 (%) IGNORE sf If errors in (i) and (ii) are both doubled allow 1 mark in e(ii)	0.40/ 0.409	**1**

Question Number	Correct Answer	Reject	Mark
3(f)	Brown /straw-coloured/yellow to colourless solution/white solid Both colours in change needed	Blue to colourless Red-brown to colourless Clear for colourless	**1**

Question Number	Correct Answer	Reject	Mark
4(a)(i)	Corrosive so wear gloves ALLOW burns skin/damages skin ALLOW exothermic reaction so keep cool/add acids drop by drop	Toxic Irritant/irritates skin	**1**

Question Number	Correct Answer	Reject	Mark
4(a)(ii)	(In)flammable so use water bath/ electric hotplate/keep away from naked flames	Keep away from heat Use fume cupboard	**1**

Question Number	Correct Answer	Reject	Mark
4(b)	(Reacts with nitric acid) to make NO_2^+ /to make nitronium ion/to make an electrophile	To make a nitrating agent/ NO_2/ nitrate/ nitro group/nitrite ion Just "as a catalyst/to speed up reaction" Just "Drying agent" Oxidizing agent Reducing agent Just a correct equation	**1**

Question Number	Correct Answer	Reject	Mark
4(c)(i)	(5.0/ 136 = 0.0367647) =0.0368/ 0.037 (mol) IGNORE sf except 1 sf		**1**

Question Number	Correct Answer	Reject	Mark
4(c)(ii)	(5.0 / 1.09 = 4.587156) = 4.59/ 4.6 (cm^3) IGNORE sf except 1 sf		**1**

Question Number	Correct Answer	Reject	Mark
4(c)(iii)	M_r for product = 181 (1) Max yield = (181 x 0.0367647 = 6.6544118) = 6.65/ 6.7g **(1)** % yield = (3.4/6.6544118 x 100 = 51.09392) = 51.1/ 51 **(1)** OR M_r for product = 181 (1) Moles product = (3.40/181 = 0.0187845) = 0.0188/ 0.019 **(1)** % yield = (0.01878/ 0.036747 x 100 = 51.111854) = 51.1/ 51 **(1)** IGNORE sf except 1 sf ALLOW final answers rounding to 51 which will depend how number of moles is rounded. Working need not be shown, but if incorrect molar mass used max **(2)** TE from (c)(i) and in intermediate stages		**3**

Question Number	Correct Answer	Reject	Mark
4(d)(i)	**First mark:** Use a spot/small drop (of the ethanol washings) **(1)** Then any 3 points from the following: put spot near the bottom of the plate/on a marked line/on a datum line **(1)** Put plate in a sealed container **(1)** with the (suitable) solvent below the spot **(1)** Leave until the solvent has moved to near the top of the plate/till solvent has risen up/until separated **(1)** ALLOW any of these points shown on a diagram. ALLOW use of paper instead of plate IGNORE references to spraying with a reagent to make spots visible	Put the solvent on the plate Put the sample under the solvent level Use of electric current	**4**

Question Number	Correct Answer	Reject	Mark
4(d)(ii)	Add pure samples (of methyl 2-nitrobenzoate and methyl 3-nitobenzoate) to chromatogram and get two spots at different levels corresponding to pure samples This may be shown on a diagram GIVE THE MARK FOR THIS QUESTION IF THIS PROCEDURE IS DESCRIBED IN 4(d)(i) OR measure R_f values on chromatogram of washings and compare with R_f of pure samples	Use of electrophoresis Spectroscopy	**1**

Question Number	Correct Answer	Reject	Mark
4(e)(i)	Higher proportion of product would remain in solution/ more product would stay dissolved/ less product would crystallize out/ product is more soluble in solvent 1 **at room temp**	Solvent is more soluble Just "It dissolves more in solvent 1"	**1**

Question Number	Correct Answer	Reject	Mark
4(e)(ii)	$\frac{(9.5 - 2)}{2}$ =3.75 (g) IGNORE sf except 1 sf		1

Question Number	Correct Answer	Reject	Mark
4(f)	Measure the melting temperature ALLOW measure the boiling temperature / measure the melting and boiling temperature (1) Should be sharp ALLOW Should match data book value (1)	Recrystallization Just "compare with data book"	2

TOTAL FOR PAPER = 50 MARKS

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