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Mark Scheme (Results)

Summer 2013

GCE Chemistry 6CH08/01
Chemistry Laboratory Skills II
Alternative

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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)(i)	Green IGNORE qualifications of green such as light / dark / emerald **(1)** Carbon dioxide ALLOW CO_2 **(1)** CO_3^{2-} ALLOW HCO_3^- **(1)**	Blue-Green Turquoise	**3**

Question Number	Acceptable Answers	Reject	Mark
1(a)(ii)	$[NiCl_4]^{2-}$ ALLOW -2 for 2- $NiCl_4^{2-}$ $[Ni(Cl)_4]^{2-}$ $Ni(Cl)_4^{2-}$ $[Ni(H_2O)_2Cl_4]^{2-}$ $[NiCl_6]^{4-}$		**1**

Question Number	Acceptable Answers	Reject	Mark
1(a)(iii)	$Ni(OH)_2$ / $Ni(H_2O)_4(OH)_2$ / $Ni(OH)_2$ $(H_2O)_4$ / $[Ni(H_2O)_4(OH)_2]$ / $[Ni(OH)_2$ $(H_2O)_4]$		**1**

Question Number	Acceptable Answers	Reject	Mark
1(a)(iv)	Blue solution (forms) ALLOW lavender blue solution and any other shade of blue OR (Green) precipitate dissolves	 Blue-green Precipitate dissolves to give incorrect coloured solution	**1**

Question Number	Acceptable Answers	Reject	Mark
1(b)(i)	$24.2 / 1000 \times 0.01 = 2.42 \times 10^{-4}$ (mol) **(1)** Concentration of $[Ni(H_2O)_6]^{2+}$ ions $= 2.42 \times 10^{-4} \times 100 = 0.0242$ (mol dm^{-3}) **(1)** ALLOW TE on number of moles Correct answer alone scores both marks IGNORE significant figures except 1		**2**

Question Number	Acceptable Answers	Reject	Mark
1(b)(ii)	0.1 / 24.2 x 100 = (±) 0.413% / (±) 0.41 % / (±) 0.4%	4 or more SF	**1**

Question Number	Acceptable Answers	Reject	Mark
1(b)(iii)	(Mean) titre would be greater **(1)** $EDTA^{(4-)}$ would also complex to / react with Cu^{2+} / $[Cu(H_2O)_6]^{2+}$ / $CuSO_4$ / copper ions / copper sulphate **(1)** Both marks are stand alone.	More needed to react with unspecified impurity	**2**

Total for Question 1 = 11 Marks

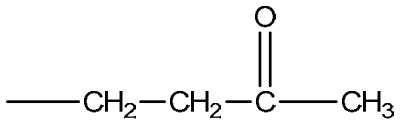
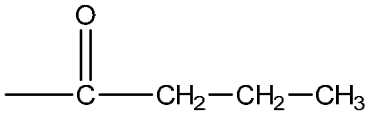
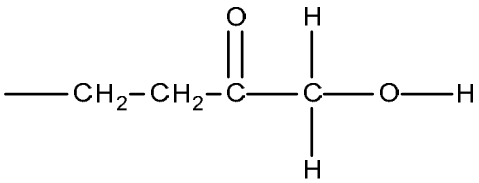
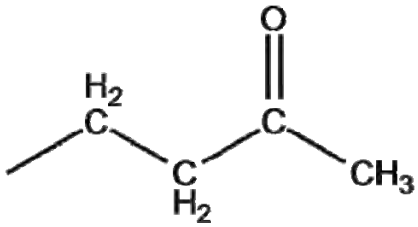
Question Number	Acceptable Answers	Reject	Mark
2(a)	Smoky / sooty flame IGNORE reference to yellow flame	White smoke	**1**

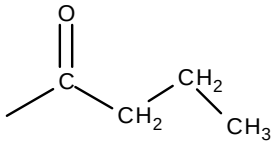
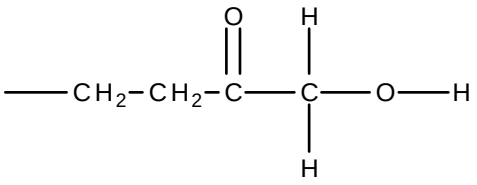
Question Number	Acceptable Answers	Reject	Mark
2(b)(i)	It contains a phenol group / has OH attached to benzene ring ALLOW hydrox**yl** group attached to benzene ring ALLOW "is a phenol" ALLOW drawn benzene ring with OH	Just OH group Hydrox**ide** group	**1**

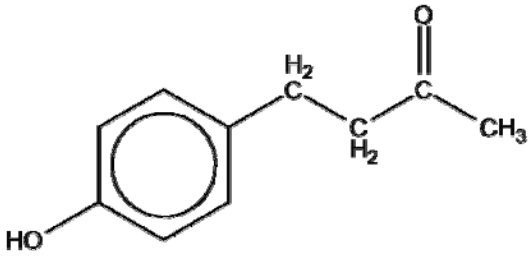
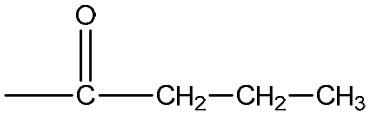
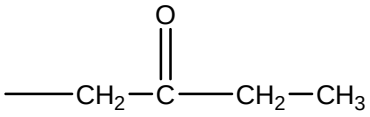
Question Number	Acceptable Answers	Reject	Mark
2(b)(ii)	It could be an aldehyde or a ketone / contains a carbonyl group ALLOW C=O	Either aldehyde or ketone on its own	**1**

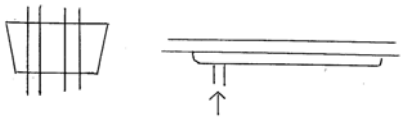
Question Number	Acceptable Answers	Reject	Mark
2(b)(iii)	**X** is a ketone ALLOW aromatic ketone ALLOW R-CO-R ALLOW not an aldehyde if both ketone and aldehyde mentioned in b(ii)		**1**

Question Number	Acceptable Answers	Reject	Mark
2(c)(i)	(hydrogen atoms / protons on) benzene ring / phenyl group / arene ring	Hydrogen atoms in phenol	**1**

Question Number	Acceptable Answers	Reject	Mark
2(c)(ii)	To score any marks in this question the side chain must be: (a)  OR (b)  OR (c)  Ketone on correct carbon Structure (a) Or structure (c) **(1)** ALLOW displayed or skeletal ALLOW $-CH_2CH_2COCH_3$ IGNORE presence or position of –OH on the benzene ring  triplet triplet singlet both triplets labelled **(1)** singlet labelled **(1)** ALLOW If the side chain is (b) the triplet CH_2 next to the C=O correctly labelled scores one mark	Any other side chain scores zero for 2c(ii)	**3**

	 triplet **(1)** If the side chain is (c) the triplets, both labelled, score the mark.  triplet triplet **(1)**		

Question Number	Acceptable Answers	Reject	Mark
2(c)(iii)	 IGNORE position of OH and side chain on the ring ALLOW displayed or skeletal ALLOW $C_6H_4(OH)CH_2CH_2COCH_3$ ALLOW TE if one of the following side chains is carried forward from 2c(ii):  OR 	TE for any other side chain	

Question Number	Acceptable Answers	Reject	Mark
2(d)	Steam source with delivery tube to flask with the steam passing into the liquid in the flask IGNORE incorrectly positioned safety vents in the steam generator OR Flask being heated and containing **water** (and raspberries) **(1)** Condenser with water jacket in correct position and with correct direction of water flow shown **(1)** Collection vessel **(1)** Minus 1 if apparatus does not work (e.g. sealed or leaky joints)  Correctly drawn reflux apparatus scores 1 IGNORE fractionating columns Collection vessel may be any shape of flask, test tube or cylinder	Steam delivered above the liquid in the flask Unlabelled liquid in the flask	**3**

Total for Question 2 = 12 Marks

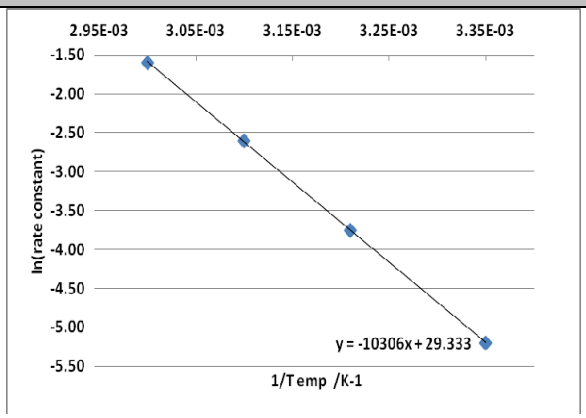
Question Number	Acceptable Answers	Reject	Mark
3(a)(i)	Burette / (graduated / volumetric) pipette **(1)** Allows accurate /precise measurement **(1)** OR measuring cylinder **(1)** Allows you to do multiple experiments quickly / accurate enough (to determine orders) **(1)** IGNORE Ease of use Cylinder allows variety of different volumes to be measured	Dropping / teat pipette	**2**

Question Number	Acceptable Answers	Reject	Mark
3(a)(ii)	Pink / purple **(1)** To colourless **(1)** Reverse order scores 1	Lilac Clear for colourless	**2**

Question Number	Acceptable Answers	Reject	Mark
3(a)(iii)	To keep the (overall) volume constant/ 50 cm^3 OR So the concentration of each reactant is proportional to the volume used	Any other volume quoted	**1**

Question Number	Acceptable Answers	Reject	Mark
3(a)(iv)	(Monitor change in concentration of MnO_4^- using) colorimetry OR Titrate with reducing agent / named reducing agent e.g. Fe^{2+}	Just observing the intensity of the colour Electrical conductivity pH meter Just “titrate”	**1**

Question Number	Acceptable Answers	Reject	Mark
3(a)(v)	0 order wrt glucose 1st order wrt sulfuric acid 1st order wrt potassium manganate(VII) All 3 correct scores 2 marks 2 correct scores 1 mark 0 or 1 correct scores 0 marks **(2)** Rate/r/R = $k[MnO_4^-][H^+]([C_6H_{12}O_6]^0)$ **(1)** ALLOW full formulae or names in rate equation If formulae given they must be correct ALLOW "K" for "k" ALLOW TE from incorrect orders for last mark	Rate equation for rate	**3**

Question Number	Acceptable Answers	Reject	Mark
3(b)(i)	 Suitable linear scales **(1)** IGNORE units Points plotted correctly **(1)** Straight line of best fit drawn **(1)**		**3**

Question Number	Acceptable Answers	Reject	Mark
3(b)(ii)	Gradient = – 10300 ALLOW any value in the range -9600 to -11000 IGNORE units even if incorrect	Positive gradient	**1**

Question Number	Acceptable Answers	Reject	Mark
3(b)(iii)	E_A = (-) gradient from b(ii) x 8.31 **(1)** E_A = Value to at least 2 sf with units **(1)** Units must be correct Correct value: E_A = -(-10300) x 8.31 = 85593 J mol^{-1} / 85.6 kJ mol^{-1} Correct answer with no working scores both marks	Negative E_A	**2**

Gradient	E_A/ $kJmol^{-1}$
-9600	79.8
-9700	80.6
-9800	81.4
-9900	82.3
-10000	83.1
-10100	83.9
-10200	84.8
-10300	85.6
-10400	86.4
-10500	87.3
-10600	88.1
-10700	88.9
-10800	89.7
-10900	90.6
-11000	91.4

Total for Question 3 = 15 Marks

Question Number	Acceptable Answers	Reject	Mark
4(a)(i)	Any **three** from: Shake / mix **(1)** Release pressure / open stopper (from time to time) **(1)** Remove lower / dichloromethane layer by opening tap / using teat pipette OR Decant the top layer / remove top layer with teat pipette. To score this mark it must be clear that the bottom layer is the layer required **(1)** Repeat extraction with additional solvent **(1)**	Just "add the dichloromethane" Just "separate the liquids"	**3**

Question Number	Acceptable Answers	Reject	Mark
4(a)(ii)	Add named drying agent (anhydrous) calcium chloride / magnesium sulfate / sodium sulfate **(1)** ALLOW silica gel IGNORE desiccator (Allow to stand) decant / filter (to separate drying agent) **(1)** Both marks are stand alone	Sulfuric acid KOH NaOH **Heat** with drying agent Dry with filter paper	**2**

Question Number	Acceptable Answers	Reject	Mark
4(b)(i)	Carry out in fume cupboard / hood / chamber / well ventilated lab **(1)** IGNORE gas / face masks Wear (protective) gloves **(1)** IGNORE lab coat and eye protection		**2**

Question Number	Acceptable Answers	Reject	Mark
4(b)(ii)	Distillation / evaporate under reduced pressure / rotary evaporation ALLOW fractional distillation IGNORE recrystallisation	Just evaporate	**1**

Question Number	Acceptable Answers	Reject	Mark
4(c)	CO_2 is less harmful / not harmful / less hazardous / not hazardous / less irritant / not irritant / non-flammable / non-toxic / evaporates easily / easily removed IGNORE comments regarding ozone layer or global warming	Just CO_2 safer/less risky	**1**

Question Number	Acceptable Answers	Reject	Mark
4(d)	85 mg = 0.085 g **(1)** % caffeine = 0.085/25 x 100 = 0.34% **(1)** ALLOW TE on incorrect mass Correct answer alone scores both marks IGNORE sf except 1	% caffeine>100%	**2**

Question Number	Acceptable Answers	Reject	Mark
4 (e)	Recrystallization ALLOW column chromatography ALLOW sublimation	Distillation	**1**

Total for Question 4 = 12 Marks

Total for Paper = 50 Marks

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