Rewarding Learning

ADVANCED
General Certificate of Education
2014

Chemistry

Assessment Unit A2 3
Internal Assessment
Practical Examination 2

[AC232]

FRIDAY 16 MAY, MORNING

MARK SCHEME

Annotation

AVAILABLE MARKS

1. Please do all marking in **red** ink.

2. All scripts should be checked for mathematical errors. Please adopt a system of one tick (✓) equals 1 mark, e.g. if you have awarded 4 marks for part of a question then 4 ticks (✓) should be on this candidate's answer.

3. The total mark for each question should be recorded in a circle placed opposite the question number in the teacher mark column.

4. As candidates have access to scripts please do not write any inappropriate comments on their scripts.

General points

- All calculations are marked according to the number of errors made.

- Errors can be carried through. If the wrong calculation is carried out then the incorrect answer can be carried through. One mistake at the start of a question does not always mean that all marks are lost.

- Any number of decimal places may be used provided the 'rounding' is correct.

- Listing is when more than one answer is given for a question that only requires one answer, e.g. the precipitate from a chloride with silver nitrate is a white solid; if the candidate states a white or a cream solid, one answer is correct and one answer is wrong. Hence they cancel out.

- Although names might be in the mark scheme it is generally accepted that formulae can replace them. Formulae and names are often interchangeable in chemistry.

- The marking of colours is defined in the 'CCEA GCE Chemistry Acceptable Colours' document.

MARKING GUIDELINES

Interpretation of the Mark Scheme

- **Carry error through**
  This is where mistakes/wrong answers are penalised when made, but if carried into further steps of the question, then no further penalty is applied. This pertains to calculations and observational/deduction exercises. Please annotate candidates' answers by writing the letters c.e.t. on the appropriate place in the candidates' answers.

- **Oblique/forward slash**
  This indicates an acceptable alternative answer(s).

- **Brackets**
  Where an answer is given in the mark scheme and is followed by a word/words in brackets, this indicates that the information within the brackets is non-essential for awarding the mark(s).

AVAILABLE MARKS

1 (a) (i) Mass between given values
Mass to 2 decimal places
Units
Error [–1] [2]

(ii) Correct RFM for ammonium iron(II) sulfate (392)
Correct calculation of moles
Correct calculation of concentration
Error [–1] [3]

(b) Table [3]
Significant figures [2]
Calculation of average titre [2]
Titration consistency [1] [8]

Table

Titration	Initial burette reading/cm^3	Final burette reading/cm^3	Volume added/cm^3
1			
2			
3			

Average titre = cm^3

Table [3]
The Table should be drawn as a table. It should be labelled with the following: initial burette reading, final burette reading and the titre. It is not necessary to use exactly these words but there should be appropriate columns and rows [1]. Units, i.e. cm^3, should be stated [1]. The rough titration value should not be the same as the accurate values [1].

Significant figures [2]
All accurate titration readings recorded to one decimal place (including initial burette reading at 0.0 if used). Accept, however, 0.00 and 0.05 but penalise by [–1] if other readings are given to two or more decimal places. The use of 0 is penalised by [–1] if used (only penalise once).

Average titre [2]
Accurate titrations only should be used. The use of a rough value is [–1].

The average value can be calculated to two decimal places or more, e.g. 25.17 and 25.18 average to 25.175.

If three accurate titres are recorded, then the average titre must be calculated using all three accurate titres.

Any error is [–1]. This might be an incorrect calculation or the omission of units. If the average titre is included in the table then the units indicated on the table apply.

Titration consistency

Difference	Mark
±0.1	[1]
>0.1	[0]

				AVAILABLE MARKS
(c)	**(i)**	add solution from burette slowly/dropwise at end point [1] swirl the flask/wash down the sides with deionised water etc. [1]	[2]	
	(ii)	colourless to pink	[1]	
(d)	**(i)**	$MnO_4^- + 8H^+ + 5e^- \rightarrow Mn^{2+} + 4H_2O$	[2]	
	(ii)	$Fe^{2+} \rightarrow Fe^{3+} + e^-$	[1]	
	(iii)	$5Fe^{2+} + 8H^+ + MnO_4^- \rightarrow 5Fe^{3+} + 4H_2O + Mn^{2+}$	[2]	
	(iv)	for a concentration of 0.09 mol dm^{-3} Fe^{2+} and a titration value of 20.1 cm^3 25/1000 × 0.09 mol in 25 cm^3 of Fe^{2+} solution = 2.25×10^{-3} mol 2.25×10^{-3}/5 mol $KMnO_4$ in 20.1 cm^3 = 4.5×10^{-4} mol in 20.1 cm^3 $KMnO_4$ = 158; 4.5×10^{-4} mol = $158 \times 4.5 \times 10^{-4}$ g = 0.0711 g 0.0711 g in 20.1 cm^3 = $0.0711/20.1 \times 10^3$ = 3.537 g = 3.54 g	[4]	25

2 Observation/deduction

AVAILABLE MARKS

Safety glasses must be worn at all times and care should be exercised during this practical examination.

(a) (i) You are provided with a solid, labelled X. Carry out the following tests. Record your observations in the spaces below.

Test	Observations
1 Describe the appearance of X.	Blue solid/crystals/powder [1]
2 Dissolve two spatula measures of X in approximately 50 cm^3 of water. Keep this solution for use in further tests.	Blue (solution) [1]
3 Place 4 cm^3 of the solution from test 2 in a test tube. Add an equal volume of concentrated hydrochloric acid.	Yellow-green/Green solution [1]
4 Place 4 cm^3 of the solution from test 2 in a test tube. Add an equal volume of 1,2-diaminoethane solution.	Darker blue solution/ blue-violet/blue-purple [1]
5 (a) Place 4 cm^3 of the solution from test 2 in a test tube. Slowly add an equal volume of sodium hydroxide solution. **(b)** Add a further 5 cm^3 of sodium hydroxide solution.	Blue precipitate Precipitate remains [2]
6 Place 4 cm^3 of the solution from test 2 in a test tube. In a **fume cupboard**, add an equal volume of concentrated ammonia solution.	Deep blue solution forms [1]
7 Place 4 cm^3 of the solution from test 2 in a test tube. Add 1 cm^3 of barium chloride solution dropwise.	White precipitate [1]

(ii) hydrated [1] copper(II) sulfate [1] [2]

(iii) $[Cu(H_2O)_6]^{2+}$ [1]

(iv) $[CuCl_4]^{2-}$ [1]

(v) $[Cu(H_2O)_6]^{2+} + 3\ en \rightleftharpoons [Cu(en)_3]^{2+} + 6\ H_2O$ [2]

(vi) $[Cu(H_2O)_6]^{2+} + 4\ NH_3 \rightleftharpoons [Cu(NH_3)_4\ (H_2O)_2]^{2+} + 4\ H_2O$ [2]

(b) (i) You are provided with an aqueous solution of an organic compound B. Carry out the following tests. Record your observations in the spaces below.

AVAILABLE MARKS

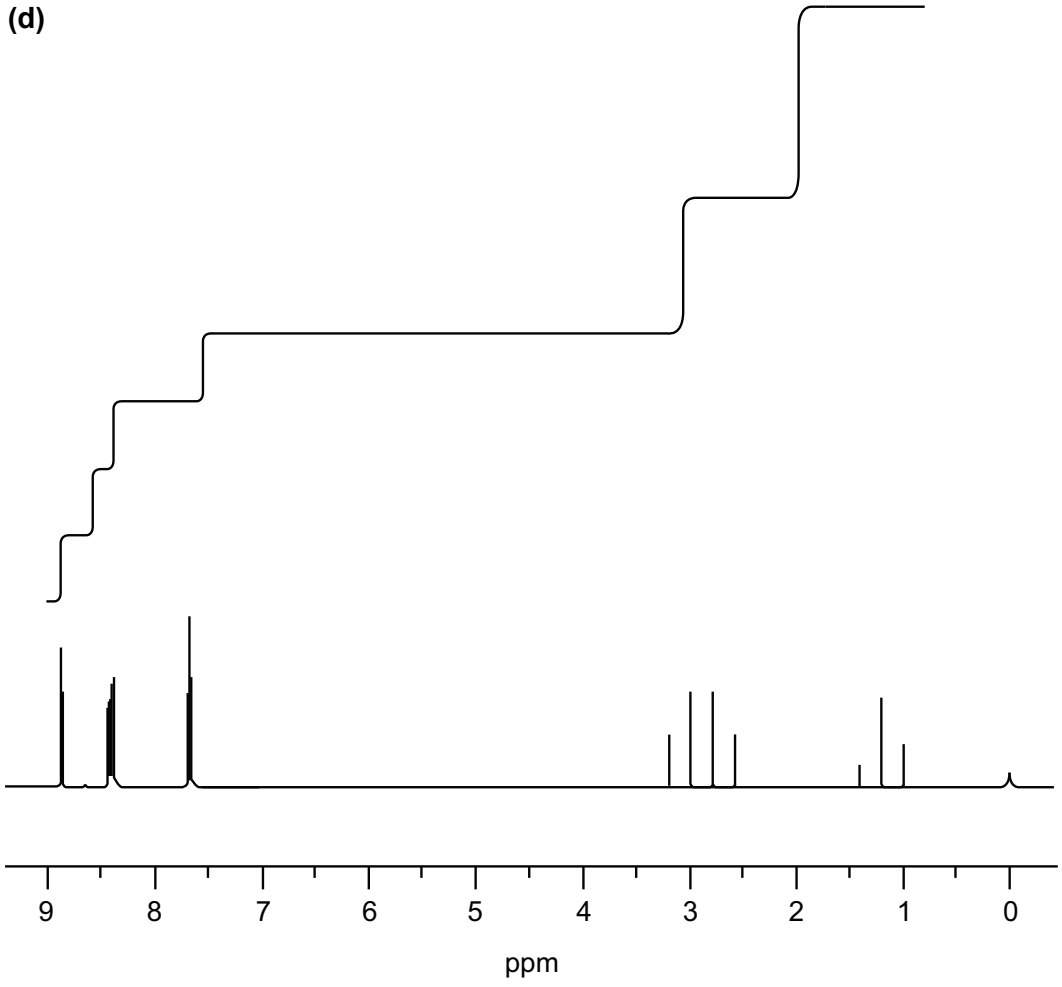
Test	Observations
1 Describe the solution. Include a description of its smell.	Colourless Vinegar smell/sharp/ irritating [1]
2 Place 4 cm^3 of the solution in a test tube. Add an equal volume of potassium dichromate solution and acidify with 1 cm^3 of dilute sulfuric acid. Heat in a water bath for five minutes.	Solution remains orange [1]
3 Place 4 cm^3 of the solution in a test tube. Add half a spatula measure of sodium hydrogencarbonate.	Solid dissolves bubbles/effervescence/ fizzing [2]

(ii) –COOH [1]

(iii) strong C═O absorption [1]
strong O—H absorption [1] [2]

(iv) position of molecular ion gives RMM [1]
uniqueness of fragmentation [1] [2] 25

3 Planning Exercise

			AVAILABLE MARKS
(a)	**(i)**	$C_6H_5COOC_2H_5 + HNO_3 \rightarrow C_6H_4NO_2COOC_2H_5 + H_2O$ [1]	
	(ii)	Theoretical yield = 9.75 g or 0.05 mole [1] Min mass of ethyl benzoate 7.5 g [1] [2]	
(b)		Place concentrated sulfuric and concentrated nitric acid in a flask [1] Add slowly to ethyl benzoate [1] temperature kept below 15 °C [1] pour reaction mixture onto crushed ice [1] filter [1] [5]	
		Quality of written communication [2]	
(c)	**(i)**	To remove impurities [1] dissolve in minimum amount of hot ethanol/methanol [1] filter while hot allow (filtrate) to cool/crystals to form [1] vacuum filtration for crystals [1] [4]	
	(ii)	between filter papers/cool oven/desiccator [1]	
	(iii)	sharp m. pt [1] compare to 42°C [1] [2]	
(d)		 quartet and triplet [1] triplet closer to TMS [1] integration (2:3) [1] [3]	20
		Total	**70**