



Rewarding Learning

ADVANCED
General Certificate of Education
2016

Chemistry

Assessment Unit A2 3

assessing

Module 3: Practical Examination

Practical Booklet B

[AC234]

FRIDAY 13 MAY, MORNING

**MARK
SCHEME**

Annotation

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).

- 1 (a)** (iodine solution) is yellow/brown [1]
 (add sodium thiosulfate) until straw coloured [1]
 add starch [1]
 blue/black [1] to colourless [1] [5]
- (b) (i)** $I_2 + 2 S_2O_3^{2-} \rightarrow S_4O_6^{2-} + 2 I^-$ [2]
- (ii)** moles of thiosulfate = 0.000925 [1]
 moles of iodine = 0.000463 [1] [2]
- (c) (i)** $2IO_3^- + 12H^+ + 10e^- \rightarrow I_2 + 6H_2O$ [2]
- (ii)** $IO_3^- + 6H^+ + 5I^- \rightarrow 3I_2 + 3H_2O$ [2]
- (d)** moles of iodate (V) ions in 25 cm³ = 0.000154
 moles of iodate (V) ions in 1000 cm³ = 0.006173
 molar mass of potassium iodate = 214
 concentration in g dm⁻³ = 1.32 [4]

AVAILABLE
MARKS

17

2 (a) (i) Based on the following observations, make deductions for salts X and Y.

AVAILABLE
MARKS

Test	Observations	Deductions
1 Dissolve two spatula measures of X in 50 cm ³ of water. Keep this solution for use in further tests.	<i>Green crystals dissolve to produce a green solution.</i>	Contains Ni ²⁺ or Fe ²⁺ or Cr ³⁺ or V ³⁺ (any 3 from 4 for 1 mark) [1]
2 Dissolve two spatula measures of Y in 50 cm ³ of water. Keep this solution for use in further tests.	<i>Pink crystals dissolve to produce a pink solution.</i>	
3 Place 4 cm ³ of the solution of X in a test tube. Slowly add an equal volume of sodium hydroxide solution. Add concentrated ammonia.	<i>A green precipitate forms.</i> <i>The precipitate disappears and a blue solution is formed</i>	Contains nickel(II) ions [1]
4 Place 4 cm ³ of the solution of Y in a test tube. Slowly add concentrated ammonia until present in excess. Shake the solution.	<i>A blue precipitate forms. The precipitate disappears and a yellow solution is formed.</i> <i>The yellow solution turns brown.</i>	Contains cobalt(II) ions [1]
5 Place 4 cm ³ of the solution of Y in a test tube. Add 2 cm ³ of concentrated hydrochloric acid. Add 8 cm ³ of water and shake vigorously.	<i>Solution turns blue and back to pink.</i>	
6 Slowly add a solution of 1,2-diaminoethane to the solution of X until it is present in excess.	<i>Solution turns purple.</i>	

(ii) Ni(OH)₂ or [Ni(OH)₂(H₂O)₄] [1]

(iii) [Ni(NH₃)₆]²⁺ [1]

(iv) [Co(NH₃)₆]²⁺ [1]

(v) [Co(H₂O)₆]²⁺ + 4Cl⁻ ⇌ [CoCl₄]²⁻ + 6H₂O [2]

(vi) [Ni(en)₃]²⁺ [1]

(b) (i) Based on the following observations, make deductions for compound Z.

Test	Observation	Deductions
1 Add a few drops of Z into water.	<i>One layer formed.</i>	
2 Add sodium hydrogencarbonate to Z.	<i>No bubbles produced.</i>	Not acidic [1]
3 Add a few drops of Z to a solution of 2,4-dinitrophenylhydrazine.	<i>An orange solid forms.</i>	Aldehyde or ketone [1]
4 Heat Z with Tollen's reagent.	<i>The solution remains colourless.</i>	Not aldehyde or is a ketone (depends on test 3) [1]

(ii) Structure of a water soluble ketone, up to 5 carbon atoms, e.g. propanone

[1]

13

AVAILABLE
MARKS

			AVAILABLE MARKS	
3	(a)	(i) $\text{CH}_3\text{COOH} + (\text{CH}_3)_2\text{CHOH} \rightleftharpoons \text{CH}_3\text{COOCH}(\text{CH}_3)_2 + \text{H}_2\text{O}$	[2]	
		(ii) concentrated sulfuric acid	[1]	
		(iii) anti-bumping granules	[1]	
	(b)	propan-2-ol	[1]	
	(c)	theoretical yield = 25.5 g RMM of ester = 102 theoretical yield = 0.25 moles RMM of alcohol = 60 15 g of isopropyl alcohol required	[4]	
	(d)	distillation	[1]	
	(e)	(i) Shake crude product with (aqueous) sodium carbonate in a separating funnel Release pressure – correct method Separate the layers	[3]	
		(ii) Swirl with anhydrous calcium chloride Until liquid goes clear Filter/decant	[3]	
		Quality of written communication	[2]	
	(f)	(Both reactants contain O–H) Absence of any O–H absorption	[1]	
	(g)	3:1:6	[1]	20
			Total	50