Rewarding Learning

**ADVANCED**
**General Certificate of Education**
**2018**

# Chemistry

## Assessment Unit A2 3

*assessing*

## Module 3: Practical Examination
## Practical Booklet B

**[AC234]**

**WEDNESDAY 20 JUNE, 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).

AVAILABLE MARKS

**1** **(a)** moles required for 250 $cm^3$ = 250 × $10^{-3}$ × 0.1 = 0.025
RFM = 2(14 + 4) + 56 + 2(32 + 64) + 6(18) = 392
Mass = 0.025 × 392 = 9.80 g [3]

**(b)** **(i)** The acidified manganate(VII) acts as an indicator [1]

**(ii)** colourless to pink [2]

**(iii)**

| titration | initial burette reading/$cm^3$ | final burette reading/$cm^3$ | volume added/ $cm^3$ |
|---|---|---|---|
| Rough | 0.0 | 30.5 | 30.5 |
| 1 | 0.4 | 30.5 | 30.1 |
| 2 | 0.6 | 30.5 | 29.9 |

30.0 $cm^3$ [2]

**(c)** **(i)** $MnO_4^- + 8H^+ + 5e^- \rightarrow Mn^{2+} + 4H_2O$ [2]

**(ii)** $Fe^{2+} \rightarrow Fe^{3+} + e^-$ [1]

**(iii)** $MnO_4^- + 8H^+ + 5Fe^{2+} \rightarrow Mn^{2+} + 4H_2O + 5Fe^{3+}$ [2]

**(iv)** moles of iron(II) = 25 × (0.1/1000) = 0.0025
(1:5 ratio) moles of manganate(VII) in 30.0 $cm^3$ = 0.0005
concentration of manganate(VII) = 0.0005 ÷ (30.0/1000) = 0.0167 mol $dm^{-3}$
RFM of potassium manganate(VII) = 39 + 55 + (4 × 16) = 158
concentration of potassium manganate(VII) = 2.64 g $dm^{-3}$ [4]

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**2** **(a)** Based on the following observations, make deductions for the organic liquids **A**, **B** and **C**.

AVAILABLE MARKS

| Test | Observations | Deductions |
|---|---|---|
| **1** In a fume cupboard add a spatula measure of phosphorous(V) chloride to liquid **A**.<br><br>Test any gas given off using a glass rod which has been dipped in concentrated ammonia solution | *Vigorous reaction.*<br>*Heat produced.*<br>*Steamy fumes given off.*<br><br>*White smoke produced.* | Contains –OH group<br><br>Gas is hydrogen chloride [2] |
| **2** Add 2 $cm^3$ of water to 2 $cm^3$ of liquid **A**.<br><br>Add 1 $cm^3$ of dilute sulfuric acid followed by a few drops of potassium dichromate solution and heat. | *A single layer forms.*<br><br>*The solution remains orange.* | Completely soluble in water/miscible<br><br>Cannot be oxidised [2] |
| **3** Add 2 $cm^3$ of water to 2 $cm^3$ of liquid **A** followed by a spatula measure of sodium carbonate. Test any gas given off using limewater. | *Bubbles of gas.*<br>*Solid disappears*<br><br>*Limewater turns milky.* | **A** is acidic/carboxylic acid<br><br>Gas is carbon dioxide [2] |
| **4** Add a few drops of liquid **B** to 2 $cm^3$ of 2, 4-dinitrophenylhydrazine solution. | *An yellow solid forms.* | Aldehyde or ketone [1] |
| **5** Heat **B** with Fehling's solution. | *The solution remains blue.* | Ketone [1] |
| **6** Add a few drops of liquid **C** to 2 $cm^3$ of 2, 4-dinitrophenylhydrazine solution. | *An orange solid forms.* | Aldehyde or ketone [1] |
| **7** Heat **C** with Tollens' reagent. | *A silver mirror forms.* | Aldehyde [1] |

**(b)** $CH_3CH_2COOH$ [1]

**(c)** $CH_3CH_2COCH_2CH_3$ [1]

**(d)** $CH_3CH_2CHO$ [1] 13

| | | | | AVAILABLE MARKS |
|---|---|---|---|---|
| **3** | **(a)** | **(i)**   [1] | | |
| | | **(ii)** Theoretical yield = (5.43 ÷ 60) × 100 = 9.05 g<br>RFM (product) = (8 × 12) + (7 × 1) + (4 × 16) + (14) = 181<br>Theoretical yield = 9.05 ÷ 181 = 0.05 moles<br>(1:1 ratio) 0.05 moles of methyl benzoate<br>RFM (methyl benzoate) = (8 × 12) + (8 × 1) + (2 × 16) = 136<br>Minimum mass of methyl benzoate = 0.05 × 136 = 6.80 g | [3] | |
| | **(b)** | Place concentrated sulfuric and concentrated nitric acids in a flask [1]<br>Add slowly to methyl benzoate [1]<br>temperature kept below 15°C [1]<br>pour reaction mixture onto crushed ice [1]<br>filter [1] | [5] | |
| | | Quality of written communication | [2] | |
| | **(c)** | **(i)** To remove impurities/purify the product [1]<br>dissolve in minimum amount/volume of hot ethanol/methanol [1]<br>filter while hot allow (filtrate) to cool/crystals to form [1]<br>filter [1] | [4] | |
| | | **(ii)** cream | [1] | |
| | | **(iii)** between filter papers/low temperature (below melting point)<br>oven/desiccator | [1] | |
| | | **(iv)** sharp melting point | [1] | |
| | **(d)** | 59 $CH_3OCO^+$ [1]<br>150 $C_6H_4NO_2CO^+$ [1] | [2] | 20 |
| | | | **Total** | **50** |