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).

1 **(a)** moles required for $250 \, cm^3$ = $250 \times 10^{-3} \times 0.1$ = 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) = $25 \times (0.1/1000)$ = 0.0025
(1:5 ratio) moles of manganate(VII) in $30.0 \, cm^3$ = 0.0005
concentration of manganate(VII) = $0.0005 \div (30.0/1000)$ = 0.0167 mol dm^{-3}
RFM of potassium manganate(VII) = $39 + 55 + (4 \times 16)$ = 158
concentration of potassium manganate(VII) = 2.64 g dm^{-3} [4]

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AVAILABLE MARKS

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

Test	Observations	Deductions
1 In a fume cupboard add a spatula measure of phosphorous(V) chloride to liquid **A**.	*Vigorous reaction.* *Heat produced.* *Steamy fumes given off.*	Contains –OH group
Test any gas given off using a glass rod which has been dipped in concentrated ammonia solution	*White smoke produced.*	Gas is hydrogen chloride [2]
2 Add $2\,cm^3$ of water to $2\,cm^3$ of liquid **A**.	*A single layer forms.*	Completely soluble in water/miscible
Add $1\,cm^3$ of dilute sulfuric acid followed by a few drops of potassium dichromate solution and heat.	*The solution remains orange.*	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.* *Solid disappears* *Limewater turns milky.*	**A** is acidic/carboxylic acid 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]

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AVAILABLE MARKS

3 **(a)** **(i)**

$COOCH_3$ + HNO_3 → $COOCH_3$, NO_2 + H_2O

[1]

(ii) Theoretical yield = (5.43 ÷ 60) × 100 = 9.05 g
RFM (product) = (8 × 12) + (7 × 1) + (4 × 16) + (14) = 181
Theoretical yield = 9.05 ÷ 181 = 0.05 moles
(1:1 ratio) 0.05 moles of methyl benzoate
RFM (methyl benzoate) = (8 × 12) + (8 × 1) + (2 × 16) = 136
Minimum mass of methyl benzoate = 0.05 × 136 = 6.80 g   [3]

(b) Place concentrated sulfuric and concentrated nitric acids in a flask [1]
Add slowly to methyl 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/purify the product [1]
dissolve in minimum amount/volume of hot ethanol/methanol [1]
filter while hot allow (filtrate) to cool/crystals to form [1]
filter [1]   [4]

(ii) cream   [1]

(iii) between filter papers/low temperature (below melting point)
oven/desiccator   [1]

(iv) sharp melting point   [1]

(d) 59 CH_3OCO^+ [1]
150            $C_6H_4NO_2CO^+$ [1]   [2]   20

Total   **50**