Rewarding Learning

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
2019

Chemistry

Assessment Unit AS 3

assessing

Module 3: Practical Examination
Practical Booklet B

[SCH32]

WEDNESDAY 29 MAY, AFTERNOON

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.

- 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)** **(i)** effervescence/bubbling/fizzing [1]

(ii) oxidation number of C in charcoal increased from 0 to +2 in carbon monoxide/oxidation number of C in CO_2 reduced from +4 to +2 [1]
reducing agent is oxidised [1] [2]

(iii) more particles with energy greater/equal to E_{act} [1]
more frequent/successful collisions [1] [2]

(iv) incomplete reduction of carbon dioxide/charcoal not heated enough/ carbon dioxide passed through too quickly (soon) [1]

(v) $CO_2 + 2NaOH \rightarrow Na_2CO_3 + H_2O$ [1]

(vi) add dilute acid [1]
bubble gas produced through limewater [1]
turns milky [1] [3]

(b) 100 kg of Fe_2O_3 = 100,000 g
RFM of Fe_2O_3 = 160
moles of Fe_2O_3 = 625

56 kg of CO = 56,000 g
RMM of CO = 28
moles of CO = 2000

Fe_2O_3 is limiting factor

moles of Fe = 1250
mass of Fe = 1250 × 56 = 70,000 g = 70 kg
(error [–1]) [3]

(c) **(i)** (high temperature) decreases yield [1]

(ii) (high pressure) increases yield [1]

(d) **(i)** to ensure the even distribution of heat [1]

(ii) surround apparatus with screen to reduce draughts [1]
place a lid on the copper can [1] [2]

(iii) % error = $\frac{2 \times 0.5}{70.5} \times 100 = 1.4\% = 1\%$ [2]

(iv) mass of methanol = 20.33 – 18.92 = 1.41 g
moles of methanol = 1.41/32 = 141/3200 (0.0440625)

q = (–)100 × 4.2 × 70.5 = (–)29610 J (29.61 kJ)

ΔH = –29610/0.044 = –672954.5 J (mol^{-1})
= –673 kJ (mol^{-1}) = –700kJ (mol^{-1})
(error [–1]) [3]

(v) carbon [1]
incomplete combustion [1] [2]

(vi) more (bonds) broken/formed [1]

AVAILABLE MARKS

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2 **(a)** **(i)** $H_2SO_4 + NaCl \rightarrow NaHSO_4 + HCl$ [1]

(ii) $MnO_2 + 4HCl \rightarrow Cl_2 + MnCl_2 + 2H_2O$ [2]

(iii) dissolves in the water (to form hydrochloric acid) [1]

(iv) heavier than air [1]

(v) bleaches damp Universal/litmus Indicator paper [2]
(error [–1])

(b) **(i)** a solution of chlorine water is green [1]

(ii) add silver nitrate solution [1]
white precipitate is formed [1] [2]

(c) **(i)** two layers are formed [1]

(ii) the bottom layer turns colourless
or
the upper layer turns (pale) green [1]

(iii) pale green colour disappears [1]

(iv) separating funnel [1]

(d) **(i)**

	C:	H:	Cl
Mass	32.2	4.5	63.3
R.A.M	12	1	35.5
Moles	2.68	4.5	1.78
Ratio	1.50	2.52	1.00
	3	5	2
Empirical formula = $C_3H_5Cl_2$			

(error [–1]) [3]

(ii) mass of hexane = 9.75 g
RMM = 86
moles of hexane = 9.75/86
= 0.1134
moles of X obtained = 0.01134
RFM of X = 2.54/0.01134 = 223.986
= 224
(error [–1]) [3]

(iii) $C_6H_{10}Cl_4$ [1]

(iv) substitution can replace any H atom/multiple substitution can occur [1]

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AVAILABLE MARKS

			AVAILABLE MARKS
3	**(a)**	repeated boiling and condensing of a reaction mixture [1]	
	(b)	add anhydrous magnesium sulfate/calcium sulfate/calcium chloride to the distillate until clear/no longer cloudy filter off drying agent/decant off liquid (error [–1]) [2]	
	(c)	mass of cyclohexanol = 0.96 × 20 = 19.2 g moles of cyclohexanol = 19.2/100 = 0.192 expected moles of cyclohexanone = 0.192 expected mass of cyclohexanone = 0.192 × 98 = 18.82 g actual mass of cyclohexanone = 15 × 0.95 = 14.25 g actual moles of cyclohexanone = 14.25/98 = 0.145 % yield = 14.25/18.82 × 100 = 75.7% = 76% **or** % yield = 0.145/0.192 × 100 = 75.5% = 76% (error [–1]) **or** $\%\ \text{yield} = \frac{15 \times 0.95}{0.192 \times 98} \times 100 = 75.733$ [3]	
	(d)	cyclohexanol is a secondary alcohol/not a primary alcohol/ cyclohexanone will not be oxidised to the carboxylic acid (with this oxidising agent) [1]	7
		Total	**55**