Rewarding Learning

ADVANCED
General Certificate of Education
2022

Chemistry

Assessment Unit A2 3

assessing

Further Practical Chemistry
Practical Booklet B (Theory)

[ACH32]

TUESDAY 21 JUNE, MORNING

MARK SCHEME

General Marking Instructions

Introduction

Mark schemes are published to assist teachers and students in their preparation for examinations. Through the mark schemes teachers and students will be able to see what examiners are looking for in response to questions and exactly where the marks have been awarded. The publishing of the mark schemes may help to show that examiners are not concerned about finding out what a student does not know but rather with rewarding students for what they do know.

The Purpose of Mark Schemes

Examination papers are set and revised by teams of examiners and revisers appointed by the Council. The teams of examiners and revisers include experienced teachers who are familiar with the level and standards expected of students in schools and colleges.

The job of the examiners is to set the questions and the mark schemes; and the job of the revisers is to review the questions and mark schemes commenting on a large range of issues about which they must be satisfied before the question papers and mark schemes are finalised.

The questions and the mark schemes are developed in association with each other so that the issues of differentiation and positive achievement can be addressed right from the start. Mark schemes, therefore, are regarded as part of an integral process which begins with the setting of questions and ends with the marking of the examination.

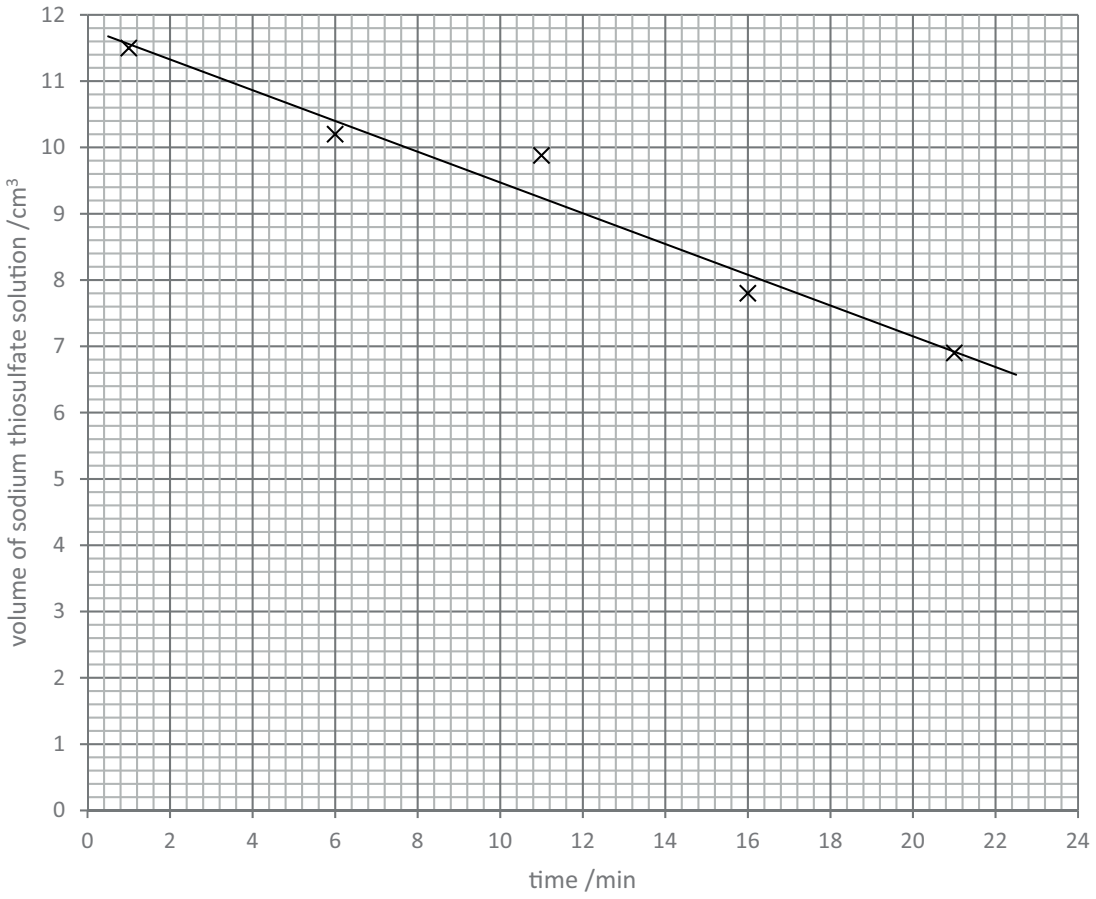
The main purpose of the mark scheme is to provide a uniform basis for the marking process so that all the markers are following exactly the same instructions and making the same judgements in so far as this is possible. Before marking begins a standardising meeting is held where all the markers are briefed using the mark scheme and samples of the students' work in the form of scripts. Consideration is also given at this stage to any comments on the operational papers received from teachers and their organisations. During this meeting, and up to and including the end of the marking, there is provision for amendments to be made to the mark scheme. What is published represents this final form of the mark scheme.

It is important to recognise that in some cases there may well be other correct responses which are equally acceptable to those published: the mark scheme can only cover those responses which emerged in the examination. There may also be instances where certain judgements may have to be left to the experience of the examiner, for example, where there is no absolute correct response – all teachers will be familiar with making such judgements.

COVID-19 Context

Given the unprecedented circumstances presented by the COVID-19 public health crisis, senior examiners, under the instruction of CCEA awarding organisation, are required to train assistant examiners to apply the mark scheme in case of disrupted learning and lost teaching time. The interpretation and intended application of the mark scheme for this examination series will be communicated through the standardising meeting by the Chief or Principal Examiner and will be monitored through the supervision period. This paragraph will apply to examination series in 2021–2022 only.

		AVAILABLE MARKS
1	**(a)** y-axis labelled [1] x-axis labelled [1] points correctly plotted [1] line of best fit [1] [4]	



(b) 9.9 cm^3/11 min [1]

(c) concentrations of propanone and sulfuric acid remain effectively constant [1]

(d) to quench the reaction/react with acid [1]

(e) **(i)** concentration of iodine is related to the volume of sodium thiosulfate solution/concentration of iodine is directly proportional to the volume of thiosulfate [1]

(ii) zero order [1]
graph is a straight line/gradient constant [1] [2]
second mark is dependent on the first

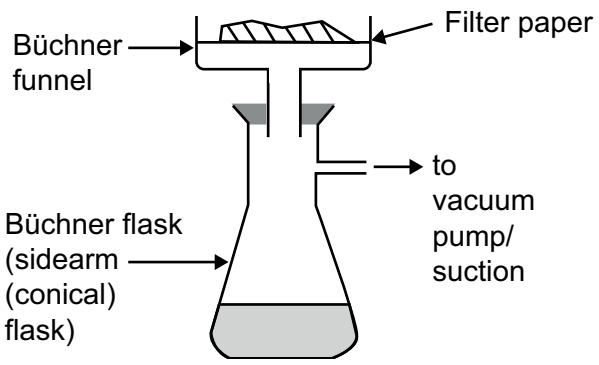
(iii) consistent as iodine does not appear in the proposed rate-determining step [1]

(f) **(i)** straw/yellow to blue-black [1]
blue-black to colourless [1] [2]

(ii) iodine forms irreversible/insoluble complex with starch/adsorbs on surface of the starch [1]

14

					AVAILABLE MARKS
2	**(a)**	**(i)**	$12.5\ cm^3$	[1]	
		(ii)	4.7–4.8	[1]	
		(iii)	$pH = pK_a = 4.7$ to 4.8 $K_a = 1.58 \times 10^{-5}$ to 2.00×10^{-5}	[1]	
	(b)		curve starts at same pH as original curve [1] similar shape of curve, vertical section drawn at volume of sodium hydroxide added = $12.5\ cm^3$ [1]	[2]	
	(c)	**(i)**	solution which resists changes in pH on addition of small amounts of acid or alkali	[1]	
		(ii)	$CH_3COOH + OH^- \rightarrow CH_3COO^- + H_2O$	[2]	
	(d)		ethanoic acid is a weak acid and sodium hydroxide is a strong base/ salt of a weak acid and strong base	[1]	
	(e)		thymol blue [1] changes colour in the vertical section of the pH curve [1]	[2]	11

				AVAILABLE MARKS
3	**(a)**	sodium sulfanilate is more soluble than sulfanilic acid	[1]	
	(b)	**(i)** made in the reaction vessel	[1]	
		(ii) $NaNO_2 + HCl \rightarrow HNO_2 + NaCl$	[1]	
		(iii) diazonium ions unstable at temperatures above 10°C	[1]	
	(c)	**(i)** volume = 1.71/0.956 = 1.79 cm^3	[1]	
		(ii) $C_6H_5N(CH_3)_2 + CH_3COOH \rightarrow CH_3COO^-C_6H_5N^+H(CH_3)_2$	[2]	
	(d)	indicator in acid base titration	[1]	
	(e)	**(i)** 	[3]	
		(ii) faster (than gravity filtration) [1] drier product obtained [1]	[2]	
	(f)	**(i)** place some solid in a capillary tube sealed at one end/ melting point tube [1] heat slowly (using melting point apparatus) [1] record the temperature at which the solid starts and finishes melting [1]	[3]	
		(ii) melts at a lower temperature [1] melts over a larger range [1]	[2]	
	(g)	**(i)** 2.70/195 = 0.0138 moles sodium sulfanilate 1.71/121 = 0.0141 moles dimethylamine ratio 1:1; sodium sulfanilate limiting	[3]	
		(ii) moles sodium sulfanilate = moles methyl orange = 0.0138 mass methyl orange = 0.0138 × 327 = 4.51 (g) percentage yield = 2.32/4.51 × 100 = 51.4%	[3]	24

4 **(a)** **(i)** Presence of two chlorine isotopes ^{35}Cl and ^{37}Cl [1]
Relevant abundance of m/z = 106 and m/z = 108 is 3 : 1/ ^{35}Cl has higher abundance [1] [2]

(ii) CH_3CO^+ [1]

(b) **(i)** $CCl_4/CDCl_3$ [1]

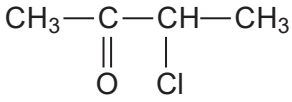
(ii) tetramethylsilane [1]
one signal as all hydrogen atoms equivalent/chemically inert/ non-toxic/easily removed from sample/H atoms more shielded [1] [2]

(iii)

	Integration value	Splitting pattern	Number of bonded to adjacent carbon atoms hydrogen atoms
peak 1	3	doublet	1
peak 2	3	singlet	**0** [1]
peak 3	1	quartet [1]	3

[2]

(c)



[1]

(d) add compound to 2,4-dinitrophenylhydrazine solution [1]
yellow/orange precipitate [1] [2]

Total

AVAILABLE MARKS

11

60