Rewarding Learning

ADVANCED
General Certificate of Education
2017

Chemistry

Assessment Unit A2 2

assessing

Analytical, Transition Metals, Electrochemistry and Further Organic Chemistry

[AC222]

MONDAY 19 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.

Section A

	AVAILABLE MARKS
1 C	
2 C	
3 B	
4 C	
5 C	
6 B	
7 D	
8 D	
9 A	
10 B	
[2] for each correct answer [20]	20
Section A	**20**

Section B

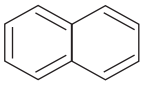
AVAILABLE MARKS

11

Fe^{2+}	green precipitate	no further reaction/insoluble
Fe^{3+}	rust/brown precipitate	no further reaction/insoluble
Co^{2+}	blue precipitate	yellow solution
Ni^{2+}	green precipitate	blue solution
Cu^{2+}	blue precipitate	dark/deep blue solution

[–1] for two errors [8] 8

12 **(a)**



[1]

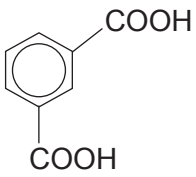
(b) **(i)** π electrons spread over several atoms [2]

(ii) electrons in p orbitals [1] which overlap (sideways) [1] [2]

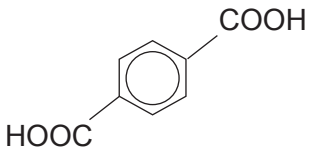
(iii) 5 × 2 = 10 [1]

(c) naphthalene is a larger molecule/greater mass/more electrons [1]
van der Waals forces are greater [1]

(d) **(i)**



A



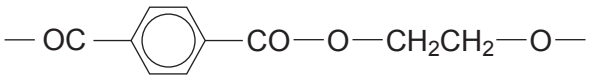
B

[2]

(ii) B

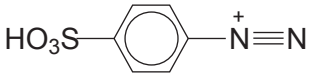
[1]

(iii)

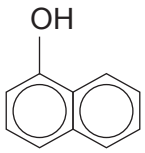


[2]

(e) **(i)**



[1]

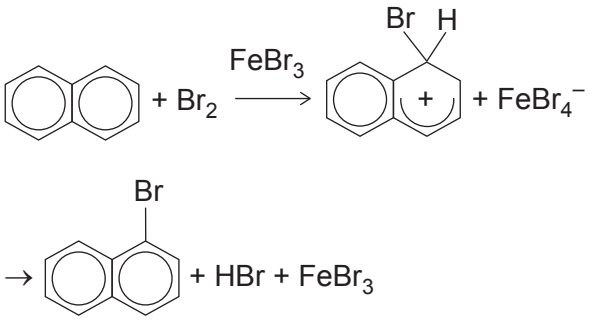


[1]

[2]

(ii) sodium nitrite + (dil or conc) hydrochloric acid [1]
add amine [1]
< 10°C [1]
add naphthol [3]

(iii) electrons exclusively delocalised [1]
energy levels closer [1]
light (energy) raises electrons to higher (energy) levels
removes/absorbs (a) colour (from the light) [1]

				AVAILABLE MARKS
	(iv)	$-SO_3H + NaOH \rightarrow -SO_3Na + H_2O$	[1]	
	(v)	ions are surrounded by water molecules which disperse the ions	[1]	
(f)	**(i)**	iron/iron bromide/iron(III) bromide etc	[1]	
	(ii)		[3]	
	(iii)	relative stabilities of the electron systems, benzene delocalised	[1]	
		in ethene electrons are available	[1]	29

					AVAILABLE MARKS
13	**(a)**	**(i)**	starch	[1]	
		(ii)	when the iodine colour has largely disappeared/straw coloured	[1]	
		(iii)	blue-black to colourless	[2]	
		(iv)	22.5 cm^3 of 0.01 M thiosulfate contains $22.5 \times 10^{-2} \times 10^{-3} = 2.25 \times 10^{-4}$ mol mol Cl_2 in 25 cm^3 = $0.5 \times 2.25 \times 10^{-4} = 1.125 \times 10^{-4}$ mol mol Cl_2 in 75 cm^3 = $3 \times 1.125 \times 10^{-4} = 3.375 \times 10^{-4}$ mol volume of gas = $24 \times 3.375 \times 10^{-4}$ dm^3 = 0.0081 dm^3 = 8.1 cm^3	[4]	
	(b)		select the appropriate filter for the colorimeter use different concentrations of chlorine with orthotoluidine to produce a calibration curve match the colour of sample with the calibration curve	[4]	
			Quality of written communication	[2]	14
14	**(a)**		they have the same (molecular) formula but a different structure	[2]	
	(b)	**(i)**	trimethylamine cannot form H bonds/only van der Waals propylamine has H bonds between the amino groups	[1] [1]	
		(ii)	use GLC/TLC/paper chromatography remove the amines at different retention times	[2]	
	(c)	**(i)**	$CH_3CH_2CH_2Cl + NH_3 \rightarrow CH_3CH_2CH_2NH_3^+Cl^-$	[2]	
		(ii)	Add sodium hydroxide solution	[1]	
	(d)		primary: propylamine and isopropylamine + explanation secondary: ethylmethylamine + explanation tertiary: trimethylamine + explanation	[3]	
	(e)		2-aminopropane	[2]	
	(f)		$C_3H_7^+ = 43$ either $CH_3CH_2CH_2^+$ or $(CH_3)_2CH^+$ propylamine or isopropylamine	[2]	
	(g)	**(i)**	tetramethylsilane	[1]	
		(ii)	four methyl groups/hydrogens/protons all in the same chemical environment	[2]	
		(iii)	integration curve is the ratio of hydrogen atoms nitrogen is the lowest peak only one hydrogen	[1] [1]	
		(iv)	D triplet due to CH_3 next to CH_2 B quartet due to CH_2 next to CH_3	[1] [1]	
		(v)	ethylmethylamine	[1]	
		(vi)	compare the spectrum with those of the amines the identical ones confirm which amine	[1] [1]	26

					AVAILABLE MARKS
15	**(a)**		the oxidation number of S in thiosulfate is +2 [1] in sulphite it is +4 [1]	[2]	
	(b)	**(i)**	iron(III)	[1]	
		(ii)	(blood) red	[1]	
		(iii)	$[Fe(H_2O)_6]^{3+} + SCN^- \rightarrow [Fe(SCN)(H_2O)_5]^{2+} + H_2O$	[2]	
	(c)	**(i)**	rhodanase takes part in the reaction in step 1 rhodanase reformed in step 2	[1] [1]	
		(ii)	biological catalyst	[1]	
		(iii)	the structure of the protein is denatured/changed/H bonds broken active site destroyed	[1] [1]	
		(iv)	$2CH_2SHCH(NH_2)COOH + Na_2CO_3 \rightarrow 2CH_2SHCH(NH_2)COONa + CO_2 + H_2O$	[2]	
			$CH_2SHCH(NH_2)COOH + HNO_2 \rightarrow CH_2SHCHOHCOOH + N_2 + H_2O$	[2]	
		(v)	disulfide bridge holding chains together	[1] [1]	
	(d)	**(i)**	ligands	[1]	
		(ii)	octahedral diagram [1] the cyanide ion is small [1]	[2]	
		(iii)	$1+/Ag^+$	[1]	
		(iv)	the thiocyanate ion can attach itself to the central metal atom/ion by either the sulfur atom or the nitrogen atom	[1] [1]	23
			Section B		**100**
			Total		**120**