Rewarding Learning

ADVANCED
General Certificate of Education
2018

Chemistry

Assessment Unit A2 2

assessing

Analytical, Transition Metals, Electrochemistry and Further Organic Chemistry

[AC222]

TUESDAY 12 JUNE, AFTERNOON

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	D	
2	A	
3	C	
4	A	
5	B	
6	C	
7	B	
8	B	
9	D	
10	A	
	[20]	20
	Section A	**20**

Section B

AVAILABLE MARKS

11 (a) (i) a spectrum which does not show the splitting pattern [1]

(ii) they are in the same chemical environment [1]

(iii) the position of the resonant frequency or peak absorption in the nmr spectrum [1]

(iv) **(**the ratio of) the areas underneath the peaks [1]
which gives the ratio of the hydrogen atoms/protons [1] [2]

(v) the number of peaks produced in a signal/splitting pattern [1]
where n is the number of hydrogen atoms/protons on the next carbon atom [1] [2]

(b) solvent, e.g. tetrachloromethane [1]
baseline/standard ie tetramethylsilane/TMS [1]
method, e.g. add a few drops to the solution of the compound [1] 10

12 (a) 4-amino-3-phenylbutanoic acid [2]

(b) because it is not an alpha amino acid [1]

(c) it exists as a zwitterion/positive and negative ions [1]
attraction between the charges or molecules is (very) strong [1]

(d) (i) $NH_2CH_2CH(C_6H_5)CH_2COOH + HNO_2 \rightarrow$
$HOCH_2CH(C_6H_5)CH_2COOH + N_2 + H_2O$ [2]

(ii) $NH_2CH_2CH(C_6H_5)CH_2COOH + CH_3OH \rightarrow$
$NH_2CH_2CH(C_6H_5)CH_2COOCH_3 + H_2O$ [2]

(iii) $NH_2CH_2CH(C_6H_5)CH_2COOH + NaHCO_3 \rightarrow$
$NH_2CH_2CH(C_6H_5)CH_2COONa + CO_2 + H_2O$ [2]

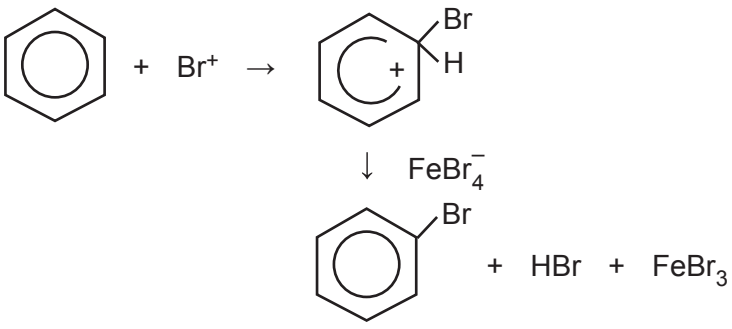
(iv) $NH_2CH_2CH(C_6H_5)CH_2COOH + CH_3COCl \rightarrow$
$CH_3CONHCH_2CH(C_6H_5)CH_2COOH + HCl$ [2]

(e) (i) rotates the plane of plane polarised light [2]

(ii) four different groups [1]
attached to the carbon atom (attached to the benzene ring) [1]

(iii) it has a structure that fits into a (receptor) site/it is the key [1]
like a lock and key mechanism [1]

(f) (i) add (hydrochloric) acid to the solution [1]
boil down the solution until solid/ extract the solid/salt out [1]
find a suitable solvent i.e. soluble when hot but “not” when cold [1]
dissolve in minimum amount [1]
of hot solvent allow to cool and filter/crystallise [1]
QwC [2]

					AVAILABLE MARKS
		(ii)	spot the pure and impure samples on a TLC plate	[1]	
			run in a polar solvent/find a suitable solvent	[1]	
			run to near the top of the plate	[1]	
			compare the number of spots	[1]	
		(iii)	no [1], same R_f value [1]	[2]	32
13	**(a)**	**(i)**	eriochrome black T	[1]	
			adjust to pH 10	[1]	
			from red/pink	[1]	
			to blue	[1]	
		(ii)	0.4505 g of calcium carbonate = 0.4505/100 = 4.505×10^{-3} mol in 250 cm^3 or 0.01802 mol dm^{-3} they react in the ratio 1:1, moles of edta = $0.01802 \times 25/24{,}25 = 0.0186$ mol dm^{-3}	[3]	
		(iii)	tetradentate	[1]	
	(b)	**(i)**	the complex dissolves in the butan-1-ol	[1]	
		(ii)	the green (etc.) (part of the spectrum) is absorbed by the complex	[1]	
			and red/pink light is transmitted/hence greater sensitivity with green light	[1]	
		(iii)	it is a blank/measures zero absorption/a comparison	[1]	
		(iv)	use solutions of specific concentrations of calcium complex	[1]	
			measure the absorption of the solutions (in the colorimeter)	[1]	
			plot graph of concentration v absorption	[1]	15
14	**(a)**		relative stability of benzene (with delocalised electrons)	[1]	
			the pi electron systems of alkenes more readily available/not delocalised	[1]	
	(b)		$FeBr_3 + Br_2 \rightarrow Br^+ \ FeBr_4^-$		
					
				[4]	
	(c)	**(i)**	N(+5) goes to N(+4)	[1]	
			I(0) goes to I(+1)	[1]	
			+5 to +4 is reduction and 0 to +1 is oxidation	[1]	
		(ii)	I^+	[1]	
			ion or molecule which attacks regions of high electron density	[2]	
		(iii)	it is not reformed/it is used up in the reaction	[1]	

(d) (i) concentrated nitric acid is very corrosive/reacts with skin
or
nitrogen dioxide is poisonous [1]

(ii) dissolve phenylamine in (dilute) hydrochloric acid [1]
below 10 °C [1]
add sodium nitrite [1]

(iii) the higher temperature provides the energy [1]
to overcome the activation energy for decomposition [1]

(iv) potassium iodide (solution) [1]

(v) $C_6H_5N_2Cl + KI \rightarrow C_6H_5I + N_2 + KCl$ [2]

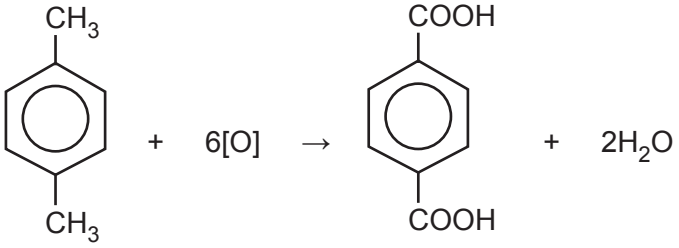
(e) (i) chlorobenzene [1]
chlorine has the greatest electronegativity [1]

(ii) it has the greatest mass [1]
the van der Waals forces are greater (than the polar forces)
(of the other molecules) [1]

26

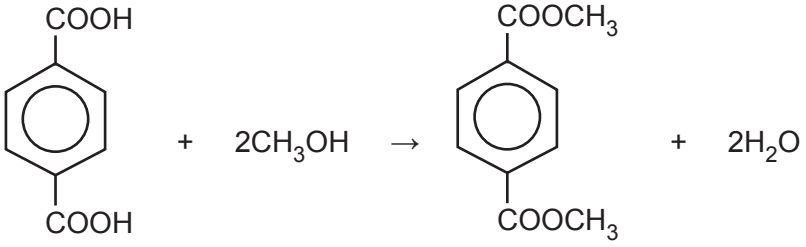
15 (a) B forms inter-hydrogen bonding more easily than the others [1]

(b) (i)



[2]

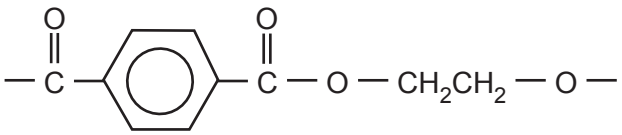
(ii)



[2]

(iii) the ester is more easily removed from the recycling [1]
because it is (more) volatile [1]

(c) (i)



[2]

(ii) nature: enzymes in bacteria/microorganisms (break the ester bond) [2]

industrially: acid/alkali with heat (break the ester bond to form
the reactants or the sodium salt) [2]

(iii) the molecules pack closely together (to give a crystalline structure) [1]
there are no side chains to keep the chains separated [1]
crystalline structure is regular/ordered [1]

	AVAILABLE MARKS
(d) cheaper to burn/not easily separated/not (easily) broken down **or** burning produces heat/electricity [1]	17
Section B	**100**
Total	**120**