Rewarding Learning

ADVANCED
General Certificate of Education
2019

Chemistry

Assessment Unit A2 2

assessing

Analytical, Transition Metals, Electrochemistry and Further Organic Chemistry

[ACH22]

TUESDAY 11 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. The document 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.

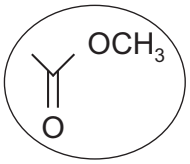
Section A

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

Section B

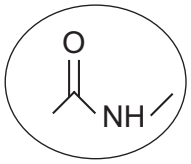
AVAILABLE MARKS

11 **(a)** **(i)** circle the ester group



[1]

(ii) circle the peptide link



[1]

(b) amine group and carboxylic acid group [1]

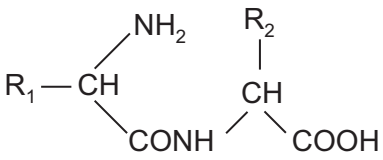
attached to the same/first carbon atom [1] [2]
(second mark dependent on first)

(c) contains a carbon atom attached to 4 different groups/chiral centre [1]

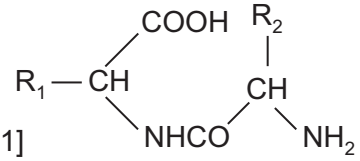
(d) aspartic acid has two –COOH and one basic [1]

phenylalanine has one basic and one acidic [1] [2]

(e)



[1]



[1] [2]

(f) a named strong acid, e.g. (dilute) sulfuric acid or (dil/conc) hydrochloric acid
a named strong base, e.g. (dilute/conc) sodium/potassium hydroxide [1]

(g) indicative content

- spot onto TLC sheet the mixture (of products and spot onto TLC sheet samples of phenylalanine and aspartic acid)
- use appropriate solvent, e.g. ethanol
- place in "sealed" beaker
- run until near end of TLC sheet
- place under UV/place in iodine/ninhydrin
- methanol evaporates/ethanol and methanol are miscible
- comparison, e.g. of spots or Rf values

Band	Response	Mark
A	Candidates must use appropriate specialist terms using a minimum of 6 points of indicative content. They must use good spelling, punctuation and grammar and the form and style are of an excellent standard.	[5]–[6]
B	Candidates must use appropriate specialist terms using a minimum of 4 points of indicative content. They must use satisfactory spelling, punctuation and grammar and the form and style are of a good standard.	[3]–[4]
C	Candidates must use appropriate specialist terms using a minimum of 2 points of indicative content. They use limited correct spelling, punctuation and grammar and the form and style are of a basic standard.	[1]–[2]
D	Response not worthy of credit	[0]

[6]

(h) baking occurs at a high temperature, soft drinks are at room temperature
Or have a pH in range 2.5–4.0. Soft drinks are acidic [2]

(i) the aspartame molecule (specifically) fits into [1]
the binding site of the taste receptor [1] [2]

20

					AVAILABLE MARKS
12	**(a)**	**(i)**	e.g. potassium chloride	[1]	
		(ii)	soak a strip of filter paper in a (saturated/concentrated) solution of potassium chloride	[1]	
		(iii)	to complete the circuit/conducts without introducing a metal [1] maintains the balance of anions and cations [1]	[2]	
	(b)	**(i)**	(+)0.23 V	[2]	
		(ii)	$Pt\|I^-(aq), I_2(aq)\|\|Fe^{3+}(aq), Fe^{2+}(aq)\|Pt$	[2]	
		(iii)	$2Fe^{3+} + 2I^- \rightarrow 2Fe^{2+} + I_2$	[1]	
		(iv)	electrons are produced in the iodine system and flow from left to right	[2]	
	(c)	**(i)**	react with aqueous NaOH/ammonia [1]		
			brown precipitate [1]	[2]	
		(ii)	react with aqueous NaOH/ammonia [1]		
			green precipitate [1]	[2]	
		(iii)	react with aqueous silver nitrate [1]		
			yellow precipitate [1]	[2]	
		(iv)	starch (solution) [1]		
			goes blue-black [1]	[2]	19
13	**(a)**	**(i)**	have the same formula [1]		
			position of the functional group/double bond in the isomers is different [1]	[2]	
		(ii)	$CH_3(CH_2)_7COOH$ [1]		
			$HOOC(CH_2)_7COOH$ [1]	[2]	
	(b)	**(i)**	petroselinic acid has hydrogen bonds between molecules [1] which are stronger than intermolecular forces [1]	[2]	
			removal of –COOH/H bond answer/van der Waals forces lower than H-bond [1]		
		(ii)	the ester is more volatile and passes through the GLC faster	[1]	
		(iii)	add the areas under the peaks/signal [1]		
			divide the area under the petroselinic acid peak by the total × 100 [1]	[2]	

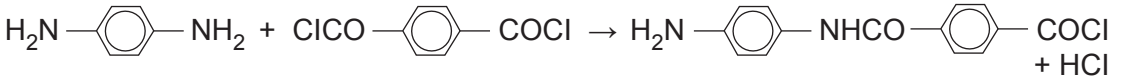
AVAILABLE MARKS

(c) **(i)** $(HOOC(CH_2)_4COOH + NH_2(CH_2)_6NH_2 \rightarrow)$
$-OC(CH_2)_4CONH(CH_2)_6NH-$ [2]

(ii) Polymers formed by the elimination of small molecules such as water or hydrogen chloride when monomers join together [1]

(iii) peptides formed from amino acids [1]

(iv)



[3]

(v) both contain an amide group [1]/which is hydrolysed by microorganisms [1] [2]

(d) **Indicative content**

- primary structure is the sequence of amino acids
- secondary structure is twisting/coiling of the chain into a helix/or β-pleated sheets using hydrogen bonds
- tertiary structure is the bending/folding of the secondary structure using disulfide bridges and one other interaction
- enzymes lose their activity at (low) or high temperature
- enzymes lose their activity at low or high pH
- enzyme structure is denatured

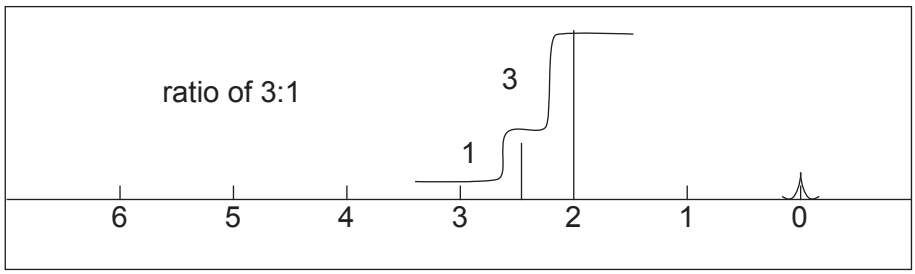
Band	Response	Mark
A	Candidates must use appropriate specialist terms using a minimum of 5 points of indicative content. They must use good spelling, punctuation and grammar and the form and style are of an excellent standard.	[5]–[6]
B	Candidates must use appropriate specialist terms using a minimum of 3 points of indicative content. They must use satisfactory spelling, punctuation and grammar and the form and style are of a good standard.	[3]–[4]
C	Candidates must use appropriate specialist terms using a minimum of 1 point of indicative content. They use limited correct spelling, punctuation and grammar and the form and style are of a basic standard.	[1]–[2]
D	Response not worthy of credit	[0]

[6]

24

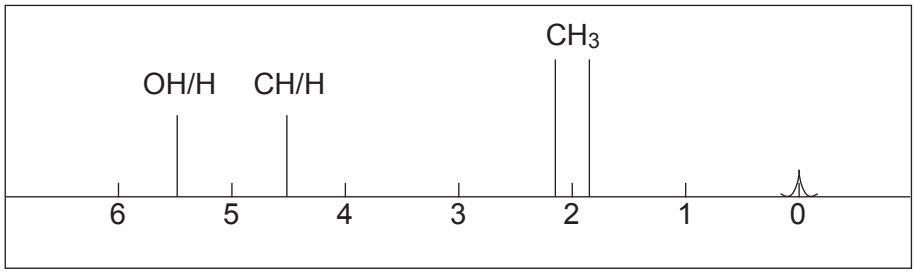
AVAILABLE MARKS

14 (a) (i)



chemical shift [2]

(ii)



chemical shift [2]

(b) Any **two** from:
peak in spectrum which fits with range 3200–3600 cm^{-1} for alcohols [1]
peak at 1610 in spectrum which fits with range 1600–1700 for alkenes [1]
peak at 1750 in spectrum which fits with range 1650–1800 for ketones [1]
(2 × [1]) [2]

(c) (i) wrap in paper/keep in dark [1]

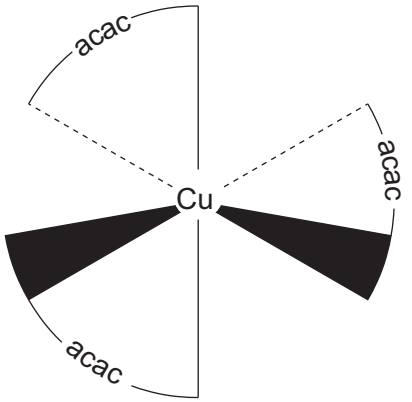
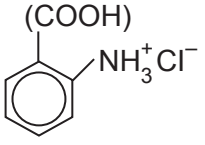
(ii) the orange/yellow/brown colour of bromine remains [1]

(iii) 25 cm^3 of 0.008 M pentane-2,4-dione
contains $25 \times 10^{-3} \times 8 \times 10^{-3} = 2 \times 10^{-4}$ mol

4.6 cm^3 of 0.002 M bromine solution
contains $4.6 \times 10^{-3} \times 2 \times 10^{-3} = 9.2 \times 10^{-6}$ mol

% of double bonds in
pentane-2,4-dione = $9.2 \times 10^{-6} / 2 \times 10^{-4} = 4.6 \times 10^{-2} \times 100$

$= 4.6\% = 5\%$ [4]

				AVAILABLE MARKS
(d)	**(i)**	two	[1]	
	(ii)		[2]	
	(iii)	(one) edta reacts to produce three molecules of acac [1] increase in entropy [1]	[2]	
(e)		measure the melting point of the product; if it is 107–8 °C it must be pentane-2,4-dione	[1]	18
15	**(a)**	sodium nitrite and (dil/conc) hydrochloric acid [1] temperature 0–10 °C/in ice [1]	[2]	
	(b)	**(i)** highly delocalised electrons in molecule [1] gives closer proximity of electronic energy levels [1] electrons more easily promoted (to higher levels) [1] a colour is removed from the light [1]	[4]	
		(ii) the structure of the double bonds/the delocalisation is different in the molecules [1] different proximity of energy levels/more easily promoted in one molecule, etc. [1]	[2]	
	(c)	sodium salt is ionic or can form bonds with water [1] methyl red does not have groups to increase solubility except –COOH [1]	[2]	
	(d)	**(i)** conc/concentrated sulfuric acid/H_2SO_4/H_2SO_4(l) [1] conc/concentrated nitric acid/HNO_3/HNO_3(l) [1]	[2]	
		(ii) purple to colourless	[2]	
	(e)	**(i)** $Sn + 2HCl \rightarrow SnCl_2 + H_2$	[2]	
		(ii)  [1] the NaOH reacts with $–NH_3^+Cl^-$ to give $–NH_2$ + NaCl [1] the NaOH reacts with –COOH to give $–CO_2Na$ [1]	[3]	19
			Section B	**100**
			Total	**110**