Rewarding Learning

ADVANCED
General Certificate of Education
2024

Life and Health Sciences

Assessment Unit A2 2

assessing

Organic Chemistry

[AZ021]

WEDNESDAY 5 JUNE, AFTERNOON

MARK SCHEME

Foreword

Introduction

Mark Schemes are published to assist teachers and students in the 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 16–18-year-old 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 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 a part of an integral process which begins with the setting of questions and ends with the marking of the examination.

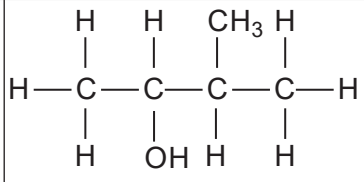
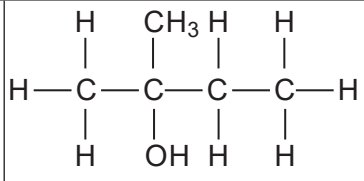
The main purpose of the mark scheme is to provide a uniform basis for the marking process so that all markers are following exactly the same instructions and making the same judgements in so far as this is possible. Before marking begins a standardising meeting is held where all the markers are briefed 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.

The Council hopes that the mark schemes will be viewed and used in a constructive way as a further support to the teaching and learning processes.

1 **(a)** (Structural) isomers [1]

(b)

Alcohol	IUPAC name	Structural formula	Classification
A	**Pentan-1-ol** [1]		**Primary** [1]
B		 [1]	**Secondary** [1]
C	**2-methylbutan-2-ol** [1]	 [1]	

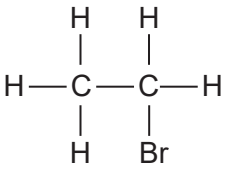
[6]

(c) L: O-H [1]
M: C-H [1]
N: C-O [1] [3]

10

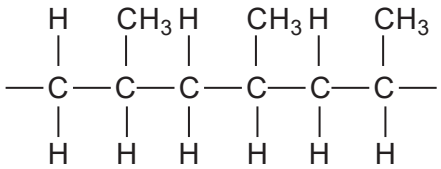
2 **(a)** **(i)** C_nH_{2n} [1]

(ii) pi bond/π bond [1]

(b) **(i)**  [1]

IUPAC name: bromoethane [1] [2]

(ii) electrophilic [1] addition [1] [2]

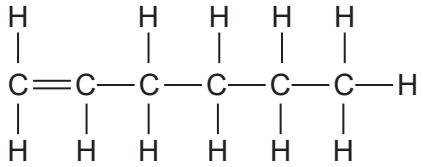
(c) **(i)** 

C — C back bone [1]
Correct side groups [1] [2]

(ii) Removing/neutralising polluting/acidic gases from incineration [1]
Developing biodegradable polymers/biopolymers [1] [2]

AVAILABLE MARKS

(d) **(i)** hydration [1]

(ii)  [1]

(iii) Catalyst: concentrated [1] phosphoric acid [1]
IUPAC name: hexan-2-ol/ hexan-1-ol [1] [3]

AVAILABLE MARKS

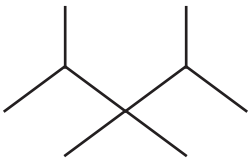
15

3 **(a)** **(i)** Contains **only** single bonds / does **not** contain any C═C **or** C≡C [1]

(ii) Cracking [1]

(iii) C_4H_8: butene [1]
C_6H_{14}: hexane [1] [2]

(iv) Reforming [1]

(v)  [1]

(vi) Reagent **X**: hydrogen *allow* H_2 [1]
Catalyst: Nickel [1] [2]

(vii) Homologous series: alkane [1]
Explanation: (General formula) C_nH_{2n+2} [1] [2]

(viii) add bromine water [1]
shake/idea of mixing [1]
(bromine water) decolourised by C_5H_{10}/
orange to colourless with C_5H_{10} [1] [3]

(b) **(i)** Fractional distillation [1]

(ii) $C_8H_{18} + 12.5O_2 \longrightarrow 8CO_2 + 9H_2O$/
$2C_8H_{18} + 25O_2 \longrightarrow 16CO_2 + 18H_2O$
Formulae [1] Balancing [1]
Balancing dependent on all formula correct [2]

(iii) carbon monoxide/CO [1]
Soot/carbon/C [1] [2]

(c) Indicative content

Alternative fuels made from plants

- Alcohol
- Biodiesel

Why alternative fuels made from plants are renewable

- Can be replaced as it is used

Compare and contrast use of alternative fuels made from plants and traditional fossil fuels

- Fossil fuels are cheaper/alternative fuels are more expensive
- Fossil fuels are more readily available/alternative fuels are less available
- Alternative fuels are (close to) carbon neutral
- Fossil fuels cause global warming/acid rain/smog/named effect

Level of response	Marking Criteria	Marks
Excellent	Candidate clearly articulates the details of the two industrial processes. There is excellent use of spelling, punctuation and grammar. Form and style are of an excellent standard using **more than 4** indicative points.	[5]–[6]
Good	Candidate provides a good description of the two industrial processes. There is good use of spelling, punctuation and grammar. Form and style are of a good standard using **3–4** indicative points.	[3]–[4]
Basic	Candidate provides a limited description of the industrial process. There is limited use of spelling, punctuation and grammar. Form and style are of basic standard. **1–2** indicative points used.	[1]–[2]
	This response is not worthy of credit	[0]

[6]

AVAILABLE MARKS

24

4 (a) (i) Compound **P**: Propanone [1]
Compound **Q**: Propanal [1] [2]

(ii) In **P** blue (solution) remains [1]
In **Q** forms/changes to a red [1] precipitate [1]
(if observations are **all** correct but for the wrong compounds award [1]) [3]

(b) (i) $C_nH_{2n+1}OH/C_nH_{2n+2}O$ [1]

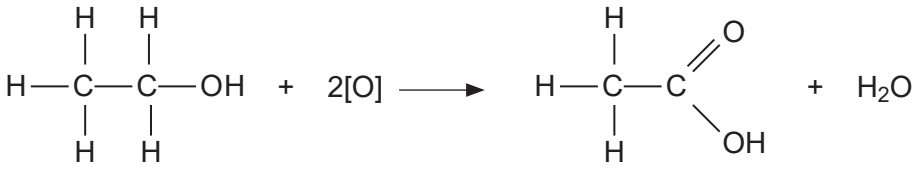
(ii) hydroxyl [1]

(iii) $C_2H_5OH \longrightarrow C_2H_4 + H_2O$ [1]
IUPAC name: ethene [1] [2]

(c) **(i)** (A reaction in which) oxygen is gained (or hydrogen is lost) [1]

(ii) add acidified [1] potassium dichromate(VI) [1]
heat (in a water bath) [1] [3]

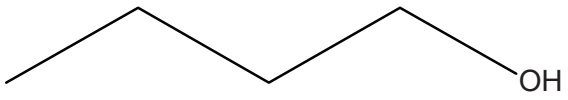
(iii)



Structures correct [1] Balancing [1] [2]

(d) **(i)** Aldehyde [1]

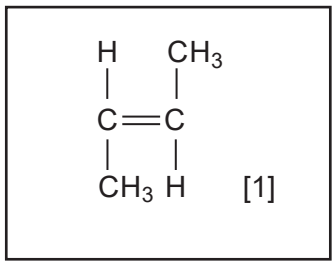
(ii)



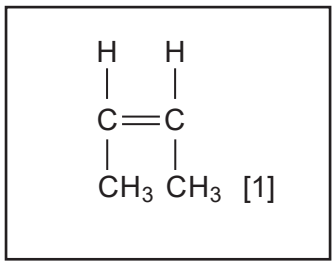
[1]

(e) **(i)** But-2-ene [1]

(ii)



E



Z

(Both structures correct but in wrong box award [1]) [2]

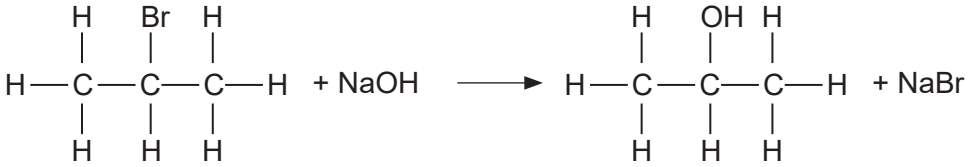
20

5 **(a)** **(i)** Fermentation [1]

(ii) warm/25–35°C [1]
yeast [1]
anaerobic/air kept out [1] [3]

(b) **(i)** repeated boiling and condensing (of a reaction mixture) [1]

(ii)



LHS correct [1] RHS correct [1] [2]

(iii) distillation [1]

AVAILABLE MARKS

					AVAILABLE MARKS
	(c)	**(i)**	$CH_4 + Cl_2 \longrightarrow CH_3Cl + HCl$	[1]	
		(ii)	Breaking up molecules by reaction with water	[1]	10
6	**(a)**	**(i)**	Reactant **A**: 2-hydroxybenzoic acid/salicylic acid [1] Product **B**: ethanoic acid/acetic acid [1]	[2]	
		(ii)	8.87 Moles of **A**: 6.80/138 = 0.0493 [1] Mass of aspirin: 0.0493 × 180 = 8.87g [1] *allow ECF* *2nd mark dependent on answer being to 3 significant figures*.	[2]	
		(iii)	5.96/9.60 × 100 = 62.1%	[1]	
		(iv)	side reactions reaction doesn't go to completion impurities in reactants product lost at separation/purification Any 2	[2]	
	(b)	**(i)**	recrystallisation	[1]	
		(ii)	minimum volume [1] of hot solvent [1]	[2]	
		(iii)	to reform crystals	[1]	
		(iv)	vacuum/suction filtration (using buchner funnel) [1] Rinsed with (ice) cold solvent/impurities are in filtrate [1]	[2]	
		(v)	melting point	[1]	
	(c)	**(i)**	Fragment X: 109 [1] Fragment Y: 80 [1]	[2]	
		(ii)	$C_8H_9NO_2$ Moles of carbon: 63.58/12 = 5.30 [1] Moles of hydrogen: 5.96/1 = 5.96 [1] Moles of nitrogen: 9.27/14 = 0.66 [1] Moles of oxygen: 21.19/16 = 1.32 [1] Correct formula [1]	[5]	21
				Total	**100**