



Rewarding Learning

**ADVANCED
General Certificate of Education
2019**

Life and Health Sciences

Assessment Unit A2 2

assessing

Organic Chemistry

[AZ021]

TUESDAY 28 MAY, 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.

			AVAILABLE MARKS	
1	(a)	(i) orange/yellow [1] to colourless [1]	[2]	17
		(ii) 1,2-dibromoethane	[2]	
		(iii) steam	[1]	
	(b)	(i) arrow from one of the bonds of C=C to H of H—Br [1] arrow from bond of H—Br to Br [1]	[2]	
		(ii) carbocation/carbonium ion	[1]	
		(iii) arrow from lone pair of Br ⁻ to C ⁺	[1]	
		(iv) bromoethane	[1]	
		(v) electrophilic [1] addition [1]	[2]	
		(vi) C ₂ H ₄ + HBr → C ₂ H ₅ Br	[1]	
	(c)	(i) CH ₃ F = fluoromethane CH ₂ F ₂ = difluoromethane	[1]	
		(ii) substitution	[1]	
		(iii) CH ₄ + 4F ₂ → CF ₄ + 4HF correct formula of reactants and products [1] correct balancing [1]	[2]	

2 (a) (i)

AVAILABLE
MARKS

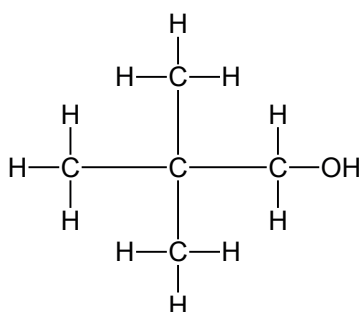
Alcohol	Alcohol IUPAC name	Structural formula	Classification
A	pentan-1-ol [1]	$ \begin{array}{cccccc} & \text{H} & \text{H} & \text{H} & \text{H} & \text{H} \\ & & & & & \\ \text{H} & -\text{C} & -\text{C} & -\text{C} & -\text{C} & -\text{C}-\text{OH} \\ & & & & & \\ & \text{H} & \text{H} & \text{H} & \text{H} & \text{H} \end{array} $	P
B	pentan-2-ol	$ \begin{array}{cccccc} & \text{H} & \text{H} & \text{H} & \text{H} & \text{H} \\ & & & & & \\ \text{H} & -\text{C} & -\text{C} & -\text{C} & -\text{C} & -\text{C}-\text{H} \\ & & & & & \\ & \text{H} & \text{H} & \text{H} & \text{OH} & \text{H} \end{array} $ [1]	S [1]
C	2-methylbutan-1-ol [1]	$ \begin{array}{cccccc} & \text{H} & \text{H} & \text{CH}_3 & \text{H} & \\ & & & & & \\ \text{H} & -\text{C} & -\text{C} & -\text{C} & -\text{C}-\text{OH} \\ & & & & & \\ & \text{H} & \text{H} & \text{H} & \text{H} & \end{array} $	P
D	2-methylbutan-2-ol [1]	$ \begin{array}{cccccc} & \text{H} & \text{CH}_3 & \text{H} & \text{H} & \\ & & & & & \\ \text{H} & -\text{C} & -\text{C} & -\text{C} & -\text{C}-\text{H} \\ & & & & & \\ & \text{H} & \text{OH} & \text{H} & \text{H} & \end{array} $	T [1]

[6]

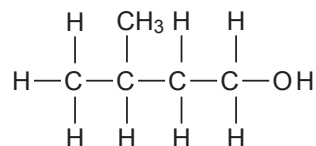
(ii) B

[1]

(iii)



or



(2,2-)dimethylpropan-1-ol

3-methylbutan-1-ol

[1] for structure

[1] for name

[2]

(b) (i) elimination/dehydration

[1]

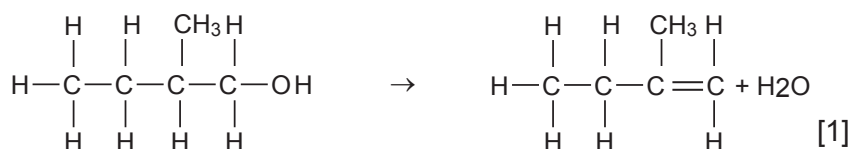
(ii) pent-1-ene

[1]

(iii) concentrated [1] phosphoric acid [1]

[2]

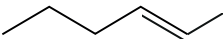
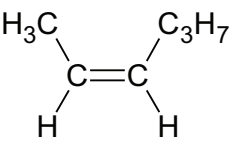
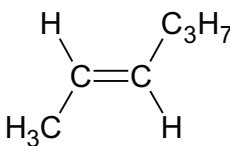
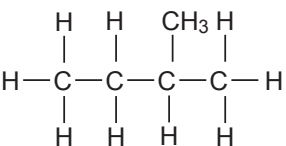
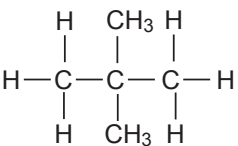
(iv)



2-methylbut-1-ene [1]

[2]

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- 3 (a) (i) A = fractional distillation [1]
 B = cracking [1]
 C = reforming [1] [3]
- (ii) contains at least one C=C (or C≡C) [1]
- (iii) contains **only** carbon and hydrogen (atoms) [1]
- (b) (i) pentane, octane, propane **all three required** [1]
- (ii)  [1]
- (iii)  [1]  [1]
- cis labels [1] [3]
- trans labels [1] [3]
- (iv) catalyst: nickel [1]
 product: hexane [1] [2]
- (v)  **or**  [1] for structure
 2-methylbutane (2,2)-dimethylpropane [1] for name [2]
- (vi) $C_5H_{12} + 8O_2 \rightarrow 5CO_2 + 6H_2O$
 correct formula of reactants and products [1]
 correct balancing [1] [2]
- (c) (i) empirical formula = formula which shows the simplest ratio of the atoms (of each element) in a compound [1]
 molecular formula = formula which shows the actual number of atoms of each element in a compound [1] [2]
- (ii) moles of carbon = $\frac{0.96}{12} = 0.08$ [1] mol
 mass of hydrogen = $1.16 - 0.96 = 0.2$ g [1]
 moles of hydrogen = $\frac{0.2}{1} = 0.2$
 simplest ratio = 2:5 or empirical formula = C_2H_5 [1] [3]
- (iii) mass of empirical formula = 29 [1]
 $58/29 = 2 \times C_2H_5 = C_4H_{10}$ [1] [2]
- (iv) alkanes [1]
 follows the general formula C_nH_{2n+2} [1] [2]

- 4 (a) long chain molecule [1]
made up of repeating units [1] [2]
- (b) (i)
$$\begin{array}{cc} \text{Cl} & \text{H} \\ | & | \\ \text{C} & = & \text{C} \\ | & | \\ \text{H} & \text{H} \end{array}$$
 [1]
- (ii) addition [1]
- (iii) incineration [1]
heat released can be harnessed for energy (qualified) [1] [2]
- (c) (i) condensation [1]
- (ii) 6 carbon atoms [1] in both monomers/named monomers [1] [2]
- (iii) hydrolysis [1]

AVAILABLE
MARKS

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5 (a) **Indicative content:**

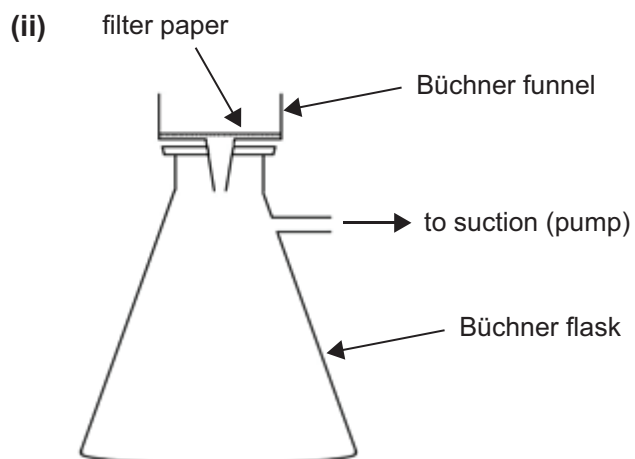
- sugar/source of sugar [1]
- in solution/water/juice [1]
- yeast [1]
- anaerobic conditions [1]
- warm [1]
- carbon dioxide produced [1]

Level of Response	Marking Criteria	Marks
Excellent	Candidates provide an excellent description of fermentation containing at least five indicative content points. They use excellent spelling, punctuation and grammar and the form and style are of an excellent standard.	[5]–[6]
Good	Candidates provide a good description of fermentation containing at least three indicative content points. They use good spelling, punctuation and grammar and the form and style are of a good standard.	[3]–[4]
Basic	Candidates provide a limited description of fermentation containing at least one indicative content point. They use some good spelling, punctuation and grammar and the form and style are of a basic standard.	[1]–[2]
The response is not worthy of credit		[0]

[6]

- (b) (i) $C_9H_8O_4$ [1]
- (ii) 180 [1]
- (iii) $\frac{2.25}{180} = 0.0125 \text{ mol}$ [1]
- (iv) 0.0125 mol [1]
- (v) $\frac{0.0125}{0.024} \times 100 [1] = 52.1 [1]$ [2]
- (vi) not enough salicylic acid/ethanoic anhydride in excess [1]

- (c) (i) more aspirin dissolves when hot/
 minimum volume to ensure more recrystallises when cool [1] [1]



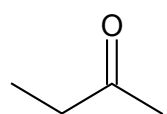
Büchner funnel [1]
 filter paper in the funnel [1]
 sealed connection to a side-arm flask/Büchner flask/vacuum flask [1]
 suction applied to side-arm [1] [4]

- (iii) faster [1]
 drier product [1] [2]

- (iv) lower melting point [1]
 melts over a range [1] [2]

AVAILABLE
 MARKS

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6	(a) (i) acidified potassium/sodium dichromate(VI) [1] orange [1] to green [1]	[3]	AVAILABLE MARKS
	(ii) B = propanal [1] D = butanone [1] F = ethanoic acid [1]	[3]	
	(iii) 	[1]	
	(b) E [1] rfm/highest mass peak is 46 [1]	[2]	
	(c) F [1] OH present and C=O present [1]	[2]	11
	Total		100