



Rewarding Learning

ADVANCED
General Certificate of Education
2025

Life and Health Sciences

Assessment Unit A2 2

assessing

Organic Chemistry

[AZ021]

FRIDAY 6 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.

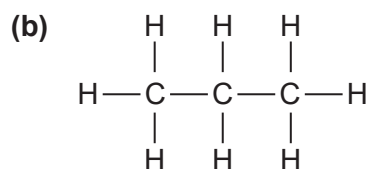
The questions and mark schemes are developed in association with each other so that the issues of differentiation and positive achievement can be addressed right from the start. Mark schemes therefore are regarded as a part of an integral process which begins with the setting of questions and ends with 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.

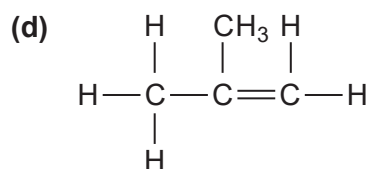
The Council hopes that the mark schemes will be viewed and used in a constructive way as a further support to the teaching and learning processes.

1 (a) but-1-ene, ethene, propene (all required) [1]



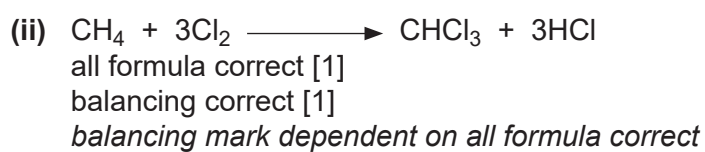
[1]

(c) C_3H_6 [1]



[1]

(e) (i) (free radical) substitution [1]



(f) hydrocarbon molecule has been rearranged [1]
there is loss of a small molecule / hydrogen [1] [2]

(g) (i) C_4H_8 [1]

(ii) alkane [1]
general formula $\text{C}_n\text{H}_{2n+2}$ [1] [2]

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2 (a) (i) C_3H_7 [1]

(ii) $C_6H_{14} + 9.5O_2 \longrightarrow 6CO_2 + 7H_2O$
all formula correct [1]
balancing correct [1]
balancing mark dependent on all formula correct [2]

(iii) carry out reaction in limited supply of oxygen [1]

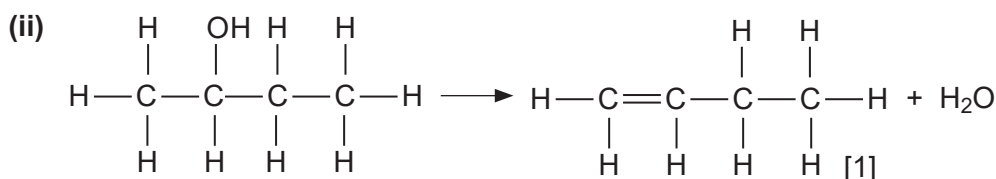
(b) (i) add / use bromine water [1]
shake / mix [1] *dependent on correct reagent*
orange / yellow (solution) [1] turns colourless [1] [4]

(ii) (Compound B) contains a pi bond [1]
pi bond has a high electron density /
is open to attack by electrophiles [1] [2]

(c) (i) hydrogenation / addition [1]
Nickel / Ni [1] [2]

(ii) $C_5H_{10} + H_2 \longrightarrow C_5H_{12}$ [1]
Pentane [1] [2]

(d) (i) concentrated phosphoric acid [1]



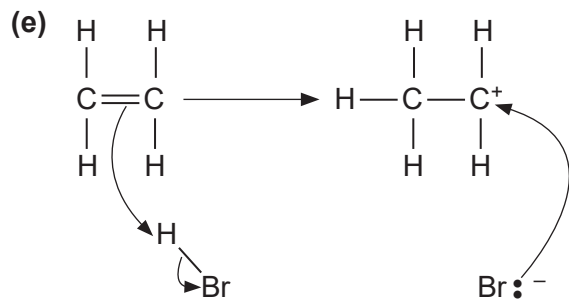
(Allow condensed structural formula)
But-1-ene [1] [2]

(iii)

Geometric isomer form of compound Y	Structural formula
E	$\begin{array}{ccc} H & CH_3 & \\ & & \\ C & =C & \\ & & \\ CH_3 & H & \end{array} [1]$
Z	$\begin{array}{ccc} CH_3 & CH_3 & \\ & & \\ C & =C & \\ & & \\ H & H & \end{array} [1]$

[2]

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structural formula for ethene [1]

curly mechanism arrow from C=C bond to H of H-Br [1]

curly mechanism arrow from H-Br bond to Br [1]

structural formula for carbocation [1]

curly mechanism arrow from lone pair of electrons on Br :⁻ to C⁺ [1] [5]

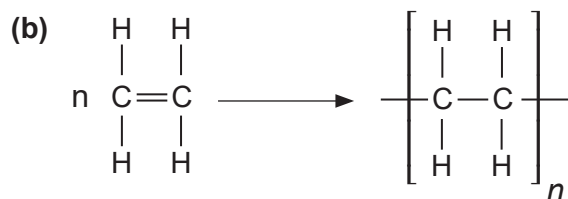
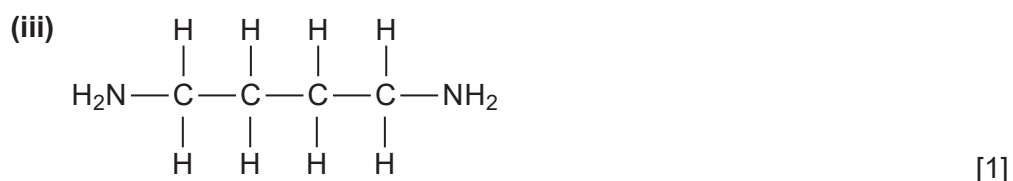
- (f) (i) same molecular formula [1]
 different structural formula [1] [2]
- (ii) butanone / allow butan-2-one [1]
- (iii) add Benedict's / Fehling's (solution) [1]
 warm / heat [1] *dependent on correct reagent*
 blue (solution) [1] turns to a red precipitate [1] [4]

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3 (a) (i) small molecules that join together to form a polymer [1]

(ii) condensation (polymerisation) [1]



LHS correct [1]

RHS correct [1]

[2]

(c) (i) recycling [1]
feedstock for cracking [1] [2]

(ii) A large molecule / polymer that can be hydrolysed by the action of microorganisms. [1]

(iii) removing / neutralising toxic / acidic waste gases [1]

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5 (a) (i) **Indicative content**

- place the salicylic acid and ethanoic anhydride in a beaker / conical flask / pear-shaped flask
- add (a few drops of) concentrated phosphoric acid
- swirl/stir to dissolve
- heat
- on a hot plate / water bath / reflux
- for 30 minutes
- add cold water
- cool (to crystallise)
- in an ice bath
- filter

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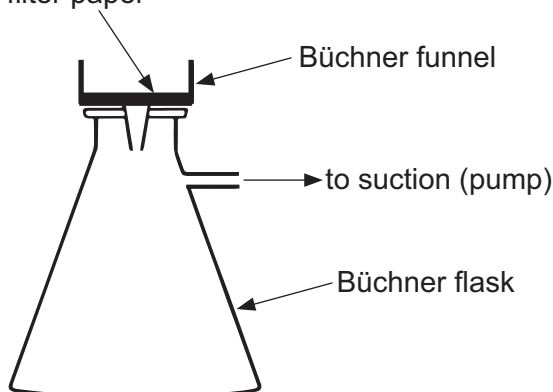
Level of response	Marking Criteria	Marks
Excellent	Candidate clearly articulates the details of the main steps in the laboratory preparation of an impure sample of aspirin. There is excellent use of spelling, punctuation and grammar. Form and style are of an excellent standard using 7 or more indicative points.	[5]–[6]
Good	Candidate provides a good description of the main steps in the laboratory preparation of an impure sample of aspirin. There is good use of spelling, punctuation and grammar. Form and style are of a good standard using 4-6 indicative points.	[3]–[4]
Basic	Candidate provides a limited description of the main steps in the laboratory preparation of an impure sample of aspirin. There is limited use of spelling, punctuation and grammar. Form and style are of basic standard. 1-3 indicative points used.	[1]–[2]
	This response is not worthy of credit	[0]

[6]

(ii) recrystallisation

[1]

(iii) filter paper



Büchner funnel [1]

filter paper [1]

sealed connection to Büchner flask [1]

suction applied to side-arm of Büchner flask [1]

[4]

- (b) (i) ferric chloride / iron(III) chloride [1]
(ii) aspirin sample is impure / it contains salicylic acid [1]
(iii) melting point analysis [1]
- (c) (i) moles of salicylic acid = 0.0221 [1]
moles of ethanoyl chloride = 0.0318 [1] [2]
(ii) moles of aspirin formed = 0.0221 [1] ecf
mass of aspirin formed = 0.0221 × 180 = 3.98g [1]
percentage yield = 3.10 ÷ 3.98 × 100 = 77.9% [1] [3]

AVAILABLE
MARKS

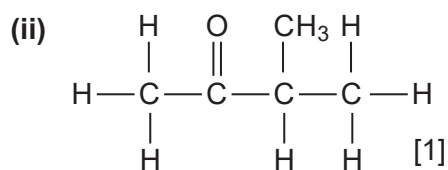
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- 6 (a) (i) moles of carbon = 62.069 ÷ 12 = 5.172 [1]
moles of hydrogen = 10.345 ÷ 1 = 10.345 [1]
moles of oxygen = 27.586 ÷ 16 = 1.724 [1]
divide each answer by 1.724 to give mole ratio 3 : 6 : 1 [1] [4]
- (ii) C₆H₁₂O₂
empirical Mr = 58 [1]
116 ÷ 58 = 2 therefore C₆H₁₂O₂ [1] [2]
- (iii) carboxylic acid [1]
absorbance at 3000 / presence of O-H carboxylic acid [1]
absorbance at 1800 / presence of C=O [1] [3]

(b) (i)

m/z value	Molecular formula
43	C ₂ H ₃ O ⁺
71	C₄H₇O⁺ [1]
86	C₅H₁₀O⁺ [1]

[2]



3-methylbutanone [1]
Allow methylbutanone

[2]

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Total

100