Pearson Edexcel

Additional Assessment Materials

Summer 2021

Pearson Edexcel GCE in Chemistry 8CH0

Resource Set 1 – Topic Group 3

Topics included:

Topic 6: Organic Chemistry I

Topic 7: Modern Analytical Techniques I

(Public release version)

Pearson: helping people progress, everywhere

Pearson aspires to be the world's leading learning company. Our aim is to help everyone progress in their lives through education. We believe in every kind of learning, for all kinds of people, wherever they are in the world. We've been involved in education for over 150 years, and by working across 70 countries, in 100 languages, we have built an international reputation for our commitment to high standards and raising achievement through innovation in education. Find out more about how we can help you and your students at: www.pearson.com/uk

Additional Assessment Materials, Summer 2021

All the material in this publication is copyright

© Pearson Education Ltd 2021

General guidance to Additional Assessment Materials for use in 2021

Context

- Additional Assessment Materials are being produced for GCSE, AS and A levels (with the exception of Art and Design).
- The Additional Assessment Materials presented in this booklet are an **optional** part of the range of evidence teachers may use when deciding on a candidate's grade.
- 2021 Additional Assessment Materials have been drawn from previous examination materials, namely past papers.
- Additional Assessment Materials have come from past papers both published (those materials available publicly) and unpublished (those currently under padlock to our centres) presented in a different format to allow teachers to adapt them for use with candidate.

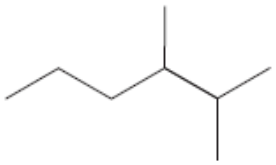
Purpose

- The purpose of this resource to provide qualification-specific sets/groups of questions covering the knowledge, skills and understanding relevant to this Pearson qualification.
- This document should be used in conjunction with the mapping guidance which will map content and/or skills covered within each set of questions.
- These materials are only intended to support the summer 2021 series.

Some questions must be answered with a cross in a box ☒.
If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

1 Alkanes are a homologous series of hydrocarbons.

(a) What is the name of this compound?



(1)

☒ **A** 1,1,2-trimethylpentane

☒ **B** 2,3-dimethylhexane

☒ **C** 4,5-dimethylhexane

☒ **D** 4,5,5-trimethylpentane

(b) The number of structural isomers with the molecular formula C_5H_{12} is

(1)

☒ **A** 3

☒ **B** 4

☒ **C** 5

☒ **D** 6

(c) Write the equation for reforming heptane into cycloheptane, showing the **skeletal** formulae of the organic molecules.

(2)

(d) Ethane reacts with chlorine in the presence of ultraviolet light to form a mixture of products.

(i) In the initiation step, chlorine molecules are converted into radicals.

$$Cl_2 \rightarrow 2Cl^{\bullet}$$

Identify the type of bond broken and the type of bond fission occurring in this step.

(1)

	Bond broken	Bond fission
☒ **A**	π	heterolytic
☒ **B**	σ	heterolytic
☒ **C**	π	homolytic
☒ **D**	σ	homolytic

(ii) Write the propagation steps to show the formation of C_2H_5Cl.

(2)

(iii) State how some butane, C_4H_{10}, is formed in the reaction.

(1)

.....

.....

(Total for Question 1 = 8 marks)

2 This question is about organic compounds.

(a) Organic compounds can be grouped together in homologous series.

(i) Describe **two** characteristics of a homologous series.

(2)

(ii) Name the homologous series to which propene belongs.

(1)

(b) Propene can be converted into a mixture of 1-chloropropane and 2-chloropropane, in which 2-chloropropane is the major product.

(i) Give the reagent required for this reaction.

(1)

(ii) What is the type and mechanism of the reaction in (b)(i)?

(1)

- ☐ **A** electrophilic addition
- ☐ **B** nucleophilic addition
- ☐ **C** electrophilic substitution
- ☐ **D** nucleophilic substitution

(c) 1-chloropropane and 2-chloropropane can be converted into compounds containing the nitrile functional group.

(i) Under appropriate conditions, 1-chloropropane can be converted into butanenitrile, $CH_3CH_2CH_2CN$.

Which is the reagent for this conversion?

(1)

☒ **A** ammonia

☒ **B** nitric acid

☒ **C** potassium cyanide

☒ **D** silver nitrate

(ii) Under appropriate conditions, 2-chloropropane can be converted into a structural isomer of butanenitrile.

State what is meant by the term 'structural isomer'.

(2)

.....

.....

.....

.....

(iii) Give the displayed formula **and** systematic name of the isomer of butanenitrile formed in (c)(ii). You must show **all** the bonds.

(2)

Displayed formula

Name

.....

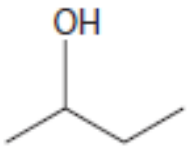
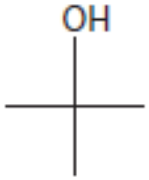
(Total for Question 2 = 10 marks)

2 This question is about alcohols and their reactions.

The table gives some of the names and skeletal formulae of isomers having the formula C_4H_9OH.

(a) Complete the table.

(2)

Name	Skeletal formula
	
butan-2-ol	
2-methylpropan-1-ol	
2-methylpropan-2-ol	

(b) (i) Some alcohols react with concentrated phosphoric acid to form alkenes.

What is the type of this reaction?

(1)

- ☐ **A** addition
- ☐ **B** elimination
- ☐ **C** oxidation
- ☐ **D** substitution

(ii) When butan-2-ol reacts with concentrated phosphoric acid, two stereoisomers are formed.

Explain what is meant by the term stereoisomers.

(2)

.....

.....

.....

.....

(iii) Draw the structures and give the names of the two stereoisomers.

(2)

Stereoisomer 1	Stereoisomer 2
Name:	Name:

(iv) Name this type of stereoisomerism.

(1)

.....

(c) 2-methylpropan-2-ol may be formed by the reaction between 2-bromo-2-methylpropane and aqueous potassium hydroxide.

What is the role of the hydroxide ions in this reaction?

(1)

☒ **A** alkali

☒ **B** catalyst

☒ **C** electrophile

☒ **D** nucleophile

(d) (i) $CH_3CH_2CH_2CH_2OH$ reacts with the oxidising agent potassium dichromate(VI) in dilute sulfuric acid.

Two organic products can be formed, depending on the conditions.

Write a balanced equation for the formation of **one** of these products, giving its name and the condition required to achieve this product in high yield.

Use **[O]** in the equation to represent each oxygen atom from the oxidising agent.

(3)

Equation

Name .....

Condition .....

(ii) The colour of the solution at the end of the reaction in (d)(i) will be

(1)

☒ **A** brown

☒ **B** green

☒ **C** orange

☒ **D** yellow

(Total for Question 2 = 13 marks)

7 This question is about the identification of an alcohol, **X**.

(a) Alcohol **X** has the following percentage composition by mass:

carbon, C = 68.2%

hydrogen, H = 13.6%

oxygen, O = 18.2%

The molecular ion peak in the mass spectrum for alcohol **X** occurs at $m/z = 88$.

Use all of these data to show that the molecular formula for alcohol **X** is $C_5H_{12}O$. Include your working.

(2)

(b) (i) When alcohol **X** is oxidised, a carboxylic acid is formed.

State what information this gives about alcohol **X**.

(1)

.....

(ii) Draw the **displayed** formulae of the four possible structural isomers that could be alcohol **X**.

(3)

Alcohol 1	Alcohol 2
Alcohol 3	**Alcohol 4**

(iii) The mass spectrum of alcohol **X** has a major peak at $m/z = 45$.

Draw the structure of the species that could give this peak.

(1)

(iv) Alcohol **X** has a branched chain.

Identify alcohol **X**, explaining your reasoning.

(2)

.....

.....

.....

.....

(Total for Question 7 = 9 marks)

Total for Test = 40 marks