



Additional Assessment Materials
Summer 2021

Pearson Edexcel GCE in Chemistry 9CH0

Resource Set 2 – Topic Group 4

Topics included:

Topic 6: Organic Chemistry I

Topic 7: Modern Analytical Techniques I

Topic 17: Organic Chemistry II

Topic 18A: Arenes – benzene,

Topic 18B: Amines, amides, amino acids
and proteins

(Public release version)

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Additional Assessment Materials, Summer 2021

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General guidance to Additional Assessment Materials for use in 2021

Context

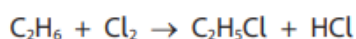
- Additional Assessment Materials are being produced for GCSE, AS and A levels (with the exception of Art and Design).
- The Additional Assessment Materials presented in this booklet are an **optional** part of the range of evidence teachers may use when deciding on a candidate's grade.
- 2021 Additional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- Additional Assessment Materials have come from past papers both published (those materials available publicly) and unpublished (those currently under padlock to our centres) presented in a different format to allow teachers to adapt them for use with candidate.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

1 This question is about alkanes.

(a) The reaction of ethane and chlorine in UV radiation produces chloroethane.



This reaction is classified as

(1)

- A addition
- B elimination
- C initiation
- D substitution

(b) The black smoke produced from the incomplete combustion of alkane fuels is

(1)

- A carbon particulates
- B oxides of nitrogen
- C oxides of sulfur
- D unburnt hydrocarbons

(c) A reaction of hexane is shown below.

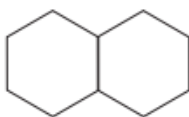


This is **best** described as

(1)

- A elimination
- B hydrogenation
- C isomerisation
- D reforming

(d) The skeletal formula of decalin is



The molecular formula of decalin is

(1)

- A** $C_{10}H_{22}$
- B** $C_{10}H_{20}$
- C** $C_{10}H_{18}$
- D** $C_{10}H_{16}$

(Total for Question 1 = 4 marks)

3 This is a question about halogenoalkanes and related compounds.

(a) Explain the trend in reactivity of the **primary** chloro-, bromo- and iodoalkanes with aqueous hydroxide ions.

(2)

(b) In aqueous sodium hydroxide, 1-bromoethane reacts to produce ethanol.

(i) Write the mechanism for this reaction, including all relevant curly arrows, lone pairs and dipoles. Include the transition state.

(4)

(ii) Give the reagents that are used to test that bromide ions are formed in this reaction mixture. Include the result of the test.

(2)

- (c) The halogenoalkane 2-bromobutane reacts with ethanolic potassium hydroxide to produce a mixture of alkenes.

Draw the **skeletal** formulae of all the alkenes that could be produced.

(3)

- (d) Explain why ethene has a boiling temperature of -104°C , whereas ethanol has a boiling temperature of 78°C .

(3)

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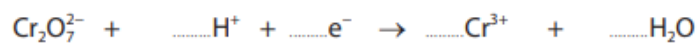
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(Total for Question 3 = 14 marks)

5 Some alcohols can be oxidised by acidified sodium dichromate(VI), $\text{Na}_2\text{Cr}_2\text{O}_7$.

- (a) Balance the ionic half-equation for the reduction of the dichromate(VI) ion.
Give the colours of all of the species involved, or state colourless if appropriate.

(2)

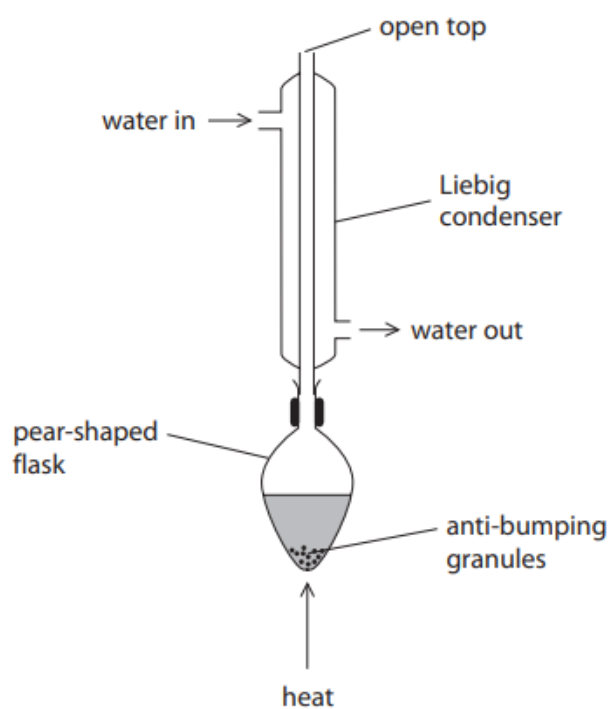


Colour

(b) Reflux apparatus can be used to carry out the oxidation of alcohols.

- (i) This Liebig condenser has been set up incorrectly. Add shading to the diagram to show the water in the condenser, illustrating the effect of the incorrect water flow.

(1)



- (ii) State how the granules prevent bumping.

(1)

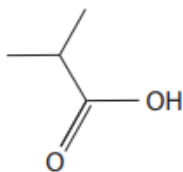
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(c) The carboxylic acid shown can be produced by oxidation of an alcohol under reflux.



Which alcohol would be oxidised under reflux to produce this carboxylic acid?

(1)

- A 1,1-dimethylethanol
- B 2-methylpropan-1-ol
- C 2-methylbutan-1-ol
- D propan-2-ol

(d) Using the apparatus for distillation instead of reflux is not an efficient way to produce ethanoic acid from ethanol. Explain why.

(2)

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(Total for Question 5 = 7 marks)

5 This question is about hydrocarbons.

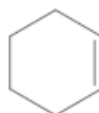
(a) Which of these molecular formulae represents a non-cyclic, saturated hydrocarbon? (1)

- A C_6H_6
- B C_6H_{10}
- C C_6H_{12}
- D C_6H_{14}

(b) How many **structural** isomers are there with the molecular formula C_5H_{12} ? (1)

- A 2
- B 3
- C 4
- D 5

(c) How many σ bonds and π bonds are there in one molecule of cyclohexene?



(1)

	σ bonds	π bonds
<input type="checkbox"/> A	5	2
<input type="checkbox"/> B	6	1
<input type="checkbox"/> C	15	2
<input type="checkbox"/> D	16	1

(d) When hydrocarbons undergo complete combustion, there is a change in the total volume of gases.

(i) Ethane burns in excess oxygen.



All gas volumes are measured at the same temperature and pressure when water is a gas.

What is the **increase** in the total volume when 100 cm^3 of ethane is burned in excess oxygen?

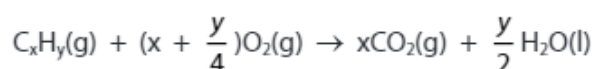
(1)

- A 50 cm^3
- B 100 cm^3
- C 200 cm^3
- D 500 cm^3

(ii) A combustion experiment was carried out using conditions under which water was a liquid.

A cyclic hydrocarbon, C_xH_y , was mixed with excess oxygen and ignited. Under the conditions of the experiment, this hydrocarbon was gaseous and had a volume of 25 cm^3 .

The equation for the complete combustion of C_xH_y is



The total gas volume **decreased** by 75 cm^3 .

The remaining gases were shaken with aqueous sodium hydroxide and the total gas volume **decreased** by a further 125 cm^3 .

All gas volumes were measured at the same temperature and pressure.

Suggest the identity of the cyclic hydrocarbon by calculating the molecular formula of C_xH_y .

Include the **skeletal formula** of the cyclic hydrocarbon.

(3)

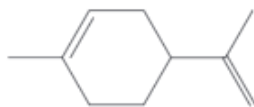
(e) Propene reacts with iodine monochloride, ICl, by an electrophilic addition mechanism.

Draw the mechanism for the reaction between propene and iodine monochloride to form the **major** product.

Include the dipole on the ICl molecule, curly arrows and any relevant lone pairs of electrons.

(4)

(f) Limonene is obtained from the oil in lemon peel and it is the only alkene present.



0.500 g of the oil reacted with exactly 30.6 cm^3 of a solution of bromine dissolved in cyclohexane with a concentration of $0.200 \text{ mol dm}^{-3}$.

Calculate the percentage by mass of limonene in the oil.

Give your answer to an appropriate number of significant figures.

Assume that there is nothing else in the oil that reacts with bromine.

(4)

(Total for Question 5 = 15 marks)

Total for Test = 40 marks