

## Monday 19 October 2020 – Morning

### A Level Chemistry B (Salters)

#### H433/03 Practical skills in chemistry

Time allowed: 1 hour 30 minutes



**You must have:**

- the Practical Insert (inside this document)
- the Data Sheet for Chemistry B

**You can use:**

- a scientific or graphical calculator
- an HB pencil



Please write clearly in black ink. **Do not write in the barcodes.**

Centre number

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Candidate number

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First name(s)

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Last name

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### INSTRUCTIONS

- Use black ink. You can use an HB pencil, but only for graphs and diagrams.
- Write your answer to each question in the space provided. If you need extra space use the lined pages at the end of this booklet. The question numbers must be clearly shown.
- Answer **all** the questions.
- Where appropriate, your answer should be supported with working. Marks might be given for using a correct method, even if your answer is wrong.

### INFORMATION

- The total mark for this paper is **60**.
- The marks for each question are shown in brackets [ ].
- Quality of extended response will be assessed in questions marked with an asterisk (\*).
- This document has **16** pages.

### ADVICE

- Read each question carefully before you start your answer.



Additional answer space if required

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- (c) The student is given a sample of an unknown Group 2 carbonate  $\text{MCO}_3$ .

The student is told to heat the sample to constant mass and use the results to identify the Group 2 carbonate.

- (i) Explain the term 'heat to constant mass'.

.....  
..... [1]

- (ii) 4.00 g of a metal carbonate  $\text{MCO}_3$  gives 1.91 g of  $\text{MO}$  on heating to constant mass.

Identify metal M in  $\text{MCO}_3$  showing a suitable calculation.

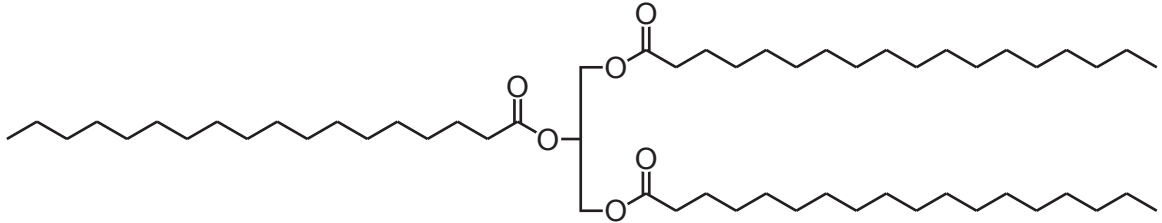
metal M is ..... [3]



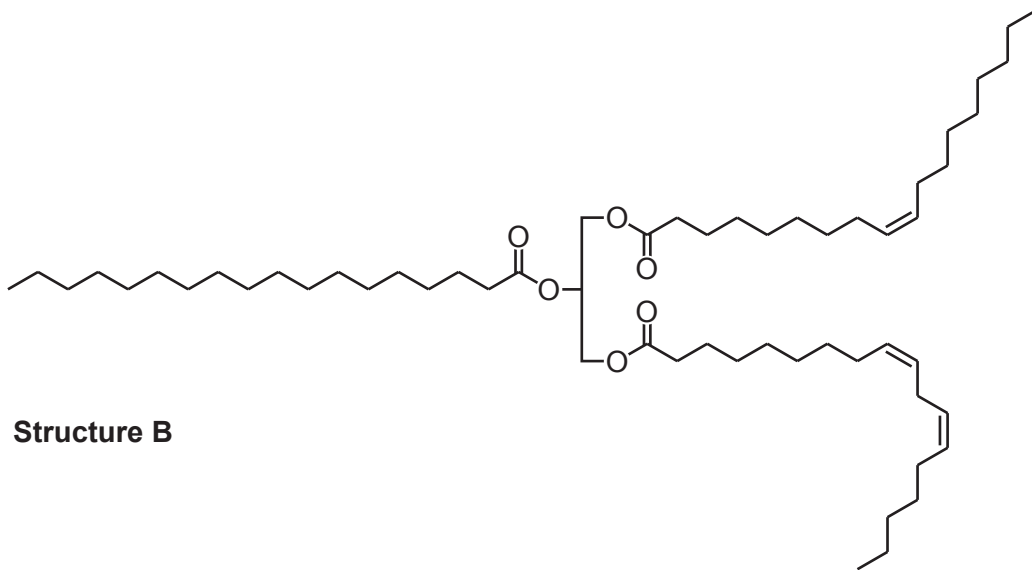
2 Fats and oils are essential to living systems.

Most fats and oils are triesters formed from the reaction of propane-1,2,3-triol (glycerol) with long chain carboxylic acids (fatty acids).

(a) Two triesters **A** and **B** are shown below.



**Structure A**



**Structure B**

(i) Structure **B** is described as a 'cis' unsaturated oil.

Explain the meanings of 'cis' and 'unsaturated'.

.....

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.....

.....

..... [2]

- (ii) State the types of intermolecular bonds between molecules of both structures **and** describe where in the molecules they occur.

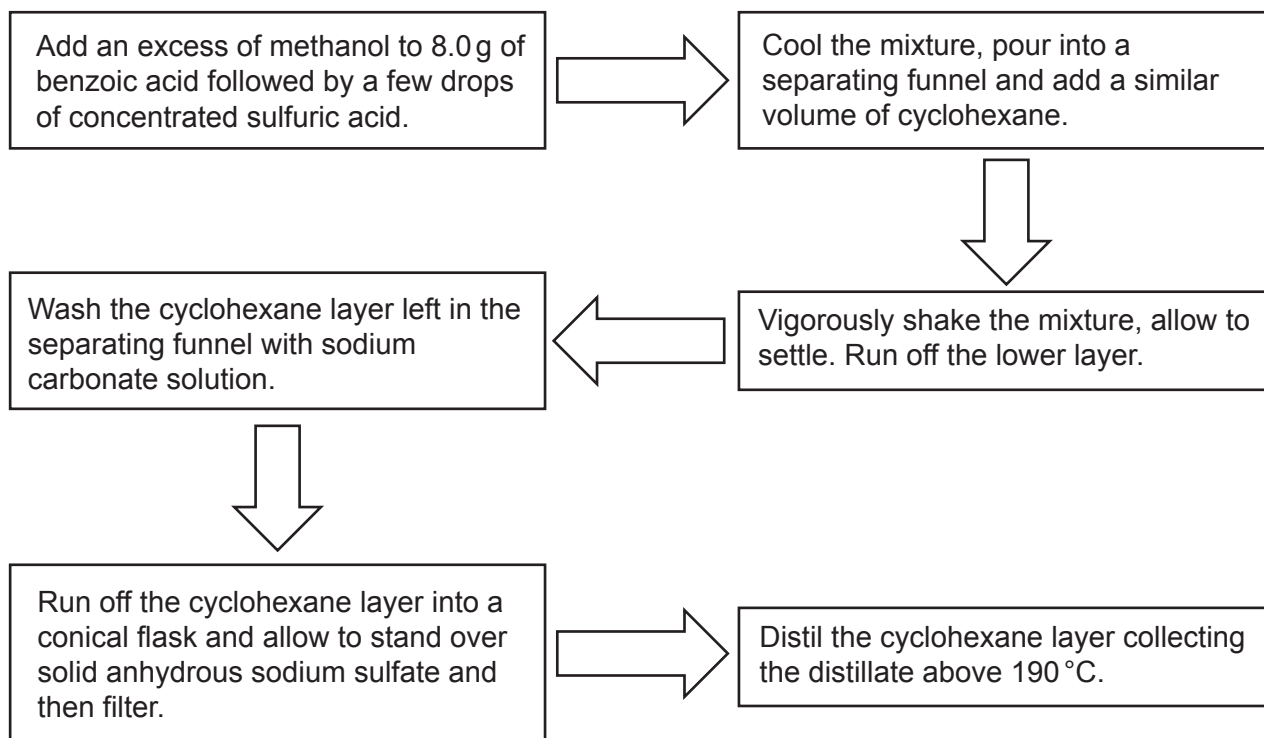
.....  
.....  
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.....  
..... [2]

- (iii) Suggest why Structure **A** is more likely to be a solid at room temperature than Structure **B**.

.....  
.....  
.....  
.....  
..... [3]

(b) Methyl benzoate is a liquid at room temperature and has a boiling point of 200 °C.

The steps in a procedure for preparing and purifying the simple ester, methyl benzoate, are shown in the flow chart.



Give the reasons for the following experimental procedures in the flow chart:

(i) adding cyclohexane

.....  
 ..... [1]

(ii) adding sodium carbonate solution

.....  
 ..... [1]

(iii) standing the cyclohexane layer over solid anhydrous sodium sulfate

.....  
 ..... [1]

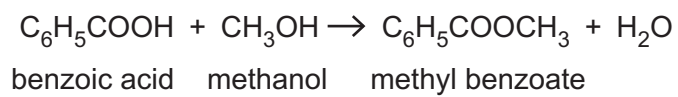
(iv) collecting the distillate above 190 °C

.....  
 ..... [1]



(c) A student followed the procedure in the flow chart and obtained 5.46 g of methyl benzoate.

The equation for the preparation is:



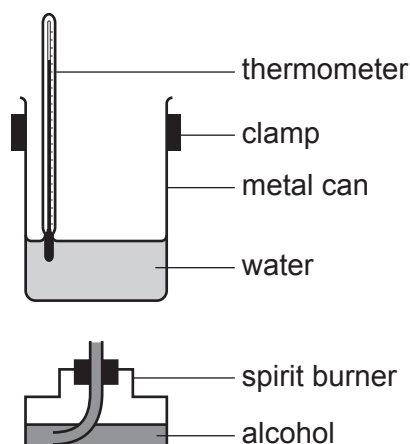
Calculate the percentage yield of methyl benzoate.

Give your answer to an **appropriate** number of significant figures.

percentage yield = ..... % [4]

3 The two isomers of propanol,  $C_3H_7OH$  can be used as fuels.

(a) A student measures the enthalpy change of combustion of propan-1-ol,  $C_3H_7OH$ . The apparatus used is shown in **Fig. 3.1**.



**Fig. 3.1**

The student's results are shown in **Table 3.1**.

Mass of spirit burner + propan-1-ol	43.11 g
Mass of spirit burner + propan-1-ol after burning	42.92 g
Initial temperature of water	19.7 °C
Final temperature of water	31.2 °C
Mass of water in metal can	100 g

**Table 3.1**

Use the results in **Table 3.1** to calculate a value for the enthalpy change of combustion of propan-1-ol,  $\Delta_c H$ , in  $\text{kJ mol}^{-1}$ .

Enthalpy change of combustion of propan-1-ol,  $\Delta_c H = \dots\dots\dots \text{kJ mol}^{-1}$  [3]

(b) The data book value for the enthalpy change of combustion of propan-1-ol is  $-2021 \text{ kJ mol}^{-1}$ .

(i) One reason for the difference is heat loss to the surroundings.

Suggest **two** other reasons for the difference between the experimental value and the data book value.

1 .....

.....

2 .....

.....

[2]

(ii) Describe **one** addition to the apparatus in **Fig. 3.1** that would improve the accuracy of the experimental value for the enthalpy change of combustion.

.....

..... [1]

(c) The data book value for the enthalpy change of combustion of propan-2-ol is very similar to that of propan-1-ol.

(i) Write out the **full** structural formulae of the **two** compounds.

**propan-1-ol**

**propan-2-ol**

[1]

(ii) Explain why the enthalpy change of combustion values are exothermic and very similar. Use your answer to (c)(i) and the idea of average bond enthalpies in your answer.

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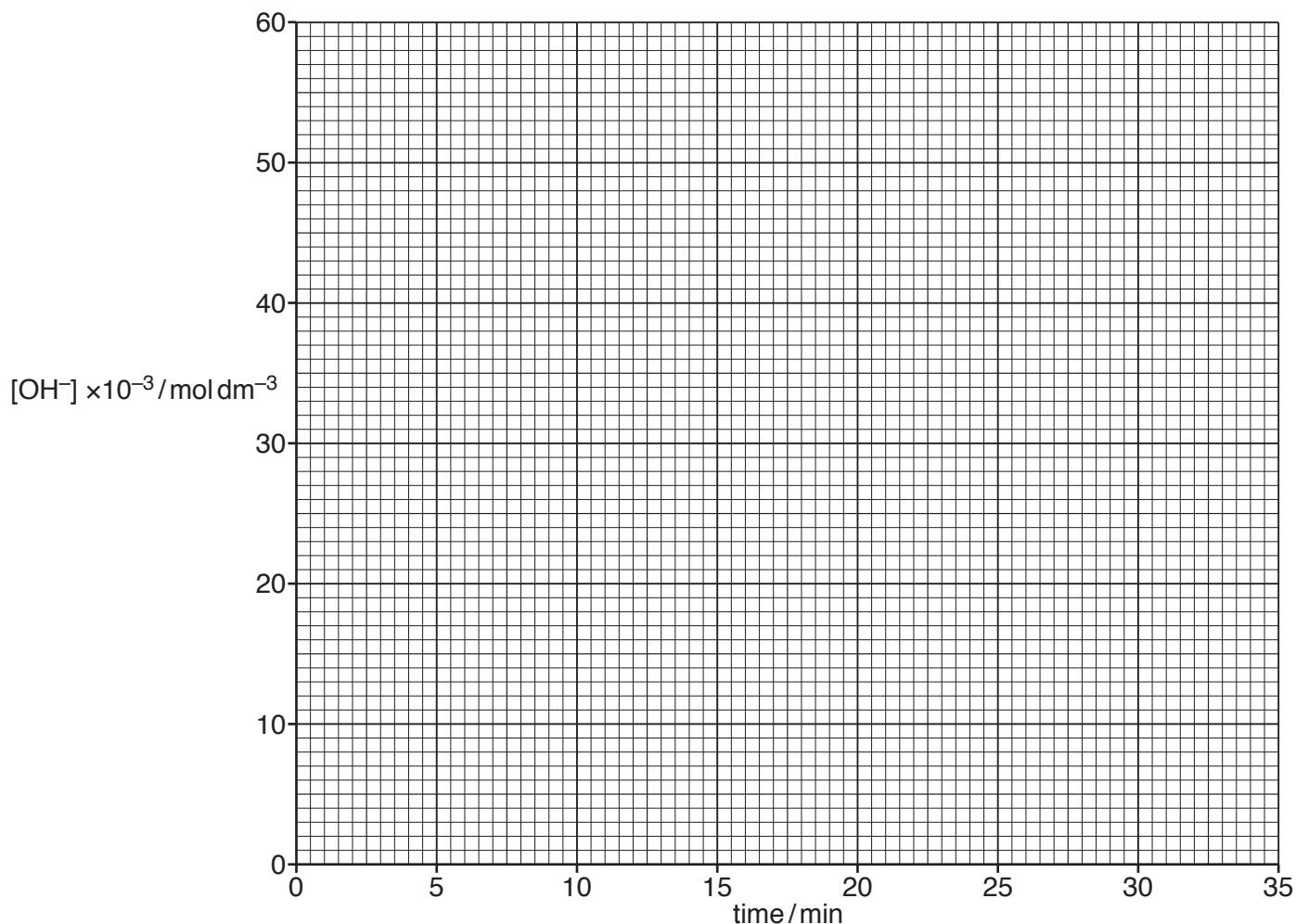
.....

..... [3]



(b) (i) Using the data from **Table 4.1** in the Practical Insert, plot a graph on the grid below.

Include a curve of best fit.



[2]

(ii) Use your graph to calculate the time taken for the concentration of hydroxide ions to fall from  $40 \times 10^{-3}$  to  $20 \times 10^{-3}$  and from  $20 \times 10^{-3}$  to  $10 \times 10^{-3}$  mol dm $^{-3}$ .

Show your working on the graph.

Time taken to fall from  $40 \times 10^{-3}$  to  $20 \times 10^{-3}$  mol dm $^{-3}$  = ..... min

Time taken to fall from  $20 \times 10^{-3}$  to  $10 \times 10^{-3}$  mol dm $^{-3}$  = ..... min

[2]

(iii) Explain how the graph shows that the **overall** order of the reaction is first order.

.....  
 .....  
 .....  
 .....  
 .....

[2]

- (iv) A student is told that the reaction followed using **Method 1** goes by **mechanism B**.

The student says that the first reaction in **mechanism B** must be the rate-determining step. This accounts for the overall first order of the reaction.

Comment on the student's statement.

.....  
.....  
.....  
.....  
..... [2]

- (c) (i) Use the data in **Table 4.2** to determine the order of reaction with respect to 1-bromobutane and hydroxide ions in **Method 2**.

Give your reasoning.

.....  
.....  
.....  
.....  
..... [2]

- (ii) Complete the rate equation for the reaction in part (c)(i).

Rate = [1]

**END OF QUESTION PAPER**

**ADDITIONAL ANSWER SPACE**

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).

This block contains a large area of lined paper for writing. It features a vertical margin line on the left side and horizontal dotted lines for writing. The lines are evenly spaced and extend across the width of the page.

A large rectangular area for writing, bounded by a solid vertical line on the left and horizontal dotted lines on the top, bottom, and right.



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