AQA A-level Chemistry Y11-Y12 Transition Task

As part of your preparation for A-level chemistry you need to complete the following GCSE level questions.

You should attempt **every part of these questions** and carry out your own research to attempt them if you are not sure.

You can use the following links as a starting point if you need support.

[Quantitative chemistry](#)

[Organic chemistry](#)

You will be given an attitude grade based on the criteria below.

Attitude	
Independent: It is evident you have a **deep** understanding of the topic. You have completed all of the questions and researched how to complete any areas you are unsure on After receiving your 'next steps', you have made **all** improvements to a high standard.	
Engaged: It is evident you have a **good** understanding of the topic. You have completed all of the questions and researched most of the areas you are unsure on After receiving your 'next steps', you have made **most** of the improvements to a high standard.	
Coasting: It is evident you have a **moderate** understanding of the topic. You have not completed all of the questions or made little effort to complete them After receiving your 'next steps', you have made **some** of the improvements but they are not consistently to a high standard.	
Unacceptable: It is evident you have a **weak** understanding of the topic. You have note completed or attempted all of the questions After receiving your 'next steps', you have **not** made improvements to a high standard.	

Moles and Equations

1   "Fizzy sherbet" contains citric acid ($C_6H_8O_7$) and sodium hydrogencarbonate ($NaHCO_3$).
     When water is added to fizzy sherbet, the citric acid and the sodium hydrogencarbonate
     react to form carbon dioxide, water and sodium citrate ($C_6H_5O_7Na_3$).

The equation for this reaction is:

$$C_6H_8O_{7(s)} + 3NaHCO_{3(s)} \rightarrow 3CO_{2(g)} + 3H_2O_{(l)} + C_6H_5O_7Na_{3(aq)}$$

A student tested two brands of fizzy sherbet by mixing 10 g of each type
with water in an open flask. She measured the mass of each flask and its
contents at the start and end of the reaction.

1.1 Explain why a decrease in mass was expected.

     ....

     ....

                                                                                                                    [1]

1.2 The student tested the pH of the colourless solution in each flask at the end of the experiment.
     She concluded that unreacted citric acid was present in one of the flasks.
     Which of the reactants was the limiting reactant in this case? Explain your answer.

     ....

     ....

     ....

     ....

                                                                                                                    [2]

1.3 The student decided to make her own fizzy sherbet using 20.0 g of citric acid.
     Calculate the minimum mass of sodium hydrogencarbonate needed to ensure all of
     the citric acid is used up in the reaction. Give your answer to three significant figures.
     Relative formula mass (M_r) of $NaHCO_3$ = 84
     Relative atomic masses (A_r): H = 1; C = 12; O = 16; Na = 23

                                                                         Mass = ... g
                                                                                                                    [4]

1.4 Another student repeated the reaction between citric acid and sodium hydrogencarbonate, but used different quantities of reactants. At the end of the reaction the water was evaporated and a 61.15 g sample of sodium citrate was collected. Use the reaction equation to calculate the mass of citric acid that reacted. Give your answer to three significant figures.
Relative formula mass (M_r) of $C_6H_5O_7Na_3$ = 258

Mass = ... g

[3]

[Total 10 marks]

2 A student is investigating the effects of two different catalysts on a reaction.
One of the catalysts is manganese dioxide (MnO_2, M_r = 87.0).
The other is a catalyst with the formula XO_a (M_r = 79.5), where X is a metal.
Both catalysts are powders.

2.1 The student uses 1.74 g of MnO_2 in his experiment. In order to make it a fair test, the same number of moles of XO_a is also used. Calculate the mass of XO_a required.

Mass = ... g

[2]

2.2 The catalyst XO_a can be made by reacting metal X with oxygen gas.
This reaction was carried out using 14.10 g of X in an excess of oxygen gas.
The reaction went to completion and 17.65 g of XO_a was formed. There were no other products.
Write a balanced symbol equation for this reaction, and give the value of a.
Relative formula mass (M_r) of O_2 = 32

Balanced symbol equation: .... X + ... $O_2 \rightarrow$ .... XO_a

a = ...

[6]

[Total 8 marks]

3   Sodium hydrogencarbonate, $NaHCO_3$, is an important ingredient in baking powder. It gives off carbon dioxide when added to acidic liquids, such as vinegar. A student adds different volumes of vinegar to six beakers of $NaHCO_3$ and measures the mass loss of the reaction mixture, due to the production of CO_2. **Table 2** shows the student's results.

Table 2

Volume of vinegar (cm³)	Mass loss (g)
5	1.0
10	1.3
15	1.6
20	1.8
25	2.0
30	2.0

3.1 Explain why the mass eventually stops decreasing, despite more vinegar being added.

....

....
[1]

3.2 Suggest **one** way in which the student could adapt their method to give a more accurate indication of the minimum volume of vinegar required to reduce the mass by 2.0 g.

....

....
[1]

Baking powder is a mixture of sodium hydrogencarbonate, $NaHCO_3$, and tartaric acid, $C_4H_6O_6$. The equation for the reaction between sodium hydrogencarbonate and tartaric acid is:

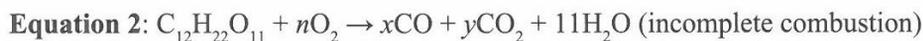$$2NaHCO_3 + C_4H_6O_6 \rightarrow 2CO_2 + 2H_2O + C_4H_4O_6Na_2$$

The reaction is carried out using 12.9 g of sodium hydrogencarbonate and 14.1 g of tartaric acid. Sodium hydrogencarbonate is the limiting reactant.

3.3 Calculate the mass of tartaric acid that will be left over once the reaction is complete. Give your answer to two significant figures.
Relative formula masses (M_r): $NaHCO_3 = 84$; $C_4H_6O_6 = 150$

Mass = ... g
[4]

[Total 6 marks]

4 Sucrose has the chemical formula $C_{12}H_{22}O_{11}$. Sucrose can react as follows:

Equation 1: $C_{12}H_{22}O_{11} + 12O_2 \rightarrow 12CO_2 + 11H_2O$ (complete combustion)

Equation 2: $C_{12}H_{22}O_{11} + nO_2 \rightarrow xCO + yCO_2 + 11H_2O$ (incomplete combustion)

Equation 3: $C_{12}H_{22}O_{11} \rightarrow 12C + 11H_2O$ (decomposition)

Relative formula masses (M_r): $C_{12}H_{22}O_{11} = 342$; $CO_2 = 44$; $CO = 28$; $H_2O = 18$;
Relative atomic mass (A_r) of $C = 12$

4.1 Use **Equation 1** to calculate the number of moles of carbon dioxide that will be produced from the complete combustion of 6.84 g of sucrose. Tick **one** box.

10.56 moles of carbon dioxide ☐

44 moles of carbon dioxide ☐

0.24 moles of carbon dioxide ☐

6.84 moles of carbon dioxide ☐

[1]

4.2 A student heats 5.13 g of sucrose in a sealed container to ensure incomplete combustion. 3.36 g of CO and 2.64 g of CO_2 are produced. Re-write **Equation 2** as a balanced equation.

Balanced symbol equation: $C_{12}H_{22}O_{11} +$ .... $O_2 \rightarrow$ .... $CO +$ .... $CO_2 + 11H_2O$
[5]

4.3 Another student strongly heats a sample of sucrose until a black residue of carbon remains. Use **Equation 3** to calculate the mass of carbon produced from 12.0 g of sucrose.

Mass = ... g
[3]

[Total 9 marks]

Exam Tip

It's really important that you give numerical answers to a sensible number of significant figures. If the question doesn't specifically tell you how many significant figures are required then always round your final answer to the lowest number of significant figures given in the question.
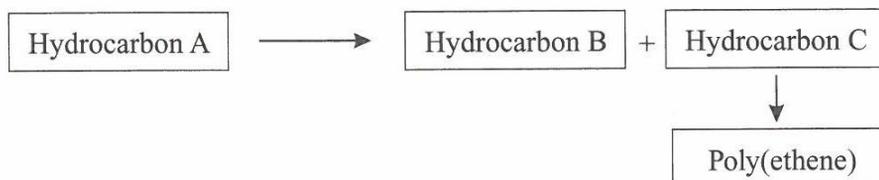
Score: ☐

33

Topic 7 — Organic Chemistry

Hydrocarbons and Crude Oil

1 Hydrocarbons from crude oil can be used to produce compounds such as poly(ethene).

Figure 1 represents a two-step process that produces poly(ethene). Hydrocarbon **A** has 10 carbon atoms. Its hot vapours are passed over a heated catalyst and hydrocarbons **B** and **C** are formed in a 1:1 ratio. Hydrocarbon **C** is used to produce the polymer poly(ethene).

Figure 1

| Hydrocarbon A | ⟶ | Hydrocarbon B | + | Hydrocarbon C |

⟶

| Poly(ethene) |

1.1 Give the formulas of hydrocarbons **A**, **B** and **C**.

Hydrocarbon A: ....

Hydrocarbon B: ....

Hydrocarbon C: ....

[3]

1.2* Compare the properties of hydrocarbon **A** with those of the hydrocarbon $C_{35}H_{72}$.
Explain why hydrocarbon **A** might be a more desirable product than $C_{35}H_{72}$.

....

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....

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....

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....

....

[6]

1.3 Other reactions can occur when hot vapours of hydrocarbon **A** are passed over a heated catalyst.
Write an equation to show hydrocarbon **C** and **one** other product being formed in the ratio 3:1.

....

[1]

[Total 10 marks]

Exam Tip

Pay close attention to any information in the question — you could even underline the key bits so that you can refer back to them quickly. You'll often need to apply your own knowledge to some information you're given in order to work something out — just like in Q1.1 above...
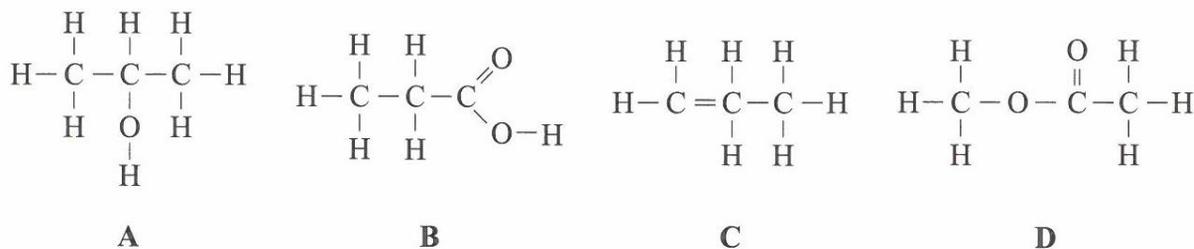
Score:

10

Reactions of Organic Compounds

1   A student is studying organic compounds. He draws the four structures shown in **Figure 1**.

Figure 1

A   B   C   D

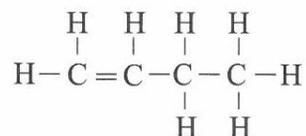1.1 Which of the four structures in **Figure 1** has been drawn incorrectly? Tick **one** box.

A ☐   B ☐   C ☐   D ☐

[1]

The student was asked to draw the structure of butene.   **Figure 2**
The student drew the structure shown in **Figure 2**.

1.2 Draw an alternative structure for butene and explain why the structure you have drawn is also correct.

....

....

[2]