Questions

Q1.

Calculate the relative formula mass of ethanol, C_2H_5OH.

(relative atomic masses: H = 1, C = 12, O = 16)

(2)

relative formula mass = ...

(Total for question = 2 marks)

Q2.

The balanced equation for the production of ethanol from the carbohydrate sucrose is

$$\underset{\text{sucrose}}{C_{12}H_{22}O_{11}} + H_2O \rightarrow 4C_2H_5OH + 4CO_2$$

Calculate the minimum mass of sucrose needed to produce 26.9 g of ethanol.

(relative formula masses: C_2H_5OH = 46, $C_{12}H_{22}O_{11}$ = 342)

(2)

.....

.....

.....

.....

minimum mass of sucrose = ... g

(Total for question = 2 marks)

Q3.

Alcohols can be dehydrated.

Complete the balanced equation for the dehydration of butan-1-ol by drawing the structures of the two products in the boxes. Name the two products.

(3)

butan-1-ol → ..... +
.....

(Total for question = 3 marks)

Q4.

Ethanol, C_2H_5OH, can be converted into ethanoic acid, CH_3COOH.

(i) In this reaction ethanol is

(1)

- ☒ **A** hydrated
- ☒ **B** oxidised
- ☒ **C** polymerised
- ☒ **D** reduced

(ii) Draw the structure of a molecule of ethanoic acid, CH_3COOH, showing all covalent bonds.

(2)

(Total for question = 3 marks)

Q5.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

(i) Figure 14 shows an incomplete diagram of the structure of a molecule of propanol, $CH_3CH_2CH_2OH$.

Complete the structure of the molecule of propanol in Figure 14.

(2)

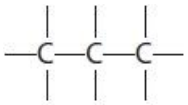

Figure 14

(ii) Propanol can be converted into propanoic acid.

What happens to propanol in this reaction?

(1)

- ☐ **A** it is dehydrated
- ☐ **B** it is neutralised
- ☐ **C** it is oxidised
- ☐ **D** it is polymerised

(Total for question = 3 marks)

Q6.

This question is about alcohols.

A student used an alcohol burner to find the mass of different alcohols needed to raise the temperature of 100 cm^3 of water by 20 °C.

Figure 15 shows their results.

alcohol	initial mass of alcohol burner and alcohol in g	final mass of alcohol burner and alcohol in g	mass of alcohol used in g
ethanol	122.51	122.02	0.49
propanol	168.55	168.13	0.42
butanol	152.62	152.23	
pentanol	67.22	66.86	0.36

Figure 15

(i) Calculate the mass of butanol used.

(1)

.....

mass of butanol = ... g

*(ii) Figure 16 shows equipment that can be used to obtain the results shown in Figure 15.

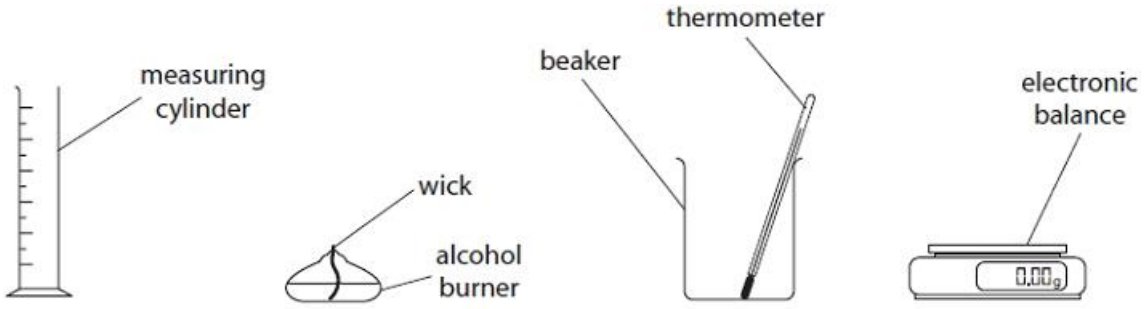

Figure 16

Describe an experiment, using the equipment in Figure 16, that could be used to obtain results like those shown in Figure 15.

(6)

(iii) The results show that 0.36 g of pentanol was needed to raise the temperature of the water by 20 °C.

Calculate the mass of pentanol needed to raise the temperature of water by 1 °C.
Give your answer to 2 decimal places.
Show your working.

(2)

.....

.....

.....

mass of pentanol = ... g

(Total for question = 9 marks)

Q7.

Figure 10 shows a flask fitted with a cotton wool plug.
The flask contains an aqueous solution of a carbohydrate.

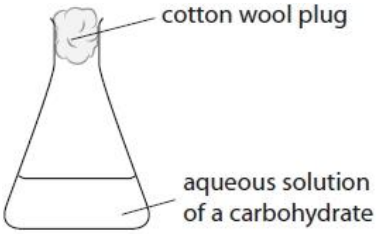

Figure 10

(i) State **two** steps that need to be taken to turn the solution of the carbohydrate in the flask into a solution of ethanol.

(2)

1 .....

.....

2 .....

.....

(ii) The apparatus in Figure 11 is used to increase the concentration of the dilute solution of ethanol.

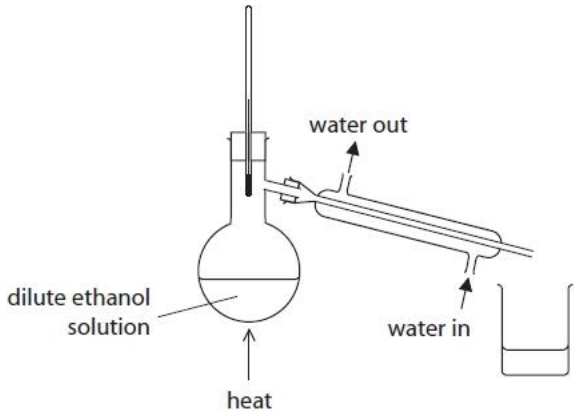

Figure 11

This apparatus did not produce a very concentrated solution of ethanol.
Describe how the apparatus can be altered to produce a more concentrated solution of ethanol.

(2)

.....

.....

.....

(Total for question = 4 marks)

Q8.

(i) The apparatus in Figure 16 can be used to investigate the temperature rise produced in a known mass of water when a sample of ethanol is burned.

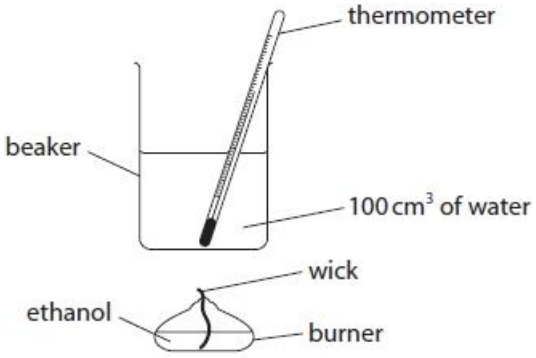

Figure 16

The first steps of the method are

1. put 100 cm^3 of water into a beaker
2. determine the mass of the burner containing ethanol
3. measure the initial temperature of the water
4. place the burner under the beaker of water
5. light the wick

Describe the remaining steps of the method that are needed to determine the mass of ethanol required to raise the temperature of the water by 30 °C.

(3)

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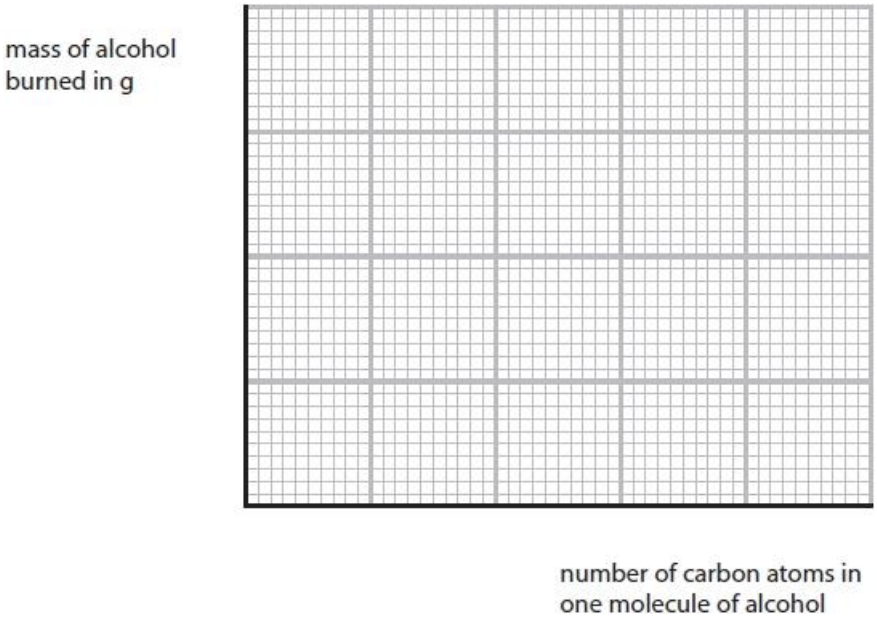
.....

(ii) In a different experiment, separate samples of the alcohols methanol, ethanol, propanol, butanol and pentanol were burned to determine the mass of each alcohol that needs to be burned to raise the temperature of 100 cm^3 water by 10 °C.

alcohol	number of carbon atoms in one molecule of alcohol	mass of alcohol burned in g
methanol	1	0.37
ethanol	2	0.28
propanol	3	0.25
butanol	4	0.23
pentanol	5	0.22

Draw a graph of the mass of each alcohol required to raise the temperature of 100 cm^3 of water by 10 °C against the number of carbon atoms in one molecule of that alcohol.

(3)



(Total for question = 6 marks)

Q9.

Ethanol, C_2H_5OH, can be oxidised to form ethanoic acid.

Draw the structure of a molecule of ethanoic acid, showing all the covalent bonds.

(2)

(Total for question = 2 marks)

Q10.

Ethanol can be used as a liquid fuel.

A student investigates how much heat energy is released when a known mass of ethanol is burned.

The apparatus is set up as shown in Figure 15.

A known volume of water is placed in a metal can.
The temperature of the water is measured.
The ethanol is ignited and placed under the beaker so that the flame is touching the beaker.
The water is heated by the flame.
The flame is extinguished.
The final temperature of the water is measured.

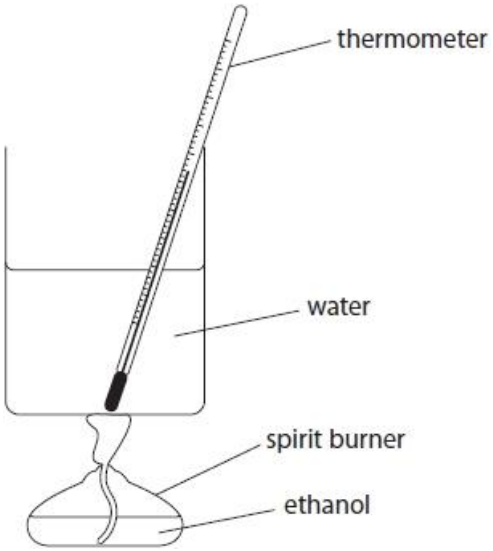


Figure 15

The theoretical temperature rise for burning a given mass of ethanol is 82.4 °C.

In the experiment the actual temperature rise for burning this mass of ethanol was only 34.8 °C.
One reason why the temperature rise is less than expected is that the ethanol does not burn completely.

(i) Give a reason why, even if the ethanol burns completely, the actual temperature rise is much less than the theoretical value.

(1)

.....

(ii) Explain how the method described above could be improved to give a temperature rise closer to the theoretical value.

(2)

.....

.....

.....

.....

(iii) The amount of heat energy used to raise the temperature of the water by 34.8 °C can be calculated using

heat energy = 210 × temperature rise

Calculate the amount of heat energy used.

(2)

.....

.....

.....

heat energy = ... (energy units)

(Total for question = 5 marks)

Q11.

Ethanol is made by fermentation of a carbohydrate dissolved in water, in the presence of yeast.

The reaction is carried out at 30 °C.

Explain why the reaction is carried out at a temperature of 30 °C rather than at a temperature of 80 °C.

(2)

.....

.....

.....

.....

(Total for question = 2 marks)

Q12.

*Figure 12 shows information about some compounds in the same homologous series.

name	structural formula	formula mass	density in g cm^{-3}	boiling point in °C	does it react with an alcohol?	does it react with sodium hydroxide solution?
butanoic acid	$CH_3CH_2CH_2COOH$	88	0.96	164	yes	yes
ethanoic acid	CH_3COOH	60	1.05	118	yes	yes
hexanoic acid	$CH_3CH_2CH_2CH_2CH_2COOH$	116	0.93	205	yes	yes
pentanoic acid	$CH_3CH_2CH_2CH_2COOH$	102	0.94	186	yes	yes
propanoic acid	CH_3CH_2COOH	74	0.99	141	yes	yes

Figure 12

Explain, using the data in Figure 12, why these compounds belong together in the same homologous series.

(6)

(Total for question = 6 marks)

Q13.

Ethanol can be used as a liquid fuel.

A student investigates how much heat energy is released when a known mass of ethanol is burned.

The apparatus is set up as shown in Figure 15.

A known volume of water is placed in a metal can.
The temperature of the water is measured.
The ethanol is ignited and placed under the beaker so that the flame is touching the beaker.
The water is heated by the flame.
The flame is extinguished.
The final temperature of the water is measured.

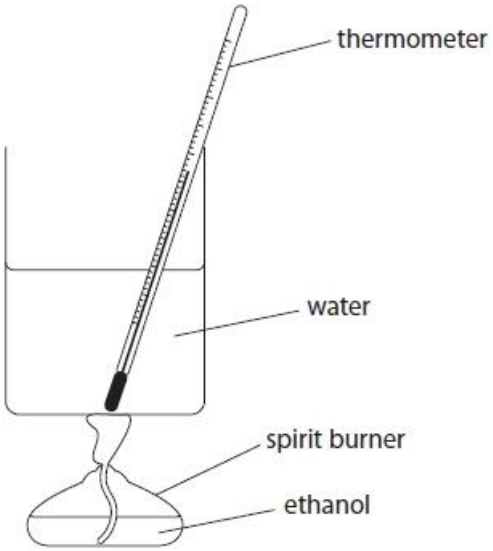
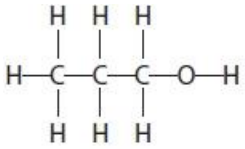
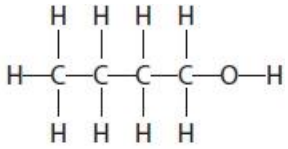


Figure 15

Propanol and butanol are both members of the same homologous series as ethanol.



propanol



butanol

Propanol and butanol can also be burned in the apparatus shown in Figure 15.

Give **three** reasons why ethanol, propanol and butanol are members of the same homologous series.

(3)

reason 1

.....

.....

reason 2

.....

.....

reason 3

.....

.....

(Total for question = 3 marks)

Q14.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Ethanol can be produced by the fermentation of glucose solution.

Which of these shows the word equation for the fermentation of glucose solution?

(1)

- ☐ **A** glucose → ethanol + water
- ☐ **B** glucose → ethanol + carbon dioxide
- ☐ **C** glucose → ethanol + hydrogen
- ☐ **D** glucose → ethanol + water + carbon dioxide

(Total for question = 1 mark)

Q15.

The temperature rise in water when liquid fuels burn can be found using the equipment shown in Figure 9.

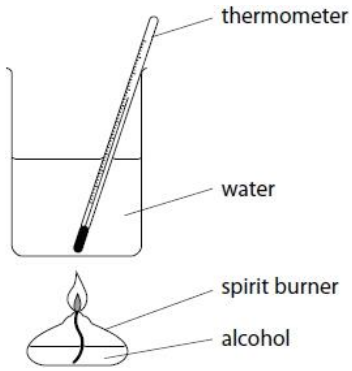


Figure 9

(i) A student compares the temperature rise produced in the water when propanol burns with the temperature rise produced when ethanol burns.

State **two** factors that the student must keep the same in both experiments in order to have a fair comparison.

(2)

1 .....

.....

2 .....

.....

(ii) The results for the two alcohols are shown in Figure 10.

alcohol	mass of alcohol burned / g	temperature rise / °C
ethanol	0.33	20
propanol	0.28	20

Figure 10

Explain, using only the information in Figure 10, why propanol might be the better fuel.

(2)

.....

.....

.....

.....

(Total for question = 4 marks)

Q16.

An alcohol **A**, with molecular formula C_2H_5OH is oxidised to a compound **B** with molecular formula $C_2H_4O_2$.

(i) Compound **B** is not an alcohol and is a member of another homologous series.

State the name of this homologous series.

(1)

.....

(ii) Draw the structure of a molecule of compound **A** and a molecule of compound **B**, showing all covalent bonds.

(2)

Compound **A**

Compound **B**

(Total for question = 3 marks)

Q17.

Figure 15 shows the arrangement of atoms in a molecule of an alcohol.

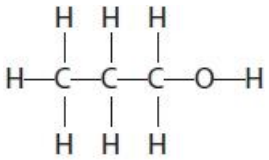


Figure 15

(i) Give the name of the carbon-containing product formed when the alcohol in Figure 15 undergoes dehydration.

(1)

.....

(ii) Give the formula of the functional group of the product formed when the alcohol in Figure 15 undergoes oxidation.

(1)

.....

(iii) A student wants to investigate the amount of energy released when 1.00 g of the alcohol is burned.

They set up the apparatus shown in Figure 16 to measure the temperature rise of the water.

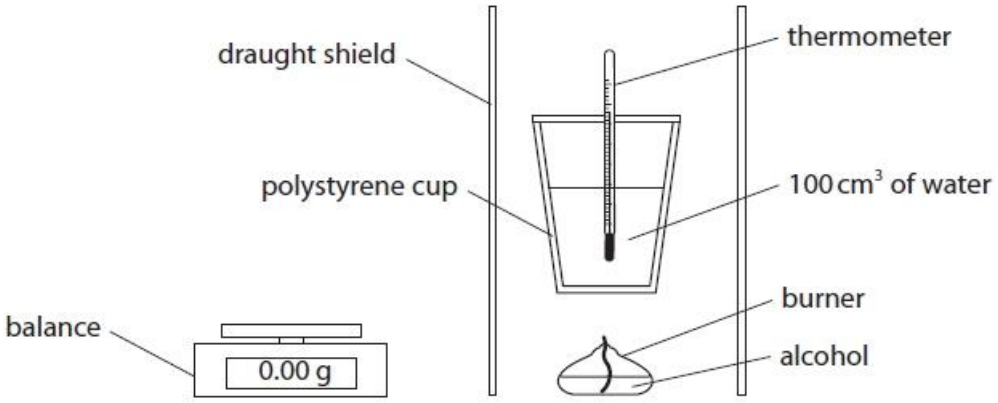


Figure 16

State why this apparatus is not suitable for use in this experiment.

(1)

.....

.....

(Total for question = 3 marks)

Q18.

Ethanol can be used as a liquid fuel.

A student investigates how much heat energy is released when a known mass of ethanol is burned.

The apparatus is set up as shown in Figure 15.

A known volume of water is placed in a metal can.
The temperature of the water is measured.
The ethanol is ignited and placed under the beaker so that the flame is touching the beaker.
The water is heated by the flame.
The flame is extinguished.
The final temperature of the water is measured.

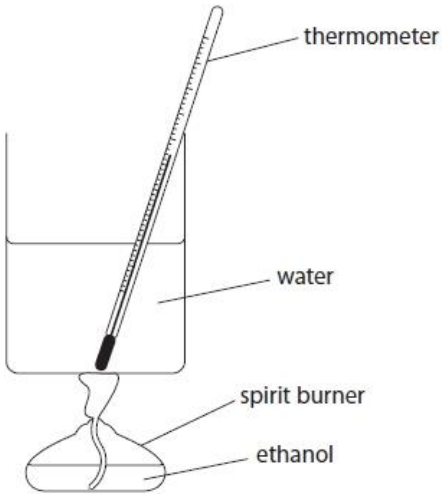


Figure 15

Ethanol can oxidise when exposed to air to produce ethanoic acid and water.
Propanol can also oxidise in a similar reaction when it is exposed to air.

(i) Write the word equation for the reaction when **propanol** oxidises when it is exposed to air.

(2)

.....

.....

(ii) What is the formula of the functional group in carboxylic acids?

(1)

- ☒ **A** −OH
- ☒ **B** $-CH_3$
- ☒ **C** −COOH
- ☒ **D** $-CO_2$

(Total for question = 3 marks)

Q19.

Alcohols and carboxylic acids are important organic compounds.

Figure 8 shows the names and formulae of three alcohols in a homologous series.

name	formula
methanol	CH_3OH
ethanol	C_2H_5OH
propanol	C_3H_7OH

Figure 8

Predict the formula of the alcohol that has **five** carbon atoms in its molecule, using the information in Figure 8.

(1)

.....

(Total for question = 1 mark)

Q20.

Answer the questions with a cross in the boxes you think are correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Propanol, C_3H_7OH, can undergo reactions to form compounds **Y** and **Z** shown in Figure 14.

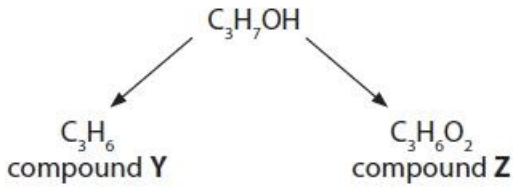


Figure 14

(i) What happens to propanol when it forms compound **Y**?

(1)

- ☒ **A** propanol undergoes an addition reaction
- ☒ **B** propanol is dehydrated
- ☒ **C** propanol is hydrated
- ☒ **D** propanol is oxidised

(ii) Compound Y can also be formed in the following reaction

$$\underset{\text{compound X}}{C_3H_8} \rightarrow \underset{\text{compound Y}}{C_3H_6} + H_2$$

Explain how bromine water can be used to distinguish between compound **X** and compound **Y**.

(3)

.....

.....

.....

.....

.....

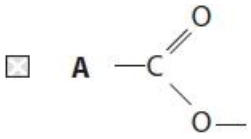
.....

(iii) Compound **Z** is a carboxylic acid.

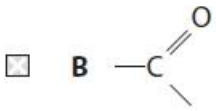
Which of the following shows the functional group of a carboxylic acid?

(1)

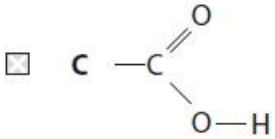
☒ **A**



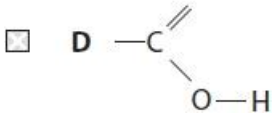
☒ **B**



☒ **C**



☒ **D**



(iv) Compound **Z** is an acid and turns litmus and universal indicator papers red.
Compound **Z** also shows other acidic properties.

Devise an experiment that would show another acidic property of compound **Z**.

(2)

.....

.....

.....

.....

(Total for question = 7 marks)

Q21.

The names and formulae of the first four alcohols in the homologous series of alcohols are given in Figure 12.

name of alcohol	formula
methanol	CH_3OH
ethanol	C_2H_5OH
propanol	C_3H_7OH
butanol	C_4H_9OH

Figure 12

(i) Pentanol is the next member of this series.
A molecule of pentanol contains five carbon atoms.

Suggest the formula of a molecule of pentanol.

(1)

.....

(ii) Draw the structure of a molecule of ethanol.
Show all bonds.

(2)

(Total for question = 3 marks)

Mark Scheme

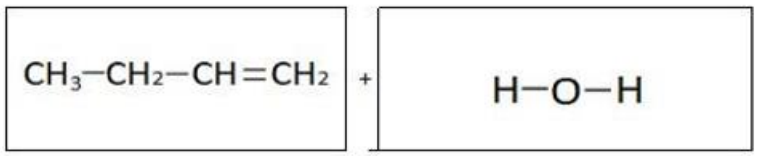
Q1.

Question number	Answer	Additional guidance	Mark
	(2 × 12) + (5 × 1) + 16 + 1 (1) = 46 (1)	Award full marks for correct numerical answer without working.	(2)

Q2.

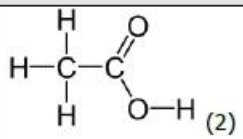
Question number	Answer	Mark
	moles of sucrose = $\frac{\text{moles of ethanol}}{4}$ (1) (= $\frac{26.9}{4 \times 46}$ = 0.146) mass of sucrose = $\frac{\text{moles of ethanol}}{4}$ x 342 (1) (= $\frac{26.9 \times 342}{4 \times 46}$ = 49.999 g) allow 50 g for 2 marks	(2) AO2

Q3.

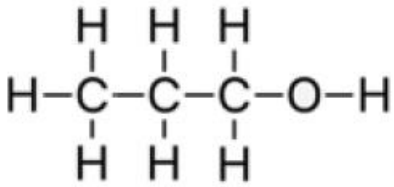
Question number	Answer	Mark
	 → but-1-ene + water structure of but-1-ene (1) name of but-1-ene (1) structure or formula **and** name of water (1)	(3)

Q4.

Question number	Answer	Mark
(i)	**B** oxidised is the only correct answer **A, C** and **D** are factually incorrect	(1)

Question number	Answer	Additional guidance	Mark
(ii)	 (2) or correct carboxylic acid group (1) correct methyl group (1)	allow correct dot and cross diagram ignore incorrect bond angles allow OH for O-H reject methyl group with additional carbons max 1 mark if double bond present 2 carbons	(2)

Q5.

Question number	Answer	Additional guidance	Mark
(i)	 (2) OR hydroxyl group on a carbon (1) rest of molecule correct (1)	 allow OH for O-H reject any multiple bonds drawn	(2) AO1

Question number	Answer	Mark
(ii)	C it is oxidised A, B and D are incorrect as this is an oxidation reaction.	(1) AO2

Q6.

Question number	Answer	Mark
(i)	0.39 with or without working scores 1 mark 152.62 – 152.23 (= 0.39) (1)	(1) AO2

Question number	Indicative content	Mark
* (ii)	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material that is indicated as relevant. Additional content included in the response must be scientific and relevant. **AO1 (6 marks)** • measure 100 cm^3 of water into a beaker. • place the beaker above the burner • place draft shields around the equipment • weigh the (alcohol) burner containing the alcohol • record this mass and the name of the alcohol. • place a thermometer in the water • record the initial temperature of the water • place a lid on beaker • light the wick. • heat the water so the temperature rises by 20°C. • extinguish the flame. • re-weigh the (alcohol) burner • subtract final mass from initial mass of burner and alcohol/ calculate the mass of alcohol used. • repeat with the next alcohol • using same volume of water • keep the height of the beaker the same	(6)

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1–2	Heat the water by 20°C and then subtract the final mass from the initial mass of the burner and alcohol
Level 2	3–4	Measure 100 cm^3 of water into a conical flask, allow the alcohol to heat the water so the temperature rises by about 20°C. re-weigh the spirit burner and cap then calculate the mass of alcohol used.
Level 3	5–6	Measure 100 cm^3 of water into a conical flask/beaker. Weigh the burner and cap containing the alcohol. Record the initial temperature of the water in the flask. Allow the alcohol to heat the water so the temperature rises by about 20°C. Re-weigh the spirit burner and cap, subtract final mass from initial mass of burner and alcohol.

Question number	Answer	Mark
(iii)	0.02 with or without working scores 2 marks $\frac{0.36}{20}$ = (0.018) (1) 0.02 (1)	(2) AO2

Q7.

Question number	Answer	Additional guidance	Mark
(i)	• add yeast **(1)** • warm **(1)**	accept zymase / enzymes accept any sensible method of warming eg waterbath reject boiling allow 'heat' only if temperature range within 20-45°C specified	(2)

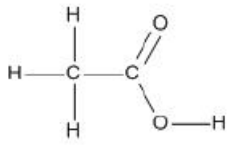
Question number	Answer	Additional guidance	Mark
(ii)	A description to include • add fractional distillation column/fractionating column (1) • in neck of flask/between flask and condenser (1)	allow use fractional distillation for MP1	(2)

Q8.

Question number	Answer	Additional guidance	Mark
(i)	A description to include • heat water to increase temperature by 30°C (1) **AND** any two from • extinguish flame (1) • (re-)determine mass of burner containing ethanol (1) • subtract final from initial mass / calculate the change in mass (1)	ignore references to timing allow watch thermometer until the temperature increases 30°C / wait for temperature to rise 30°C allow put a cap on the burner (to extinguish flame) allow '(re-)weigh the burner'	(3)

Question number	Answer	Additional guidance	Mark
(ii)	vertical axis with linear scale that uses more than half of the edge of the grid (1) all points correctly plotted to +/- ½ small square (1) single line of best fit drawn (1)	allow axis not starting at 0 allow points joined by straight lines / dot to dot ignore the line after points reject tramlines correct bar chart can gain MP1 and MP2	(3)

Q9.

Question number	Answer	Additional guidance	Mark
	 Structure to show 2 carbon atoms with 3 hydrogens joined to one of them (1)  Rest of structure correct (1)	Allow OH	(2)

Q10.

Question Number	Answer	Additional guidance	Mark
(i)	{heat/energy} is lost/escapes	Allow anywhere heat is transferred e.g. can absorb heat, heat lost to air etc.	(1) AO 3 2b

Question Number	Answer	Additional guidance	Mark
(ii)	An explanation including: • add a lid/ use of draught shield (1) • so more {heat/energy} goes to water/ less {heat/energy} escapes (1) MP2 dependent on MP1	Ignore altering distance between flame and can Allow any <u>suitable</u> insulating material Ignore burning more fuel/ less water	(2) AO 3 3b

Question Number	Answer	Additional guidance	Mark
(iii)	Final answer of 7308 with or without working scores 2 210 x 34.8 (1) = 7308 (1)	Allow 1 for 210 x (any temp change) **correctly evaluated with working** e.g. 210 x 82.4 = 17304 (1) Allow 7300, 7310; Do not allow 7000 Ignore any units	(2) AO 2 1

Q11.

Question number	Answer	Additional guidance	Mark
	An explanation linking • yeast provides enzymes (1) • (at 80°C) the enzymes {not effective / denatured} (1)	 allow yeast provides a biological catalyst allow yeast provides zymase allow yeast {contains/is} an enzyme allow yeast is denatured ignore enzyme is killed allow yeast grows well at 30°C but yeast cells are killed at 80°C .	(2)

Q12.

Question number	Indicative content	Mark
	Answers will be credited according to candidates' deployment of knowledge and understanding of the material in relation to the qualities and skills outlines in the generic markscheme. The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. **AO1 (3) and AO2 (3)** **Formula** • same general formula • $C_nH_{2n+1}COOH$ • same functional group • functional group is –COOH • members differ by CH_2 • formula mass increases by 14 • they are carboxylic acids **Physical properties** • trend in physical properties • density falls • boiling point increases **Chemical properties** • similar chemical {properties/ reactions} • all react with alcohols • form esters • all react with sodium hydroxide solution • form sodium salts • they are all acids	**(6)**

Level	Mark	Descriptor	Additional Guidance
	0	No rewardable material.	e.g. they all have similar reactions they all have high/low density they have similar densities
Level 1	1–2	• Interpretation and evaluation of the information attempted but will be limited with a focus on mainly just one variable. Demonstrates limited synthesis of understanding. (AO3) • The explanation attempts to link and apply knowledge and understanding of scientific ideas, flawed or simplistic connections made between elements in the context of the question. (AO2) States information from the table or states that are carboxylic acids.	they all have COOH (1) they are carboxylic acids because they all have COOH (2) they all react with alcohols and sodium hydroxide (2)
Level 2	3–4	• Interpretation and evaluation of the information on both variables, synthesising relevant understanding. (AO3) • The explanation is mostly supported through linkage and application of knowledge and understanding of scientific ideas, some logical connections made between elements in the context of the question. (AO2) Uses the table to draw deductions	The formula show that they differ by CH_2 each time and they all have the same functional group, COOH, so they are carboxylic acids (4) they all react with alcohols to form an ester and water, they all react with sodium hydroxide and they all have the same functional group (4)
Level 3	5–6	• Interpretation and evaluation of the information, demonstrating throughout the skills of synthesising relevant understanding. (AO3) • The explanation is supported throughout by linkage and application of knowledge and understanding of scientific ideas, logical connections made between elements in the context of the question. (AO2) Uses the table to draw deductions and describes a **pattern**	e.g. they all react with alcohols to form an ester and water, they all react with sodium hydroxide and they all have the same functional group and as molecules get bigger…. density falls ….boiling point rises

Q13.

Question Number	Answer	Additional guidance	Mark
	Any three of the following • all have –OH group/ hydroxyl group / same functional group (1) • same **general formula**/ $C_nH_{2n+1}OH$ (1) • formulae differ by CH_2 units (1) • react similarly with oxygen/all burn to form carbon dioxide and water (1) • trend in physical properties	 Ignore 'all alcohols' Do not allow 'hydroxide' Allow similar chemical reactions/ chemical properties/ a specified reaction Allow any sensible physical property e.g. increase in boiling point Ignore reference to containing C,H,O or single bonds or no double bonds	**(3)** AO 2 1

Q14.

Question number	Answer	Mark
	B glucose → ethanol + carbon dioxide **B** is the only correct answer. **A** is incorrect because water is not produced **C** is incorrect because hydrogen is not produced **D** is incorrect because water is not produced	**(1)**

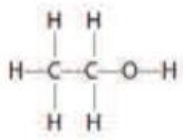
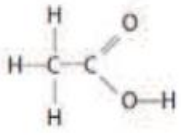
Q15.

Question number	Answer	Mark
(i)	Any two from: • mass/volume of water (1) • height of container above wick (1) • length of wick/height of flame (1) • the container needs to be the same {shape/size/material} (1) • same number of moles of alcohol (1)	**(2)**

Question number	Answer	Mark
(ii)	An explanation that combines identification via a judgement (1 mark) to reach a conclusion via justification/reasoning (1 mark): • the same temperature rise is achieved (1) • using a lower mass of alcohol/propanol (1)	**(2)**

Q16.

Question number	Answer	Marks
(i)	carboxylic acids	**(1)**

Question number	Answer	Marks
(ii)	A is  (1) B is  (1)	**(2)**

Q17.

Question number	Answer	Additional guidance	Mark
(i)	propene	accept prop-1-ene / 1-propene	(1) AO2 1

Question number	Answer	Additional guidance	Mark
(ii)	-COOH / COOH /	allow CO_2H allow displayed formula	(1) AO2 1

Question number	Answer	Additional guidance	Mark
(iii)	the polystyrene cup {is a poor conductor of heat / will melt / will burn}	ignore reference to any equipment other than the polystyrene cup (e.g. clamp stand)	(1) AO1 2

Q18.

Question Number	Answer	Additional guidance	Mark
(i)	propanol + oxygen → propanoic acid + water (2) allow $CH_3CH_2CH_2OH + O_2 \rightarrow CH_3CH_2COOH + H_2O$ (2)	Allow 1 mark for any three correctly named substances Air is not acceptable for oxygen If a mixture of words and symbols, ignore all of the symbols If 5 substances in equation, remove 1 mark If 6 or more substances in equation, score 0	(2) AO 2 1

Question Number	Answer	Mark
(ii)	**C** -COOH **The only correct answer is C** ***A*** *is not correct because this is functional group of alcohols* ***B*** *is not correct because this is a methyl group* ***D*** *is not correct because this is not a functional group*	(1) AO 1 1

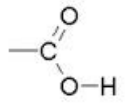
Q19.

Question number	Answer	Mark
	$C_5H_{11}OH$	**(1)**

Q20.

Question number	Answer	Mark
(i)	**B** propanol is dehydrated is the only answer Reaction **B** involves loss of water, **A**, **C** and **D** do not involve loss of water	**(1)** **AO1**

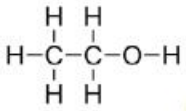
Question number	Answer	Mark
(ii)	An explanation linking • bromine water is yellow (1) • with compound **X**, yellow colour remains / no change of colour (1) • with compound **Y**, bromine water turns colourless (1) or • bromine water and compound **X** – no change in colour of bromine water (1) • bromine water and compound **Y** – bromine water changes from yellow (1) to colourless (1)	**(3)** **AO2**

Question number	Answer	Mark
(iii)	**C**  is the only answer. **A**, **B** and **D** are not correct	**(1)** **AO1**

Question number	Answer	Additional guidance	Mark
(iv)	Any suitable reaction and result such as • add a piece of magnesium ribbon (1) • bubbles of gas form (1) • add a (metal) carbonate (1) • bubbles of gas form (1) • add a metal oxide and warm (1) • metal oxide reacts to form a solution (1) • measure pH (1) • pH less than 7 (1) • add an alkali (1) • a neutral solution produced (1)	ignore add any metal but allow MP2 ignore using other indicators	**(2)** **AO3**

Q21.

Question number	Answer	Additional guidance	Mark
(i)	$C_5H_{11}OH$	allow $C_5H_{12}O$	**(1)**

Question number	Answer	Additional guidance	Mark
(ii)	 (2)	allow 1 for any molecule containing 2 carbon atoms and one single C-C bond OR any molecule containing one C-O-H allow the OH without bond between allow dot-and-cross diagrams	**(2)**