

Time Allowed: 45 minutes

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- Write your answers in the spaces provided.
 - The task is out of a total of 35 marks. The marks in brackets at the end of each question represent the value of that question.
 - All diagrams must be drawn in pencil.
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1. In class you performed an investigation to compare the heats of combustion of 3 different alkanols using a spirit burner and a conical flask.

(a) In the space below draw a fully labelled scientific diagram showing how the apparatus was set up. (2)

(b) The volume of water, height of flask above burner and the time of heating are three variables in this investigation. Identify the one variable out of these three which must be controlled for this investigation to be valid. Justify your choice. (2)

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(c) Identify the independent variable in the experiment. (1)

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(d) The following are the results a student obtained when heating 100 g of water with ethanol as the fuel for 5 minutes with the above apparatus.

Initial mass of burner and fuel = 138.8 g
Mass of burner and fuel after 5 minutes = 138.0 g
Initial temperature of water = 20°C
Final temperature of water = 71°C

Question 1(d) continued next page

(i) Calculate the heat of combustion of ethanol in kJ/mol (3)

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(ii) Calculate the energy released per gram. (1)

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(e) The chemical data book states that the accepted value for the heat of combustion of ethanol is 1360 kJ/mol. Account for the difference between this value and the value determined in the investigation above. (3)

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(f) Explain 2 improvements that could be made to the design of this investigation. (2)

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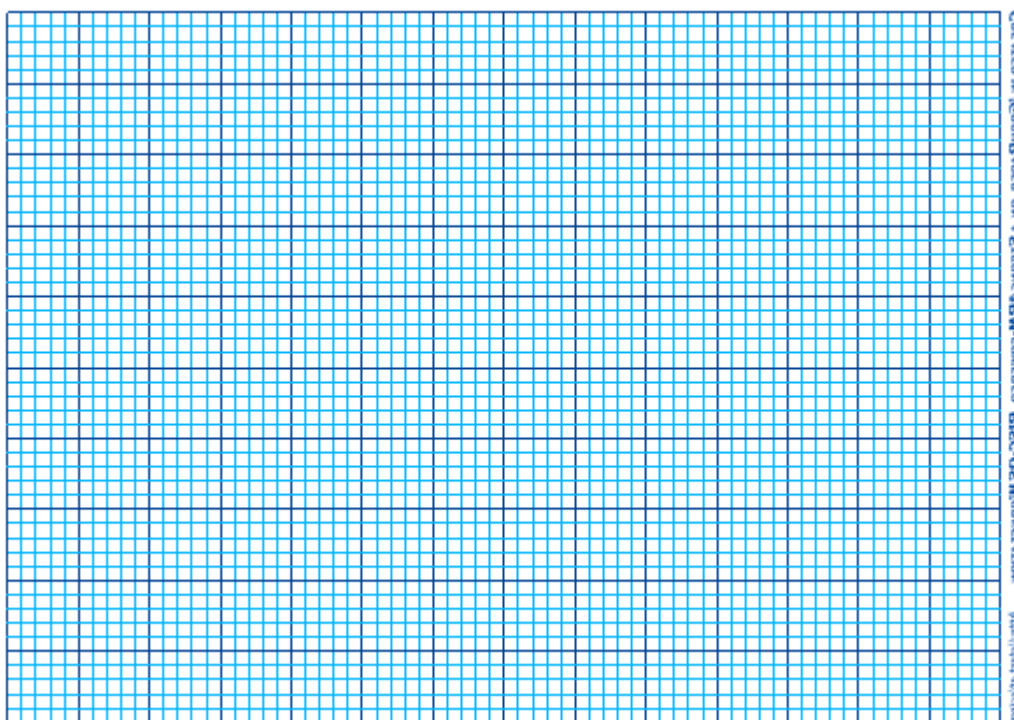
(g) Classify this procedure as destructive or non destructive testing. (1)

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2. A student carried out an investigation to produce ethanol through the fermentation of glucose and to monitor the mass changes throughout the experiment. The student placed sugar, water and yeast in a flask and sealed it with a one-way valve. The apparatus was set up on a balance connected to a data logger which recorded the mass every 8 hours. The results obtained are below.

Mass of flask and contents (g)	Time (hours)
260.0	0
255.5	8
252.5	16
250.0	24
248.0	32
246.5	40
245.0	48
244.0	56
243.0	64

- (a) Plot a line graph of the above data (3)



- (b) Account for the shape of the graph. (2)

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(c) Use the above results to calculate the mass of ethanol produced after 64 hours. (4)

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(d) Write the equation for the fermentation of glucose. (1)

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(e) Identify the dependent variable in this investigation. (1)

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(f) In carrying out this investigation the student also set up identical apparatus with sugar and water but no yeast. Explain the purpose of this. (2)

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3. Around the lab you will find the models of 4 molecules labelled A-D. Below the models is a key indicating what each colour ball used to build the models represents.

(a) Identify each of the name of each compound. (2)

A _____ B _____

C _____ D _____

(b) Describe the procedure you would use to convert A into C. Include balanced equations to support your answer. (4)

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KEY FOR MOLECULAR MODELS

BLACK = CARBON

RED = HYDROGEN

SILVER = OXYGEN

BLUE = CHLORINE

PLEASE NOTE :

- 1. Check the colour code key for the models in front of you as the colours used may not be what was used during normal class time.**
- 2. As soon as you have collected enough information to answer all parts of question one, move back to your seat so that another student can use the models.**

Marking Criteria

1. (a)

Criteria	Marks
Correctly draws a scientific labelled diagram using a pencil and straight lines	2 marks
Correctly draws a scientific diagram and does not include all labels	1 mark

1. (b)

Criteria	Marks
Correctly identifies the height of the flask as the variable necessary to control and gives a reason	2 marks
Correctly identifies the height of the flask as the required variable	1 mark

1. (c)

Criteria	Marks
Correctly identifies the fuel as the independent variable	1 mark

1. (d) (i)

Criteria	Marks
Correctly shows calculations for the ΔH , moles, and the heat of combustion	3 marks
Correctly shows calculations for two of the above	2 marks
Correctly shows calculations for one of the above	1 mark

1. (d) (ii)

Criteria	Marks
Correctly shows calculations for the energy released	1 mark

1. (e)

Criteria	Marks
Correctly gives three reasons why the value calculated in the test is less than the theoretical value based on heat loss	3 marks
Correctly gives two reasons why the value calculated in the test is less than the theoretical value based on heat loss	2 marks
Correctly gives one reason why the value calculated in the test is less than the theoretical value based on heat loss	1 mark

1. (f)

Criteria	Marks
Identifies two improvements and explains the improvements towards the design of the experiment	2 marks
Identifies one improvement and explains the improvement towards the design of the experiment	1 mark

1. (g)

Criteria	Marks
Correctly classifies the procedure used as destructive testing	1 mark

2. (a)

Criteria	Marks
Correctly plotted graph using an appropriate scale, line of best fit and correct label and units	3 marks
Correctly plotted graph with one of the above components missing	2 marks
Correctly plotted graph with 2 of the above components missing.	1 mark

2. (b)

Criteria	Marks
Correctly describes the decrease in mass due to loss of CO_2 and correctly accounts for shape of graph	2 marks
Correctly describes the decrease in mass due to loss of CO_2 or correctly accounts for shape of graph	1 mark

2. (c)

Criteria	Marks
Correctly calculates the mass of CO_2 , moles of CO_2 , mole ratio of CO_2 :ethanol and mass of ethanol produced.	4 marks
Correctly calculates 3 of the above 4 values	3 marks
Correctly calculates 2 of the above 4 values	2 marks
Correctly calculates 1 of the above 4 values	1 mark

2. (d)

Criteria	Marks
Writes correct balanced equation	1 mark

2. (e)

Criteria	Marks
Correctly identifies mass as the variable	1 mark

2. (f)

Criteria	Marks
Identifies the set up of as a control and explains the purpose (to show the effect was due to fermentation in the presence of yeast)	2 marks
Identifies the set up as a control	1 mark

3. (a)

Criteria	Marks
Correctly identifies each model using IUPAC nomenclature	2 marks
Correctly identifies 2 models using IUPAC nomenclature	1 mark

3. (b)

Criteria	Marks
2 full descriptions using correct balanced equations	4 marks
2 correctly described procedures and 1 balanced equation or 1 correctly described procedure and 2 balanced equations	3 marks
Correctly describes two procedures or writes 2 balanced equations or writes one procedure and one balanced equation	2 marks
Identifies 2 procedures or correctly describes one procedure or writes one balanced equation	1 mark