

Surname						Other Names					
Centre Number						Candidate Number					
Candidate Signature						Date					

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General Certificate of Secondary Education  
June 2008 / June 2009



**CHEMISTRY**  
**ISA C3.2 Burning Fuels**

**CHYC/C3.2**

To be conducted before 4 May 2009  
For submission in May 2008 or May 2009 or May 2010

<p><b>For this paper you must have:</b></p> <ul style="list-style-type: none"> <li>• results tables and charts or graphs from your own investigation.</li> </ul> <p>You may use a calculator.</p>
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For Teacher's Use	
Section	Mark
1	
2	
Total (max 34)	

Time allowed: 45 minutes

**Instructions**

- Use blue or black ink or ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions in **Section 1** and **Section 2**.
- Answer the questions in the spaces provided.
- Do all rough work in this book. Cross through any work you do not want to be marked.

**Information**

- The maximum mark for this paper is 34.
- The marks for questions are shown in brackets.
- You are reminded of the need for good English and clear presentation in your answers.

Did this candidate take part in the practical activity?	<b>YES / NO</b>
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Signature of teacher marking this ISA ..... Date .....

**SECTION 1**

These questions are about the investigation that **you** did.

Answer **all** questions in the spaces provided.

**1** What were you trying to find out in your investigation?

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

*(2 marks)*

**2** In your investigation:

(a) state **one** variable that it was important to keep the same;

.....

*(1 mark)*

(b) it was important to keep this variable the same to make it a fair test.

Explain why.

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

*(2 marks)*

**3** Suggest **one** change in your apparatus which would improve the **precision** of your results.

.....  
.....

*(1 mark)*

4 Which term best describes your **independent** variable (the variable that you deliberately changed)?

Draw a ring around your answer.

**categoric**

**continuous**

**control**

(1 mark)

5 State **one** possible cause of error in your investigation.

.....  
.....

(1 mark)

6 In an investigation, it is usual to repeat each measurement more than once.

Explain why you should repeat measurements.

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

(2 marks)

7 What did you find out from your investigation?

I found out that .....  
.....  
.....  
.....

(2 marks)

8 Make sure that **your** results tables and charts or graphs are handed in with this paper.

You will be awarded up to 6 marks for these.

(6 marks)

**SECTION 2**

These questions are about an investigation that may be similar to the one that you did.

Answer **all** questions in the spaces provided.

An oil company's research department investigated alternative fuels that could be used instead of petrol.

A series of alcohols was investigated to find out how much energy the alcohols would produce when they were burnt.

Look at the results in **Table 1** and then answer the questions that follow.

**Table 1**

Alcohol	Number of carbon atoms in the alcohol molecule	Energy produced on burning in kJ/g			
		Test 1	Test 2	Test 3	Mean
<b>Methanol</b>	1	21.7	22.9	23.5	
<b>Ethanol</b>	2	29.9	25.7	29.3	29.6
<b>Propanol</b>	3	32.7	33.9	34.2	33.6
<b>Butanol</b>	4	36.4	35.7	36.2	36.1
<b>Pentanol</b>	5	36.9	38.5	33.5	37.7

**9** What was the range of results for pentanol?

The range was from ..... kJ/g to ..... kJ/g.

*(1 mark)*

**10** Use **Table 1** to calculate the mean energy produced on burning methanol.

Show clearly how you work out your answer.

.....

.....

.....

.....

Write your answer into the table.

*(2 marks)*

11 Which of the following would be the best way to show these results, using the number of carbon atoms in the alcohol?

Put a tick (✓) in the box next to your choice.

Bar chart

Line graph

Pie chart

(1 mark)

12 Choose **one** result in the table that should have been checked during the investigation.

Result: Alcohol ..... Test .....

Explain why you chose this result.

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

(2 marks)

13 The temperature change, produced by the energy released when the alcohol is burnt, is measured using a thermometer.

The thermometer gives a 2 mm change in mercury length for every 1 °C change in temperature.

A second thermometer gives a 4 mm change in mercury length for every 1 °C change in temperature.

What is the advantage of using the second thermometer instead of the first thermometer?

.....  
.....

(1 mark)

14 What is the relationship between the energy produced on burning and the number of carbon atoms in the alcohol molecule?

.....  
.....

(1 mark)

- 15 The research department wanted to check the reliability of the tests without carrying out any further measurements.

Suggest **one** way in which this could be done.

.....

.....

*(1 mark)*

The research department thinks that most people would find the results in **Table 1** difficult to understand. A different table was produced showing the energy output per litre (kJ/l) of fuel and an estimate of how many miles an average car could travel using 10 litres of fuel.

**Table 2**

<b>Fuel</b>	<b>Energy produced on burning in kJ/l</b>	<b>Estimated distance that a car could travel using 10 litres of fuel in miles</b>
<b>Methanol</b>	28.6	39
<b>Ethanol</b>	37.6	51
<b>Propanol</b>	41.7	57
<b>Butanol</b>	44.6	61
<b>Pentanol</b>	46.2	63
<b>Petrol</b>	49.1	70

- 16 Explain why the research department included petrol in **Table 2** as well as the five alcohols.

.....

.....

*(1 mark)*

17 Do you agree with the research department that the results in **Table 2** are easier to understand?

Draw a ring around your answer. **Yes / No**

Explain your answer.

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

(2 marks)

18 All the alcohols can be made indirectly from crude oil. However, there are different ways of making methanol and ethanol. Methanol can be made by heating wood strongly. Ethanol can be made from a variety of plants, fruits and grains by fermentation.

Write a short report for the oil company discussing the advantages and disadvantages of using alcohols as a replacement for petrol.

*To gain full marks in this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words.*

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(4 marks)

**END OF QUESTIONS**

**There are no questions printed on this page**