

8<sup>th</sup> International Junior Science Olympiad  
Durban, South Africa

**Experimental Examination: Practical 2**  
**Answer Sheet**

**7 December 2011**

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**Complete the following:**

<b>NAME:</b>	
<b>SEAT NO.:</b>	
<b>COUNTRY:</b>	
<b>SIGNATURE:</b>	

This answer sheet consists of 6 pages. Please ensure you have them all.

**DATA TABLE**

Record as many data points as necessary.

Time/s	Temperature/°C	
	<i>Ethanol</i>	<i>Biodiesel</i>

[2.0 marks]

DATA PAGE

	Part 1: Ethanol	Part 2: Biodiesel
Initial mass of fuel + oil lamp	g	g
Final mass of fuel + oil lamp	g	g
Mass of fuel burned <b>[0.5 mark]</b>	g	g
Mass of stainless steel cup and water	g	g
Mass of empty stainless steel cup	g	g
Mass of water heated <b>[0.5 mark]</b>	g	g
Final temperature, $t_2$	°C	°C
Initial temperature, $t_1$	°C	°C
Temperature change, $\Delta t$ <b>[1 mark]</b>	°C	°C

Heat, q <b>[2.0 marks]</b>	kJ	kJ
Heat of combustion, in $\text{kJ g}^{-1}$ <b>[1.0 mark]</b>	$\text{kJ g}^{-1}$ ethanol	$\text{kJ g}^{-1}$ biodiesel
% efficiency <b>[1.0 mark]</b>	%	%

QUESTIONS

1. Give a balanced equation for the complete combustion of biodiesel (use the following formula for biodiesel:  $C_{19}H_{34}O_2$ ).

Balanced Equation	$2C_{19}H_{34}O_2 + 53O_2 \rightarrow 34H_2O + 38CO_2$
	0.25      0.25      0.25      0.25

[1.0 Marks]

2. Based on your results, which fuel produces more energy per gram burned?

**BIODIESEL or whatever is correct from the results**

[0.25 Marks]

3. Which of the following causes the largest error:

- a. Heat lost to the surroundings.
- b. Heat gained by the stainless steel cup.
- c. Condensation on the stainless steel cup.
- d. Evaporation of the water.

[0.25 Marks]

Letter of answer:	<b>a</b>
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4. Consider the following two statements:

- I. Incomplete combustion of reactants can form soot.
- II. Incomplete combustion of reactants can form carbon monoxide.

Select the correct option.

- a. Both the statements in I and II are true.
- b. Both the statements in I and II are false.
- c. Only statement I is true.
- d. Only statement II is true.

[0.5 Marks]

Letter of answer:	<b>a</b>
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**Accuracy mark**

Ethanol		Biodiesel	
Range	Mark	Range	Mark
9.20 - 9.60	<b>0.5</b>	11.80 - 12.30	<b>0.5</b>
8.80 - 9.19	<b>1</b>	11.30 - 11.79	<b>1</b>
8.40 - 8.79	<b>2</b>	10.80 - 11.29	<b>2</b>
8.00 - 8.39	<b>2</b>	10.30 - 10.79	<b>2</b>
7.60 - 7.99	<b>1</b>	9.80 - 10.29	<b>1</b>
7.20 - 7.59	<b>0.5</b>	9.30 - 9.79	<b>0.5</b>