

8th International Junior Science Olympiad
Durban, South Africa

Experimental Examination: Practical 1
Model Answer

7 December 2011

**TO DETERMINE THE EFFECT OF CHEMICALS AND TEMPERATURE ON
MEMBRANE DESTRUCTION AND PERMEABILITY IN BEETROOT (*Beta vulgaris*)**

SECTION A

a. State whether the following statements are true or false by ticking the appropriate box.

	TRU E	FALSE
1. Betacyanin is not soluble in water. 0.25 mark		<input type="checkbox"/>
2. Betacyanin is soluble in organic solvents only. 0.25 mark		<input type="checkbox"/>
3. Damaged cells were empty of betacyanin after repeated washing, and no further cell membrane damage occurred. 0.25 mark	<input type="checkbox"/>	

(0.25 x 3 = 0.75 marks)

b. Choose the correct answer by ticking the appropriate box.

TT1 <input type="checkbox"/>	TT2	TT3	TT4
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(0.5

mark)

c. Choose the correct answer by ticking the appropriate box.

TT2 <input type="checkbox"/>	TT3
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(0.5 mark)

d. Choose the correct answer by ticking the appropriate box.

Upper

Lower

(0.5 mark)

e. State whether the following statements are true or false by ticking the appropriate box.

	TRU E	FALSE
1. The cell membranes in TT1 were not further disrupted.	<input type="checkbox"/>	
2. Cyclohexane damaged the cell membranes in TT4, causing betacyanin to leak out.	<input type="checkbox"/>	
3. Cyclohexane dissolved the lipids in the cell membranes in TT4, causing betacyanin to leak out, which dissolved in the water only.	<input type="checkbox"/>	

(0.5 x 3 = 1.5 mark)

SECTION B**f.**

- i.** Draw a table to show the mean absorbance (to 2 decimal places) at each temperature and record it in the space provided below.

(0.25 x 5 = 1.25 marks)

Temperature (°C)	Mean
20	0.02
30	0.02
40	0.03
60	0.45
80	0.50

- ii.** Write your answer in the box below.

(0.5 mark)

- iii. Draw a line graph on the graph paper provided using the mean absorbance to show the effect of temperature on membrane permeability in beetroot.

(2.5 marks)

SECTION C

g. Write T or F in the box provided.

- i. Betacyanin requires water for maximum solubility
- ii. Betacyanin is more soluble in 100% acetone than in 50% acetone

(0.5 x 2 = 1 mark)

h. Choose the correct answer by ticking the appropriate box/es.

Cyclohexane	<input type="checkbox"/> Room temperature water	<input type="checkbox"/> Hot water
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(0.5 mark)

SECTION D

- i. Record the masses of the 2 cylinders (TT5 and TT6) in the table below.

	Initial Mass	Final Mass	
TT5			
TT6			

(0.25 x 6 = 1.5 marks)

- j. Indicate whether the following statements are true or false by ticking the appropriate box.

	TRUE	FALSE
i. NaCl caused plasmolysis in the beetroot cells.	<input type="checkbox"/>	
ii. NaCl dissolved the lipids in the cell membranes.		<input type="checkbox"/>
iii. The beetroot cells absorbed NaCl and became turgid.		<input type="checkbox"/>
iv. The beetroot cells lost betacyanin to the surrounding water.	<input type="checkbox"/>	

(0.5 x 4 = 2 mark)

Figure 1: Effect of temperature on membrane permeability in beetroot

Mark scheme	
0.25	For each plotted point = 1.5
0.25	For each correct axis label = 0.5
	Scale = 0.5
0.25	For caption = 0.25. No penalty if Figure-1 is not written. Must have caption.

TOTAL MARK (13)

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Experimental Examination: Practical 2
Answer Sheet

7 December 2011

Complete the following:

NAME:	
SEAT NO.:	
COUNTRY:	
SIGNATURE:	

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

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 [0.5 mark]	g	g
Mass of stainless steel cup and water	g	g
Mass of empty stainless steel cup	g	g
Mass of water heated [0.5 mark]	g	g
Final temperature, t_2	°C	°C
Initial temperature, t_1	°C	°C
Temperature change, Δt [1 mark]	°C	°C

Heat, q [2.0 marks]	kJ	kJ
Heat of combustion, in kJ g^{-1} [1.0 mark]	kJ g^{-1} ethanol	kJ g^{-1} biodiesel
% efficiency [1.0 mark]	%	%

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:

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

[0.25 Marks]

Letter of answer:	a
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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:	a
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Accuracy mark

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