

Module 4 Summative Assessment

Marks		
Maximum Possible	Earned	%
63		

Lesson 1

View the Virtual Investigation “Calorimetry” in Module 4 Lesson 1.2
Use the information from the Virtual Investigation to answer Questions 1-6.

1. Using the series of photographs provided, complete the following data table:

Answer (2 Marks)

mass of pecan (g)	
mass of water (g)	
initial temperature of water (°C)	
final temperature of water (°C)	

2. Calculate the quantity of energy that was absorbed by the water.

Answer (2 marks):

3. Explain how calculating the thermal energy absorbed by the water is related to the enthalpy change of the burning nut.

Answer (1 Mark)

4. Calculate the quantity of energy produced **per gram** of fuel (nut) burned.

Answer (2 Marks):

5. Judging from the experimental design, predict whether the experimental enthalpy of combustion for the nut will be greater or smaller than the theoretical enthalpy of combustion for the nut. Explain why.

Answer (2 Marks):

6. Describe how the experimental design could be improved in order to improve the accuracy of the results.

Answer (2 Marks):

View the Virtual Investigation “Molar Enthalpy of Reaction” in Module 4 Lesson 1.4.

Use the information from the Virtual Investigation to answer Questions 7 – 9.

7. Record your data from the Virtual Investigation in the following table.

Answer (3 Marks)

Mass of Mg(s) (g)	Initial temperature (°C)	Final temperature (°C)	Change in temperature (°C)
0.15			
0.25			
0.35			

8. Calculate the experimental molar enthalpy of reaction for Mg(s) for each of the three trials.

Answer (6 Marks):

9. List any assumptions made in this experiment.

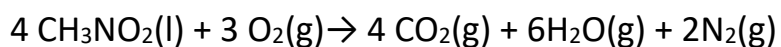
Answer (3 Marks):

10. Calculate the molar enthalpy of combustion for methanal, $\text{CH}_2\text{O}(\text{l})$, if 47.5 kJ of energy is transferred when 2.50 g of methanal is burned in a calorimeter.

Answer (3 Marks)

Use the following information to answer Questions 11 and 12.

Top fuel dragsters (sometimes called funny cars) burn nitromethane. This combustion is represented by the equation below.



$$\Delta_c H = -1418.4 \text{ kJ}$$

11. Calculate the **molar enthalpy of combustion** for nitromethane.

Answer (2 Marks)

12. A 5.00 g sample of nitromethane was burned in a calorimeter that contained 250 g of water at 20.5°C. Calculate the final temperature of the water if all 5.00 g of nitromethane is combusted.
Hint – you will need to use the molar enthalpy of combustion that you calculated in Question 11.

Answer (4 Marks)

13. Draw a diagram showing how the following fuel burner, with additional equipment, could be used to measure the experimental enthalpy of combustion of methanol, a common fondue fuel.



Answer (3 Marks)

14. Refer to your diagram in Question 13. Identify the measurements that must be taken in order to determine the experimental molar enthalpy of combustion for liquid methanol. Assume negligible heat absorption by the container.

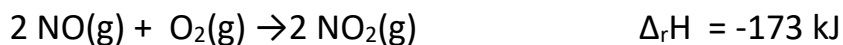
Answer (3 Marks)

Lesson 2

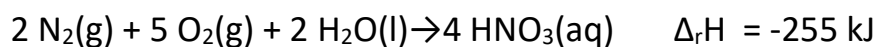
Use the following information to answer Question 15.

Given the following reactions:

Reaction I



Reaction II



Reaction III



15. Calculate the enthalpy of reaction for the reaction of nitrogen dioxide with water represented by the following equation.



Answer (4 Marks)

Lesson 3

16. Write a balanced equation for the formation of copper(II) oxide at standard state. Include the enthalpy change as an energy term in the balanced equation.

Answer (1 Mark)

17. Sketch and label a chemical potential energy diagram for the formation of copper(II) oxide at standard state.

Answer (2 Marks)

18. Write a balanced equation for the simple decomposition of iron(II) oxide at standard state. Include the enthalpy change as an energy term in the balanced equation.

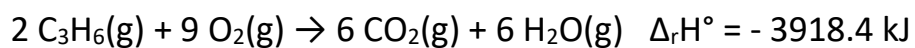
Answer (1 Mark)

19. Sketch and label a chemical potential energy diagram for the simple decomposition of iron(II) oxide.

Answer (2 Marks)

Use the following information to answer Question 20.

Cyclopropane combusts according to the following reaction



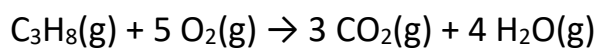
20. Calculate the **standard molar enthalpy of formation** for cyclopropane.

Answer (3 Marks)

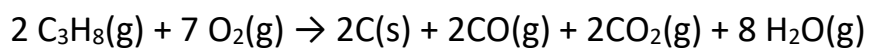
Use the following information to answer Questions 21, 22 and 23.

In an effort to maximize the efficiency of a propane barbeque, the oxygen to fuel ratio is altered. In two different trials the following two reactions were observed.

Trial I



Trial II



21. Identify the following variables in this experiment.

Answer (4 Marks)

Manipulated	
Responding	

22. Calculate the molar enthalpy of combustion for propane in each of the above reactions.

Answer (6 Marks)

23. Based on your calculations, which reaction is a more efficient combustion process? Justify your response.

Answer (2 Marks)