

# QUIZ I: THERMOCHEMISTRY

SCH4UE 2002-2003

Name: \_\_\_\_\_

Total Score: /20)

## Matching (6)

Find the most appropriate match between the item in Column A and the description of that item in Column B.

### Column A

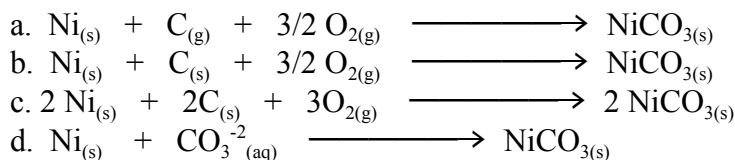
### Column B

- |   |  |
|---|--|
| 1. $\Delta H = + 25 \text{ kJ}$   | _____ a. standard conditions for reporting $\Delta H^0$  |
| 2. $\text{Na}_{(s)} + 1/2 \text{Cl}_{2(g)} \rightarrow \text{NaCl}_{(s)}$ | _____ b. standard enthalpy of formation for an element in its most stable state at 100 kPa and 25 °C |
| 3. $q_p = \Delta H$   | _____ c. standard enthalpy of formation of a compound  |
| 4. $q = mc\Delta T$   | _____ d. heat calculated at constant pressure  |
| 5. 100 kPa and 25°C   | _____ e. endothermic process   |
| 6. $\Delta H_f^0 = 0.00 \text{ kJ}$                                       | _____ f. formula for calculating the amount of heat transferred.                                     |

## Multiple Choice (10)

7. The specific heat of silver is  $0.226 \text{ J g}^{-1}\text{C}^{-1}$ . Calculate the heat required to raise the temperature of 30.0 g of silver metal from 18.2 °C to 35.6 °C.
- a. 118 J                      b. 123 J                      c. 241 J                      d. 1.08 kJ
8. Given the following thermochemical equation:
- $$\text{H}_{2(g)} + 1/2 \text{O}_{2(g)} \longrightarrow \text{H}_2\text{O}_{(l)} \quad \Delta H^0 = - 285.8 \text{ kJ}$$
- How much heat is evolved when 100.0 g of  $\text{H}_2\text{O}_{(l)}$  are formed from the combustion of hydrogen gas and oxygen gas?
- a. - 51.44                      b. - 285 kJ                      c. - 1587 kJ                      d. - 2297 kJ
9.  $\text{H}_{2(g)}$  and  $\text{Cl}_{2(g)}$  react according to the following equation, forming  $\text{HCl}_{(g)}$ :
- $$\text{H}_{2(g)} + \text{Cl}_{2(g)} \longrightarrow 2 \text{HCl}_{(g)} \quad \Delta H^0 = - 92.0 \text{ kJ}$$
- If  $\text{H}_{2(g)}$  and  $\text{Cl}_{2(g)}$  are mixed in a thermally insulated vessel, the reaction that occurred would be:
- a. endothermic, and the temperature of the reaction system would rise.  
b. endothermic, and the temperature of the reaction system would fall.  
c. exothermic, and the temperature of the reaction system would rise.  
d. exothermic, and the temperature of the reaction system would fall.
10. Given the following thermochemical equation:
- $$2 \text{Al}_{(s)} + 3/2 \text{O}_{2(g)} \longrightarrow \text{Al}_2\text{O}_{3(s)} \quad \Delta H^0 = - 400 \text{ kJ}$$
- Determine  $\Delta H^0$  for:  $2 \text{Al}_2\text{O}_{3(s)} \longrightarrow 4 \text{Al}_{(s)} + 3 \text{O}_{2(g)}$
- a. + 200 kJ                      b. + 400 kJ                      c. - 400 kJ                      d. + 800 kJ
11. Which one of the following equation represents the standard enthalpy of formation of

nickel (II) carbonate,  $\text{NiCO}_3$ :



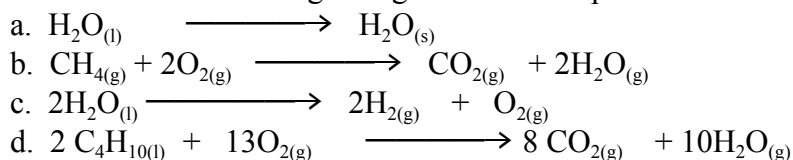
12. What is the specific heat capacity for metal X from the following information. 95 g of metal at  $75^\circ\text{C}$  are placed in 50 g of water, (specific heat capacity of water,  $c = 4.184 \text{ J g}^{-1} \text{ }^\circ\text{C}^{-1}$ ). The final temperature of the water is  $23^\circ\text{C}$ .

a. 23                      b. 0.21                      c. 0.76                      d. 3.6

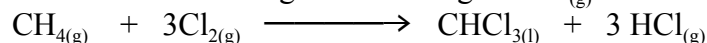
13. The average fuel value, (i.e. the energy released upon ingestion), of sugar is  $17 \text{ kJ g}^{-1}$ . A 2.0 L jug of sweetened Kool-Aid contains 400 g of sugar. What is the fuel value (in kJ) of a  $500 \text{ cm}^3$  serving of Kool-Aid? (Assume the sugar is the only fuel source.)

a.  $4.2 \times 10^4$               b.  $1.7 \times 10^3$               c.  $1.7 \times 10^6$               d.  $1.7 \times 10^2$

14. Which one of the following changes will have a positive value of  $\Delta H^\circ$  ?

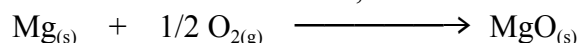


15. The value of  $\Delta H^\circ$  for the following reaction is  $-336 \text{ kJ}$ . Determine the amount of heat in kJ exchanged with the surroundings when 23.0 g of  $\text{HCl}_{(g)}$  is formed.



a. 177                      b.  $2.57 \times 10^3$               c. 70.7                      d. 211

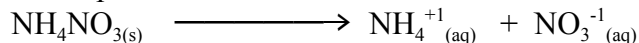
16. A 0.1326 g sample of magnesium was burned in an oxygen bomb calorimeter. The total heat capacity of the calorimeter plus water was  $5.760 \text{ J }^\circ\text{C}^{-1}$ . If the temperature rise of the calorimeter with water was  $0.570^\circ\text{C}$ , calculate the enthalpy of combustion of magnesium.



a.  $-3280 \text{ kJ mol}^{-1}$       b.  $435 \text{ kJ mol}^{-1}$               c.  $106 \text{ kJ mol}^{-1}$               d.  $-602 \text{ kJ mol}^{-1}$

### **Problem (4)**

1. When a 4.25 g sample of solid ammonium nitrate dissolves in 60.0 g of water in a coffee cup calorimeter, the temperature drops from  $22.0^\circ\text{C}$  to  $16.9^\circ\text{C}$ . Calculate  $\Delta H$  (in  $\text{kJ mol}^{-1}$   $\text{NH}_4\text{NO}_3$ ) for the solution process:



Assume that the specific heat of the solution is the same as that of pure water. Write a thermochemical equation dissolution of ammonium nitrate.