

# CH 05 blank

## Section 5.1:

1. Identify the kind of energy change usually associated with each of the following:  
(a) Toaster (e) Automobile (h) Ski jump  
(b) Radio generator (i) Fluorescent lamp  
(c) Automobile engine (f) Model airplane (j) Photoelectric cell  
(d) Automobile battery engine (k) furnace  
(g) Friction
2. distinguish between a change of state and a phase change. Give an example of each.

## Section 5.2: & 5.3

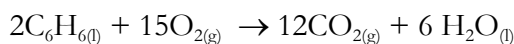
3. **(6 points)** For the following processes determine whether the process is endothermic or exothermic:
  - a. A piston is heated by adding 51 kJ of heat. It expands, doing 15 kJ of work on the atmosphere.
  - b. A system releases 125 kJ of heat while 104kJ of work is done on it.
  - c. A chemical reaction releases 5.75 kJ of heat and does no work on the surroundings.

|   | $\Delta E$ | Endo thermic | Exo thermic |
|---|------------|--------------|-------------|
| A |            |              |             |
| B |            |              |             |
| C |            |              |             |

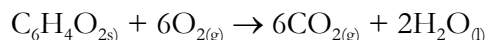
4. **(6 points)** For the following processes determine whether the process is endothermic or exothermic:
  - d. A balloon is heated by adding 240J of heat. It expands, doing 135J of work on the atmosphere.
  - e. A 50-g sample of iron metal is cooled from 100 °C to 90°C, thereby losing approximately 225 J of heat.
  - f. A chemical reaction releases 5.75 kJ of heat and does no work on the surroundings.

**Section 5.4:**

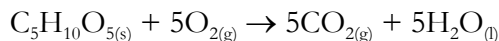
5. Deterioration of buildings, bridges, and other structures through the rusting of iron costs millions of dollars ad day. The actual process requires water, but a simplified equation is
- $$4\text{Fe}_{(s)} + 3\text{O}_{2(g)} \rightarrow 2\text{Fe}_2\text{O}_{3(s)} \Delta H = -1.65 \times 10^3 \text{kJ}$$
- a) How much heat is released when 0.250 kg of iron rusts?
- b) How much rust forms when  $4.85 \times 10^3$  kJ of heat is released?
6. **(4 points)** Benzene is an organic liquid that easily combusts in the presence of oxygen. The value of  $\Delta H$  for the following reaction is -6535kJ. How many kJ of heat will be evolved during the combustion of 16.0 g of  $\text{C}_6\text{H}_{6(l)}$ ?

**Section 5.5:**

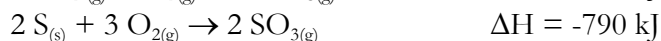
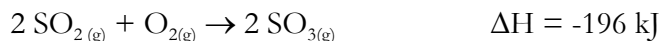
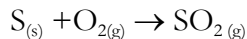
7. **(combines with 11.4) (5 points)** What is the quantity of heat (in joules) needed to raise the temperature of 454 g of tin from room temperature (25.0°C) to its melting point, 231.9°C, and then melt the tin to form liquid tin? The  $C_p$  tin = 0.277J/g-K and the  $\Delta H_{\text{fus}}$  tin = 59.2J/g.
8. **(6 points)** A 20.0 g piece of metal at 100.0 °C is placed in a calorimeter containing 50.7 g of water at 22.0 °C the final temperature of the mixture is 25.7 °C. What is the specific heat capacity of the metal?
9. **(8 points)** The Quinone,  $\text{C}_6\text{H}_4\text{O}_2$ , is burned completely in oxygen in a bomb calorimeter. Burning a 0.1964-g sample caused the temperature of the calorimeter to rise 3.200°C. The heat capacity of the calorimeter and its contents (the bomb and the water) is 1.56kJ/C. Calculate the  $\Delta H$  (kJ/g of Quinone) for the combustion reaction of Quinone



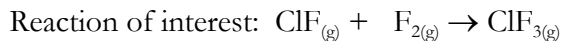
10. **(6 points)** A 20.0 g piece of metal at 100.0 °C is placed in a calorimeter containing 50.7 g of water at 22.0 °C, the final temperature of the mixture is 25.7 °C. What is the specific heat capacity of the metal?
11. **(6 points)** The sugar arabinose,  $\text{C}_5\text{H}_{10}\text{O}_5$ , is burned completely in oxygen in a bomb calorimeter. Burning a 0.548-g sample caused the temperature of the calorimeter to rise from 20.00°C to 20.54°C. The heat capacity of the calorimeter and its contents (the bomb and the water) is 15.8kJ/C. Calculate the  $\Delta H$  (kJ/mole arabinose) for the combustion reaction per mole of arabinose.

**Section 5.6:**

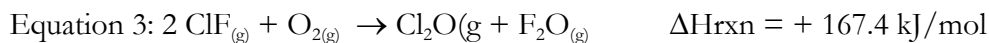
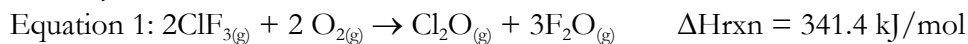
12. **(5 points)** From the following enthalpies of reaction (2 equations) listed below, calculate the  $\Delta H_{\text{rxn}}$  for the reaction of sulfur with oxygen gas:



13. **(6 points)** What is the  $\Delta H_{\text{RXN}}$  at constant pressure for the reaction of interest?

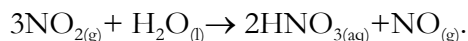


Pathway reactions:



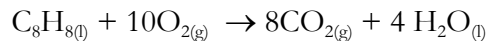
### Section 5.7:

14. **(5 points)** Calculate the  $\Delta H^\circ_{\text{rxn}}$  for the reaction of



Heats of formation for the compounds are:  $\Delta H^\circ_f \text{NO}_{2(\text{g})} = 33.84 \text{ kJ/mol}$ ,  $\Delta H^\circ_f \text{H}_2\text{O}_{(\text{l})} = -285.83 \text{ kJ/mol}$ ,  $\Delta H^\circ_f \text{HNO}_{3(\text{aq})} = -206.6 \text{ kJ/mol}$ ,  $\Delta H^\circ_f \text{NO}_{(\text{g})} = 90.37 \text{ kJ/mol}$

15. Styrene is an organic liquid that easily combusts in the presence of oxygen. The  $\Delta H^\circ_{\text{rxn}}$  for the following reaction is  $-4395.0 \text{ kJ}$ . Using the standard heats of formation listed on the formula page, calculate the heat of formation ( $\Delta H^\circ_f$ ) for styrene,  $\text{C}_8\text{H}_{8(\text{l})}$ ?



16. **(6 points)** Aspartame is a white crystalline solid that was discovered in 1963 by accident in the lab. A careless chemist licked his dirty fingers and tasted sweetness. Aspartame has a molecular formula of  $\text{C}_{14}\text{H}_{18}\text{N}_2\text{O}_5$ . Write the equation for the standard enthalpy of formation for 1 mole of aspartame. Include all phases, correct formulas, and coefficients.