CHM151 Quiz 5a 25 Pts Fall 2018 Name: Key

1. (2 Pts) Which of the following has a $\Delta H°_f = 0$ kJ/mol?
   A) NO(g) B) CS_2(l) C) Fe^{2+}(aq) D) H_2O(l) (E) N_2(g)

2. (4 Pts) How much heat (kJ) is evolved when 4.50 g of Fe_2O_3 is reacted with excess carbon monoxide using the equation below? (atomic masses: Fe55.85, O 16.00)
   $Fe_2O_3(s) + 3CO(g) \rightarrow 2\,Fe(s) + 3\,CO_2(g)$ $\Delta H°_{rxn} = -24.8$ kJ/mol,

$$4.50\ g\ Fe_2O_3 \left| \frac{mol\ Fe_2O_3}{159.72\ g\ Fe_2O_3} \right| \frac{24.8\ kJ}{mol\ Fe_2O_3} = 0.699\ kJ$$

3. (2 Pts) Given $2Al(s) + (3/2)O_2(g) \rightarrow Al_2O_3(s)$, $\Delta H°_f = -1{,}670$ kJ/mol for Al_2O_3 (s).
   Determine $\Delta H°$ for the reaction $2Al_2O_3(s) \rightarrow 4Al(s) + 3O_2(g)$.
   since the 2nd reaction is the 1st reversed and doubled

$$2 \times (+1{,}670) = 3{,}340\ kJ$$

4. (6 Pts) At 25°C, the following heats of reaction are known:
   1. $2ClF(g) + O_2(g) \rightarrow Cl_2O(g) + F_2O(g)$ $\Delta H°_{rxn} = 167.4$ kJ/mol
   2. $2ClF_3(g) + 2O_2(g) \rightarrow Cl_2O(g) + 3F_2O(g)$ $\Delta H°_{rxn} = 341.4$ kJ/mol
   3. $2F_2(g) + O_2(g) \rightarrow 2F_2O(g)$ $\Delta H°_{rxn} = -43.4$ kJ/mol

   At the same temperature, calculate $\Delta H°_{rxn}$ for the following reaction:
   Goal: $ClF(g) + F_2(g) \rightarrow ClF_3(g)$

ClF: #1 ÷ 2 $\quad ClF(g) + \frac{1}{2}O_2 \rightarrow \frac{1}{2}Cl_2O(g) + \frac{1}{2}F_2O(g)$ 83.7

F_2: #3 ÷ 2 $\quad F_2(g) + \frac{1}{2}O_2(g) \rightarrow F_2O(g)$ -21.7

ClF_3: #2 reverse & ÷ 2 $\quad \frac{1}{2}Cl_2O(g) + \frac{3}{2}F_2O(g) \rightarrow ClF_3(g) + O_2(g)$ -170.7

$ClF(g) + F_2 \rightarrow ClF_3(g)$ -108.7 kJ

More questions on Back.

5b Key (white)

5. (3 Pts) Given the specific heat for aluminum is 0.900 J/g·°C, how much heat is released when a 3.8 g sample of Al cools from 450.0°C to 25°C.

$$\frac{0.900\ J}{g \cdot °C} \left| \begin{array}{l} 3.8\ g \\ \\ \end{array} \right| \begin{array}{l} 425\ °C \\ \\ \end{array} = 1453.5\ J$$

6. (4 Pts) Find the standard enthalpy of formation of ethylene, $C_2H_4(g)$, given the following data: heat of combustion of $C_2H_4(g) = -1411$ kJ/mol; $\Delta H°_f[CO_2(g)] = -393.5$ kJ/mol; $\Delta H°_f[H_2O(l)] = -285.8$ kJ/mol. You must first write a balanced chemical equation for the combustion of ethylene.

$$C_2H_4(g) + 3O_2(g) \rightarrow 2CO_2(g) + 2H_2O(g) \quad \Delta H_{RXN} = -1411\ kJ$$

X kJ/mol; 0 kJ/mol; -393.5 kJ/mol; -285.8 kJ/mol

$$\Delta H_{RXN} = \sum n\Delta H_{products} - \sum n\Delta H_{reactants}$$

$$-1411 = [2(-393.5) + 2(-285.8)] - [X + 3(0)]$$

$$X = 52.4\ kJ/mol$$

7. (4 Pts) Calculate the amount of heat necessary to raise the temperature of 135.0 g of water from 50.4°F to 85.0°F. The specific heat of water = 4.184 J/g·°C.

$$\frac{4.184\ J}{g \cdot °C} \left| \begin{array}{l} 135.0\ g \\ \\ \end{array} \right| \begin{array}{l} (34.6\ °F \mid 100\ °C \\ \quad\quad 180°F) \end{array} = 10857\ J$$

$10.9\ kJ$

If worked with °F (Failed to convert):

$$\frac{4.184\ J}{g \cdot °C} \left| \begin{array}{l} 135.0\ g \\ \\ \end{array} \right| \begin{array}{l} 34.6\ °F \\ \\ \end{array} = 19.5\ kJ$$

wrong answer