CHM151 Quiz7a 25 Pts Fall 2010 Name: Key

SHOW ALL WORK TO RECEIVE CREDIT

1. (5 Pts) Octane (C_8H_{18}) undergoes combustion according to the following thermochemical equation:

$2C_8H_{18}(l) + 25O_2(g) \rightarrow 16CO_2(g) + 18H_2O(l)$ $\Delta H°rxn =$ _____ kJ.

Given: $\Delta H°_f[CO_2(g)] = -393.5$ kJ/mol; $\Delta H°_f[H_2O(l)] = -285.8$ kJ/mol; $\Delta H°_f[C_8H_{18}(l)] = -210$ kJ/mol
Determine the value of $\Delta H°$ for the reaction.

$\Delta H°_{rxn} = \sum n\Delta H°_{products} - \sum n\Delta H°_{reactants}$

$= [16(-393.5) + 18(-285.8)] - [2(-210) + 25(0)]$

$= -11020$ kJ $= -1.1 \times 10^4$ kJ

2. (5 Pts) Copper metal has a specific heat of 0.385 J/g·°C. Calculate the amount of heat required to raise the temperature of 42.8 g of Cu from 20.0°C to 895°C.

$$\frac{0.385\ J}{g \cdot °C} \left| \frac{42.8\ g}{} \right| \frac{875\ °C}{} = 14400\ J$$

14.4 kJ

3. (5 Pts) Glycine $C_2H_5O_2N$ is important for biological energy. The combustion reaction of glycine is given by the equation

$4C_2H_5O_2N(s) + 9O_2(g) \rightarrow 8CO_2(g) + 10H_2O(l) + 2N_2(g)$ $\Delta H°rxn = -3857$ kJ

Given that $\Delta H°_f[CO_2(g)] = -393.5$ kJ/mol, and $\Delta H°_f[H_2O(l)] = -285.8$ kJ/mol. Calculate the enthalpy of formation $\Delta H°_f$ ***per mole*** of glycine.

$\Delta H°_{rxn} = \sum n\Delta H°_{products} - \sum n\Delta H°_{reactants}$

$-3857\ kJ = [8(-393.5) + 10(-285.8) + 2(0)] - [4(x) + 9(0)]$

$x = -537.25$ kJ

4. (5 Pts) Calculate the enthalpy change for the reaction

$2C_8H_{18}(l) + 21O_2(g) \rightarrow 8CO(g) + 8CO_2(g) + 18H_2O(l)$ $\Delta H°rxn = ?$

Given:

$2C_8H_{18}(l) + 25O_2(g) \rightarrow 16CO_2(g) + 18H_2O(l)$ $\Delta H°rxn = -11{,}020$ kJ.

$2CO(g) + O_2(g) \rightarrow 2CO_2(g)$ $\Delta H°f = -566.0$ kJ.

$2C_8H_{18}(l) + \cancel{25}\,21O_2(g) \rightarrow \cancel{16}\,8CO_2(g) + 18H_2O(l)$ -11020 kJ

rev. ×4 $\cancel{8CO_2(g) \rightarrow 8CO(g) + 4O_2(g)}$ $+2264$ kJ

$2C_8H_{18}(l) + 21O_2(g) \rightarrow 8CO(g) + 8CO_2(g) + 18H_2O(l)$ -8756 kJ

5. (5 Pts) Given the thermochemical equation: $2SO_2 + O_2 \rightarrow 2SO_3$ $\Delta H°rxn = -198$ kJ.
What is the enthalpy change ($\Delta H°$) for the decomposition of 3.5 moles of SO_3?

$$\frac{3.5\ \cancel{mol}\ SO_3}{} \left| \frac{-198\ kJ}{2\ \cancel{mol}\ SO_3} \right. = -346.5\ kJ$$

-350 kJ