CHM151 Quiz #7b 25 Pts Fall 2007 Name: Key

SHOW ALL WORK TO RECEIVE CREDIT.

1. (5 Pts) Given the ΔH_f° values in kJ/mole: $NH_3(g)$ -45.9, $NO(g)$ = 90.3, $H_2O(g)$ -241.8, calculate the standard enthalpy change for the following reaction:

$$4NH_3(g) + 5O_2(g) \rightarrow 4NO(g) + 6H_2O(g)$$

$\Delta H^\circ_{RxN} = \sum \Delta H_{prod} - \sum \Delta H_{react}$

$= [4(90.3) + 6(-241.8)] - [4(-45.9) + 0] = -906\ kJ$

2. (5 Pts) $C_6H_{12}O_6(s) + 6O_2(g) \rightarrow 6CO_2(g) + 6H_2O(g)$ $\Delta H = -2803$ kJ

Calculate the value of ΔH if 85.9 g of $H_2O(g)$ are produced.

$$\frac{85.9\ g\ H_2O}{18.02\ g} \left| \frac{mol}{6\ mol\ H_2O} \right| \frac{-2803\ kJ}{} = -2227\ kJ$$

3. (10 Pts) Calculate the value of ΔH for the reaction:

$$CH_4(g) + NH_3(g) \rightarrow HCN(g) + 3H_2(g)$$

Use the following reactions:

(a) $H_2(g) + 2C(graphite) + N_2(g) \rightarrow 2HCN(g)$ $\Delta H = 270.3$ kJ

(b) $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$ $\Delta H = -98.8$ kJ

(c) $C(graphite) + 2H_2(g) \rightarrow CH_4(g)$ $\Delta H = -74.9$ kJ

CH_4: rev. c $\quad CH_4(g) \rightarrow C(graphite) + 2H_2(g)$ $\quad +74.9$ kJ

NH_3: rev. b ÷ 2 $\quad NH_3(g) \rightarrow \frac{1}{2}N_2(g) + \frac{3}{2}H_2(g)$ $\quad +49.4$ kJ

HCN: a ÷ 2 $\quad \frac{1}{2}H_2(g) + C(graphite) + \frac{1}{2}N_2(g) \rightarrow HCN(g)$ $\quad +135.15$ kJ

$CH_4(g) + NH_3(g) \rightarrow HCN(g) + 3H_2(g)$ $\quad +259.45$ kJ

4. (5 Pts) Given the reaction: $2NO(g) + O_2(g) \rightarrow 2NO_2(g)$ $\Delta H = -114$ kJ

Calculate the enthalpy change per gram of NO.

Since $\Delta H = \frac{-114\ kJ}{2\ mol\ NO}$

and molar mass of $NO = \frac{30.007\ g}{mol}$

$$\frac{-114\ kJ}{2\ mol\ NO} \left| \frac{1\ mol\ NO}{30.007\ g} \right| = -1.90\ \frac{kJ}{g\ NO}$$