CM205 Exam 4
Open Books/Open Notes

Name: _____

1. (20 pts) What is the specific heat of formation for nitrogen dioxide at T=100^{o}C and 1 atm?

2. (20 pts) Obtain the standard heat of mixing for $AB_2(aq,r=\infty)$ given the following data:

$$A(aq,r=\infty)+2B(aq,r=\infty)\rightarrow AB_2(aq,r=\infty) \qquad \Delta\hat{H}_r{}^o = +110\ kJ/mol$$

$$\Delta\hat{H}_f{}^o(A) = -100\ kJ/mol$$

$$\Delta\hat{H}_f{}^o(B) = -50\ kJ/mol$$

$$\Delta\hat{H}_f{}^o(AB_2) = -120\ kJ/mol$$

$$\Delta\hat{H}_m{}^o{}_{A(aq,r=\infty)} = -20\ kJ/mol$$

$$\Delta\hat{H}_m{}^o{}_{B(aq,r=\infty)} = -35\ kJ/mol$$

3 (5 pts) What is the formation reaction for magnesium hydroxide ?

4 (5 pts) What is the combustion reaction for liquid benzyl alcohol ?

5 Ethylene is mixed with air and fed at 200^{o}C to a reactor to form ethylene oxide:

$$C_2H_4(g)+\tfrac{1}{2}O_2(g)\rightarrow C_2H_4O(g)$$

with a side reaction:

$$C_2H_4(g)+3O_2(g)\rightarrow 2CO_2(g)+2H_2O(g)$$

The product gas is 6.90 mol% C_2H_4O, 9.20 mol% CO_2, 9.20 mol% H_2O, 0.00 mol % C_2H_4, and the balance is a mixture of O_2 and N_2. The product gas exits the reactor at 600^{o}C.

a) (25 pts) Using the basis of 100 mols/hr of ethylene oxide, calculate the molar flow rates of the components in the feed and in the product gas.
b) (25 pts) Using the same basis of a), calculate the rate of heat supplied (or removed) in kJ per hour.

Additional data for ethylene-oxide:

$\Delta H_f{}^o$ = -51 kJ/mol
C_p(kJ/(mol K))= $0.441\text{x}10^{-3} + 0.151\text{x}10^{-5}\ T - 0.995\text{x}10^{-8}\ T^2$ (T in ^{o}C)

6. (Bonus 10 pts) What is the standard specific enthalpy of reaction for the partial combustion reaction of one mole of liquid heptane to form $CO(g)$ and $H_2O(g)$?