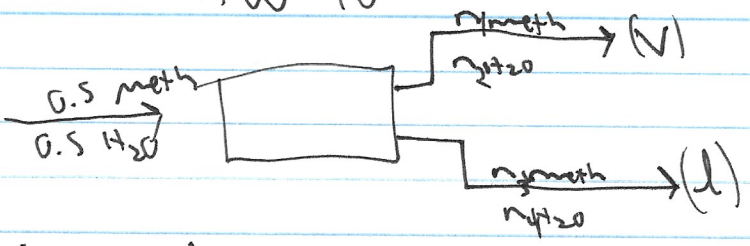
Josh Whitehead
Ch En 2800

Hw 10

1.)



$0.722 + 0.405\,l = 0.5 \rightarrow V = 0.693 - 0.561\,l$

$0.278\,V + 0.595\,l = 0.5 \rightarrow 0.278(0.693 - 0.561\,l) + 0.595\,l = 0.5$

$l = 0.7 \quad V = 0.3$

$\therefore n_1 = 0.7 \cdot 0.722 = 0.2835$

$n_2 = 0.4165$

$n_3 = 0.2166$

$n_4 = 0.0834$

$H_1 = (\text{Enthalpy}(\text{methanol}, 20, 80, C, l)$

$H_2 = \text{Enthalpy}(\text{water}, 20, 80, C, l)$

$H_3 = \text{Enthalpy}(\text{Methanol}, 20, T_b, C, l) + H_v + \text{Enthalpy}(\text{methanol}, T_b, 80, C, g)$ $\quad T_b = 64.7$, $H_v = 35.27$

$H_4 = \text{Enthalpy}(\text{water}, 20, T_b, C, l) + H_v + \text{Enthalpy}(\text{water}, T_b, 80, C, g)$ $\quad T_b = 100$, $H_v = 40.656$

$\Delta H = n_1 H_1 + n_2 H_2 + H_3 n_3 + n_4 H_4$

$= 15.76 \frac{kJ}{mol}$

$Q = 15.76 \cdot 50\,mol = 787 \frac{kJ}{min}$

$= 787 \frac{kJ}{min} \cdot \frac{1\,min}{60\,sec} = 13.13 \frac{kJ}{sec}$

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2.) a.) $\Delta H^\circ_{rxn} = \sum_{Product} v_i(\Delta H^\circ_f) - \sum_{react} v_i(\Delta H^\circ_f)$ $\quad \Delta H_f(H_2, Cl_2) = 0$

$\therefore -385.76 \frac{kJ}{mol} = \Delta H_f(C_2H_2Cl_4) - \Delta H_f(C_2H_4)$

$\therefore \Delta H_f = -385.76 + 52.28 = \boxed{-333 \frac{kJ}{mol}}$

b.) $C_2H_4(g) + 2Cl_2(g) \rightarrow C_2HCl_3(l) + H_2(g) + HCl(g)$

$52.28 \quad 0 \quad -276.2 \quad 0 \quad -92.31$

$\Delta H_{rxn} = -276.2 - 92.31 - 52.28 = \boxed{-421 \frac{kJ}{mol}}$

c.) $-421 \frac{kJ}{mol} \cdot 300 \frac{mol}{hr} = \boxed{-1.26 \times 10^5 \frac{kJ}{hr}}$

3.) a.) $rxn\ 3 = \frac{1}{2} rxn\ 1 - rxn\ 2$

$\therefore \Delta H_{rxn3} = \frac{1}{2}\Delta H_{rxn1} - \Delta H_{rxn2} = -326.2 + 285.8$

$= \boxed{123 \frac{kJ}{mol}}$

b.) ΔH_{rxn} for the decomposition rxn cannot be measured directly. The rxn may not be possible in a lab.

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4) a.) The Standard heat of combustion is the amount of heat produced when 1 mol of the substance reacts with O_2 (combusts). The value $-1299.6 \frac{kJ}{mol}$ is @ 25°C and 1 atm but is in reference to a reference state so that $H_2^c - H_{ref}^c = -1299.6 \frac{kJ}{mol}$

b.) $C_2H_2 + \frac{5}{2}O_2 \longrightarrow 2CO_2 + H_2O$

ΔH_f°: $+226.75 \quad +0 \qquad 2(-393.5) \qquad -285.84$

$\therefore \Delta H_{rxn} = \Delta H_c = 2(-393.5) - 285.84 - 226.75$

$= -1299.6$ ✓

c) a.) $C_2H_2 + 2H_2 \longrightarrow C_2H_6$

ΔH_f°: $226.75 \qquad 0 \qquad -84.67$

$\therefore \Delta H_{rxn} = -84.67 - 226.75 = -311. \frac{kJ}{mol}$

b.) $\Delta H_{rxn} = -\sum \nu_i (\Delta H_c)_i$

$C_2H_2 + 2H_2 \longrightarrow C_2H_6$

ΔH_c°: $-1299.6 \qquad 2(-285.84) \qquad -1559.9$

$\Delta H_{rxn} = -1299.6 + 2(-285.84) + 1559.9 = -311. \frac{kJ}{mol}$

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E13

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1			p1	1	atm									
2			p2	1	atm	34.8	mmHg							
3			T1	20	c									
4			T2	80	C									
5			Tbp_me	64.7	c									
6			Tbp_wat	100	c									
7			H1	5.0565	kJ/mol	1.43351775								
8			H2	4.524	kJ/mol	1.884246								
9			HV_metl	35.27	kJ/mol									
10			HV_wat	40.656	kJ/mol									
11			H3	39.72670853	kJ/mol	8.604805067								
12			H4	46.00523212	kJ/mol	3.836836358								
13						15.75940518	kJ/mol							
14						787.9702588								
15						13.13283765								
16														