CHM152 Quiz#1a 25 Pts Fall 2009 Name: Key

SHOW ALL WORK TO RECEIVE CREDIT. take care of − sign

1. (5 Pts) The oxidation of ammonia produces nitrogen and water via the reaction $4NH_3 + 3O_2 \rightarrow 2N_2 + 6H_2O$. If the rate of formation of N_2 is 2.0 mol/(L · s), then the rate at which O_2 disappears is 3 M·s⁻¹?

$$\text{rate} = \frac{\Delta[N_2]}{2\Delta t} = \frac{-\Delta[O_2]}{3\Delta t} \quad \text{so:} \quad \frac{\Delta[O_2]}{\Delta t} = \frac{-3[N_2]}{2\Delta t} = \frac{-3[2.0\,M]}{2\cdot s}$$

2. The equation and the rate law for the reaction between NO(g) and H_2(g) are

$$2NO(g) + 2H_2(g) \rightarrow N_2(g) + 2H_2O(g) \qquad \text{Rate} = k[NO]^2[H_2]$$

a. (2 Pts) The overall reaction order is 3.

b. (2 Pts) What effect on the rate would tripling the concentration of NO and doubling the concentration of H_2 have? 18 Fold

$$\text{rate} = k[3]^2[2] = 18\,k$$

3. For the reaction aA + bB + cC → dD + eE, the following data were obtained:

Initial Concentrations (mol/L)			Initial Rate (mol/(L · min))
[A]	[B]	[C]	
0.40	0.40	0.20	160
0.20	0.40	0.40	80.
0.60	0.10	0.20	15
0.20	0.10	0.20	5.0
0.20	0.20	0.40	20.
0.20	0.20	0.20	20.

General rate law:

$$\text{rate} = k[A]^x[B]^y[C]^z$$

a. (12 Pts) Determine the orders for each reactant, A, B, and C, are, respectively. **SHOW ALL WORK TO RECEIVE CREDIT**

for A: $\left(\frac{0.60}{0.20}\right)^x = \frac{15}{5}$ $\quad 3^x = 3$ $\quad x = 1$

for B: $\left(\frac{0.40}{0.20}\right)^y = \frac{80}{20}$ $\quad 2^y = 4$ $\quad y = 2$

for C: $\left(\frac{0.40}{0.20}\right)^z = \frac{20}{20}$ $\quad 2^z = 1$ $\quad z = 0$

$$\text{rate} = k[A]^1[B]^2$$

b. (4 Pts) Determine the value of the rate constant and it UNITS.

use any set: $160 = k[0.40][0.40]^2$

$$k = 2500\ M^{-2}\cdot min^{-1}$$