CHM152/54 Quiz #1a 25 Pts Fall 05 Name: Key

show work where possible

1. (4 Pts) Use the following expression to write a balanced chemical equation representing the reaction.

$$\text{rate} = -\frac{\Delta[CH_4]}{\Delta t} = -\frac{\Delta[O_2]}{2\Delta t} = \frac{\Delta[H_2O]}{2\Delta t} = \frac{\Delta[CO_2]}{\Delta t}$$

$CH_4 + 2O_2 \rightarrow 2H_2O + CO_2$

2. (4 Pts) Answer each of the following for the general rate law: Rate = $k[BrO_3^-][Br^-][H^+]^2$

a. What is the overall order? 4

b. What are the units of the rate constant? rate = $k[\ ]^4$ so $k_{units} = \frac{M^3}{time}$

3. For for the reaction below.

$2A + B_2 + C \rightarrow A_2B + BC$

Trial	Initial [A]	Initial [B2]	Initial [C]	Initial Rate of Formation of BC
1	0.20 *M*	0.20 *M*	0.20 *M*	2.4×10^{-6} *M*·min^{-1}
2	0.40 *M*	0.30 *M*	0.20 *M*	9.6×10^{-6} *M*·min^{-1}
3	0.20 *M*	0.30 *M*	0.20 *M*	2.4×10^{-6} *M*·min^{-1}
4	0.20 *M*	0.40 *M*	0.40 *M*	4.8×10^{-6} *M*·min^{-1}

a.(12 Pts) Determine the rate-law expression (rate law equation with orders).

General rate law: $\text{rate} = k[\ ]^x[B_2]^y[C]^z$

use Exp 2 & 3 for A: $\left(\frac{0.40}{0.20}\right)^x = \frac{9.6\times10^{-6}}{2.4\times10^{-6}} \Rightarrow 2^x = 4 \Rightarrow x = 2$

using Exp 1 & 3 for B shows 0 order for $[B]$ $\quad y = 0$

using Exp 1 & 4 for C shows $\left(\frac{0.40}{0.20}\right)^z = \frac{4.8\times10^{-6}}{2.4\times10^{-6}} \Rightarrow 2^z = 2;\ z = 1$

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

b. (3 Pts) Determine the value of the rate constant and its units.

using Trial 1: $2.4\times10^{-6} = k[0.20]^2[0.20]$

$k = 3\times10^{-4}\ M^{-2}\ min^{-1}$

4. (2 Pts) What is meant by the half-life of a reaction?

The time it takes for concentration of a reaction to decrease by ½ its value.