CHM152 Quiz 1 Spring 2020 25 Pts Name: Key

SHOW ALL WORK TO RECEIVE CREDIT.

1. (2 Pts) The reaction A + 2B → products has the rate law, rate = k[A][B]^3. If the concentration of B is doubled while that of A is unchanged, by what factor will the rate of reaction increase?

$[1][2]^3 = (8)$

2. a) (2 Pts) Concerning the rate law, Rate = k[A]^2[B], what are appropriate units for the rate constant k?

$k = \frac{\text{rate}}{[A]^2[B]} = \frac{\frac{M}{t}}{M^2 M} = t^{-1} \cdot M^{-2}$

b) (1 Pt) What is the overall order of the reaction?

(3rd)

3. (3 Pts) A reaction has the following rate law:

Rate = k[A][B]^2

In experiment 1, the concentrations of A and B are both 0.10 mol L^{-1}; in experiment 2, the concentrations are both 0.30 mol L^{-1}. If the temperature stays constant, what is the value of the ratio, Rate(2)/Rate(1)?

(A) 27 B) 9.0 C) 18 D) 3.0 E) 6.0

$\frac{\text{rate 2}}{\text{rate 1}} = \frac{k[0.3][0.3]^2}{[0.1][0.1]^3} = (27)$

4. (4 Pts) The kinetics of the decomposition of dinitrogen pentaoxide is studied at 50°C and at 75°C. Which of the following statements concerning the studies is correct?

A) The rate at 75°C will be greater than the rate at 50°C because the activation energy will be higher at 75°C than at 50°C.

B) The rate at 75°C will be greater than at 50°C because the concentration of a gas increases with increasing temperature.

(C) The rate at 75°C will be greater than the rate at 50°C because the number of molecules with enough energy to react increases with increasing temperature.

D) The rate at 75°C will be less than the rate at 50°C because the molecules at higher speeds do not interact as well as those at lower speeds.

E) The rate at 75°C will be greater than the rate at 50°C because the activation energy will be lower at 75°C than at 50°C.

MORE QUESTIONS ON BACK.

Key

5. For the reaction

$3A(g) + 2B(g) \rightarrow 2C(g) + 2D(g)$

the following data were collected at constant temperature.

a) (4 Pts)) Determine the correct rate law for this reaction.

Trial	Initial [A] (mol/L)	Initial [B] (mol/L)	Initial Rate (mol/(L·min))
1	0.200	0.100	6.00×10^{-2}
2	0.100	0.100	1.50×10^{-2}
3	0.200	0.200	1.20×10^{-1}
4	0.300	0.200	2.70×10^{-1}

General rate law: $\text{rate} = k[A]^x[B]^2$

For A use 1+2: $\left(\frac{0.200}{0.100}\right)^x = \frac{6\times10^{-2}}{1.5\times10^{-2}}$, $2^x = 4$, $x = 2$

For B use 1+3: $\left(\frac{0.2}{0.1}\right)^y = \frac{12}{6}$, $2^y = 2$, $y = 1$

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

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

From any Trial

$k = \frac{\text{rate}}{[A]^2[B]} = \frac{M}{\text{min}\ M^2\ M} = \text{min}^{-1}\cdot M^{-2}$ $\quad (15\ M^{-2}\cdot\text{min}^{-1})$

6. (2 Pts) Which one of the following sets of units is appropriate for a second-order rate constant?

A) $L\ mol^{-1}\ s^{-1}$ B) $mol^2\ L^{-2}\ s^{-1}$ C) $mol\ L^{-1}\ s^{-1}$ D) $L^2\ mol^{-2}\ s^{-1}$ E) s^{-1}

2nd order: $\text{rate} = k[A]^2$ $\quad k = \frac{\text{rate}}{[A]^2} = \frac{M/s}{M^2} = s^{-1}\cdot M^{-1}$

7. (4 Pts) Consider the following reaction

$8A(g) + 5B(g) \rightarrow 8C(g) + 6D(g)$

If [C] is increasing at the rate of 4.0 mol $L^{-1}s^{-1}$, at what rate is [B] changing?

$\frac{-\Delta[B]}{5t} = \frac{\Delta[C]}{8t}$

$\frac{\Delta[B]}{t} = \frac{-5\ \Delta[C]}{8\ t} = \frac{5}{8}[4.0] = 2.5$

can ignore for this question if you desire