

QUIZ SOLUTION

QUIZ # 1, Chapter -12

ID #

Name:

Date:

Attempt all questions.

[2]

Q.1

1

a) Write down the rate law equation of the following reaction.



$$\text{Rate} = \frac{-\Delta[\text{NO}_2]}{\Delta t} = k[\text{NO}_2]^n$$

1

b) The rate constant (k) and order of the reactant (n) must both be determined by

- a) Coefficient of balanced equation only.
- b) Concentration of the product only.
- c) Experiment only.
- d) both coefficients of the balanced equation and experiment.

[2.5]

Q. 3.

a) Write down the integrated form of the following equation and unit of the rate constant (k)?

$$-\frac{\Delta[A]}{\Delta t} = k[A]^n \quad (n=1)$$

b) What is half life time of second order reaction. ?

1.5

$$\textcircled{a} \ln[A] = -kt + \ln[A]_0, \text{ Unit of } k = \text{s}^{-1}$$

1

$$\textcircled{b} t_{1/2} = \frac{1}{k[A]_0}$$

[5.5]

Q.2. The following data were obtained for the reaction



where $\text{Rate} = -\frac{\Delta[\text{ClO}_2]}{\Delta t}$

- 2.5 a) Determine rate law
 1.5 b) The value of the rate constant (k)
 1.5 c) What would be the value of initial rate for an experiment with $[\text{ClO}_2]_0 = 0.175 \text{ mol/L}$, and $[\text{OH}^-]_0 = 0.0844 \text{ mol/L}$.
 Show all calculations

(a) $\text{Rate} = k[\text{ClO}_2]^x[\text{OH}^-]^y$

From exp-1 & 2

$$\frac{2.30 \times 10^{-1}}{5.75 \times 10^{-2}} = \frac{k(0.100)^x(0.100)^y}{k(0.050)^x(0.100)^y}$$

$$4:0 = \frac{(0.100)^x}{(0.050)^x} = 2:0^x$$

$$\frac{4:0}{2:0} = x, \quad \boxed{x = 2}$$

From exp. 2 & 3

$$\frac{2.30 \times 10^{-1}}{1.15 \times 10^{-1}} = \frac{k(0.100)^x(0.100)^y}{k(0.100)^x(0.050)^y}$$

$$2:0 = (2:0)^y \quad \boxed{y = 1} \quad \boxed{y = 1}$$

$$\boxed{\text{Rate} = k[\text{ClO}_2]^2[\text{OH}^-]}$$

(b) Rate Const $k = ?$

$$\text{Rate} = k[\text{ClO}_2]^2[\text{OH}^-]$$

$$2.30 \times 10^{-1} = k[0.100]^2[0.100]$$

$$\boxed{k = 2.30 \times 10^2 \text{ L}^2/\text{mol}\cdot\text{s}}$$

third order.

	$[\text{ClO}_2]_0$ mol/L	$[\text{OH}^-]_0$ mol/L	Initial Rate mol/L.s
1	0.0500	0.100	5.75×10^{-2}
2	0.100	0.100	2.30×10^{-1}
3	0.100	0.050	1.15×10^{-1}

For

(c) Initial Rate = ?

$$[\text{ClO}_2]_0 = 0.175 \text{ mol/L}$$

$$[\text{OH}^-]_0 = 0.0844 \text{ mol/L}$$

$$\text{Rate} = k[\text{ClO}_2]^2[\text{OH}^-]$$

$$= \frac{2.30 \times 10^2 \text{ L}^2/\text{mol}\cdot\text{s}}{\text{mol}^2} \times \frac{0.175 \text{ mol}}{\text{L}} \times \frac{0.0844 \text{ mol}}{\text{L}}$$

$$\boxed{\text{Rate} = 0.594 \text{ mol/L}\cdot\text{s}}$$