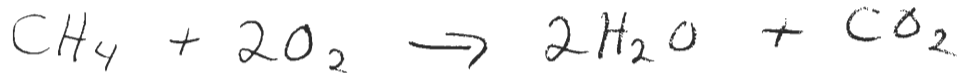


show work where possible

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

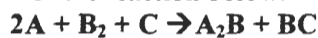
$$\text{rate} = -\frac{\Delta[\text{CH}_4]}{\Delta t} = -\frac{\Delta[\text{O}_2]}{2\Delta t} = \frac{\Delta[\text{H}_2\text{O}]}{2\Delta t} = \frac{\Delta[\text{CO}_2]}{\Delta t}$$



2. (4 Pts) Answer each of the following for the general rate law:
- $\text{Rate} = k[\text{BrO}_3^-][\text{Br}^-][\text{H}^+]^2$

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

3. For the reaction below.



Trial	Initial [A]	Initial [B ₂]	Initial [C]	Initial Rate of Formation of BC
1	0.20 M	0.20 M	0.20 M	$2.4 \times 10^{-6} \text{ M} \cdot \text{min}^{-1}$
2	0.40 M	0.30 M	0.20 M	$9.6 \times 10^{-6} \text{ M} \cdot \text{min}^{-1}$
3	0.20 M	0.30 M	0.20 M	$2.4 \times 10^{-6} \text{ M} \cdot \text{min}^{-1}$
4	0.20 M	0.40 M	0.40 M	$4.8 \times 10^{-6} \text{ M} \cdot \text{min}^{-1}$

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

General rate law: $\text{rate} = k[\]^x [\text{B}_2]^y [\text{C}]^z$

use Exp 2 & 3 for A: $\left(\frac{0.40}{0.20}\right)^x = \frac{9.6 \times 10^{-6}}{2.4 \times 10^{-6}} \Rightarrow 2^x = 4 \Rightarrow x = 2$

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

using Exp 1 & 4 for C shows $\left(\frac{0.40}{0.20}\right)^z = \frac{4.8 \times 10^{-6}}{2.4 \times 10^{-6}} \Rightarrow 2^z = 2; z = 1$

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

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

using Trial 1: $2.4 \times 10^{-6} = k[0.20]^2[0.20]$

$$k = 3 \times 10^{-4} \text{ M}^{-2} \text{ min}^{-1}$$

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 $\frac{1}{2}$ its value.