P CHM1311 L5 Calculations

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Finding Concentration of H_2O_2 Trials

Assuming a solution of 6 mol/L

4mL:

$$C_{H_2O_2} = 6mol/L \cdot 0.004L = 0.024M$$

3mL

$$C_{H_2O_2} = 6mol/L \cdot 0.003L = 0.018M$$

$$C_{Tot} = \frac{v_1}{v_2} \cdot C_{H_2O_2}$$

$$C_{Tot} = \frac{0.003L}{0.004L} \cdot 0.018M$$

2mL

$$C_{H_2O_2} = 6mol/L \cdot 0.002L = 0.012M$$

$$C_{Tot} = \frac{v_1}{v_2} \cdot C_{H_2O_2}$$

$$C_{Tot} = \frac{0.002L}{0.004L} \cdot 0.006$$

Finding Partial Order of H_2O_2

Average Rate of Trial 1: 0.20566 kpa/s

Average Rate of Trial 2: 0.12675 kpa/s

To calculate Partial Order we use:

$$\frac{\text{Rate T2}}{\text{Rate T1}} = \frac{k[H_2O_2]_2^x[catalase]_2^y}{k[H_2O_2]_1^x[catalase]_1^y}$$

$$= \frac{\text{Rate T2}}{\text{Rate T1}} = \frac{[H_2O_2]_2^x}{[H_2O_2]_1^x}$$

$$= \frac{\text{Rate T2}}{\text{Rate T1}} = \left(\frac{[H_2O_2]_2}{[H_2O_2]_1}\right)^x$$

$$x = \log_{\left(\frac{[H_2O_2]_2}{[H_2O_2]_1}\right)} \frac{\text{Rate T2}}{\text{Rate T1}}$$

$$x = log_{(\frac{0.0135}{0.024})}\left(\frac{0.12675}{0.20566}\right)$$

$$x = 0.84$$

Finding Activation Energy of Catalase Reactions

$$\ln(\frac{k_2}{k_1}) = -\frac{E_a}{R}(\frac{1}{T_2} - \frac{1}{T_1})$$

K is directly proportional to initial rate, therefore it can be replaced by the actual initial rate and can be shown as a ratio:

$$\frac{k_2}{K_1} = \frac{\text{Rate T2}}{\text{Rate T1}}$$

Average Rate of Trial 2.1: 0.07977 kpa/s at 299.15 $^\circ C$

Average Rate of Trial 2.2: 0.40119 kpa/s at 304.15 $^\circ C$

$$ln(\frac{0.40119}{0.07977}) = -\frac{E_a}{R}(\frac{1}{304.15} - \frac{1}{299.15})$$

$$1.61528 = -\frac{E_a}{R}(-5.4953 \times 10^{-5})$$

$$29393.84R = E_a$$

$$E_a = 244.262kJ/mol$$

Finding Activation Energy of KI Reactions

$$\ln(\frac{k_2}{k_1}) = -\frac{E_a}{R}(\frac{1}{T_2} - \frac{1}{T_1})$$

Average Rate of Trial 3.1: 0.02682 kpa/s at 303.15 $^\circ C$

Average Rate of Trial 2.2: 0.07084 kpa/s at 308.15 $^\circ C$

$$ln(\frac{0.07084}{0.02682}) = -\frac{E_a}{R}(\frac{1}{308.15} - \frac{1}{303.15})$$

$$0.97128 = -\frac{E_a}{R}(-5.35242 \times 10^{-5})$$

$$18146.55R = E_a$$

$$E_a = 150.797kJ/mol$$

0 Unlinked Reference