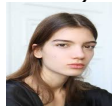


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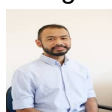
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## CHAPTER 13 CHEMICAL KINETICS

**Problem Categories**

Biological: 13.60, 13.115, 13.122, 13.127, 13.133, 13.138  
Conceptual: 13.26, 13.30, 13.37, 13.47, 13.65, 13.67, 13.68, 13.75, 13.76, 13.77, 13.81, 13.85, 13.86, 13.87, 13.88, 13.91, 13.92, 13.98, 13.99, 13.100, 13.113, 13.117, 13.124  
Descriptive: 13.95, 13.98, 13.109, 13.123  
Environmental: 13.86, 13.102  
Industrial: 13.72, 13.96, 13.111, 13.119, 13.125, 13.142

**Difficulty Level**

Easy: 13.12, 13.17, 13.18, 13.25, 13.27, 13.28, 13.41, 13.42, 13.43, 13.44, 13.45, 13.55, 13.65, 13.70, 13.71, 13.77, 13.78, 13.82, 13.85, 13.91, 13.96, 13.98, 13.100, 13.113, 13.117, 13.124  
Medium: 13.44, 13.51, 13.74, 13.78, 13.79, 13.83, 13.86, 13.87, 13.89, 13.90, 13.92, 13.93, 13.94, 13.95, 13.102, 13.103, 13.106, 13.108, 13.109, 13.107, 13.108, 13.109, 13.110, 13.114, 13.116, 13.118, 13.121, 13.122, 13.126, 13.130, 13.131, 13.133, 13.134, 13.135  
Difficult: 13.20, 13.29, 13.37, 13.74, 13.75, 13.80, 13.81, 13.84, 13.89, 13.97, 13.98, 13.101, 13.111, 13.112, 13.118, 13.119, 13.120, 13.121, 13.122, 13.123, 13.126, 13.127, 13.129, 13.132, 13.136

133 In general for a reaction  $aA + bB \rightarrow cC + dD$

$$\text{rate} = -\frac{1}{a} \frac{\Delta[A]}{\Delta t} = -\frac{1}{b} \frac{\Delta[B]}{\Delta t} = \frac{1}{c} \frac{\Delta[C]}{\Delta t} = \frac{1}{d} \frac{\Delta[D]}{\Delta t}$$

(a)  $\text{rate} = \frac{\Delta[B]}{\Delta t} = \frac{\Delta[C]}{\Delta t} = \frac{1}{2} \frac{\Delta[D]}{\Delta t}$

(b)  $\text{rate} = \frac{1}{5} \frac{\Delta[B]}{\Delta t} = -\frac{\Delta[B]}{\Delta t} = -\frac{1}{6} \frac{\Delta[B]}{\Delta t} = \frac{1}{3} \frac{\Delta[B]}{\Delta t}$

Note that because the reaction is carried out in the aqueous phase, we do not monitor the concentration of water.

136 (a)  $\text{rate} = \frac{1}{2} \frac{\Delta[B]}{\Delta t} = \frac{\Delta[C]}{\Delta t} = \frac{1}{2} \frac{\Delta[D]}{\Delta t}$

(b)  $\text{rate} = -\frac{1}{4} \frac{\Delta[B]}{\Delta t} = \frac{1}{3} \frac{\Delta[C]}{\Delta t} = \frac{1}{6} \frac{\Delta[D]}{\Delta t} = \frac{1}{6} \frac{\Delta[D]}{\Delta t}$

137 Rate =  $-\frac{1}{2} \frac{\Delta[N_2O]}{\Delta t} = \frac{\Delta[N_2O]}{\Delta t} = -0.066 \text{ M/s}$

(a)  $\frac{\Delta[N_2O]}{\Delta t} = 0.066 \text{ M/s}$

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