

# Organic Reaction Mechanisms

## MCQs on Nucleophilic Substitution Reactions ( $S_n1$ and $S_n2$ )

- 1. Which of the following substrates is most likely to undergo an  $S_n1$  reaction?**
  - A) Methyl chloride ( $\text{CH}_3\text{Cl}$ )
  - B) Isopropyl chloride ( $(\text{CH}_3)_2\text{CHCl}$ )
  - C) Tertiary butyl chloride ( $(\text{CH}_3)_3\text{CCl}$ )
  - D) Ethyl chloride ( $\text{CH}_3\text{CH}_2\text{Cl}$ )
- 2. In an  $S_n2$  reaction, the rate of reaction depends on:**
  - A) Concentration of the substrate only
  - B) Concentration of the nucleophile only
  - C) Concentrations of both the substrate and the nucleophile
  - D) Neither the substrate nor the nucleophile
- 3. Which of the following statements is true for an  $S_n2$  reaction?**
  - A) It involves a carbocation intermediate.
  - B) The reaction proceeds with inversion of configuration.
  - C) It is favored by polar protic solvents.
  - D) It is a two-step process.
- 4. In an  $S_n1$  reaction, the rate-determining step involves:**
  - A) Nucleophile attacking the substrate
  - B) Formation of a carbocation
  - C) Departure of the leaving group and nucleophile attack simultaneously
  - D) The nucleophile only
- 5. Which of the following nucleophiles is most likely to participate in an  $S_n2$  reaction?**
  - A)  $\text{H}_2\text{O}$
  - B)  $\text{I}^-$
  - C)  $\text{CN}^-$
  - D)  $\text{CH}_3\text{OH}$
- 6. Which of the following will increase the rate of an  $S_n1$  reaction?**
  - A) Using a stronger nucleophile
  - B) Using a more stable carbocation
  - C) Increasing the concentration of the nucleophile
  - D) Decreasing the solvent polarity
- 7. Which solvent is most likely to favor an  $S_n1$  reaction?**
  - A) Dimethyl sulfoxide (DMSO)
  - B) Acetone
  - C) Water
  - D) Hexane
- 8. Which of the following halides is most likely to undergo an  $S_n2$  reaction?**
  - A)  $\text{CH}_3\text{Br}$
  - B)  $(\text{CH}_3)_2\text{CHBr}$
  - C)  $(\text{CH}_3)_3\text{CBr}$
  - D)  $\text{C}_6\text{H}_5\text{CH}_2\text{Br}$  (benzyl bromide)

9. In an  $S_N1$  mechanism, what type of product mixture is typically formed when the substrate is chiral?
- A) A single enantiomer
  - B) A racemic mixture
  - C) A single diastereomer
  - D) A mixture of diastereomers
10. The energy profile diagram of an  $S_N1$  reaction typically shows:
- A) One transition state
  - B) Two transition states
  - C) No transition states
  - D) Three transition states
11. Which of the following substrates is least likely to undergo an  $S_N1$  reaction?
- A) Benzyl chloride ( $C_6H_5CH_2Cl$ )
  - B) Methyl chloride ( $CH_3Cl$ )
  - C) Allyl chloride ( $CH_2=CHCH_2Cl$ )
  - D) Tert-butyl chloride ( $(CH_3)_3CCl$ )
12. Which leaving group would make an  $S_N2$  reaction proceed fastest?
- A)  $F^-$
  - B)  $Cl^-$
  - C)  $Br^-$
  - D)  $I^-$
13. In an  $S_N2$  reaction, which factor does not significantly affect the reaction rate?
- A) Strength of the nucleophile
  - B) Stability of the carbocation
  - C) Solvent polarity
  - D) Steric hindrance around the substrate
14. Which substrate would react fastest in an  $S_N2$  mechanism with a given nucleophile?
- A)  $CH_3CH_2Cl$
  - B)  $(CH_3)_2CHCl$
  - C)  $(CH_3)_3CCl$
  - D)  $C_6H_5Cl$
15. The inversion of configuration in an  $S_N2$  reaction is also known as:
- A) Racemization
  - B) Retention of configuration
  - C) Walden inversion
  - D) Diastereomerization

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**Answer Key:**

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|-------|-------|
| 1. C  | 12. D |
| 2. C  | 13. B |
| 3. B  | 14. A |
| 4. B  | 15. C |
| 5. C  |       |
| 6. B  |       |
| 7. C  |       |
| 8. A  |       |
| 9. B  |       |
| 10. B |       |
| 11. B |       |

