1. The decreasing order of reactivity of the compounds given below in acidic hydrolysis under identical conditions is:

(a) II > III > IV > I
(b) I > II > III > IV
(c) IV > III > II > I
(d) III > II > I > IV

2. Conversion of I to II:
(a) takes place by $S_N^1$
(b) takes place by $S_N^2$
(c) takes place by $S_N^1$
(d) does not take place

3. $\text{CH}_3\text{CH}_2\text{Br} + \text{NaOH} \rightarrow (\text{A})$; Product (A) is:

(a) (b) (c) (d)

4. In the reactions given below

$R - \text{Cl} \overset{(1) \text{EN}, (2) \text{LAIH}}{\rightarrow} \text{product A}$

$R - \text{Cl} \overset{(1) \text{PAP}, (2) \text{LAIH}}{\rightarrow} \text{product B}$

the compounds A and B are:

(a) chain isomers
(b) position isomers
(c) functional isomers

5. Which of the following is not expected to be intermediate in the following reaction?

$\text{CH}_3\text{CH}_2\text{OH}$

(a) (b) (c) (d)

6. Which of the following is not expected to be intermediate in the following reaction?

$\text{CH}_3\text{CH}_2\text{Br}$

(a) (b) (c) (d)
32. Under the specified conditions, substrate X undergoes substitution and elimination reactions to give products A – D. A and B are enantiomers, but not C and D. Which of the following could be the starting material X?

(a) (I)  (b) (II)  (c) (III)  (d) (IV)

33. Identify products of the given reactions:

Reaction 1

Product

(a) (I)  (b) (II)  (c) (III)  (d) (IV)

Reaction 2

Product

(a) (I)  (b) (II)  (c) (III)  (d) (IV)

34. (15.15) 1-Bromo-1-decene-2-methylbutane is converted to 1,2-dimethoxy-1-decene-2-methylbutane in a two-step process. What is the stereochemistry of the major product(s)?

(a) (1R,2S)  (b) (1S,2R)  (c) (1R,2R)  (d) (1S,2S)

35. What is the major product obtained in the following reaction?

(a) (I)  (b) (II)  (c) (III)  (d) (IV)

36. Which of the following is true about given graphs A and B?

(a) A → S<sub>2</sub>, B → S<sub>N</sub><sup>2</sup>  (b) A → S<sub>N</sub><sup>2</sup>, B → S<sub>N</sub><sup>2</sup>  (c) A → S<sub>N</sub><sup>2</sup>, B → T<sub>2</sub>  (d) A → S<sub>N</sub><sup>2</sup>, B → T<sub>2</sub>

37. The free-radical chlorination of pentane at an undisturbed temperature produced primary, secondary, and tertiary monochlorination products with relative quantities of 1:4:5. What are the yields of 1-chloropentane (1), 2-chloropentane (2), and 3-chloropentane (3)?

(a) 1:10% ; 2:40% ; 3:30%  (b) 1:24% ; 2:44% ; 3:32%  (c) 1:30% ; 2:40% ; 3:32%  (d) 1:18.75% ; 2:50% ; 3:31.25%
8. In which of the following reactions will not be obtained?

(a) \( \text{ROCl} \rightarrow \text{Cl}_2 \text{O} \rightarrow \text{ROCl} \)

(b) \( \text{X} \rightarrow \text{X} \rightarrow \text{X} \)

(c) \( \text{Ar} \rightarrow \text{Cl} \rightarrow \text{Cl} \rightarrow \text{Ar} \)

(d) \( \text{R} \rightarrow \text{Cl} \rightarrow \text{Cl} \rightarrow \text{R} \)

9. Which reaction results in the formation of a pair of stereoisomers?

(a) \( \text{CH}_3 \text{CH} = \text{CH}_2 \rightarrow \text{H} \rightarrow \text{CH}_3 \)

(b) \( \text{CH}_3 \text{CH} = \text{CH} \rightarrow \text{H} \rightarrow \text{CH}_3 \)

(c) \( \text{CH}_3 \text{CH} = \text{CH}_2 \rightarrow \text{H} \rightarrow \text{CH}_3 \)

(d) None of these

10. Which of the following products are obtained from the reaction?

(a) \( \text{CH}_3 \text{CH} = \text{CH}_2 \rightarrow \text{H} \rightarrow \text{CH}_3 \)

(b) \( \text{CH}_3 \text{CH} = \text{CH}_2 \rightarrow \text{H} \rightarrow \text{CH}_3 \)

(c) \( \text{CH}_3 \text{CH} = \text{CH}_2 \rightarrow \text{H} \rightarrow \text{CH}_3 \)

(d) All of these

42. Which of the following products can be obtained from the reaction?

(a) \( \text{CH}_3 \text{CH} = \text{CH}_2 \rightarrow \text{H} \rightarrow \text{CH}_3 \)

(b) \( \text{CH}_3 \text{CH} = \text{CH}_2 \rightarrow \text{H} \rightarrow \text{CH}_3 \)

(c) \( \text{CH}_3 \text{CH} = \text{CH}_2 \rightarrow \text{H} \rightarrow \text{CH}_3 \)

(d) All of these

43. Which of the following statements about the reaction are true?

(a) \( \text{CH}_3 \text{CH} = \text{CH}_2 \rightarrow \text{H} \rightarrow \text{CH}_3 \)

(b) \( \text{CH}_3 \text{CH} = \text{CH}_2 \rightarrow \text{H} \rightarrow \text{CH}_3 \)

(c) \( \text{CH}_3 \text{CH} = \text{CH}_2 \rightarrow \text{H} \rightarrow \text{CH}_3 \)

(d) All of these

44. Which of the following statements about the reaction are true?

(a) \( \text{CH}_3 \text{CH} = \text{CH}_2 \rightarrow \text{H} \rightarrow \text{CH}_3 \)

(b) \( \text{CH}_3 \text{CH} = \text{CH}_2 \rightarrow \text{H} \rightarrow \text{CH}_3 \)

(c) \( \text{CH}_3 \text{CH} = \text{CH}_2 \rightarrow \text{H} \rightarrow \text{CH}_3 \)

(d) All of these

45. Which of the following reactions is correct for the preparation of carboxylic acids?

(a) \( \text{CH}_3 \text{CH} = \text{CH}_2 \rightarrow \text{H} \rightarrow \text{CH}_3 \)

(b) \( \text{CH}_3 \text{CH} = \text{CH}_2 \rightarrow \text{H} \rightarrow \text{CH}_3 \)

(c) \( \text{CH}_3 \text{CH} = \text{CH}_2 \rightarrow \text{H} \rightarrow \text{CH}_3 \)

(d) None of these
46. What is the principal product of the following reaction?

\[
\begin{align*}
\text{CH}_3 - &- \text{Br} \\
\text{H} - &- \text{H} + \text{NaCl} \rightarrow \text{Product} \\
\text{Cl} - &- \text{H}
\end{align*}
\]

(a) CH\(_3\)CH\(_2\)Cl
(b) CH\(_2\)CH\(_2\)Br
(c) CH\(_3\)CH\(_2\)CH\(_2\)Cl
(d) CH\(_3\)CH\(_2\)CH\(_2\)Br

47. Which of the following statements is true?

(a) CH\(_3\)CH\(_2\)OH is both a stronger base and more nucleophilic than CH\(_3\)CH\(_2\)OH.
(b) CH\(_3\)CH\(_2\)OH is a stronger base but is less nucleophilic than CH\(_3\)CH\(_2\)OH.
(c) CH\(_3\)CH\(_2\)OH is a weaker base but is more nucleophilic than CH\(_3\)CH\(_2\)OH.
(d) CH\(_3\)CH\(_2\)OH is both a weaker base and less nucleophilic than CH\(_3\)CH\(_2\)OH.

48. The reaction of 4-bromo benzyl chloride with sodium cyanide in ethanol leads to the formation of

(a) 4-benzyloxy cyanide
(b) 4-cyanobenzyl chloride
(c) 4-cyanobenzyl cyanide
(d) 4-bromo-2-cyanobenzyl chloride

49. In the given pair of alcohols, which pair second alcohol is more reactive than first towards hydrogen bromide?

(a) CH\(_3\)CH\(_2\)OH and CH\(_3\)CH\(_2\)OH
(b) CH\(_3\)OH and CH\(_2\)CH\(_2\)OH
(c) CH\(_3\)CH\(_2\)OH and CH\(_3\)CH\(_2\)OH
(d) CH\(_3\)CH\(_2\)OH and (CH\(_3\)CH\(_2\))\(_2\)CH\(_2\)OH

51. Which of the following reactions will not favour nucleophilic substitution reaction?

(a) \(\text{Br} - \text{C}-\text{Br} \rightarrow \text{Br} - \text{Br}
(b) \text{Ph} - \text{Br} \rightarrow \text{Br} - \text{Ph}
(c) \text{CH}_3 - \text{C} - \text{CH}_2 \rightarrow \text{CH}_3 - \text{Br}
(d) All the above

52. Which of the following is most reactive towards \(S_N2\) reaction?

(a) \(\text{CH}_3 - \text{CH} - \text{CH}_2 - \text{Cl}\)
(b) \(\text{Ph} - \text{CH}_2 - \text{Cl}\)
(c) \(\text{Me} - \text{C} - \text{Cl}\)
(d) \(\text{Ph} - \text{C} - \text{CH}_2 - \text{Cl}\)

53. The product of the reaction:

\[ \text{CH}_3 - \text{CH} - \text{CH}_2 - \text{Cl} \rightarrow \text{Product} \]

(a) \(\text{CH}_3 - \text{CH} - \text{CH}_2 - \text{CO}_2\text{H}\)
(b) \(\text{CH}_3 - \text{CH} - \text{CH}_2 - \text{CO}_2\text{H}\)
(c) \(\text{CH}_3 - \text{CH} - \text{CH}_2 - \text{CO}_2\text{H}\)
(d) No reaction

54. Which product would be expected to predominate in the given reaction?

\[ \text{R} - \text{SO}_2 - \text{CH}_3 \rightarrow \text{Product} \]

(a) \(\text{R} - \text{SO}_2 - \text{CH}_3\)
(b) \(\text{R} - \text{SO}_2 - \text{CH}_3\)
(c) \(\text{R} - \text{SO}_2 - \text{CH}_3\)
(d) None of these
55. Which is the major product of the following reaction?

\[
\text{NaH, THF, } \text{H}_2\text{O, product}
\]

(a) (b) (c) (d)

56. Which is the major product of the above reaction?

(a) (b) (c) (d)

57. \( \text{Cl-CH}_2\text{-OH } \cdot \text{CH}_2\text{-Cl } \cdot \text{Cl } \text{product.} \) Major product of the above reaction is:

(a) (b) (c) (d) (e)

58. Rate of \( S_n \) reaction is:

(a) (b) > (c) > (d)

(a) (b) > (c) > (d)

59. Among the given halides, which one will give same product in both \( S_n \) and \( S_{n-1} \) reactions.

\[
\begin{align*}
\text{CH}_2\text{-CH}_2\text{-CH}_2\text{-Br} & \quad \text{Br} \\
\text{CH}_3\text{-CH}_2\text{-Br} & \quad \text{Br}
\end{align*}
\]

(a) (b) (c) (d) (e) (f)

60. Product(s) formed during this reaction is/are:

\[
\begin{align*}
\text{CH}_3\text{-CH}_2\text{-OH } + \text{Br}_2 & \xrightarrow{\Delta} \text{CH}_3\text{-CH}_2\text{-Br (a)} \\
\text{CH}_3\text{-CH}_2\text{-OH } + \text{HCl} & \xrightarrow{\Delta} \text{CH}_3\text{-CH}_2\text{-Cl (c)}
\end{align*}
\]

(a) (b) (c) (d) (e) (f)

61. 1,2-dichloroethane + \( \text{NaH, THF, } \text{H}_2\text{O, } \text{product} \) [\( C^* \) = isopropyl carbon]

Unknown product (P) of the above reaction is:

(a) (b) (c) (d) (e) (f)

62. 1,2-dichloroethane + \( \text{NaH, THF, } \text{H}_2\text{O, } \text{product} \) [\( C^* \) = isopropyl carbon]

Product (B) of above reaction is:

(a) (b) (c) (d) (e) (f)

63. In the given pairs of alkyl halide, in which pair the first compound is more reactive than second compound toward \( S_n \) reaction:

\[
\begin{align*}
\text{(a) (CH}_3\text{)}_2\text{CHBr or CH}_3\text{-CH}_2\text{-Br} & \quad \text{Br} \\
\text{(b) CH}_3\text{-CHCl } \cdot \text{CH}_2\text{-CH}_2\text{-Br or CH}_3\text{-CHCl } \cdot \text{CH}_2\text{-CH}_2\text{-I} \\
\text{(c) PhBr or CH}_3\text{-CH}_2\text{-Br or CH}_3\text{-CH}_2\text{-Br} & \quad \text{Br} \\
\text{(d) CH}_2\text{-CH}_2\text{-Cl or H}_2\text{C}^*\text{-CH}_2\text{-Cl}
\end{align*}
\]

(a) (b) (c) (d) (e) (f)
64. In the given pair of reactions, in which pair the second reaction is more reactive than first toward $\text{S}_2$ reaction?

(a) $\text{CH}_3 - \text{CH}_2 - \text{Cl} + \text{H}_2\text{O} \rightarrow \text{CH}_3 - \text{CH}_2 - \text{OH}$

(b) $\text{CH}_3 - \text{CH}_2 - \text{Cl} - \text{CH}_3 \rightarrow \text{CH}_3 - \text{CH}_2 - \text{Cl}$

(c) $\text{CH}_3 - \text{CH}_2 - \text{Cl} - \text{Br} \rightarrow \text{CH}_3 - \text{CH}_2 - \text{Br}$

(d) $\text{CH}_3 - \text{CH}_2 - \text{Cl} - \text{S} \rightarrow \text{CH}_3 - \text{CH}_2 - \text{S}$

65. Among the following pair of reactions, in which pair the second reaction is more reactive than first?

(a) $\text{Me}_2\text{C} - \text{Cl} + \text{H}_2\text{O} \rightarrow \text{Me}_2\text{C} - \text{OH}$

(b) $\text{Me}_2\text{C} - \text{CH}_2\text{OH} \rightarrow \text{Me}_2\text{C} - \text{Cl}$

(c) $\text{Me}_2\text{C} - \text{Cl} + \text{H}_2\text{O} \rightarrow \text{Me}_2\text{C} - \text{OH}$

(d) $\text{Me}_2\text{C} - \text{CH}_2\text{OH} \rightarrow \text{Me}_2\text{C} - \text{Cl}$

66. Which of the following is correct statement about $\text{CCl}_4$?

(a) $\text{CCl}_4$ is used to extinguish fire under the same principle as water.

(b) $\text{CCl}_4$ is used in hydrolysis with boiling water due to non-availability of 3-ethyl in carbon.

(c) $\text{CCl}_4$ is used to dry glassware.

(d) $\text{CCl}_4$ is used as a solvent.

67. Which of the following reactions is incorrect?

(a) $\text{CH}_3\text{CH}_2\text{CH}_2\text{Br}$ is added to $\text{CH}_3\text{CH}_2\text{Cl}$ and $\text{H}_2\text{O}$.

(b) $\text{CH}_3\text{CH}_2\text{OH} + \text{HCl} \rightarrow \text{CH}_3\text{CH}_2\text{Cl}$

(c) $\text{CH}_3\text{CH}_2\text{CH}_2\text{Br} + \text{H}_2\text{O} \rightarrow \text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$

(d) $\text{CH}_3\text{CH}_2\text{Cl} + \text{H}_2\text{O} \rightarrow \text{CH}_3\text{CH}_2\text{OH}$

68. In the given pair of reactions, in which pair the second compound is more reactive than first?

(a) $\text{Me}_2\text{C} - \text{Cl} + \text{H}_2\text{O} \rightarrow \text{Me}_2\text{C} - \text{CH}_2\text{OH}$

(b) $\text{Me}_2\text{C} - \text{CH}_2\text{Cl} + \text{H}_2\text{O} \rightarrow \text{Me}_2\text{C} - \text{CH}_2\text{OH}$

(c) $\text{Me}_2\text{C} - \text{OH} + \text{HCl} \rightarrow \text{Me}_2\text{C} - \text{Cl}$

(d) $\text{Me}_2\text{C} - \text{CH}_2\text{OH} + \text{HCl} \rightarrow \text{Me}_2\text{C} - \text{Cl}$

69. Which compound might be synthesized by the $\text{S}_2$ displacement of an allyl halide?

(a) $\text{CH}_3\text{CH} = \text{CH}_2 - \text{OH}$

(b) $\text{CH}_3\text{CH} = \text{CH}_2 - \text{Cl}$

(c) $\text{CH}_3\text{CH} = \text{CH}_2 - \text{Br}$

(d) $\text{CH}_3\text{CH} = \text{CH}_2 - \text{I}$

70. Which of the following reactions is incorrect?

(a) $\text{CH}_3\text{CH} = \text{CH}_2 + \text{HBr} \rightarrow \text{CH}_3\text{CH} = \text{CH}_2\text{Br}$

(b) $\text{CH}_3\text{CH} = \text{CH}_2 + \text{HCl} \rightarrow \text{CH}_3\text{CH} = \text{CH}_2\text{Cl}$

(c) $\text{CH}_3\text{CH} = \text{CH}_2 + \text{HI} \rightarrow \text{CH}_3\text{CH} = \text{CH}_2\text{I}$

(d) $\text{CH}_3\text{CH} = \text{CH}_2 + \text{HBr} \rightarrow \text{CH}_3\text{CH} = \text{CH}_2\text{Br}$

71. In the given reaction, the product is.

(a) $\text{CH}_3\text{CH} = \text{CH}_2\text{Br}$

(b) $\text{CH}_3\text{CH} = \text{CH}_2\text{Cl}$

(c) $\text{CH}_3\text{CH} = \text{CH}_2\text{I}$

(d) $\text{CH}_3\text{CH} = \text{CH}_2\text{Br}$

72. Which of the following is correct?

(a) $\text{CH}_3\text{CH}_2\text{CH}_2\text{Br} + \text{H}_2\text{O} \rightarrow \text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$

(b) $\text{CH}_3\text{CH}_2\text{CH}_2\text{Br} + \text{H}_2\text{O} \rightarrow \text{CH}_3\text{CH}_2\text{CH}_2\text{Cl}$

(c) $\text{CH}_3\text{CH}_2\text{CH}_2\text{Br} + \text{H}_2\text{O} \rightarrow \text{CH}_3\text{CH}_2\text{CH}_2\text{Br}$

(d) $\text{CH}_3\text{CH}_2\text{CH}_2\text{Br} + \text{H}_2\text{O} \rightarrow \text{CH}_3\text{CH}_2\text{CH}_2\text{Br}$

73. In the given reaction, the product is.

(a) $\text{CH}_3\text{CH}_2\text{CH}_2\text{Br} + \text{H}_2\text{O} \rightarrow \text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$

(b) $\text{CH}_3\text{CH}_2\text{CH}_2\text{Br} + \text{H}_2\text{O} \rightarrow \text{CH}_3\text{CH}_2\text{CH}_2\text{Cl}$

(c) $\text{CH}_3\text{CH}_2\text{CH}_2\text{Br} + \text{H}_2\text{O} \rightarrow \text{CH}_3\text{CH}_2\text{CH}_2\text{Br}$

(d) $\text{CH}_3\text{CH}_2\text{CH}_2\text{Br} + \text{H}_2\text{O} \rightarrow \text{CH}_3\text{CH}_2\text{CH}_2\text{Br}$
7. Which is the major product expected from the following $S_n_2$ reaction?

(a) $\text{CH}_3\text{CH}_2\text{Br} + \text{N}^+\text{O}^- \rightarrow \text{CH}_3\text{CH}_2\text{ON}^-$
(b) $\text{CH}_3\text{CH}_2\text{Br} + \text{Bu}^- \rightarrow \text{Bu}^-\text{CH}_3\text{CH}_2\text{Br}$
(c) $\text{CH}_3\text{CH}_2\text{Br} + \text{H}^- \rightarrow \text{CH}_3\text{CH}_2\text{H}^-$
(d) $\text{CH}_3\text{CH}_2\text{Br} + \text{S}^- \rightarrow \text{CH}_3\text{CH}_2\text{S}^-$

8. Which is the correct reaction coordinate diagram for the following substitution reaction?

(a) $\text{CH}_3\text{CH}_2\text{Br} \rightarrow \text{CH}_3\text{CH}_2\text{OH}$
(b) $\text{CH}_3\text{CH}_2\text{Br} \rightarrow \text{CH}_3\text{CH}_2\text{Cl}$
(c) $\text{CH}_3\text{CH}_2\text{Br} \rightarrow \text{CH}_3\text{CH}_2\text{Br}$
(d) $\text{CH}_3\text{CH}_2\text{Br} \rightarrow \text{CH}_3\text{CH}_2\text{I}$

9. Which of the following products are labeled?

(a) $\text{C}_6\text{H}_5\text{CH}_2\text{Cl}$
(b) $\text{C}_6\text{H}_5\text{CH}_2\text{Br}$
(c) $\text{C}_6\text{H}_5\text{CH}_2\text{I}$
(d) $\text{C}_6\text{H}_5\text{CH}_2\text{O}$

10. Which of the following is the product of the above reaction?

(a) $\text{C}_6\text{H}_5\text{CH}_2\text{O}_2\text{H}$
(b) $\text{C}_6\text{H}_5\text{CH}_2\text{OH}$
(c) $\text{C}_6\text{H}_5\text{CH}_2\text{CH}_2\text{O}$
(d) $\text{C}_6\text{H}_5\text{CH}_2\text{NH}_2$
81. Which of the following compounds would react faster with NaCN in an S_N1 reaction?
(a) (b) (c) (d) OTS

82. What sequence of reagents is required to accomplish the following transformation?

(a) 1. NBS, ROOM (2) CH_3CH_2CO_2H (3) 2 H_2O (4) NH_3-H_2O
(b) 1. C_2H_5OH, 2. H_2SO_4, 3. H_2O
(c) 1. NBS, ROOM, 2. H_2O
(d) 1. Br_2, 2. H_2SO_4, 3. H_2O

83. Which of the reagents shown below would accomplish the following transformation?

(a) H_2O (b) H_2SO_4 (c) HCl (d) HBr

84. What are the products obtained from the following reaction?

(a) (b) (c) (d) H_2O

85. The reaction proceeds by the _______ mechanism.
(a) S_N2 (b) S_N1 (c) S_N2 (d) S_N1

86. The back-side attack on 2-bromobutane by methoxide (CH_3O^-) gives the product shown below. Which Fischer projection represents 2-bromobutane used as the reactant in this reaction?

(a) (b) (c) (d) Me

87. Which best describes the product of the following reaction?

(a) (b) (c) (d) Me

88. Consider the following statements:
(a) S_N2 eliminations are more on steroids than S_N1
(b) S_N2 reactions proceed with total inversion of configuration
(c) S_N2 reactions proceed with partial loss of configuration

89. Consider the following alcohols:

(a) (b) (c) (d) CH_3OH

90. In solution of 1,2-dimethylpropyl p-toluene sulfonate in acetic acid at 75°C, how many (alkene + substitution) products will be formed?
(a) 2 (b) 3 (c) 4 (d) 5
91. Benzyl chloride reacts with milk of lime to form:
(a) Benzaldehyde
(b) Benzyl alcohol
(c) Benzyl chloride
(d) Phenol

92. Consider the following amines:
(a) CH₃NH₂
(b) CH₃CH₂NH₂
(c) C₆H₅NH₂
(d) PhCH₂NH₂

When attached to a β-hydroxylated carbon, their leaving group ability in nucleophilic substitution reaction decreases in the order:
(a) I > II > III > IV
(b) II > III > IV > I
(c) IV > I > II > III
(d) III > IV > II > I

93. H₂C=CH₂ + H₂ → Principal organic product of the reaction will be:
[a] H₂C=CH₂
[b] H₂C=CH₃
[c] CH₃CH = CH₂
[d] CH₃CH₂CH₂CH₃

94. Br₂ + C₆H₅CH₂CO₂H → Product of the reaction is:
(a) C₆H₅CH₂CO₂Br
(b) C₆H₅CH₂CO₂H
(c) C₆H₅CH₂CH₂Br
(d) C₆H₅CH₂CH₂Cl

95. The configurations of the reactant and the product in the following reaction, respectively, are:

96. Reaction of R₂Cl with p-toluensulphonic chloride in pyridine followed by reaction with LiAlH₄ gives:
(a) R₂CHCl
(b) R₂CH₂Br
(c) R₂CH₂Cl
(d) R₂CH₂Br

97. H₂C=CH₂ + H₂ → (A) Major product of the reaction is:
(a) H₂C=CH₂
(b) H₂C=CH₃
(c) CH₃CH = CH₂
(d) CH₃CH₂CH₂CH₃

98. 1,4-dichlorobenzene (1 mole) + NaOH → Product of the reaction is:
(a) Cl⁻CH₂CHCl - Cl
(b) Cl⁻CH₂CH₂Cl
(c) Cl⁻CH₂CH₂Cl
(d) Cl⁻CH₂CH₂Cl

99. Which of the following halogenide undergoes rearrangement in S₂O₅²⁻ reaction?
(a) CH₃CN
(b) CH₃CO₂H
(c) CH₃CO₂Cl
(d) CH₃CO₂Cl

100. HCl = CH₂ + Cl⁻ → (A) Major product (A) is:
(a) H₂C=CH₂
(b) CH₂=CHCl
(c) CH₃CH₂Cl
(d) CH₃CH₂Cl

101. Allyl halides can be obtained by all methods except:
(a) CH₃CH₂CH₂Br + K₂CO₃
(b) CH₃CH₂CH₂Cl + K₂CO₃
(c) CH₃CO₂H + NaCl
(d) CH₃CO₂H + NaBr

102. In order to prepare 3-chloro-2-propene, which of the following reactants can be employed?
(a) Propene and HCl in the presence of potassium carbonate
(b) Propene and Cl₂ followed by treatment with NaOH
(c) Propene and SOCl₂, followed by pyridine
(d) Any of the above can be used

103. Which allyl halide has maximum density?
(a) CH₃CH₂Cl
(b) CH₂Cl₂
(c) CH₂Br₂
(d) CH₂I₂

104. Which of the following molecules would have a carbon-halogen bond most susceptible to nucleophilic substitution?
(a) 2-fluorobenzene
(b) 2-chlorobenzene
(c) 2-bromobenzene
(d) 2-iodobenzene

105. Arrange the following three chlorides in decreasing order of their nucleophilic activity.
(a) EMS
(b) DMF
(c) DMF
(d) DMF

(a) 1 > 2 > 3
(b) 2 > 1 > 3
(c) 2 > 1 > 3
(d) 3 > 2 > 1
106. What is the major product obtained in the following reaction?

\[ \text{CH}_3\text{CH}_2\text{Br} + \text{H}_2\text{O} \rightarrow \text{Product} \]

(a) (b) (c) (d) (e)

107. The compound which undergoes SN₂ reaction most rapidly is:

(a) (b) (c) (d) (e)

108. When benzyl chloride is treated with ethanolic KCN, the major product formed is:

(a) benzyl ethyl ether (b) benzyl alcohol (c) benzylic cyanide (d) benzyl isocyanide

109. Addition of E2 accelerates the hydrolysis of primary alkyl halides because:

(a) It is soluble in organic solvents (b) the side ion is a weak base and a poor leaving group (c) the side ion is a strong base (d) the side ion is a powerful nucleophile as well as a good leaving group

110. Which compound undergoes nucleophilic substitution with NaCN as the fastest rate?

(a) (b) (c) (d) (e) Both are correct (f) None is correct

111. Which of the following phrases are not correctly associated with SN₂ reaction?

(1) Rearrangement is possible (2) Rate is affected by polarity of solvent (3) The reaction is not susceptible to competitive electrophilic substitution (4) The reaction is not susceptible to secondary reactions (5) The reaction is not susceptible to inversion of configuration (a) (b) (c) (d) (e) (f) (g) (h) (i) (j)

112. Rank the following in order of decreasing rate of solvolysis with aqueous ethanol (fastest → slowest)

\[ \text{CH}_3\text{CH}_2\text{Br} + \text{H}_2\text{O} \rightarrow \text{Product} \]

(a) 2 > 1 > 2 (b) 1 > 2 > 3 (c) 2 > 3 > 1 (d) 1 > 3 > 2

113. Which of the following is most reactive towards nucleophilic substitution reaction?

(a) CH₂=CH₂ (b) C₆H₅Cl (c) CH₃CH₂OH (d) CH₃Cl (e) CH₄
11. Which of the following represents the correct graph for $S_{N2}$ reaction?

(a) 

(b) 

(c) 

(d) 

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12. Which of the following graphs represents the correct graph for $S_{N2}$ reaction?

(a) 

(b) 

(c) 

(d)
13. The product of the reaction is:

14. Which of the following is most reactive toward \( S_n \) reaction?

15. Among the given pairs, in which pair first compound reacts faster than second compound in \( S_n \) reaction?
   (a) \( CH_3-CH_2-CH_2-Br \) or \( CH_3-CH_2-CH_2-CH_3 \)
   (b) \( CH_3-CH_2-Br \) or \( CH_3-CH=CH-CH_3 \)
   (c) \( CH_3-CH_2-CH_2-Br \) or \( CH_3-CH_2-C=CH_2 \)
   (d) \( CH_3-CH_2-CH_2-Br \) or \( CH_3-C=CH_2 \)

16. What is the major product of the following reaction?

17. \( S_n \) and \( S_{n+1} \) products are same (excluding stereoisomer):

18. Rate of \( S_{n+1} \) will be negligible in:

19. Which of the following reactions does not represent the major product given?

20. Which of the following is incorrectly matched?

21. (a) 2-ethyl anisole is solvolyzed in water under standard conditions. The product (i) will be
   (a) \( \text{-O-Br} \) and \( \text{-2-Br} \) in a 1:1 ratio
   (b) \( \text{-OH} \) and \( \text{-2-Br} \) in a 1:1 ratio
   (c) \( \text{-OH} \) and \( \text{-2-Br} \) in a 1:5 ratio
   (d) \( \text{-2-Br} \) only
   (e) \( \text{-2-OH} \) only
   (f) \( \text{-2-OH} \) only
22. Consider the following $S_2$ reaction:

$$\text{Br} \quad \text{H} \quad \text{Cl}$$

The missing product (s) is (are):

(a) 1 and 3  
(b) 3 and 4  
(c) 2 and 3  
(d) 1, 2, 3, and 4

23. What is the product of the following $S_{N_2}$ reaction?

(a) H$_2$C-Br + CN  
(b) H$_2$C-Br + SH  
(c) Br$_2$ + Cl₂  
(d) SCN$^- +$ I$^-$ in DMF

24. Which of the following reaction is not possible?

(a) CH$_3$CH$_2$ - Cl  
(b) CH$_3$CH$_2$ - COOH  
(c) CH$_3$COCl + H$_2$O  
(d) CH$_3$CH$_2$ - CN

25. Which of the following reactions does not represent major product?

(a) CH$_3$CH$_2$ - OH  
(b) CH$_3$CH$_2$ - COOH  
(c) CH$_3$CH$_2$ - CO$_2$H  
(d) CH$_3$CH$_2$ - CH$_2$COOH

26. Which of the following is not a correct statement?

(a) $S_2$ is a nucleophilic substitution reaction.  
(b) $S_{N_2}$ is a nucleophilic substitution reaction.  
(c) $S_{N_1}$ is a nucleophilic substitution reaction.  
(d) E2 is a nucleophilic substitution reaction.

27. Select the reagent that will yield the greatest amount of substitution on reaction with CH$_3$CH$_2$ - Br:

(a) CH$_3$CH$_2$OK in dimethyl sulfoxide (DMSO)  
(b) CH$_3$COOK in dimethyl sulfoxide (DMSO)  
(c) Both (a) and (b) will give comparable amounts of substitution  
(d) Neither (a) nor (b) will give any amount of substitution
28. Estersification (shown below) is a reaction converting a carboxylic acid to its ester. It involves only the carbonyl carbon. Estersification of (+)-lactic acid with methanol yields (+) methyl lactate. Assuming that there are no side reactions, what is true about this reaction?

(a) An S$_2$$_{2n}$ process has occurred, inverting the absolute configuration of the chiral center.
(b) An S$_2$$_{2n}$ process in the chiral center has inverted the optical rotation.
(c) A diastereomer has been produced; diastereomers have different physical properties including optical rotation.
(d) Optical rotation is not directly related to absolute configuration, so the change in sign of rotation is merely a coincidence.

29. Which of the two isomers of 4a-benzylcyclohexene (4Z,4E) will undergo S$_2$$_{2n}$ substitution with $^{13}$C$_{18}$F$_3$ faster, and why?

(a) $^{13}$C$_{18}$F$_3$ will react faster because it is more stable.
(b) $^{13}$C$_{18}$F$_3$ will react faster because it yields a more stable product, and the transition state for both reactions is of the same energy.
(c) $^{13}$C$_{18}$F$_3$ will react faster because the approach of $^{13}$C$_{18}$F$_3$ can proceed unhindered.
(d) $^{13}$C$_{18}$F$_3$ will react faster because it is less stable, and the transition state for both reactions is of the same energy.

30. (Z)-2-butene reacts with E$_2$/H$_2$. The resulting bromohydrocarbon when treated with methanol undergoes an intramolecular S$_2$$_{2n}$ reaction. Taking into consideration the stereoelectronic consequences of the reaction mechanisms involved, choose the final product(s) of these transformations.

(a) (I) only
(b) (II) only
(c) (III) only
(d) Equal amounts of (I) and (II)

31. Rank the following species in order of decreasing nucleophilicity in a polar protic solvent (most to least nucleophilic):

\begin{align*}
& \text{CH}_2\text{OH}^- \quad \text{CH}_3\text{CH}_2\text{OH}^- \quad \text{CH}_3\text{CH}_2\text{CH}_2\text{OH}^- \quad \text{CH}_3\text{CH}_2\text{OH}^- \\
& (a) 3 > 1 > 2 \quad (b) 2 > 3 > 1 \quad (c) 1 > 3 > 2 \quad (d) 2 > 1 > 3
\end{align*}