

**MULTIPLE CHOICE.** Choose the one alternative that best completes the statement or answers the question.

- 1) What general classification is given to the molecule below? 1) \_\_\_\_\_



- A) primary chloride  
 B) secondary chloride  
 C) tertiary chloride  
 D) benzyl chloride  
 E) vinyl chloride
- 2) Which of the following is a tertiary halide? 2) \_\_\_\_\_  
 A)  $(\text{CH}_3)_3\text{CCHClCH}_3$   
 B)  $\text{ClCH}_2\text{CH}_2\text{C}(\text{CH}_3)_3$   
 C)  $(\text{CH}_3)_2\text{CClCH}_2\text{CH}_3$   
 D)  $\text{ClCH}_2\text{CH}_2\text{CH}(\text{CH}_3)_2$   
 E)  $\text{ClCH}_2\text{C}(\text{CH}_3)\text{CH}_2\text{CH}_3$
- 3) Which of the following alkyl halides has the smallest molecular dipole moment? 3) \_\_\_\_\_  
 A)  $\text{CH}_2\text{I}_2$       B)  $\text{CH}_2\text{Cl}_2$       C)  $\text{CH}_3\text{F}$       D)  $\text{CF}_4$       E)  $\text{CH}_3\text{Cl}$
- 4) Which of the following species is the least nucleophilic? 4) \_\_\_\_\_  
 A)  $\text{CH}_3\text{O}^-$   
 B)  $\text{CN}^-$   
 C)  $\text{BF}_3$   
 D)  $\text{H}_2\text{O}$   
 E)  $(\text{CH}_3)_3\text{N}$
- 5) Which of the following compounds will undergo an  $\text{S}_{\text{N}}2$  reaction most readily? 5) \_\_\_\_\_  
 A)  $(\text{CH}_3)_2\text{CHCH}_2\text{CH}_2\text{CH}_2\text{I}$   
 B)  $(\text{CH}_3)_2\text{CHI}$   
 C)  $(\text{CH}_3)_3\text{CCH}_2\text{I}$   
 D)  $(\text{CH}_3)_3\text{CCl}$   
 E)  $(\text{CH}_3)_2\text{CHCH}_2\text{CH}_2\text{CH}_2\text{Cl}$
- 6) Which of the following alkyl halides reacts most rapidly via an  $\text{S}_{\text{N}}2$  reaction with  $\text{NaCN}$ ? 6) \_\_\_\_\_  
 A) (*R*)-2-bromohexane  
 B) 1-fluorohexane  
 C) 1-iodo-1-methylcyclohexane  
 D) 1-iodohexane  
 E) iodocyclohexane

- 7) Which of the following alkyl chlorides will undergo  $S_N2$  reaction most readily? 7) \_\_\_\_\_
- A) 3-chloro-2-methylpentane
  - B) 1-chloro-4-methylpentane
  - C) 2-chloro-4-methylpentane
  - D) 2-chloro-2-methylpentane
  - E) 2-chloro-3-methylpentane
- 8) Which of the compounds below undergoes solvolysis in aqueous ethanol most rapidly? 8) \_\_\_\_\_
- A) isopropyl chloride
  - B) methyl iodide
  - C) 3-iodo-3-methylpentane
  - D) 3-chloropentane
  - E) cyclohexyl bromide
- 9) Which of the following alkyl bromides undergoes solvolysis in aqueous methanol most rapidly? 9) \_\_\_\_\_
- A)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{Br}$
  - B)  $(\text{CH}_3)_2\text{CHCH}_2\text{CH}_2\text{Br}$
  - C)  $(\text{CH}_3)_2\text{CHCH}_2\text{CHBrCH}_3$
  - D)  $\text{PhBr}$
  - E)  $\text{PhCHBrCH}_3$
- 10) When a  $S_N1$  reaction of *R*-2-iodobutane takes place in hot methanol, the product \_\_\_\_\_. 10) \_\_\_\_\_
- A) will undergo a hydride shift
  - B) is racemic
  - C) is chiral
  - D) will rotate plane polarized light
  - E) none of the above
- 11) Which of the following alkyl chlorides is least likely to undergo rearrangement during a solvolysis reaction? 11) \_\_\_\_\_
- A) *trans*-1-chloro-2-ethylcyclohexane
  - B) 2-chloro-3-methylpentane
  - C) 2-chloro-2-methylpentane
  - D) 2-chloro-4-methylpentane
  - E) *cis*-1-chloro-2-ethylcyclohexane
- 12) Which of the following alkyl halides can produce only a single alkene product from when treated with sodium methoxide? 12) \_\_\_\_\_
- A) 3-chloro-3-ethylpentane
  - B) 2-chloro-3-ethylpentane
  - C) 2-chloro-2-methylpentane
  - D) 2-chloro-4-methylpentane
  - E) 3-chloro-2-methylpentane

13) Which of the following statements correctly describe(s) E1 reactions of alkyl halides (RX)? 13) \_\_\_\_\_

- I. Rate =  $k[\text{base}]$
- II. Rate =  $k[\text{base}][\text{RX}]$
- III. Rate =  $k[\text{RX}]$
- IV. The reactions occur in two or more distinct steps.
- V. Rearrangements are sometimes seen.

- A) II and IV
- B) III, IV, and V
- C) I, IV, and V
- D) I only
- E) III and V

14) In which of the following mechanisms ( $S_N1$ ,  $S_N2$ , E1, E2) are alkenes the major reaction products? 14) \_\_\_\_\_

- A) E1 only
- B) E2 only
- C)  $S_N1$  only
- D)  $S_N2$  only
- E) both E1 and E2

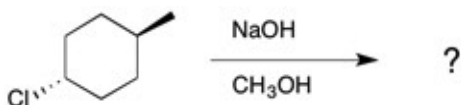
15) Predict the two most likely mechanisms for the reaction of 2-iodohexane with potassium hydroxide. 15) \_\_\_\_\_

- A)  $S_N1$  and  $S_N2$
- B) E1 and  $S_N1$
- C) E1 and E2
- D)  $S_N2$  and E2

16) One product which results when 2-chloro-2-methylpentane is heated in ethanol is an ether. 16) \_\_\_\_\_  
From which mechanistic pathway does this ether arise?

- A) E2
- B)  $S_N2$
- C) E1
- D)  $S_N1$
- E) E1cb

17) Consider the substitution reaction shown below. By what mechanism will the reaction proceed? 17) \_\_\_\_\_



- A)  $S_N2$
- B) Free radical reaction
- C)  $S_N1$
- D) There is not enough information to tell.