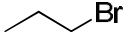
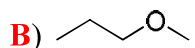
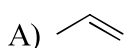


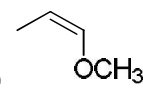
**NORTH ZONE, BANGALORE**

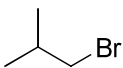
**HALO ALKANES & HALO ARENES -1**

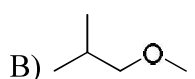
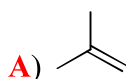
1.   $\xrightarrow[\text{CH}_3\text{OH}]{\text{CH}_3\text{O}^-}$  What is the major organic product in the given reaction?



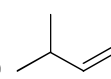
C) A&B in equal amount

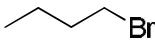


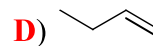
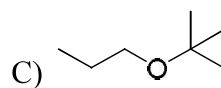
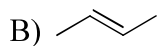
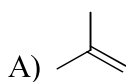
2.   $\xrightarrow[\text{CH}_3\text{OH}]{\text{CH}_3\text{O}^-}$  What is the major organic product in the given reaction?




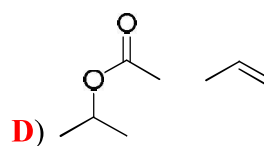
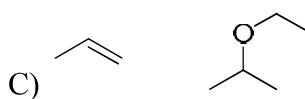
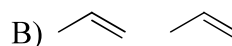
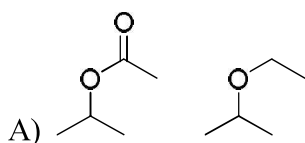
C) A&B in equal amount

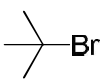


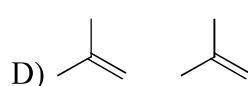
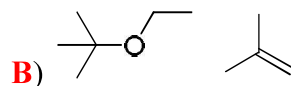
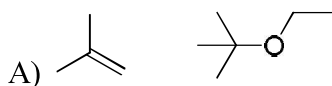
3.   $\xrightarrow[\text{tert-butanol}]{\text{tert-butoxide}}$  What is the major organic product in the given reaction?



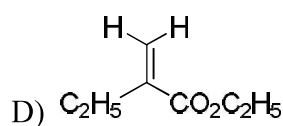
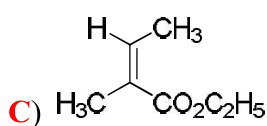
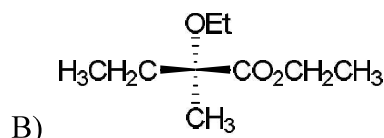
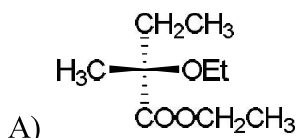
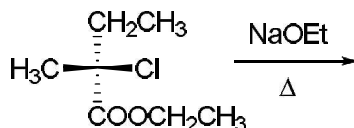
4.   $\begin{cases} \xrightarrow[\text{CH}_3\text{COOH}]{\text{CH}_3\text{COO}^-} \text{X (major organic product)} \\ \xrightarrow[\text{C}_2\text{H}_5\text{OH}]{\text{C}_2\text{H}_5\text{O}^-} \text{Y (major organic product)} \end{cases}$  X and Y are respectively



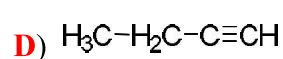
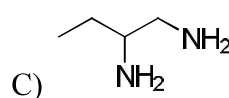
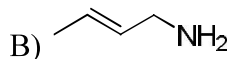
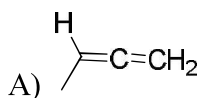
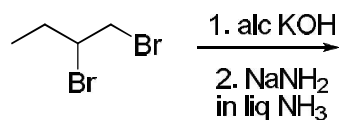
5.   $\begin{cases} \xrightarrow{\text{C}_2\text{H}_5\text{OH}} \text{X (major organic product)} \\ \xrightarrow[\text{C}_2\text{H}_5\text{OH}]{\text{C}_2\text{H}_5\text{O}^-} \text{Y (major organic product)} \end{cases}$  X and Y are respectively



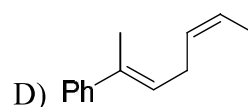
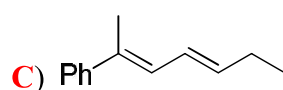
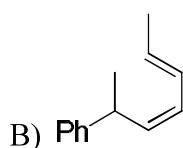
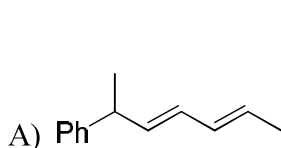
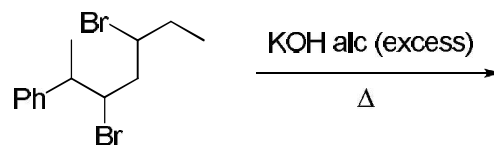
6. Major organic product of the following reaction is?



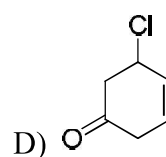
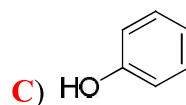
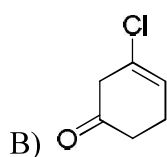
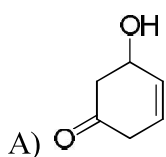
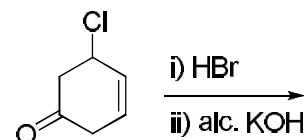
7. Major organic product of the following reaction is?



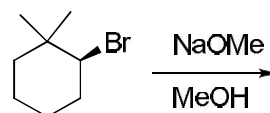
8. Major organic product of the following reaction is?

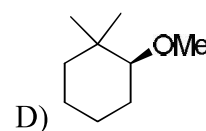
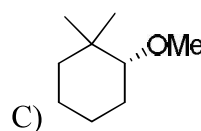
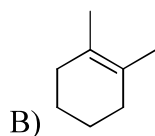
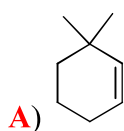


9. Major organic product of the following reaction is?

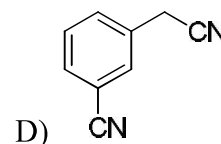
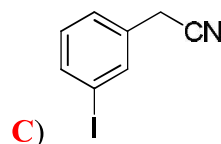
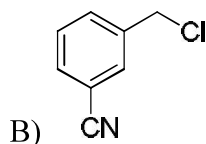
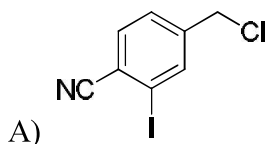
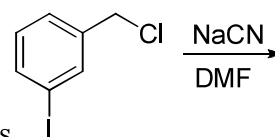


10. Major organic product of the following reaction is?





11. The structure of the major product formed in the following reaction is



12. A solution of (–)-1-chloro-1-phenylethane in toluene racemises slowly in the presence of a small amount of  $\text{SbCl}_5$  due to the formation of

A) carbanion                      B) carbene                      C) carbocation                      D) free radical

13. An unknown alcohol is treated with the “Lucas reagent” to determine whether the alcohol is primary, secondary or tertiary. Which alcohol reacts fastest and by what mechanism :

A) Secondary alcohol by  $\text{S}_\text{N}1$                       B) tertiary alcohol by  $\text{S}_\text{N}1$

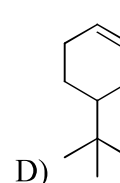
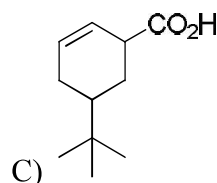
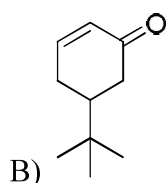
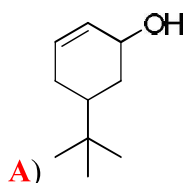
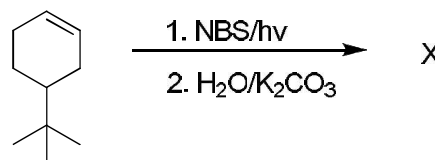
C) Secondary alcohol by  $\text{S}_\text{N}2$                       D) tertiary alcohol by  $\text{S}_\text{N}2$

14. The synthesis of alkyl fluorides is best accomplished by

A) Free radical fluorination                      B) Sandmeyer's reaction

C) Finkelstein reaction                      D) Swarts reaction

15. The product of the reaction give below is

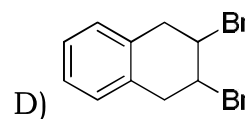
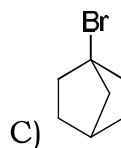
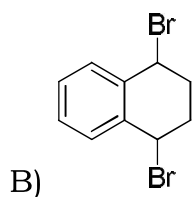
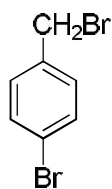


16. Which branched chain isomer of the hydrocarbon with molecular mass 72u gives only one isomer of monosubstituted alkyl halide?

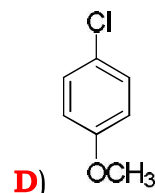
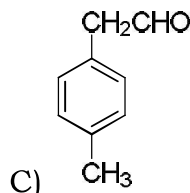
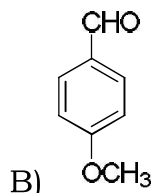
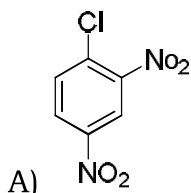
A) Tertiary butyl chloride                      B) Neopentane

C) Isohexane                      D) Neohexane

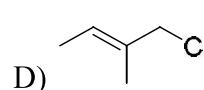
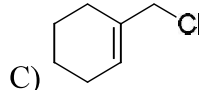
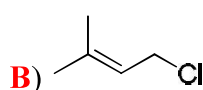
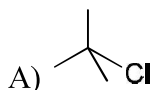
17. The compound that reacts fastest with methylamine is



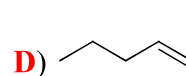
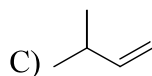
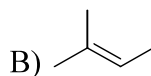
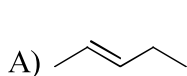
18. The compound that will NOT react with hot concentrated aqueous alkali at atmospheric pressure is



19. The compound that undergoes solvolysis in aq. Ethanol most easily is



20. Compound "X" reacts with diborane followed by alkaline hydrogen peroxide to form compound "Y". "Y" on reaction with a mixture of sodium bromide in sulphuric acid followed by bromobenzene and sodium in ether gives n-pentylbenzene. Compound "X" is



21. The best reaction sequence to convert 2-methyl-1-bromopropane into 4-methyl-2-bromopentane is

A) i) Mg in ether ii) acetaldehyde iii)  $\text{H}_3\text{O}^+$  iv) heat v) HBr,  $\text{H}_2\text{O}_2$

B) i)  $\text{NaC}\equiv\text{CH}$  in ether ii)  $\text{H}_2$ , Lindlar catalyst iii) HBr, no peroxide

C) i) alcoholic KOH ii)  $\text{CH}_3\text{COOH}$  iii)  $\text{H}_2/\text{Pt}$  iv) HBr, heat

D) i)  $\text{NaC}\equiv\text{CH}$  in ether ii)  $\text{H}_3\text{O}^+ / \text{HgSO}_4$  I iii) HBr, heat

22. The compound which undergoes hydrolysis on just warming with water and forms the corresponding hydroxyl derivatives is

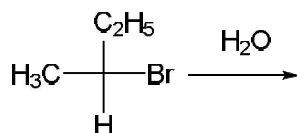
A) 2,4,6-trinitrochlorobenzene

B) 2-chloro-1-butene

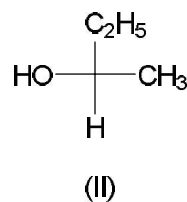
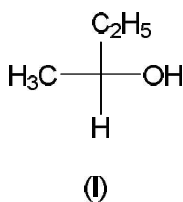
C) 2-chloro-2-methylbutane

D) 2,4-dimethoxychlorobenzene

23. In the reaction given below



The product obtained will contain



A) only compound I

B) only compound II

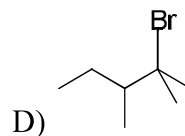
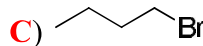
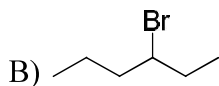
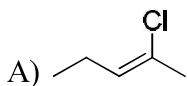
**C)** both compound I and II

D) this substitution cannot take place

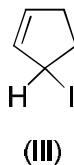
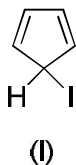
24. Select the most correct statement among the following

A)  $S_N1$  mechanism takes place in non-polar solventsB)  $S_N2$  mechanism in chiral substrates gives racemic mixtures as products**C)**  $S_N1$  mechanism is encouraged by polar solvents

D) the solvent never influences the mechanism

25. The compound which would undergo  $S_N2$  reaction fastest is

26. The order of the rate of formation of carbocations from the following iodo compounds is



A) I &gt; II &gt; III

B) I &gt; III &gt; II

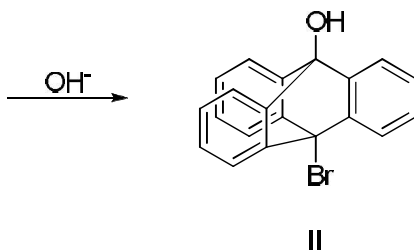
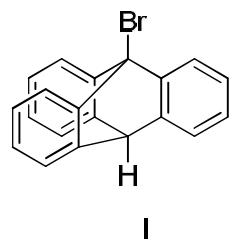
**C)** III > II > I

D) III &gt; I &gt; II

27. The substances used for the preparation of ether by Williamson's synthesis are

A)  $(\text{CH}_3)_3\text{CBr}$  and  $\text{CH}_3\text{ONa}$ B)  $(\text{CH}_3)_3\text{CBr}$  and  $\text{CH}_3\text{OH}$ **C)**  $\text{CH}_3\text{Br}$  and  $(\text{CH}_3)_3\text{CONa}$ D)  $\text{CH}_3\text{Br}$  and  $(\text{CH}_3)_3\text{COH}$ 

28. In a nucleophilic substitution reaction, the least reactive compound is

A)  $\text{CH}_3\text{CH}_2\text{Cl}$ B)  $(\text{CH}_3)_3\text{CCl}$ **C)**  $\text{CH}_2=\text{CHCl}$ D)  $\text{CH}_2=\text{CHCH}_2\text{Cl}$ 

29.

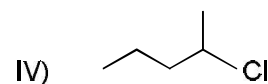
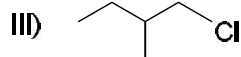
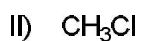
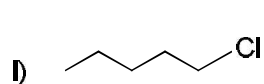
Conversion of I to II

A) takes place by  $S_N1$ B) takes place by  $S_N2$ 

C) takes place by E1

**D)** does not take place

30. Arrange in order of decrease in rates of  $S_N2$  reaction.



A)  $\text{I} > \text{II} > \text{III} > \text{IV}$

B)  $\text{IV} > \text{II} > \text{I} > \text{III}$

**C)  $\text{II} > \text{I} > \text{III} > \text{IV}$**

D)  $\text{III} > \text{II} > \text{IV} > \text{I}$

### KEY

1-10	B	A	D	D	B	C	D	C	C	A
11-20	C	C	B	D	A	B	A	D	B	D
21-30	B	A	C	C	C	C	C	C	D	C

### SOLUTIONS

1. In an  $S_N2$  reaction:  $1^\circ > 2^\circ > 3^\circ$

In an  $E2$  reaction:  $3^\circ > 2^\circ > 1^\circ$

Because a *primary* alkyl halide is the most reactive in an  $S_N2$  reaction (the back side of the alpha carbon is relatively unhindered) and the least reactive in an  $E2$  reaction, a primary alkyl halide forms principally the substitution product in a reaction carried out under conditions that favor  $S_N2/E2$  reactions. In other words, substitution wins the competition.

2. However, if either the primary alkyl halide or the nucleophile/base is sterically hindered, then

The nucleophile will have difficulty getting to the back side of the alpha carbon but will be able to remove the more accessible proton. As a result, elimination will win the competition.

3. Here base is bulkier base

4. The relative amounts of the two products depend on the strength and bulk of the nucleophile/base. The stronger and bulkier the nucleophile/base, the greater the percentage of the elimination product. For example, in the reactions that follow, acetate ion is a weaker base than ethoxide ion because acetic acid is a stronger acid ( $\text{pK}_a = 4.76$ ) than ethanol ( $\text{pK}_a = 15.9$ ). No elimination product is formed from the reaction of 2-chloropropane with the weakly basic acetate ion, whereas the elimination product is the major product formed with the strongly basic ethoxide

5. The  $S_N1/E1$  reactions of tertiary alkyl halides favor the substitution product, because under  $S_N2/E2$  conditions only the elimination product is formed.

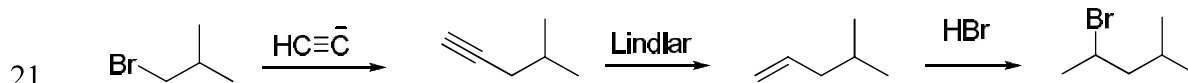
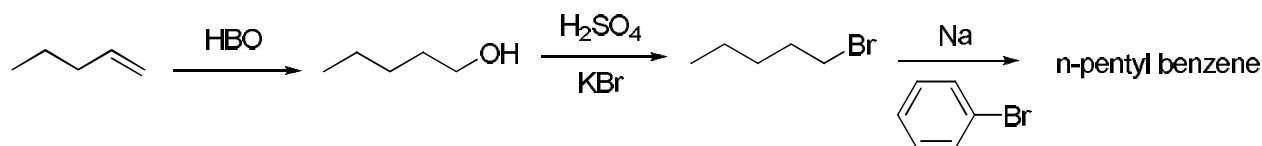
6. The given condition is  $E2$  condition,  $S_N2$  reaction will not take place due to steric hindrance.

7. Dehydrohalogenation two times

8. Conjugated system is more stable than isolated system


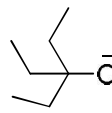

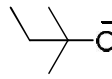
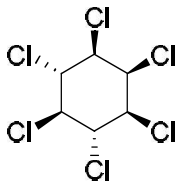
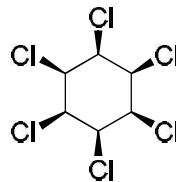
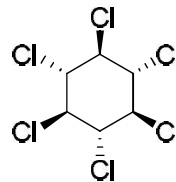
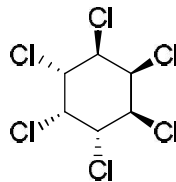
9. Elimination followed by keto-enol tautomerism

10. Given alkyl halide is sterically hindered 2° alkyl halide and nucleophile is strong nucleophile which means there is a competition between SN2/E2 but for this molecule E2 is favored.
11. Aliphatic nucleophilic substitution is much easier than aromatic nucleophilic substitution
12. Carbocation is planar structure SbCl5 acts as a lewis acid
13. 3° alcohol will give turbidity immediately due to more stable carbocation as a intermediate
14. By halogen exchange we can prepare alkyl fluorides
15. allylic bromination takes place through more stable free radical followed by nucleophilic substitution
16. all hydrogens in neopentane is identical so we will get only one type of halogenated product
17. methyl amine is a strong nucleophile, it undergoes via SN2 mechanism, primary benzyl bromide is good for SN2 compare to other substrates
18. option A will undergo SNAr mechanism, option B will undergo cannizzaro reaction  
Option C will undergo aldol reaction
19. Allylic tertiary is more reactive than simple tertiary
- 20.

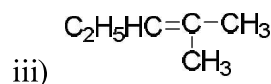
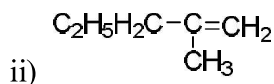
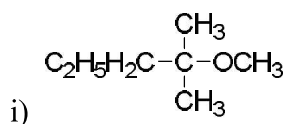


- 21.
22. SNAr mechanism
23. SN1 reaction racemization takes place
24. Carbocation and leaving group both will be stabilized by polar protic solvent
25. Alkyl halide which are less sterically hindered at halogen attached carbon undergo SN2 reaction faster
26. i compound is will give anti aromatic, ii will give non aromatic and third will give allylic cation
27. In option C Here there is no possibility of side reactions
28. Vinyl and aryl halides do not undergo simple nucleophilic substitution reaction due to +M effect
29. No SN1 because of bredts rule, No SN2 because of steric hinderence
30. SN2 reaction completely depends on the steric hinderence at the reacting site

## HALO ALKANES &amp; HALO ARENES -2

- Bottles containing  $C_6H_5I$  and  $C_6H_5CH_2I$  lost their original labels. They were labeled A and B for testing. A and B were separately taken in a test tube and boiled with NaOH solution. The end solution in each tube was made acidic with dilute  $HNO_3$  and then some  $AgNO_3$  solution was added. Substance B gave a yellow precipitate. Which one of the following statements is true for this experiment?  
**A)** A was  $C_6H_5I$       B) A was  $C_6H_5CH_2I$       C) B was  $C_6H_5I$       D) addition of  $HNO_3$
- When 2-bromo-2,3-dimethylbutane reacts with a base under E2 conditions, two alkenes (2,3-dimethyl-1-butene and 2,3-dimethyl-2-butene) are formed. Which of the bases (A, B, C, or D) would form the highest percentage of the 1-alkene?  
 A)       **B)**       C)       D) 
- Which of the following hexachlorocyclohexanes is the least reactive in an E2 reaction?  
 A)       B)       **C)**       D) 
- The compound that is most reactive with alcoholic KOH is  
 A)  $CH_2CH_2Br$       B)  $CH_3CH_2Br$       C)  $(CH_3)_2CHBr$       **D)**  $CH_3COCH_2CH_2Br$
- Acid catalysed dehydration of 2-pentanol would give mainly  
 A) 1-pentene      B) cis 2-pentene      **C)** trans 2-pentene      D) B & C(1:1)
- An alkyl bromide produces a single alkene when it reacts with sodium ethoxide and ethanol. This alkene undergoes hydrogenation and produces 2-methyl butane. What is the identity of the alkylbromide?  
**A)** 1-bromo-2-methylbutane      B) 2-bromo-2-methylbutane  
 C) 1-bromo-2,2-dimethylpropane      D) 1-bromobutane
- On heating of glycerol with con  $H_2SO_4$ , a compound obtained which has an unpleasant odour. What is that compound is  
 A) ethylene glycol      B) ally alcohol      **C)** acrolein      D) glycerol sulphate
- Consider the following reaction  $C_2H_5OH + H_2SO_4 \longrightarrow$  products  
 Among the following which one cannot be formed as a product under any conditions  
 A) Ethylene      **B)** Acetylene  
 C) Diethyl ether      D) ethyl hydrogen sulphate
- 2-chloro-2-methylpentane on reaction with sodium methoxide in methanol yields





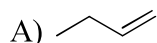
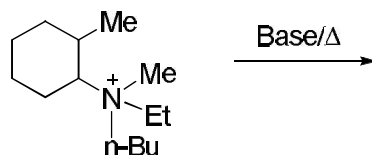
A) i & iii

B) ii only

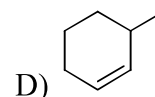
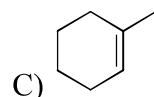
C) i & ii

**D) all of these**

10. Major alkene formed in the given elimination reaction



**B)  $\text{CH}_2=\text{CH}_2$**



11. The reagent which can react with 1-chlorobutane to give substitution reaction as major is

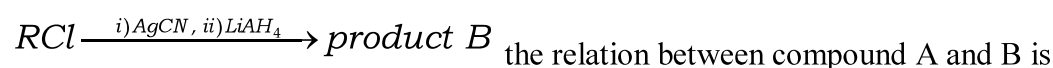
A)  $\text{AlCl}_3$

B)  $\text{KOH}-\text{MeOH}$

**C)  $\text{NaCN}$**

D)  $\text{Mg}-\text{ether}$

12. In the reactions given below



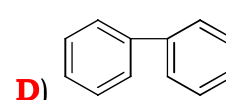
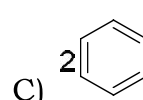
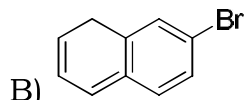
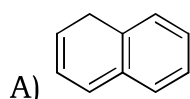
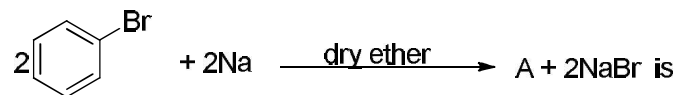
A) chain isomers

B) position isomers

**C) functional isomers**

D) metamers

13. The compound A in the reaction is



14. Ethyl phenyl ether is treated with conc.  $\text{HI}$  at  $0^\circ\text{C}$  and the mixture of products is treated with thionyl chloride. The products formed are

A) ethanol + chlorobenzene

**B) phenol + iodoethane**

C) iodoethane + chlorobenzene

D) chloroethane + phenol

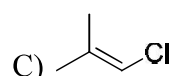
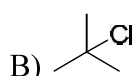
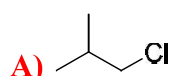
15. the maximum number of isomers (including stereoisomers) that are possible on monochlorination of the following compound is  $\text{CH}_3\text{CH}_2\text{CH}(\text{CH}_3)\text{CH}_2\text{CH}_3$

A) 5

B) 7

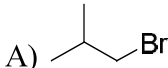
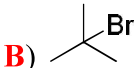
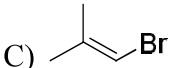
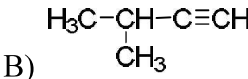
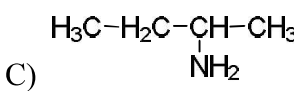
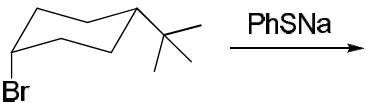
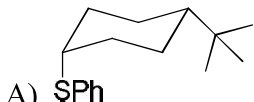
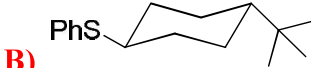
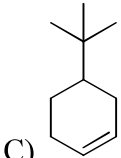
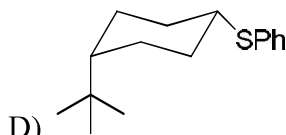
C) 6

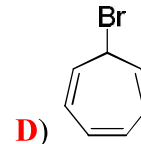
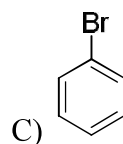
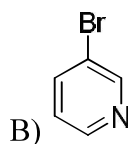
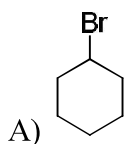
**D) 8**



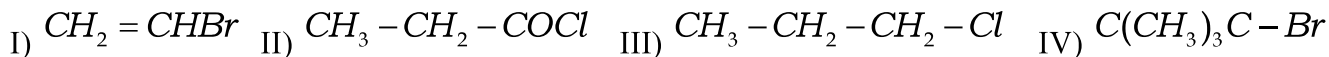
D) A & B (1:1)



- A)  B)  C)  D) A & B (1:1)
18. If cyclopentane reacts with more than one equivalent of  $\text{Cl}_2$  at a high temperature, how many dichlorocyclopentanes (including stereo isomers) would you expect to obtain as products?  
A) 5 B) 7 C) 4 D) 9
19. i) chlorobenzene is mono-nitrated to M ii) nitrobenzene is mono-chlorinated to N  
iii) anisole is mono-nitrated to P iv) 2-nitrochlorobenzene is mono-nitrated to Q  
Out of M, N, P and Q the compound that undergoes reaction with aq. NaOH fastest is  
A) M B) N C) P D) Q
20. The number of transition states in a unimolecular nucleophilic substitution ( $\text{S}_\text{N}1$ ) reaction is (consider the reaction between tertiary butanol and dil NaOH)  
A) 0 B) 1 C) 2 D) 3
21. The major product of the following reactions is  
 $\text{CH}_3 - \text{CH}_2 - \text{C} \equiv \text{CH} \xrightarrow{\text{i) NaNH}_2, \text{ii) CH}_3\text{CH}_2\text{Br}}$   
A)  $\text{H}_3\text{C} - \text{CH}_2 - \text{C} \equiv \text{C} - \text{CH}_2 - \text{CH}_3$  B)   
C)  D)  $\text{H}_3\text{C} - \text{CH}_2 - \text{C} \equiv \text{C} - \text{NH}_2$
22.  $\text{S}_\text{N}1$  reactivity of the following halides,  
(i)  $(\text{CH}_3)_3\text{CBr}$  (ii)  $(\text{C}_6\text{H}_5)_2\text{CHBr}$  (iii)  $(\text{C}_6\text{H}_5)_2\text{C}(\text{CH}_3)\text{Br}$  (iv)  $(\text{CH}_3)_2\text{CHBr}$   
A) iv > i > ii > iii B) ii > i > iii > iv C) i > iii > ii > iv D) iii > ii > i > iv
23. The major product in the following reaction is  
  
A)  B)  C)  D) 
24. Which hydrogen in compound (E) is easily replaceable during bromination reaction in presence of light?  
 $\text{CH}_3 - \text{CH}_2 - \text{CH} = \text{CH}_2$   
 $\delta \quad \quad \gamma \quad \quad \beta \quad \quad \alpha$   
(E)  
A)  $\beta$  - hydrogen B)  $\alpha$  - hydrogen C)  $\gamma$  - hydrogen D)  $\delta$  - hydrogen
25. Which of the following compounds will produce a precipitate with  $\text{AgNO}_3$ ?



26. The order of reactivity of ammonia with the following compound is



A)  $\text{IV} > \text{II} > \text{I} > \text{III}$  **B)**  $\text{II} > \text{IV} > \text{III} > \text{I}$  C)  $\text{III} > \text{IV} > \text{II} > \text{I}$  D)  $\text{I} > \text{IV} > \text{II} > \text{III}$

27. The appropriate sequence of reactions for obtaining 2-phenylbutanoic acid from benzene is

A) i) 1-chlorobutane/ $\text{AlCl}_3$  ii) limited,  $\text{Cl}_2$  light iii) aq NaCN iv)  $\text{H}_3\text{O}^+$ , heat

B) i) 2-chlorobutane/ $\text{AlCl}_3$  ii)  $\text{K}_2\text{Cr}_2\text{O}_7/\text{H}_2\text{SO}_4$

**C)** i) propanoyl chloride/ $\text{AlCl}_3$  ii)  $\text{Zn-Hg/HCl}$  iii) limited  $\text{Cl}_2(\text{g})$ , light iv) aq. NaCN v)  $\text{H}_3\text{O}^+$ , heat

D) i) butanoyl chloride/ $\text{AlCl}_3$  ii)  $\text{NaBH}_4$  iii)  $\text{CuCN}$  iv)  $\text{H}_3\text{O}^+$ , heat

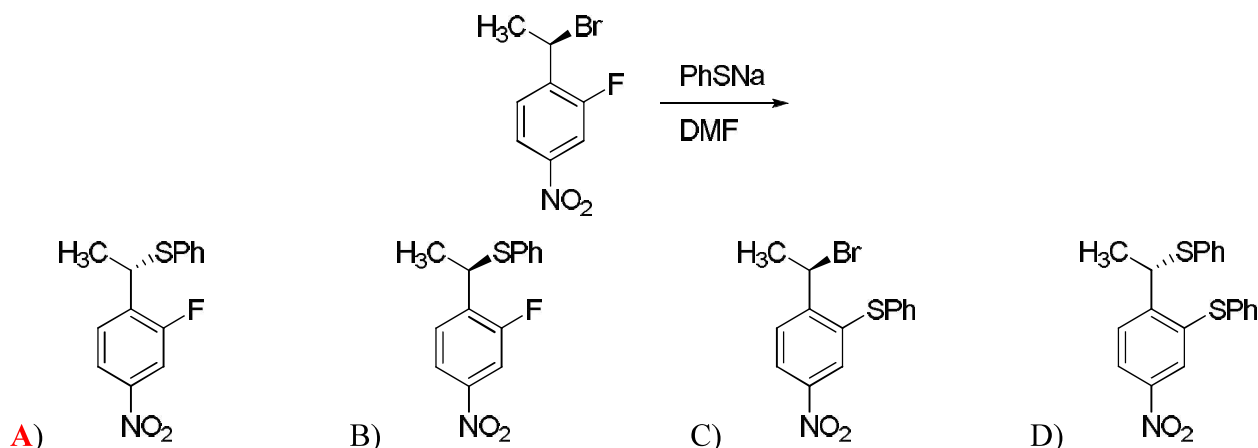
A)

B)

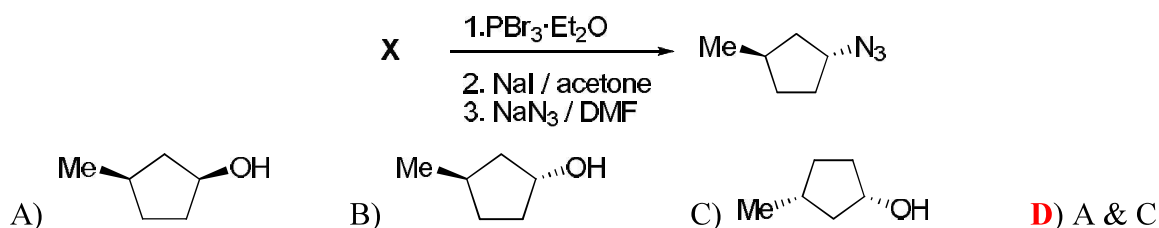
C)

D)

28. The major product in the following reaction is



29. What is the X for given reaction



30. the total number of alkenes possible by dehydrobromination of 1-bromo-1-ethyl-4-methylcyclohexane using alcoholic KOH is

A)6

B)2

C)3

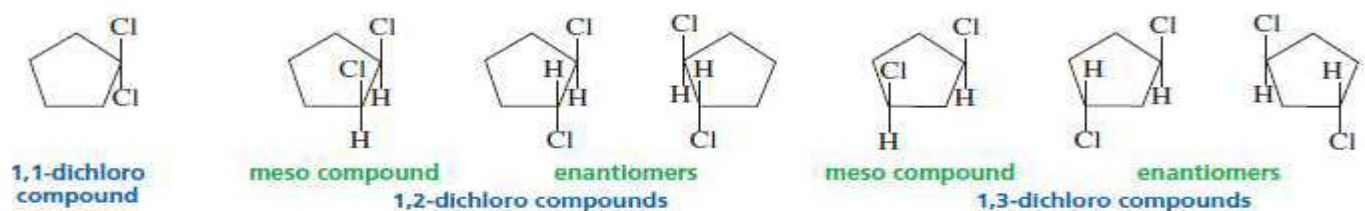
**D)4**

**KEY**

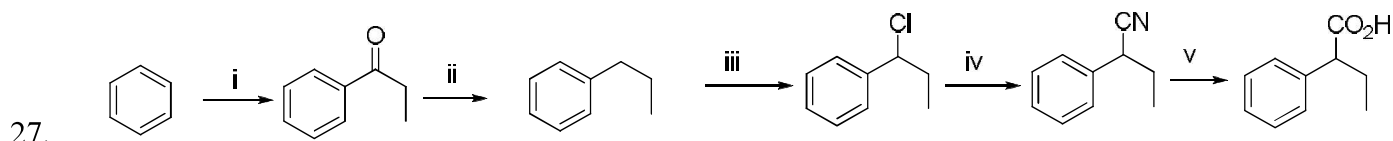
<b>1-10</b>	A	B	C	D	C	A	D	B	D	B
<b>11-20</b>	C	C	D	B	D	A	B	B	D	C
<b>21-30</b>	A	D	B	C	D	B	C	A	D	D

**SOLUTIONS**

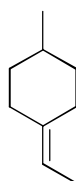
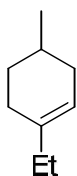
- B is giving AgI yellow ppt, which means B is reaction with NaOH in the given substrate benzyl iodide only react with NaOH, aryl iodide will not react
- With increase the bulkiness of the base hofmann product will increase
- For E2 reaction Antiperiplanar relationship is required, in option C no hydrogen is anti to the Cl
- CO group is making proton more acidic
- In elimination trans alkene is the major product
- In option A there is only one beta hydrogen is there so one alkene is possible
- Dehydration followed by keto enol tautomerism, again dehydration
- By changing the conditions we can achieve the all options except B
- For the given substrate elimination is major, but they did not mentioned major so we have to consider minor products also
- Transition state is having partial carbanion character
- Option B is alcoholic KOH which preffers elimination over substitution
- A is primary amine, but B is secondary amine, so both are functional isomers
- Fittig reaction
- Initially phenol + iodoethane will form, phenol will not undergo any reaction with SOCl<sub>2</sub>
- how many different hydrogens are there that many different products will form
- In chlorination not only radical stability population of hydrogen also matter
- Bromination mainly we have to consider radical stability only because rate of picking of 1° vs 3° hydrogen is more
- 



19. 2-nitrochlorobenzene is mono-nitration gives the 2,4-dinitro chloro benzene which will undergo readily  $ArSN_2$  mechanism
20. Number of transition states = number of intermediate + 1
21. Deprotonation followed by  $SN_2$  reaction
22. Follow the stability of carbo cation
23. It's a  $SN_2$  reaction
24. based on the stability of free radical
25. In option D intermediate is tropylium cation which is aromatic in nature
26. Just follow the stability of the carbocation



28. Simple  $SN_2$  reaction,  $NO_2$  group is not para to the F so  $SN_{Ar}$  mechanism is not possible
29. All three conditions are  $SN_2$  reactions, option A and C are identical structures



30. 2 stereo isomers      2 stereo isomers