







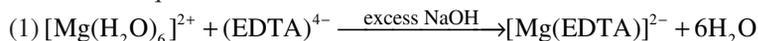






(4)  $\text{CuSO}_4 + 4\text{KCN} \rightarrow \text{K}_2[\text{Cu}(\text{CN})_4] + \text{K}_2\text{SO}_4$ ; products are not correctly written.

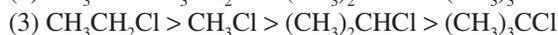
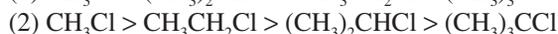
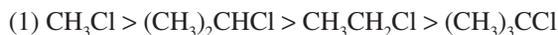
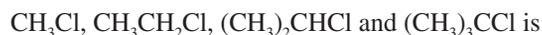
The correct equations for other reactions are:



(3)  $\text{LiO} + 2\text{KCl} \rightarrow 2\text{LiCl} + \text{K}_2\text{O}$  is unfavorable in forward reaction as  $\text{LiO}$  is stable, while  $\text{K}_2\text{O}$  is unstable.



21. In  $\text{S}_{\text{N}}2$  reactions, the correct order of reactivity for the following compounds



### Solution

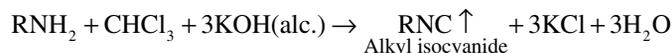
(2) Rate of  $\text{S}_{\text{N}}2$  reaction depends on steric hindrance on carbon atom which bears leaving group. Increasing steric hindrance decreases possibility of back side attack by nucleophile. This decreases the rate of  $\text{S}_{\text{N}}2$  reaction. Order of steric hindrance is  $(\text{CH}_3)_3\text{CCl} > (\text{CH}_3)_2\text{CHCl} > \text{CH}_3\text{CH}_2\text{Cl} > \text{CH}_3\text{Cl}$ , so the order of reactivity towards  $\text{S}_{\text{N}}2$  reaction is  $\text{CH}_3\text{Cl} > \text{CH}_3\text{CH}_2\text{Cl} > (\text{CH}_3)_2\text{CHCl} > (\text{CH}_3)_3\text{CCl}$ .

22. On heating an aliphatic primary amine with chloroform and ethanolic potassium hydroxide, the organic compound formed is

- (1) an alcohol                      (2) an alkanediol                      (3) an alkyl cyanide                      (4) an alkyl isocyanide

### Solution

(4) The reaction involved is



23. The most suitable reagent for the conversion of  $\text{R}-\text{CH}_2-\text{OH} \rightarrow \text{R}-\text{CHO}$  is:

- (1)  $\text{KMnO}_4$     (2)  $\text{K}_2\text{Cr}_2\text{O}_7$   
 (3)  $\text{CrO}_3$     (4) PCC (Pyridinium Chlorochromate)

### Solution

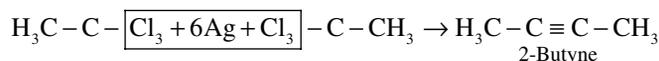
(4) All others except are stronger oxidizing agents and will convert  $\text{R}-\text{CH}_2-\text{OH} \rightarrow \text{R}-\text{COOH}$ . PCC is a mild oxidizing agent and will convert  $\text{R}-\text{CH}_2-\text{OH} \rightarrow \text{R}-\text{CHO}$ .

24. The major organic compound formed by the reaction of 1,1,1-trichloroethane with silver powder is

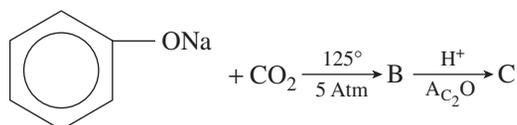
- (1) Acetylene                      (2) Ethene                      (3) 2-Butyne                      (4) 2-Butene

### Solution

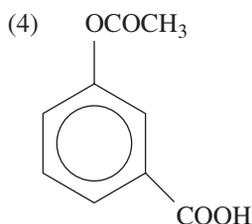
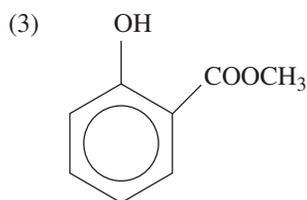
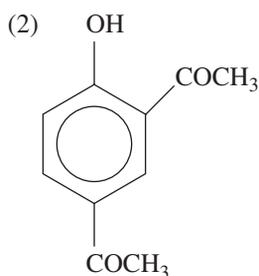
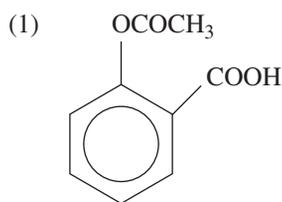
(3) The reaction involved is



25. Sodium phenoxide when heated with  $\text{CO}_2$  under pressure at  $125^\circ\text{C}$  yields a product which on acetylation produces C.

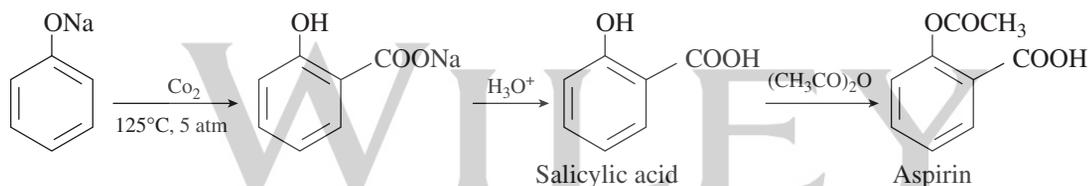


The major product C is



**Solution**

(1) The reaction is



26. Considering the basic strength of amines in aqueous solution, which one has the smallest  $pK_b$  value?

- (1)  $(CH_3)_2NH$       (2)  $CH_3NH_2$       (3)  $(CH_3)_3N$       (4)  $C_6H_5NH_2$

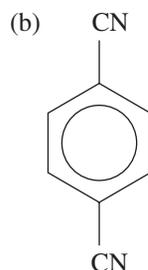
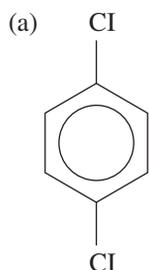
**Solution**

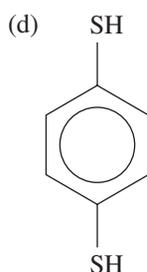
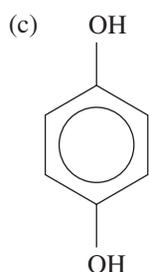
(1)  $C_6H_5NH_2$  is least basic as the lone pair is involved in resonance with benzene ring. In the case of three aliphatic amines in aqueous solutions, the basicity depends on two factors: +I effect of alkyl group and solvation of conjugate acid (aminium ion) of the respective base in the aqueous solution. +I effect as well as basicity due to the group decreases as  $(CH_3)_3N > (CH_3)_2NH > CH_3NH_2 > NH_3$ . However, solvation of conjugate acids occurs by hydrogen bonding which depends on the number of hydrogen atoms attached with nitrogen atom. The order of solvation of conjugate base is  $(CH_3)_3N < (CH_3)_2NH < CH_3NH_2 < NH_3$ . In this way, both factors are against each other and the order of resultant basic strength becomes



Hence the amine that has minimum  $pK_b$  (maximum basic) is  $(CH_3)_2NH$ .

27. For which of the following molecule significant  $\mu \neq 0$ ?





(1) Only (a)

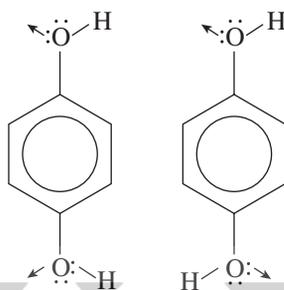
(2) (a) and (b)

(3) Only (c)

(4) (c) and (d)

### Solution

(4) In (a) and (b),  $\mu = 0$  as the dipole moments cancel each other. However, in (c) and (d) more than one conformation is possible, so, the dipole moment is not zero in those cases. For example, possible conformations in (c) is shown below.



Similarly for structure (d), two conformations are possible.

28. Which one is classified as a condensation polymer?

(1) Dacron

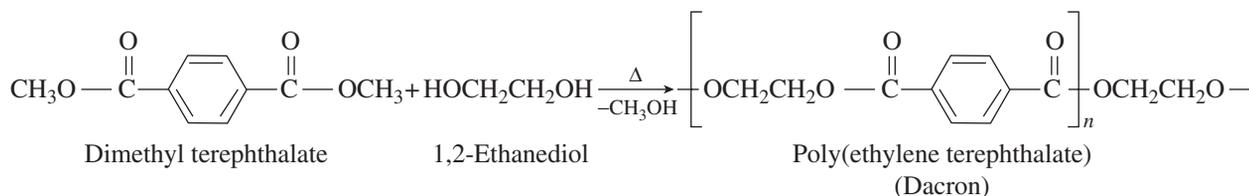
(2) Neoprene

(3) Teflon

(4) Acrylonitrile

### Solution

(1) Condensation polymer: Dacron is formed by condensation of ethylene glycol and terephthalic acid at 420–460 K using zinc acetate and antimony oxide as catalyst.



Addition polymers: Teflon formed by addition of tetrafluoroethylene. Acrylonitrile is a monomer to form addition polymer “orlon”. Neoprene is a rubber formed by addition polymerization of chloroprene, 2-chloro-1,3-butadiene.

29. Which one of the following bases is **not** present in DNA?

(1) Quinoline

(2) Adenine

(3) Cytosine

(4) Thymine

### Solution

(1) The bases in DNA are adenine, cytosine, thymine and guanine.

30. In the reaction,  $\text{CH}_3\text{COOH} \xrightarrow{\text{LiAlH}_4} \text{A} \xrightarrow{\text{PCl}_5} \text{B} \xrightarrow{\text{alc. KOH}} \text{C}$ , the product C is

(1) Acetaldehyde

(2) Acetylene

(3) Ethylene

(4) Acetyl chloride

### Solution

(3) The reaction is  $\text{CH}_3\text{COOH} \xrightarrow{\text{LiAlH}_4} \text{CH}_3\text{CH}_2\text{OH} \xrightarrow{\text{PCl}_5} \text{CH}_3\text{CH}_2\text{Cl} \xrightarrow{\text{alc. KOH}} \text{CH}_2=\text{CH}_2$   
(A) Ethanol                      (B) Ethyl chloride                      (A) Ethylene

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