

Daily Tutorial Sheet 1

JEE Advanced [Archive]

1. A is ethanol because B is an alkene (ethene).

$$\begin{split} \text{C}_2\text{H}_5\text{OH} + \text{Conc.H}_2\text{SO}_4 & \longrightarrow \text{CH}_2 = \text{CH}_2 & \xrightarrow{\text{H}_2/\text{Ni}} \text{CH}_3 - \text{CH}_3 \\ \text{CH}_2 = \text{CH}_2 + \text{Br}_2 - \text{H}_2\text{O} & \longrightarrow \text{CH}_2 - \text{CH}_2 \\ & \text{(Brown)} & & \text{|} & \text{|} \\ & \text{Br} & \text{Br} \\ & & \text{(Colourless)} \end{split}$$

$$\text{CH}_2 = \text{CH}_2 + \text{alk.KMnO}_4 & \longrightarrow \text{CH}_2 - \text{CH}_2 \\ & \text{Purple} & \text{OH} & \text{OH} \\ & & \text{(Colourless)} \end{split}$$

- **2.(C)** $C_2H_5OH \xrightarrow{H_2SO_4} C_2H_4 + H_2O \xrightarrow{\text{ethene}}$
- **3.(B)** On the basis of 'like dissolves like' principle ethanol being most polar among the given compounds, it will dissolve in water readily.
- **4.(D)** The order of reactivity of alcohol with Lucas reagent (Zn + conc. HCl) is tertiary > secondary > primary. 3° alcohols produce turbidity immediately, 2° alcohol gives turbidity within 5-10 minutes. But 1° alcohol do not give turbidity at all at room temperature.
- **5.** Compound X must be a symmetrical ether because it is unreactive towards sodium

$$\begin{array}{c} R-O-R \xrightarrow{HI} 2R-I \\ R-I \xrightarrow{H_2O} R-OH_{(Z)} \xrightarrow{[O]} \underset{EW=60}{\text{Acid}} \\ & \downarrow^{I_2/P} \\ & R-I \end{array}$$

$$\Rightarrow \quad \text{Acid is CH}_3\text{COOH and } Z=\text{CH}_3\text{CH}_2\text{OH} \quad ; \qquad X=\text{C}_2\text{H}_5-\text{O}-\text{C}_2\text{H}_5, Y=\text{CH}_3-\text{CH}_2-\text{I}} \\ \text{CH}_3\text{CH}_2-O-\text{CH}_2\text{CH}_3 \xrightarrow{HI} 2\text{CH}_3\text{CH}_2\text{I}} \end{array}$$

- **6.(C)** $C_2H_5OC_2H_5 + 2HI \xrightarrow{\Delta} 2C_2H_5I + H_2O$
- **7.(T)** Aldehydes (from 1° alcohols) may further be oxidised to acids but ketones do not (from 2° alcohols) get oxidised.

8.
$$(CH_{3}COO)_{2}Ca \xrightarrow{\Delta} CH_{3} - \overset{O}{C} - CH_{3} + CaCO_{3}$$

$$CH_{3} - \overset{O}{C}H - CH_{3} \xrightarrow{KMnO_{4}} CH_{3} - \overset{O}{C} - CH_{3}$$

$$CH_{3} - \overset{C}{C} = CH \xrightarrow{H_{2}SO_{4}} CH_{3} - \overset{O}{C} - CH_{3}$$

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$$CH_{3} - \overset{O}{C}H - CH_{3} \xrightarrow{Conc.} CH_{2} - CH_{3} \xrightarrow{CCl_{4}} CH_{3} - CH_{3} - CH_{3} \xrightarrow{NaNH_{2}} CH_{3} - C = CH_{3} - C = CH_{3} - C = CH_{$$



9. (i)
$$H-C \equiv C-H \xrightarrow{HgSO_4} CH_3 - CHO \xrightarrow{catalyst} CH_3CH_2OH$$

(ii)
$$4C_2H_5Br + 4(Na/Pb) \xrightarrow{Heat} (C_2H_5)_4Pb$$

sodium-lead
alloy tetraethyl lead

(iii)
$$Al_4C_3 \xrightarrow{H_2O} Al(OH)_3 + CH_4$$

 $CH_4 + Cl_2 \xrightarrow{hv} CH_3Cl + HCl$

10.(A)
$$CO + H_2 \xrightarrow{Cr_2O_3 - ZnO} CH_3OH$$
 water gas CH_3OH

11.(D) The -OH group activates the benzene ring to a large extent towards EAS (S_E) and facilitates substitution in o- and p-positions. Br₂ in H₂O gives Br⁺ (bromonium) ion in surplus due to polarity of H₂O.

- **12.** Extra stability via resonance.

14.
$$C_2H_5OH \xrightarrow{I_2/NaOH} CHI_3 + HCOONa$$

15.
$$CH_3 - CH_2OH + I_2 + NaOH \longrightarrow CHI_3 \downarrow \text{(Iodoform test)}$$
 yellow

Iodoform test is not given by methanol.

- **16.** Butanol forms intermolecular H-bonds, has higher boiling point than butanal.
- 17. The compound must contain a hydroxy group on the ring (Phenolic). So compound should be of form $C_6H_4(CH_3)OH$. Now CH_3 should be at 'm' position to -OH as it forms a tri-bromo derivative.

$$\begin{array}{c} \text{OH} \\ \text{OH} \\ \text{CH}_3 \end{array} + \text{Br}_2 - \text{H}_2\text{O} \\ \end{array} \begin{array}{c} \text{OH} \\ \text{Br} \\ \text{CH}_3 \end{array}$$

18. Intramolecular H-bonding in ortho-nitrophenol lowers its boiling point. No such intramolecular H-bonding is possible with p-nitrophenol and rather it is associated together by intermolecular H-bonding which increases the boiling point.

20.(F) Ethanol is not acidic enough to react with aq. NaOH. Thus sodium ethoxide is prepared by reaction of ethyl alcohol with Na metal, liberating H_2 gas.



21.
$$\begin{array}{c} \text{CH}_3\text{CH}_2\text{OH} \xrightarrow{\text{Conc. H}_2\text{SO}_4} \text{CH}_2 = \text{CH}_2 \xrightarrow{\text{Br}_2} \text{CH}_2 - \text{CH}_2 \xrightarrow{\text{NaNH}_2} \text{H} - \text{C} \equiv \text{C} - \text{H} \\ & | & | & | \\ & \text{Br} & \text{Br} \end{array}$$

$$\begin{array}{c} \text{CH}_2 - \text{CH}_2 \xrightarrow{\text{NaNH}_2} \text{H} - \text{C} \equiv \text{C} - \text{H} \\ & | & | & | \\ & \text{CH}_2 = \text{CH} - \text{OCOCH}_3 \xrightarrow{\text{CH}_3\text{COOH}} \end{array}$$

- **22.(A)** Among the given compound ethanol shows maximum hydrogen bonding.
- **23.** Phenol (a weaker acid) reacts with NaHCO₃ (a weaker base) to form phenoxide ion (a stronger base) and carbonic acid (a stronger acid).

$$\begin{array}{cccc} C_6H_5OH + NaHCO_3 & \longrightarrow & C_6H_5ONa & + & H_2CO_3 \\ Weak \ acid & Weak \ base & Stronger \ base & Stronger \ acid \end{array}$$

Since acid-base equilibria lies towards the weaker acid and weaker base, phenol does not decompose $NaHCO_3$.

Whereas carboxylic acids decompose NaHCO₃.

$$\begin{array}{c} RCOOH + NaHCO_3 \\ \hline stronger \\ acid \\ \end{array} \begin{array}{c} weaker \\ base \\ \end{array} \begin{array}{c} RCOONa + \\ weaker \ acid \\ \end{array} \begin{array}{c} H_2CO_3 \\ weaker \ acid \\ \end{array}$$

- **24.(D)** The most polar bond in CH_3CH_2OH is O-H due to high electronegativity difference between O and H.
- **25.** Isobutane < n-butylchloride < n-butanol

Alcohols have highest boiling point due to H-bonding followed by alkyl halides.

With more branching in alkanes, the boiling point will be lower as a result of decreased surface area.