

Chemistry Questions and Answers BASED ON HIGH ORDER THINKING SKILL (HOTS)

UNIT- 11

ALCOHOLS, PHENOLS AND ETHERS

1 MARK QUESTIONS

Q. 1. What is the main product obtained when vapours of t-butyl alcohol are passed over copper at 300° ?

Ans. Isobutylene (2-Methyl propene)

Q. 2. What is usually added to ethyl alcohol to make it unfit for drinking purposes ?

Ans. Methanol and Pyridine.

Q. 3. Phenol has smaller dipole moment than methanol.

(OR)

Why are dipole moments of phenols smaller than dipole moments of alcohols ?

Ans. Due to electron-withdrawing effect of the benzene ring, the C — O bond in phenol is less polar but in case of methanol due to electron-donating effect of — CH₃ group, C — O bond is more polar.

Q. 4. Name the products obtained when anisole is treated with HI.

Ans. Phenol and methyl iodide.

Q. 5. Why are Grignard reagents soluble in ether but not in benzene ?

Ans. Grignard reagents form co-ordination complexes with ether but not benzene since the former has lone pair of electrons but the later does not.

Q. 6. Alcohols are easily protonated than phenols. Justify.

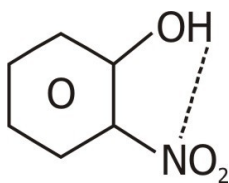
Ans. In phenols lone pair of electrons on the oxygen atom are delocalised over the benzene ring due to resonance and hence are not easily available for protonation. In contrast in alcohols, the lone pairs of electrons on the oxygen atom are localized due to absence of resonance and hence are easily available for protonation.

Q. 7. Di-tert butyl ether cannot be made by Williamson's synthesis. Explain why ?

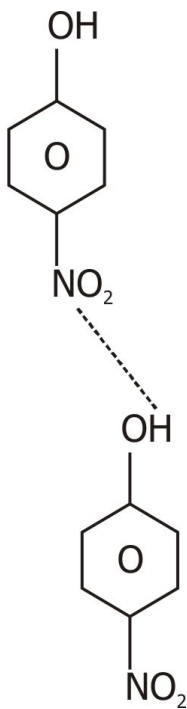
Ans. To prepare di tert-butyl ether by Williamson's synthesis, we need tert-butyl bromide and Sodium tertiary butoxide. Since tert-butyl bromide being 3°-alkyl halide prefers to undergo elimination rather than substitution, therefore the product obtained is isobutylene rather than ditertiary butyl ether.

Q. 8. While separating a mixture of ortho and para-nitro phenols by steam distillation, name the isomer which will be steam volatile. Give reasons.

Ans. In o-nitrophenol, there is intramolecular hydrogen bonding as follows :

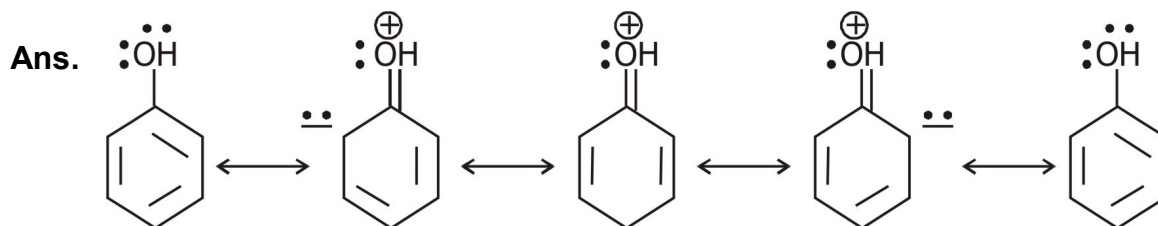


In p-nitrophenol, there is intermolecular hydrogen bonding as follows :



Due to intermolecular H bonding in p-nitrophenol, its b. p. is much higher than that of o-nitrophenol. Hence o-nitrophenol due to its lower b. p. is steam volatile while p-nitrophenol is not.

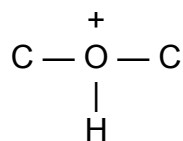
Q. 9. How an — OH group attached to carbon in the benzene ring activates benzene towards electrophilic substitution ?



The lone pair of electrons present on oxygen atom enter into resonance with the benzene ring. As a result, the electron density becomes higher at o- and p- position and due to higher electron density, the ring gets activated towards electrophilic substitution.

Q. 10. Ethers are cleaved by acids not by bases. Why ?

Ans. The C — O — C bond in ethers like the C — OH bond in alcohols is quite strong. In order to weaken it, the oxygen atom must be protonated. A subsequent nucleophile attack by a strong nucleophile such as Br⁻ or I⁻ ion on the less hindered carbon atom of the protonated :



bond brings about the cleavage of ethers to form an alcohol and an alkyl halide. The acids only can provide the H⁺ ion required for protonation of O atom of ether and therefore only acids can bring about the cleavage of ethers and not bases.

Q. 11. Phenols do not undergo substitution of the — OH group like alcohols. Explain.

Ans. The C — O bond in phenols has some double bond character due to resonance and hence cannot be easily cleaved by a nucleophile. In contrast, the C — O bond in alcohols is a pure single bond and hence can be easily cleaved by a nucleophile.

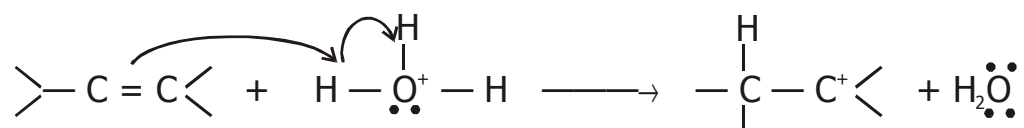
Q. 12. Alcohols act as weak bases. Explain.

Ans. The oxygen atom of the hydroxyl group has two lone pairs of electrons. Therefore alcohols accept a proton from strong mineral acid to form oxonium ions. Hence act as weak bases.

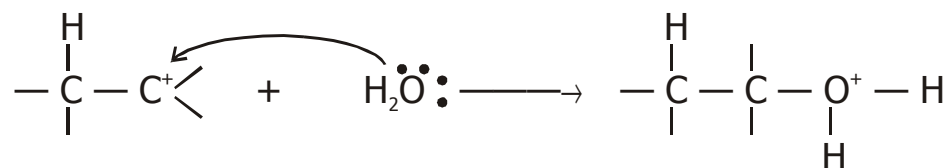
Q. 13. Write the mechanism of hydration of ethene to yield ethanol.

Ans. $\text{H}_2\text{O} + \text{H}^+ \longrightarrow \text{H}_3\text{O}^+$

Step (i) : — Protonation of alkene to form carbocation by electrophilic attack :



Step (ii) : — Nucleophilic attack of water on carbocation :



Step (iii) : — Deprotonation to form an alcohol :

