

Alcohols, Phenols and Ethers

Class 12 Chemistry · 24 NEET MCQs with answers & explanations

Alcohols, Phenols and Ethers covers preparation, properties and reactions of $-OH$ and $-O-$ containing compounds. NEET tests acidity order (phenol > water > alcohol), dehydration, oxidation, esterification, Williamson synthesis and reactions of phenol (Kolbe, Reimer-Tiemann, electrophilic substitution).

Key Reactions

Reaction / Concept	Key Fact
Acidity order	Phenol > water > 1° alcohol > 2° > 3° (electron donation destabilises alkoxide)
Dehydration	Alcohol + H_2SO_4 /heat → alkene; follows Zaitsev's rule (more substituted alkene)
Lucas test	$ZnCl_2 + HCl$; 3° → immediate turbidity; 2° → 5 min; 1° → no reaction at RT
Kolbe reaction	Phenol + NaOH + CO_2 → salicylic acid (ortho-hydroxybenzoic acid)
Reimer-Tiemann	Phenol + $CHCl_3$ + NaOH → salicylaldehyde (ortho-hydroxybenzaldehyde)
Williamson synthesis	$R-ONa + R'-X \rightarrow R-O-R'$ (ether); best with 1° alkyl halide (SN2)

Questions

Q1. Which transformation correctly describes the action of zinc dust on phenol?

- (A) Phenol is reduced to benzene
- (B) Phenol is oxidised to benzoic acid
- (C) Phenol gives salicylic acid
- (D) Phenol gives anisole

Q2. Which reagent selectively oxidizes a primary alcohol to an aldehyde without further oxidation to carboxylic acid?

- (A) PCC in CH_2Cl_2
- (B) $K_2Cr_2O_7$ in H_2SO_4
- (C) $KMnO_4$ in alkaline medium
- (D) CrO_3 in acetone

Q3. Which reagent is used for mild nitration of phenol to give ortho and para nitrophenol?

- (A) Dilute HNO_3
- (B) Conc. HNO_3 + conc. H_2SO_4
- (C) Conc. HNO_3 alone
- (D) $NaNO_3 + H_2SO_4$

Q4. Which alcohol gives immediate turbidity with Lucas reagent at room temperature?

- (A) 2-Methylpropan-2-ol
- (B) Propan-1-ol
- (C) Butan-1-ol
- (D) 2-Methylpropan-1-ol

Q5. Which of the following alcohols reacts most rapidly with Lucas reagent at room temperature?

- (A) Propan-1-ol
- (B) Propan-2-ol
- (C) 2-Methylpropan-2-ol
- (D) 2-Methylpropan-1-ol

Q6. Ethene treated with cold conc. H_2SO_4 followed by hydrolysis gives which alcohol?

- (A) Methanol
- (B) Ethanol
- (C) Propan-1-ol
- (D) Propan-2-ol

Q7. Which reagent brings about cleavage of ethers under heating?

- (A) Hot concentrated HI
- (B) Dilute HCl
- (C) Aqueous NaOH
- (D) Cold water

Q8. Which method prepares phenol from chlorobenzene at high temperature and pressure?

- (A) Dow's process
- (B) Kolbe's reaction
- (C) Reimer-Tiemann reaction
- (D) Friedel-Crafts reaction

Q9. Which alcohol is used as an antiseptic due to its protein-denaturing action?

- (A) Ethanol
- (B) Methanol
- (C) Glycerol
- (D) Propane-1,2,3-triol

Q10. Which method is commonly used for preparation of symmetrical ethers from primary alcohols?

- (A) Acid-catalysed dehydration of alcohols
- (B) Wurtz reaction
- (C) Kolbe electrolysis
- (D) Reimer-Tiemann reaction

Q11. Which intermolecular force is primarily responsible for the unusually high boiling points of alcohols compared to alkanes of similar molecular mass?

- (A) Hydrogen bonding
- (B) Dipole-dipole interaction
- (C) London dispersion forces
- (D) Ionic interactions

Q12. What is the IUPAC name of $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$?

- (A) Propan-1-ol
- (B) Propan-2-ol
- (C) Propan-3-ol
- (D) 1-methylethanol

Q13. Which intermolecular interaction is responsible for the higher boiling point of phenol compared to benzene?

- (A) Hydrogen bonding
- (B) London dispersion forces
- (C) Ionic interactions
- (D) Coordinate bonding

Q14. Which intermolecular force is dominant between ether molecules?

- (A) Dipole-dipole interaction
- (B) Intermolecular hydrogen bonding
- (C) Ionic bonding
- (D) Metallic bonding

Q15. $(\text{CH}_3)_3\text{COH}$ is classified as a tertiary alcohol because

- (A) It has three OH groups
- (B) The carbon bearing -OH has one alkyl group
- (C) The carbon bearing -OH has three alkyl groups
- (D) It is attached to a benzene ring

Q16. Which of the following is correctly classified as a polyhydric alcohol?

- (A) $\text{CH}_3\text{CH}_2\text{OH}$
- (B) $\text{CH}_2\text{OHCHOHCH}_2\text{OH}$
- (C) $\text{C}_6\text{H}_5\text{OH}$
- (D) CH_3OCH_3

Q17. The functional group present in ethers is best represented as

- (A) R-OH
- (B) R-O-R'
- (C) R-COOH
- (D) R-CHO

Q18. Which of the following is a secondary alcohol?

- (A) $\text{CH}_3\text{CH}(\text{OH})\text{CH}_3$
- (B) $\text{CH}_3\text{CH}_2\text{OH}$
- (C) $(\text{CH}_3)_3\text{COH}$
- (D) $\text{C}_6\text{H}_5\text{CH}_2\text{OH}$

Q19. The common name of CH_3OCH_3 is dimethyl ether. Its IUPAC name is

- (A) Methoxy methane
- (B) Dimethyl oxide
- (C) Methoxymethane
- (D) Ethoxy methane

Q20. $C_6H_5CH_2OH$ is classified as an aromatic alcohol, NOT a phenol, because

- (A) It dissolves in water
- (B) Its -OH is on a sp^3 carbon
- (C) It is a primary alcohol
- (D) Its -OH is not directly bonded to the aromatic ring

Q21. Which of the following correctly explains why alcohols are classified as primary, secondary, or tertiary?

- (A) Based on the number of -OH groups present
- (B) Based on the number of alkyl groups on the carbon bearing -OH
- (C) Based on the total number of carbon atoms
- (D) Based on the position of -OH from the end of the chain

Q22. Which of the following is correctly classified as an allylic alcohol?

- (A) $C_6H_5CH_2OH$
- (B) CH_3CH_2OH
- (C) $CH_2=CHCH_2OH$
- (D) $(CH_3)_3COH$

Q23. The IUPAC name of the cyclic alcohol with -OH on a 5-membered ring is

- (A) Cyclopentanol
- (B) Cyclopentanone
- (C) 1-cyclopentanol
- (D) Pentanol

Q24. In IUPAC nomenclature of ethers, the alkoxy group is named by

- (A) Replacing -ane with -oxy in the parent chain
- (B) Adding -ether suffix to both alkyl groups
- (C) Naming the larger group as substituent
- (D) Replacing -yl with -oxy in the smaller alkyl group name

Answer key

1-A	2-A	3-A	4-A	5-C	6-B	7-A	8-A
9-A	10-A	11-A	12-A	13-A	14-A	15-C	16-B
17-B	18-A	19-C	20-D	21-B	22-C	23-A	24-D

Answers with explanations

Q1 — Answer: (A) Phenol is reduced to benzene

Zinc dust removes the oxygen from phenol and converts it into benzene. This is a reductive deoxygenation. Benzoic acid requires oxidation. Salicylic acid requires Kolbe-Schmitt conditions. Anisole requires methylation of phenoxide.

Q2 — Answer: (A) PCC in CH_2Cl_2

PCC (pyridinium chlorochromate) is a mild oxidant that stops oxidation at the aldehyde stage. $KMnO_4$ and $K_2Cr_2O_7$ are strong oxidants that push primary alcohols all the way to carboxylic acids. CrO_3 in acetone (Jones reagent) also over-oxidizes.

Q3 — Answer: (A) Dilute HNO_3

Dilute HNO_3 is sufficient for mononitration of phenol because the -OH group strongly activates the ring toward EAS, giving a mixture of o- and p-nitrophenol. Conc. HNO_3 + conc. H_2SO_4 drives trinitration to picric acid. No Lewis acid catalyst is needed unlike benzene nitration.

Q4 — Answer: (A) 2-Methylpropan-2-ol

Lucas reagent (conc. HCl + ZnCl₂) converts alcohols to alkyl chlorides via a carbocation. Tertiary carbocations form most readily, so tertiary alcohols give immediate turbidity. 2-Methylpropan-2-ol is the only tertiary alcohol among the options. Primary alcohols such as propan-1-ol, butan-1-ol and 2-methylpropan-1-ol do not react appreciably at room temperature.

Q5 — Answer: (C) 2-Methylpropan-2-ol

Lucas reagent acts via S_N1. Tertiary carbocations are most stable, so tertiary alcohols react instantly. 2-Methylpropan-2-ol is the only tertiary alcohol listed. Propan-2-ol (secondary) reacts in about 5 minutes; propan-1-ol and 2-methylpropan-1-ol (both primary) do not react at room temperature.

Q6 — Answer: (B) Ethanol

Ethene forms ethyl hydrogen sulfate intermediate; hydrolysis gives ethanol (2C). No carbon is added or lost in this reaction — methanol (1C) and propanols (3C) are impossible products.

Q7 — Answer: (A) Hot concentrated HI

Ethers are cleaved by hot concentrated HI because I⁻ is a strong nucleophile that attacks the protonated ether. Dilute HCl and NaOH lack the nucleophilic strength and energy to break the C-O bond. HI is the standard reagent used for ether cleavage in NCERT.

Q8 — Answer: (A) Dow's process

In Dow's process, chlorobenzene reacts with aqueous NaOH at 300°C and 300 atm forming sodium phenoxide; acidification gives phenol. Kolbe's and Reimer-Tiemann reactions are used on phenol itself, not for its preparation.

Q9 — Answer: (A) Ethanol

Ethanol (70% v/v) is used as an antiseptic because it denatures microbial proteins effectively at this concentration. Methanol is toxic and never used medicinally. Glycerol is used as a humectant and emollient, not an antiseptic.

Q10 — Answer: (A) Acid-catalysed dehydration of alcohols

Primary alcohols heated with conc. H₂SO₄ at 413 K undergo intermolecular dehydration to give symmetrical ethers. Wurtz, Kolbe, and Reimer-Tiemann reactions are unrelated to ether preparation.

Q11 — Answer: (A) Hydrogen bonding

The O-H group in alcohols enables strong intermolecular hydrogen bonding (O-H...O), which requires significantly more energy to break than van der Waals forces in alkanes. Dipole-dipole alone cannot account for the large BP difference observed.

Q12 — Answer: (A) Propan-1-ol

The longest chain has 3 carbons; -OH on C1 gives propan-1-ol. Propan-2-ol is wrong because -OH is not on C2 here. Numbering must give -OH the lowest locant.

Q13 — Answer: (A) Hydrogen bonding

Phenol's -OH group enables intermolecular O-H...O hydrogen bonding, which requires much more energy to overcome than the London forces in benzene. Both molecules are aromatic, so this difference is directly attributable to H-bonding alone.

Q14 — Answer: (A) Dipole-dipole interaction

Ethers have a polar C-O-C bond creating a net dipole, so dipole-dipole interactions dominate between ether molecules. Unlike alcohols, ethers have no O-H bond and therefore cannot form intermolecular hydrogen bonds with each other.

Q15 — Answer: (C) The carbon bearing -OH has three alkyl groups

Tertiary alcohol: the carbon bearing -OH is bonded to three other carbon atoms. The common trap is confusing "tertiary" with number of -OH groups rather than substitution at the carbon.

Q16 — Answer: (B) CH₂OHCHOHCH₂OH

Glycerol (propane-1,2,3-triol) has three -OH groups, making it a trihydric (polyhydric) alcohol. Ethanol is monohydric; phenol is not an alcohol; CH₃OCH₃ is an ether.

Q17 — Answer: (B) R-O-R'

Ethers contain an oxygen atom bonded to two alkyl or aryl groups (R-O-R'). R-OH is alcohol; R-COOH is carboxylic acid; R-CHO is aldehyde.

Q18 — Answer: (A) CH₃CH(OH)CH₃

In propan-2-ol, the carbon bearing -OH is bonded to two other carbons, making it secondary. Ethanol is primary; (CH₃)₃COH is tertiary; benzyl alcohol is primary (the -OH carbon has only one carbon substituent).

Q19 — Answer: (C) Methoxymethane

In IUPAC nomenclature, the smaller alkyl group becomes the alkoxy prefix; the larger is the parent chain. Both groups are methyl, so the name is methoxymethane (written as one word). "Methoxy methane" as two words is incorrect format.

Q20 — Answer: (D) Its -OH is not directly bonded to the aromatic ring

Phenols have -OH directly on the aromatic ring carbon (sp²). In benzyl alcohol, -OH is on the CH₂ group (sp³ carbon) in the side chain. Options B and C are true but do not define why it is not a phenol — option D is the defining structural criterion.

Q21 — Answer: (B) Based on the number of alkyl groups on the carbon bearing -OH

Classification depends on the degree of substitution at the carbon bearing the -OH group — 1°(one alkyl group), 2°(two), 3°(three). Option D is the common trap: locant position determines nomenclature, not classification.

Q22 — Answer: (C) CH₂=CHCH₂OH

An allylic alcohol has the -OH group on a carbon adjacent to a C=C double bond. CH₂=CHCH₂OH fits this; benzyl alcohol is benzylic (adjacent to ring); the others have no adjacent double bond.

Q23 — Answer: (A) Cyclopentanol

Cyclic alcohols are named by adding -ol suffix to the cycloalkane name; the -OH carbon is C1 by default, so no locant is needed. Cyclopentanone is a ketone; pentanol is an open-chain alcohol.

Q24 — Answer: (D) Replacing -yl with -oxy in the smaller alkyl group name

The smaller alkyl group is converted to an alkoxy group by replacing -yl with -oxy (methyl→methoxy, ethyl→ethoxy). The larger group becomes the parent chain. Option A describes parent chain naming, not the substituent.

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