Solution

CET25C7 ALCOHOLS PHENOLS AND ETHERS

Class 12 - Chemistry

1.

(c) 2 - Ethoxy - 1, 1 - dimethylcyclohexane

Explanation: Lowest set of locants: The lowest set of locants is defined as the set that, when compared term by term with other locant sets, each cited in order of increasing value, has the lowest term at the first point of difference.

With regard to numbering of locants, simple prefixes (simple substituent groups consisting of just one part that describes an atom, or group of atoms as a unit, for example methyl and ethoxy) are considered together with equal seniority:

Therefore, the given compound is named as 2-ethoxy-1,1-dimethylcyclohexane rather than 1-ethoxy-2,2-dimethylcyclohexane since the locant set ‘1, 1, 2’ is lower than ‘1, 2, 2’.

2. **(a)** B, C

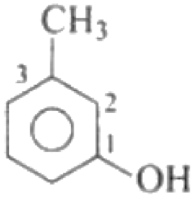
Explanation: Compound (A) i.e., phenol and compound (D) i.e. a derivative of phenol cannot be considered as aromatic alcohol. As phenol is also known as, carbolic acid cannot be considered as aromatic alcohol.

Benzyl alcohol and substituted benzyl alcohol are aromatic alcohol.

3.

(d) 3-methylphenol

Explanation:



-OH is a functional group and -CH_3 is the substituent.

We start numbering from the side of the main functional group -OH.

IUPAC name: 3-methyl phenol

4.

(d) All of these

Explanation:

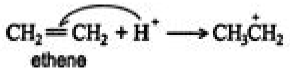
The addition of water to an alkene in the presence of a catalytic amount of strong acid leads to the formation of alcohols (hydroxy-alkanes).

$CH_2 = CH_2 + H_2O \xrightarrow{H^+} CH_3CH_2OH$

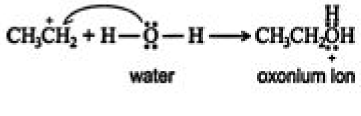
This reaction proceeds via a standard carbocation mechanism and follows the Markovnikov rule.

The mechanism for the addition of water to ethene follows.

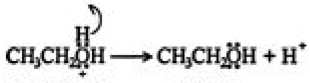
1. The hydrogen ion is attracted to the π bond, which breaks to form a σ bond with one of the double-bonded carbons. The second carbon of the original double-bonded carbons becomes a carbocation.



2. An acid-base reaction occurs between the water molecule and the carbocation, forming an oxonium ion.



3. The oxonium ion stabilizes by losing a hydrogen ion, with the resulting formation of an alcohol.



5. **(a)** Williamson's synthesis

Explanation: Williamson’s synthesis: When an alkyl halide reacts with sodium alkoxide, ether is formed. This reaction is known as Williamson’s synthesis. The reaction generally follows the S_N2 mechanism for primary alcohols.

$$R - X + R' - \underset{..}{\ddot{O}}\overset{+}{Na} \rightarrow R - \underset{..}{\ddot{O}} - R' + Na\ X$$

$$Williamson's\ synthesis$$

6.

(d) Elimination competes over substitution and alkenes are easily formed.

Explanation: The formation of ethers by dehydration of the alcohol is a bimolecular reaction (S_N^2) involving the attack of an alcohol molecule on a protonated alcohol molecule. In the method, the alkyl group should be unhindered. In the case of secondary or tertiary alcohols, the alkyl group is hindered. As a result, elimination dominates substitution as 3° carbocation is more stable.

Hence, in place of ethers, alkenes are formed.

7.

(c) i, ii, iii

Explanation:

- **Preparation of phenols from haloarenes**: Chlorobenzene is an example of haloarenes which is formed by monosubstitution of the benzene ring. When chlorobenzene is fused with sodium hydroxide at 623K and 320 atm sodium phenoxide is produced. Finally, sodium phenoxide on acidification gives phenols.
- **Preparation of phenols from diazonium salts:** When an aromatic primary amine is treated with nitrous ($NaNO_2$ + HCl) acid at 273 - 278 K, diazonium salts are obtained. These diazonium salts are highly reactive in nature. Upon warming with water, these diazonium salts finally hydrolyse to phenols. Phenols can also be obtained from diazonium salts by treating it with dilute acids.
- **Preparation of phenols from benzene sulphonic acid**: Benzenesulphonic acid can be obtained from benzene by reacting it with oleum. Benzenesulphonic acid thus formed is treated with molten sodium hydroxide at high temperature which leads to the formation of sodium phenoxide. Finally, sodium phenoxide on acidification gives phenols.

8.

(b) a substitution reaction

Explanation: Alkyl halides on alkaline hydrolysis (aqueous NaOH) get converted into alcohol. This takes place by a nucleophilic substitution reaction where the −X atom is substituted by a nucleophile i.e −OH group. The primary alkyl halides undergo nucleophilic substitution reaction by S_N2 substitution mechanism, while tertiary alkyl halides follow S_N1 substitution mechanism.

9. **(a)** CH_3NH_2

Explanation: Product formed is CH_3NH_2

10. **(a)** Propan-1-ol, butan-2-ol, butan-1-ol, pentan-1-ol

Explanation: The boiling point increases with an increase in the molecular mass of the alcohol. Thus, the correct order is Propan-1-ol < butan-2-ol < butan-1-ol < pentan-1-ol.

11.

(c) ethyl iodide

Explanation: ethyl iodide

12.

(d) Methane

Explanation: CH_3MgBr reacts with CH_3OH and form CH_4.

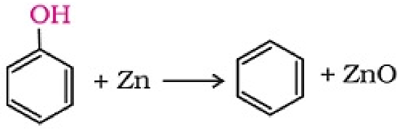
Grignard Reagent act as both base as well as a nucleophile. In the presence of alcohol, H_2O or other groups having acidic hydrogen Grignard reagent act as base and abstract acidic H.

13.

(c) benzene

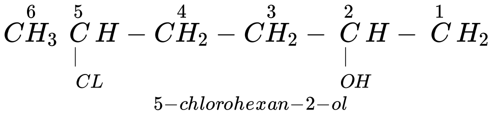
Explanation: Phenol is reduced to benzene when it is distilled with zinc dust or its vapour is passed over granules of zinc at

400^oC.



14.

(b) 5 – Chlorohexan – 2 – ol

Explanation: 
$\underset{5-chlorohexan-2-ol}{\overset{6}{CH_3}\ \underset{\overset{|}{CL}}{\overset{5}{C}}H - \overset{4}{CH_2} - \overset{3}{CH_2} - \underset{\overset{|}{OH}}{\overset{2}{C}}H - \overset{1}{C}H_2}$

-OH is given preference over -Cl so numbering is done so that –OH gets the lowest number.

15.

(b) $^{\ominus}OR$

Explanation: Hydroxy group is more electron donating group than alkoxy because alkoxy have greater number of atoms than that hydroxyl group there electronic density of oxygen of alkoxy group spreads over the whole group and greater the number of atom less will be the electron donating ability.

16.

(b) Tertiary alcohol

Explanation: The outcome of oxidation reactions of alcohol depends on the substituents on the carbinol carbon. In order for each oxidation step to occur, there must be H on the carbinol carbon.

- Primary alcohols can be oxidized to aldehydes or further to carboxylic acids. In aqueous media, the carboxylic acid is usually the major product. PCC or PDC, which are used in dichloromethane, allow the oxidation to be stopped at the intermediate aldehyde.
- Secondary alcohols can be oxidized to ketones but no further:
- Tertiary alcohols cannot be oxidized (no carbinol C-H).

17.

(c) $1^o < 2^o < 3^o$

Explanation: Correct order of reactivity of alcohol is $1^o < 2^o < 3^o$

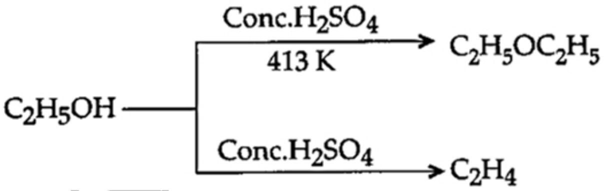
18.

(b) 2-Methylpropene

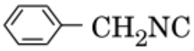
Explanation: 2-Methylpropene

19. **(a)** Ethoxyethane

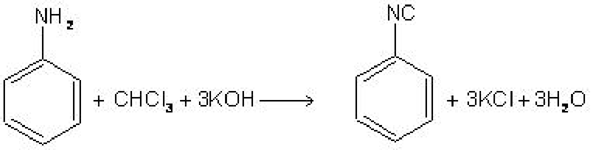
Explanation:

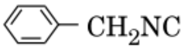


20. **(a)**



Explanation:



 gives foul smell.

21.

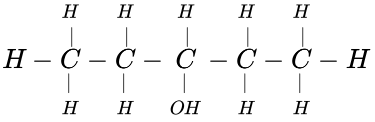
(d) All of these

Explanation: Phenol reacts with sodium hydroxide solution to give a colourless solution containing sodium phenoxide. In this reaction, the hydrogen ion has been removed by the strongly basic hydroxide ion in the sodium hydroxide solution.

22.

(b) Secondary alcohol

Explanation: Secondary alcohol is a compound in which a hydroxy group, –OH, is attached to a saturated carbon atom which has two other carbon atoms attached to it.



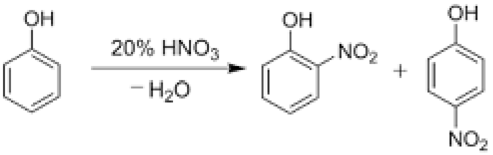
$$H - \underset{H}{\overset{H}{C}} - \underset{H}{\overset{H}{C}} - \underset{OH}{\overset{H}{C}} - \underset{H}{\overset{H}{C}} - \underset{H}{\overset{H}{C}} - H$$

23. **(a)** $(CH_3)_2CHOH$

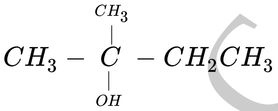
Explanation: Secondary alcohol on oxidation forms ketone which reacts with hydrazine bus doesn't gives a silver mirror test.

24. **(a)** a mixture of ortho and para nitro phenols

Explanation: Nitration of phenols: Phenols upon treatment with dilute nitric acid undergoes nitration at low temperature (298 K) to give a mixture of ortho and para nitrophenols. The mixture formed is further separated into ortho and para nitrophenols by steam distillation on the basis of their volatility. Due to intramolecular and intermolecular hydrogen bonding, ortho nitrophenols are lesser volatile in comparison to para nitrophenols which involves only intermolecular hydrogen bonding.



25. **(a)** 2-Methylbutan-2-ol



Explanation: The correct IUPAC name of $CH_3 - \underset{OH}{\overset{CH_3}{C}} - CH_2CH_3$ is 2-Methylbutan-2-ol

26. **(a)** All of these

Explanation: Oxidation of alcohols to aldehydes is partial oxidation; aldehydes are further oxidized to carboxylic acids. Conditions required for making aldehydes are heat and distillation.
In aldehyde formation, the temperature of the reaction should be kept above the boiling point of the aldehyde and below the boiling point of the alcohol.
These include:

- Chromium-based reagents, such as Collins reagent ($CrO_3 \cdot Py_2$)
- PDC or PCC.
- Heat in the presence of Cu at 573K.

27. **(a)** o-nitrophenol

Explanation: o-nitrophenol

28.

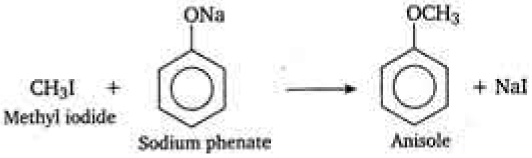
(b) 2-Methylbutan-2-ol

Explanation: 2-Methylbutan-2-ol will not undergo oxidation.

29.

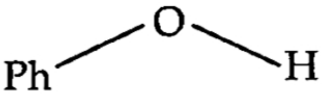
(c) Williamsons reaction

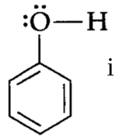
Explanation: The reaction of an alkyl halide with sodium alkoxide to give ether (alkoxy alkane), is known as Williamson's synthesis. In this reaction, an ether (anisole) is prepared by the action of alkyl halide (methyl iodide) on sodium alkoxide (sodium phenate), so it is an example of Williamson's synthesis.



30.

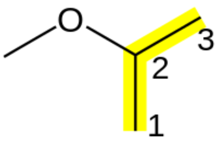
(b)



Explanation: In  ion pair of e^-s present on oxygen atom is involved in delocalization. Therefore, it is most difficult to protonate the phenol amongst the given compounds, due to less availability of e^-s.

31.

(b) 2 – methoxypropane

Explanation: 

2-methoxypropane
(isopropyl methyl ether)

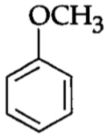
If the oxygen is not attached to the end of the main alkane chain, then the whole shorter alkyl-plus-ether group is treated as a side-chain and prefixed with its bonding position on the main chain. Thus $CH_3OCH(CH_3)_2$ is 2-methoxypropane.

32.

(b) Methoxybenzene

Explanation: $C_6H_5OCH_3$

IUPAC name: Methoxybenzene



33. **(a)** benzyl alcohol

Explanation: Monochlorination of toluene gives benzylchloride.

$C_6H_5CH_3 + Cl_2 + hv \rightarrow C_6H_5CH_2Cl$

benzyl chloride on reaction with aq. NaOH will give benzyl alcohol by substitution reaction.

$C_6H_5CH_2Cl + NaOH(aq) \rightarrow C_6H_5CH_2OH$

34. **(a)** ethyl iodide

Explanation: ethyl iodide

35. **(a)** 1

Explanation: A chiral molecule is one that is not superimposable on its mirror image.

2-Butanol is a small molecule with a chirality center. It is the simplest alcohol containing an asymmetric carbon. For a better illustration, the four different substituents are shown in different colours.

Carbon atom C-2 of 2-butanol carries four different substituents H, CH_3, OH, and CH_2CH_3. Exchange of any two of these substituents would yield the opposite enantiomer. However, such an exchange does not occur spontaneously because it requires a bond breakage. Therefore, enantiomers are different, stable, coexisting compounds.

36.

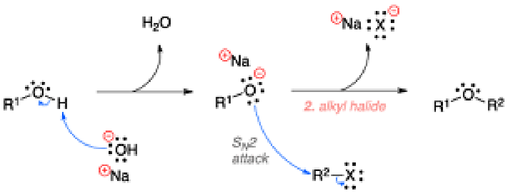
(c) Salicylic acid

Explanation: Salicylic acid

37.

(b) ethers

Explanation: The Williamson ether synthesis is an organic reaction, forming an ether from an organohalide and deprotonated alcohol (alkoxide). This reaction was developed by Alexander Williamson in 1850. Typically it involves the reaction of an alkoxide ion with a primary alkyl halide via an S_N2 reaction.



38.

(b) a primary alcohol

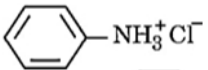
Explanation: When –CH_2OH group is replaced by –COOH group then only molecular weight will increase by 14units.

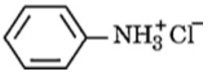
39.

(d) anhydrous $ZnCl_2$ and conc. HCl.

Explanation: "Lucas' reagent" is a solution of anhydrous zinc chloride in concentrated hydrochloric acid.

40.

(c) 

Explanation: 

41. **(a)** methoxyethane

Explanation: Ether reacts with HI to form alcohol and alkyl iodide. Alcohol on oxidation will give the iodoform test.

42.

(d) C_6H_5OH

Explanation: Phenol is more soluble in NaOH than in water is because phenol is slightly more acidic than alcohols. The Ka for phenol in water is 1e-10 which is not very strong. But by mixing with NaOH, it causes the phenol to release the H+ to form sodium phenoxide.

43.

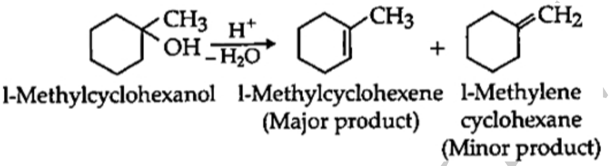
(b) both as nucleophiles and electrophiles.

Explanation: Alcohols as nucleophile: The bond between O−H is broken when alcohol react as nucleophiles.
Alcohols as electrophile : The bond between C−O is broken when alcohol reacts as electrophiles

44.

(b) 1-methylcyclohexene

Explanation: According to Saytzeff rule, i.e., highly substituted alkene is major product. Here dehydration reaction takes place, alkene is formed due to the removal of a water molecule



45. **(a)** Ether

Explanation: Williamson synthesis is used to obtain ether. For example,

$$\underset{\text{Alkyl halide}}{R-X}+\underset{\text{Sodium alkoxide}}{Na-O-R}\longrightarrow R-\underset{\text{Ether}}{O}-R'+NaX$$

46. **(a)** 3-phenylpropene

Explanation: 3-phenylpropene

47.

(c) m – Chlorophenol

Explanation: In cases of halogen derivatives of phenols or aniline or benzoic acid etc, it is very helpful to understand that all halogens, when attached to benzene ring, exerts -I as well as +R effect.
In case of Cl, Br and I, the +R effect has almost no effect on reactivity, acidic character or basic character of the benzene ring. It is due to very less effective overlapping involving 2p of carbon and 3p or 4p or 5p of halogen.
Hence, only -I effect becomes the deciding factor, which is most dominant from ortho-position and least effective from para-position. So m chlorophenol is most acidic.

48. **(a)** B_2H_6 ; H_2O_2/OH^-

Explanation: B_2H_6 ; H_2O_2/OH^-