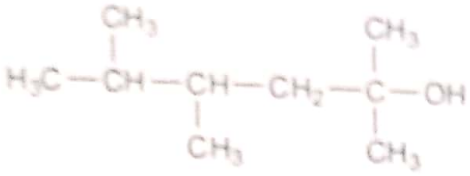
MULTIPLE CHOICE QUESTIONS

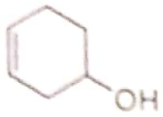
1. Which is the correct IUPAC name for the following compound ?



(*a*) 4-Isopropyl-1,1-dimethyl-1-pentanol
(*b*) 5-Isopropyl-1,1-dimethyl-2-hexanol
(*c*) 1,1,4,5-Tetramethyl-1-hexanol
(*d*) 2,5,6-Trimethyl-2-heptanol

Answer. (*d*)

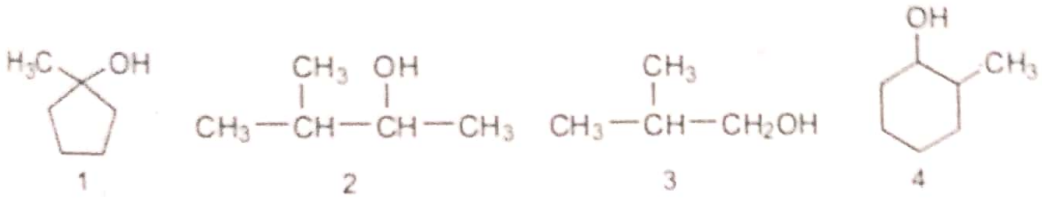
2. What is the IUPAC name for the following structure ?



(*a*) Cyclohexenol
(*b*) 3-Cyclohexen-1-ol
(*c*) 1-Cyclohexen-4-ol
(*d*) 4-Cyclohexenol

Answer. (*b*)

3. Which of the following is/are secondary (2°) alcohols ?



(*a*) only 3
(*b*) 2, 3 and 4
(*c*) only 2 and 4
(*d*) only 1

Answer. (*c*)

4. What is the systematic name of *tert*-butyl alcohol ?

(*a*) 1-Methyl-2-propanol
(*b*) 2-Methyl-3-butanol
(*c*) 2-Methyl-2-butanol
(*d*) 2-Methyl-2-propanol

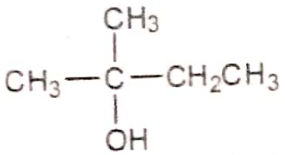
Answer. (*d*)

5. Which of the following is a tertiary alcohol ?

(*a*) 2-Methylcyclohexanol
(*b*) 1-Methylcyclohexanol
(*c*) 3-Methylcyclohexanol
(*d*) 2,2-Dimethylcyclohexanol

Answer. (*b*)

6. What type of alcohol is this ?



(*a*) Primary (1°)
(*b*) Secondary (2°)
(*c*) Tertiary (3°)
(*d*) None of these

Answer. (*c*)

7. What atomic orbitals are used to form the C-O bond in an alcohol ?
   (*a*) an sp^3 orbital of C and a *p* orbital of O
   (*b*) an sp^3 orbital of C and an *sp* orbital of O
   (*c*) an sp^3 orbital of C and an sp^3 orbital of O
   (*d*) an sp^3 orbital of C and an sp^2 orbital of O

Answer. (*c*)

8. What kind of orbital do the nonbonding electrons of the oxygen in an occupy ?
   (*a*) They occupy *sp* orbitals
   (*b*) They occupy *p* orbitals
   (*c*) They occupy sp^2 orbitals
   (*d*) They occupy sp^3 orbitals

Answer. (*d*)

9. How large is the H–O–H bond angle in water ?
   (*a*) larger than the sp^2 angle of 120.0°
   (*b*) larger than the sp^3 angle of 109.5°
   (*c*) smaller than the sp^3 angle of 109.5°
   (*d*) larger than the *sp* angle of 180.0°

Answer. (*c*)

10. Which of the following intermolecular forces are present in alcohols ?
   (*a*) Dipole-dipole forces
   (*b*) Dipole-induced dipole forces
   (*c*) Hydrogen bonding
   (*d*) All of the above

Answer. (*d*)

11. Which of the following compounds can form hydrogen bonds between its mo
   (*a*) $CH_3CH_2OCH_2CH_3$
   (*b*) $CH_3CH_2CH_2Br$
   (*c*) $CH_3CH_2CH_2OH$
   (*d*) $CH_3CH_2N(CH_3)_2$

Answer. (*c*)

12. Alcohols have higher boiling points than alkanes of comparable molecula because of
   (*a*) hydrogen bonding
   (*b*) diaxial interactions
   (*c*) steric strain
   (*d*) hyperconjugation

Answer. (*a*)

13. Which of the following molecules has the highest boiling point ?
   (*a*) Butanol
   (*b*) Dimethylbutylamine
   (*c*) Butane
   (*d*) Methyl ethyl ether

Answer. (*a*)

14. The following compounds have similar molecular weights. Which has the boiling point ?
   (*a*) CH_3CHO
   (*b*) CH_3CH_2OH
   (*c*) CH_3OCH_3
   (*d*) $CH_3CH_2CH_3$

Answer. (*b*)

15. Which of the following has the *highest* boiling point ?
   (*a*) CH_3–O–CH_3
   (*b*) CH_3–CH_2–OH
   (*c*) CH_3–CH_2–CH_3
   (*d*) CH_2=CH–CH_3

Answer. (*b*)

16. Which of the following has the highest boiling point ?
   (*a*) 1-Chlorobutane
   (*b*) Butane
   (*c*) 2-Butene
   (*d*) 1-Butanol

Answer. (*d*)

17. Which of the following has the *highest* boiling point ?
(*a*) $CH_3OCH_2CH_2CH_2OH$ (*b*) $CH_3OCH_2CH_2OCH_3$
(*c*) $HOCH_2CH_2CH_2OH$ (*d*) $CH_3OCH_2CH_2OH$
Answer. (*c*)

18. Which of the following compounds is the *most* soluble in water ?
(*a*) Cyclopentyl alcohol (*b*) Cyclopentane
(*c*) Cyclohexane (*d*) Cyclopentyl methyl ether
Answer. (*a*)

19. Which of the following is the *most* soluble in water ?
(*a*) $CH_3CH_2CH_3$ (*b*) CH_3CH_2OH
(*c*) $CH_3CH_2CH_2OH$ (*d*) CH_3OCH_3
Answer. (*b*)

20. Which of the following compounds would you expect to be most soluble in water ?
(*a*) CH_2Cl_2 (*b*) C_6H_{12} (cyclohexane)
(*c*) CH_3CH_2OH (*d*) $C_2H_5OC_2H_5$
Answer. (*c*)

21. Which reaction cannot be used to prepare an alcohol ?
(*a*) addition of H_3O^+ to an alkene
(*b*) hydroboration of alkenes
(*c*) a Grignard reagent with an aldehyde
(*d*) oxidation of ethers
Answer. (*d*)

22. Hydroboration results in ?
(*a*) An alkyl halide.
(*b*) An alkane.
(*c*) A Markovnikov addition producing an alcohol.
(*d*) An anti-Markovnikov addition producing an alcohol.
Answer. (*d*)

23. Acetone reacts with $NaBH_4$, followed by treatment with dilute acid, to form :
(*a*) an acid (*b*) a ketone (*c*) an alcohol (*d*) hydrogen
Answer. (*c*)

24. Which species is oxidized in the following reaction ?

$$CH_3CHO + LiAlH_4 \rightarrow CH_3CH_2OH$$

(*a*) CH_3CHO (*b*) $LiAlH_4$
(*c*) CH_3CH_2OH (*d*) This is not a *redox* reaction.
Answer. (*b*)

25. Which of the following reactions will form a primary alcohol?
(*a*) an aldehyde + a Grignard reagent
(*b*) a ketone + NH_2NH_2/HO^-/heat
(*c*) an aldehyde + H^+/H_2O
(*d*) an aldehyde + sodium borohydride followed by H^+/H_2O
Answer. (*d*)

26. Which of the following compounds gives a secondary alcohol upon reaction with ethylmagnesium bromide ? Assume the usual acid workup.
(*a*) Butyl formate (*b*) 3-Pentanone
(*c*) Pentanal (*d*) Methyl butanoate
Answer. (*c*)

27. Which of the following compounds *does not* give a tertiary alcohol upon reaction with methylmagnesium bromide ?
(*a*) 3-Methylpentanal (*b*) Ethyl benzoate
(*c*) 4,4-Dimethylcyclohexanone (*d*) 4-Heptanone

Answer. (*a*)

28. Which of the following does *not* give a 1° alcohol as the major organic product upon treatment with $LiAlH_4$ followed by H_3O^+ ?
(*a*) $CH_3CH_2CH_2CHO$ (*b*) $CH_3CH_2CH_2CO_2H$
(*c*) $CH_3CH_2CH_2CO_2CH_3$ (*d*) $CH_3CH_2COCH_3$

Answer. (*d*)

29. Alcohols react with active metals (Na, K, etc.) to produce _____ gas
(*a*) oxygen (*b*) hydrogen (*c*) nitrogen (*d*) helium

Answer. (*b*)

30. Primary alkyl alcohols react with thionyl chloride ($SOCl_2$) to give
(*a*) primary alkyl halides (*b*) secondary alkyl halides
(*c*) acid halides (*d*) no reaction

Answer. (*a*)

31. Thionyl chloride, $SOCl_2$, reacts with isopropyl alcohol, $(CH_3)_2CHOH$, to give
(*a*) 2-Chloropropane (*b*) 1-Chloropropane
(*c*) 2-Propanol (*d*) Acetone

Answer. (*a*)

32. PBr_3 reacts with ethanol to give
(*a*) Tribromoethane (*b*) Nromoethanol
(*c*) Bromoethane (*d*) No reaction

Answer. (*c*)

33. The reaction of HBr with *t*-butyl alcohol gives
(*a*) an alkane (*b*) an acid
(*c*) an alkyl bromide (*d*) a dibromide

Answer. (*c*)

34. The reaction of *t*-butyl alcohol with HCl at room temperature gives
(*a*) *t*-butyl chloride (*b*) *t*-butyl bromide
(*c*) isobutyl chloride (*d*) an alkene

Answer. (*a*)

35. Which reagent would be best for the conversion of *tert*-butanol into *tert*-butyl bromide ?
(*a*) PBr_3 (*b*) HBr (*c*) NaBr (*d*) Br_2, NaOH

Answer. (*b*)

36. Which of the following will *not* convert 1-butanol into 1-chlorobutane in one step ?
(*a*) $SOCl_2$ (*b*) PCl_3 (*c*) HCl (*d*) CCl_4

Answer. (*d*)

37. What molecule is lost in a dehydration reaction ?
(*a*) Ether (*b*) Alcohol (*c*) Water (*d*) Hydrogen

Answer. (*c*)

38. Isopropyl alcohol, $(CH_3)_2CHOH$, reacts with hot concentrated H_2SO_4 to give
(*a*) Propane (*b*) 2-Propanol (*c*) Propene (*d*) Propyne

Answer. (*c*)

39. What is the major product obtained from the acid-catalyzed dehydration of 1-methylcyclohexanol ?
(*a*) methylcyclohexane (*b*) 1-methylcyclohexene
(*c*) 3-methylcyclohexene (*d*) 2-methylcyclohexene

Answer. (*b*)

40. What product is formed when 1,2-dimethylcyclohexanol undergoes acid-catalyzed dehydration ?

(a) 1,2-Dimethylcyclohexene
(b) 2,3-Dimethylcyclohexene
(c) 2,2-Dimethylcyclohexene
(d) 1,3-Dimethylcyclohexene

Answer. (a)

41. The oxidation of CH_3CH_2OH with acidic sodium dichromate gives
(a) a ketone
(b) ethyl alcohol
(c) an aldehyde
(d) an acid

Answer. (d)

42. The oxidation of 1-propanol with PCC gives
(a) an alcohol
(b) an aldehyde
(c) a ketone
(d) an acid

Answer. (b)

43. The oxidation of 1-propanol with chromic acid yields
(a) an alcohol
(b) an aldehyde
(c) a ketone
(d) an acid

Answer. (d)

44. The oxidation of 2-propanol with chromic acid yields
(a) an alcohol
(b) an aldehyde
(c) a ketone
(d) an acid

Answer. (c)

45. What compound is formed when ethanol is treated with PCC in dry methylene chloride ?
(a) Acetone
(b) Acetaldehyde
(c) Acetic acid
(d) Ethyl chloride

Answer. (b)

46. What compound is formed when propanol is treated with PCC in dry methylene chloride ?
(a) Propanoic acid
(b) Propane
(c) Propanal
(d) Propanone

Answer. (c)

47. Which of the following compounds is *not* oxidized by pyridinium chlorochromate (PCC) ?
(a) 2-Methyl-2-butanol
(b) 1-Pentanol
(c) 2-Pentanol
(d) 1,3-Propanediol

Answer. (a)

48. To distinguish among primary, secondary, and tertiary alcohols, one would use the following experimental method.
(a) Sandmeyer reaction
(b) Ninhydrin test
(c) Lucas test
(d) Tollens' reagent

Answer. (c)

49. The Lucas test is used to distinguish small (7 or fewer carbons) 1°, 2° and 3° alcohols. The alcohol to be tested is added to a solution of anhydrous $ZnCl_2$ in conc. HCl at room temperature. Which of the following statements is not correct ?
(a) 1°-alcohols dissolve, but do not react.
(b) 3°-alcohols react quickly to give an insoluble alkyl chloride.
(c) 3°-alcohols rapidly dehydrate, and the gaseous alkene bubbles out of the test solution.
(d) 2°-alcohols dissolve and react slowly to give an insoluble alkyl chloride.

Answer. (c)

MULTIPLE CHOICE QUESTIONS

1. How many stereoisomers are possible for 2,3-butanediol ?
   (*a*) 1 (*b*) 2 (*c*) 3 (*d*) 4

Answer. (*c*)

2. How many stereoisomers of 2,3-butanediol, $CH_3CH(OH)CH(OH)CH_3$, exist ?
   (*a*) 4 (*b*) 3 (*c*) 1 (*d*) 2

Answer. (*b*)

3. Arrange the compounds in the order of increasing solubility in water (*lowest first*)
   I. CH_3OH II. $CH_3CH_2CH_2CH_2CH_2OH$
   III. $CH_3CH_2CH_2OH$ IV. $HOCH_2CH_2CH_2CH_2CH_2OH$
   (*a*) IV, III, II, I (*b*) II, III, IV, I
   (*c*) III, IV, II, I (*d*) II, IV, III, I

Answer. (*b*)

4. Which of the following has the *highest* boiling point ?
   (*a*) $CH_3OCH_2CH_2CH_2OH$ (*b*) $CH_3OCH_2CH_2OCH_3$
   (*c*) $HOCH_2CH_2CH_2OH$ (*d*) $CH_3OCH_2CH_2OH$

Answer. (*c*)

5. The formation of ethylene glycol ($HOCH_2CH_2OH$) from ethylene ($H_2C{=}CH_2$) is example of
   (*a*) oxidation (*b*) reduction
   (*c*) dehydration (*d*) hydrogenation

Answer. (*a*)

6. Lithium aluminium hydride ($LiAlH_4$) reacts with glyoxal, $H-\overset{O}{\overset{\|}{C}}-\overset{O}{\overset{\|}{C}}-H$, to give
   (*a*) CH_3CO_2H (*b*) $HOCH_2CH_2OH$
   (*c*) $H_2C{=}CH_2$ (*d*) $HOCH_2CO_2H$

Answer. (*b*)

7. Vicinal diols can be prepared by ?
   (*a*) oxidizing alkanes with OsO_4 (*b*) oxidizing alkenes with OsO_4
   (*c*) reducing alkanes with OsO_4 (*d*) reducing alkenes with OsO_4

Answer. (*b*)

8. Diols are synthesized by reacting an alkene with
   (*a*) water (*b*) borane (*c*) ozone (*d*) osmium tetroxide

Answer. (*d*)

9. OsO_4 is often used to form diols from alkenes instead of $KMnO_4$ for what reason ?
   (*a*) It is less toxic. (*b*) It gives higher yields.
   (*c*) It costs less. (*d*) It is a colorless liquid.

Answer. (*b*)

10. Which is the major product from the reaction of propene with OsO_4/ROOH ?
   (*a*) 1-Propanol (*b*) 2-Propanol
   (*c*) 1,2-Propanediol (*d*) 1,3-Propandiol

Answer. (*c*)

11. Periodic acid (HIO_4) is used to ?
   (*a*) oxidize aldehydes (*b*) oxidize geminal diols
   (*c*) oxidize vicinal diols (*d*) oxidize ketones

Answer. (*c*)

12. Treatment of a 1,2 diol (vicinal diol) with periodic acid results in
   (*a*) cleavage to alkenes and alkanes.
   (*b*) cleavage to carbon dioxide and water.
   (*c*) cleavage to carboxylic acids and alcohols
   (*d*) None of the above

Answer. (*d*). Periodic acid cleavage of vicinal diols gives aldehydes and ketones.