ALCOHOLS, PHENOLS AND ETHERS

NOMENCLATURE

Nomenclature

No.	Structure	C
1.	$H_3C - OH$	Methyl alcohol

Common name:- common name of alkyl group(Methyl)+alcohol =Methyl alcohol

I.U.P.A.C. Name
Methanol

Root word +an + ol=
Meth+an+ol=Methanol

Nomenclature

No.	Structure	Common Name
2.	$H_3C - CH_2 - OH$	Ethyl alcohol

I.U.P.A.C. Name
Ethanol

Nomenclature

No.	Structure	Common Name
3.	$\overset{3}{H_3C} - \overset{2}{CH_2} - \overset{1}{CH_2} - OH$	n – propyl alcohol

I.U.P.A.C. Name
Propan – 1 – ol

Nomenclature

No.	Structure	Common Name
4.	$\overset{3}{H_3C} - \overset{2}{\underset{\substack{\vert \\ OH}}{CH}} - \overset{1}{CH_3}$	Iso / sec – propyl alcohol

I.U.P.A.C. Name
Propan – 2 – ol

Nomenclature

No.	Structure	Common Name
5.	4 3 2 $H_3C - CH_2 - CH_2$ $\vert$ 1 $CH_2 - OH$	n – butyl alcohol

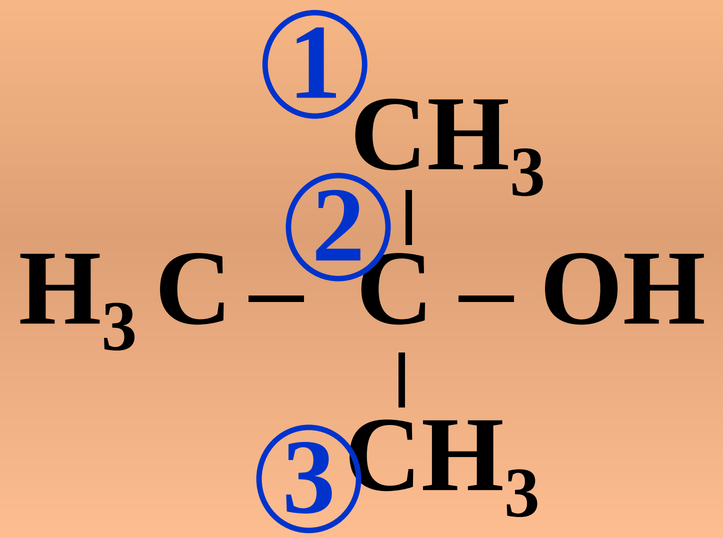
I.U.P.A.C. Name
Butan – 1 – ol

Nomenclature

No.	Structure	Common Name
6.	$\overset{1}{H_3C} - \underset{\underset{OH}{\vert}}{\overset{2}{CH}} - \overset{3}{CH_2} - \overset{4}{CH_3}$	sec – butyl alcohol

I.U.P.A.C. Name
Butan – 2 – ol

Nomenclature

No.	Structure	Common Name
7.		tert – butyl alcohol

I.U.P.A.C. Name
2 – Methyl propan – 2 – ol

Nomenclature

No.	Structure	Common Name
8.	$\overset{3}{H_3C} - \underset{\underset{CH_3}{\vert}}{\overset{2}{CH}} - \overset{1}{CH_2} - OH$	Isobutyl alcohol

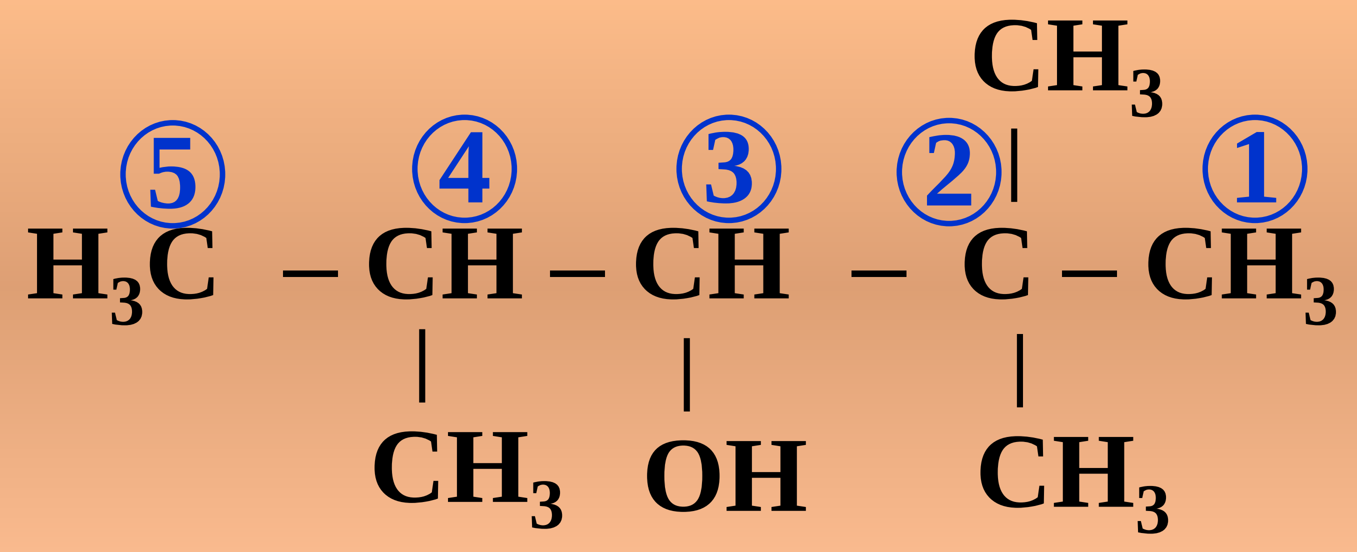
I.U.P.A.C. Name
2 – Methyl propan – 1 – ol

Nomenclature

No.	Structure	Common Name
9.	$H_3\overset{3}{C} - \overset{2}{C}(CH_3)_2 - \overset{1}{C}H_2 - OH$	neo – pentyl alcohol

I.U.P.A.C. Name
2,2–Dimethyl propan – 1 – ol

Nomenclature

No.	Structure
10.	

For complicated structure instead of common name IUPAC name is more preferred for example

I.U.P.A.C. Name
2,2,4 – Trimethyl pentan – 3 – ol

Nomenclature

No.	Structure
11.	$\begin{array}{ccccccc} 4 & & 3 & & 2 & & 1 \\ H_3C & - & CH & - & CH & - & CH_3 \\ & & \vert & & \vert & & \\ & & OH & & OH & & \end{array}$

I.U.P.A.C. Name
Butane–2,3–diol

Nomenclature

No.	Structure
12.	$\overset{1}{H_3C} - \underset{\underset{OH}{\vert}}{\overset{2}{CH}} - \underset{\underset{OH}{\vert}}{\overset{3}{CH_2}} - \underset{\underset{C_2H_5}{\vert}}{\overset{4}{CH}} - \overset{5}{CH} - \overset{6}{CH_2} - \overset{7}{CH_3}$

I.U.P.A.C. Name
4–Ethylheptane–2,3–diol

Nomenclature

No.	Structure
13.	$\overset{1}{C}H_2$, $\overset{2}{C}H$, $\overset{3}{C}H_2$, $\overset{4}{C}H_2$, $\overset{5}{C}H_3$: $$HO - \overset{1}{C}H_2 - \underset{\displaystyle OH}{\underset{\vert}{\overset{2}{C}H}} - \overset{3}{C}H_2 - \overset{4}{C}H_2 - \overset{5}{C}H_3$$

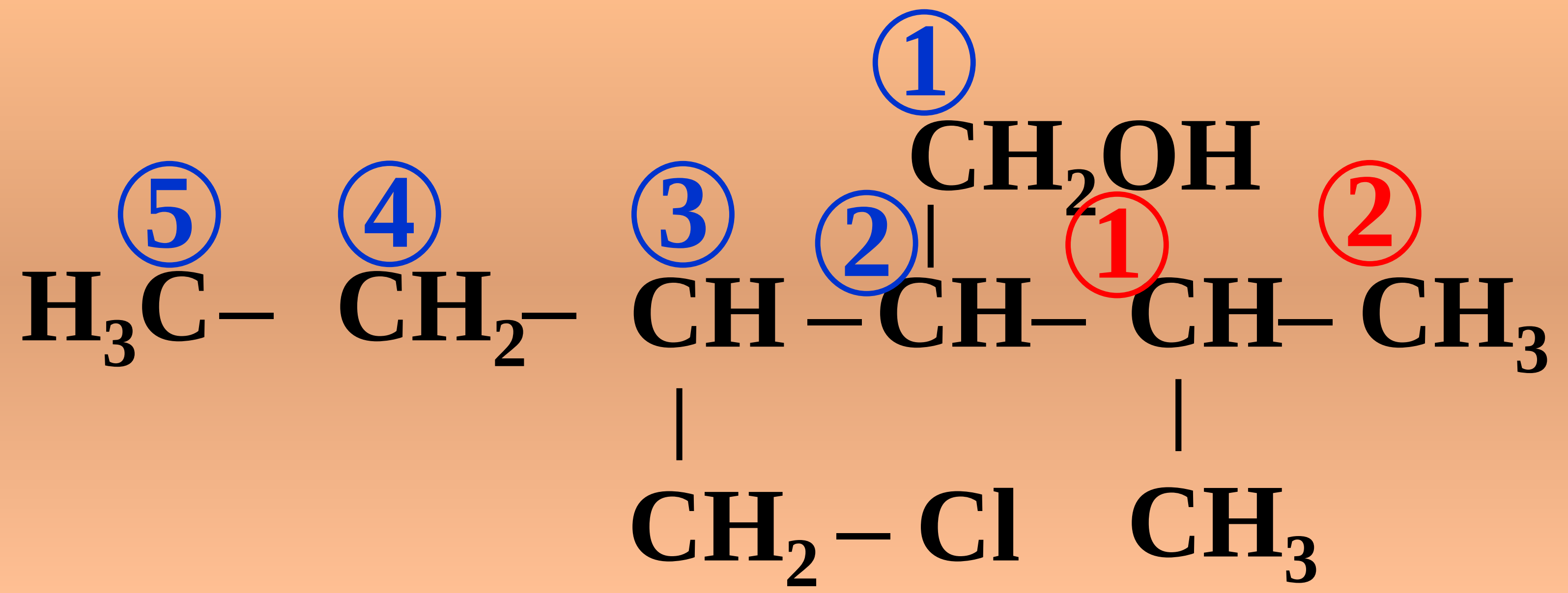
I.U.P.A.C. Name
Pentane –1,2 – diol

Nomenclature

No.	Structure
14	$\begin{array}{ccccccccc} ⑤ & & ④ & & ③ & & ② & & ① \\ H_3C & - & CH & - & CH & - & CH & - & CH_2\,OH \\ & & \vert & & \vert & & \vert & & \\ & & Cl & & CH_3 & & CH_3 & & \end{array}$

I.U.P.A.C. Name
4 – Chloro–2, 3 – dimethyl pentan – 1 – ol

Nomenclature

No.	Structure
15	

I.U.P.A.C. Name
3 –Chloro methyl – 2 – (1 – methyl ethyl) pentan – 1 – ol

Nomenclature

No.	Structure
16	$\overset{1}{CH_2OH}$ $\vert$ $\overset{6}{H_3C}-\overset{5}{CH}-\overset{4}{CH_2}-\overset{3}{CH}-\overset{2}{CH}-CH_3$ $\vert \qquad\qquad \vert$ $CH_3 \qquad\quad OH$

I.U.P.A.C. Name
2,5 – Dimethylhexane –1,3 – diol

Nomenclature

No.	Structure
17	$\overset{1}{H_2C}=\overset{2}{CH}-\underset{\underset{\displaystyle OH}{\mid}}{\overset{3}{CH}}-\overset{4}{CH_2}-\overset{5}{CH_2}-\overset{6}{CH_3}$

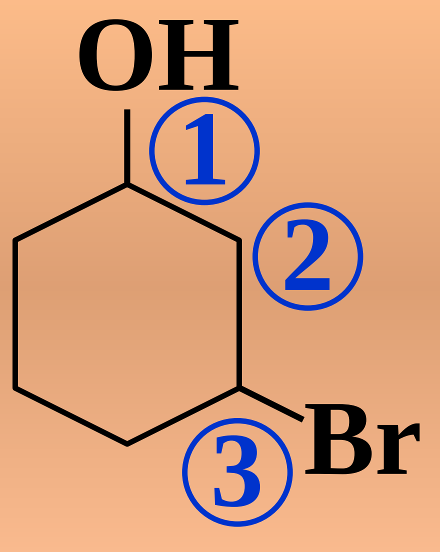
I.U.P.A.C. Name
Hex-1-en-3-ol

Nomenclature

No.	Structure
18	① ② ③ ④ ⑤ ⑥ $H_3C-CH=CH-CH_2-CH_2-CH_3$ | | OH Br

I.U.P.A.C. Name
3 – Bromo – hex – 2 – en – 2 – ol

Nomenclature

No.	Structure
19	

I.U.P.A.C. Name
3 – Bromo – cyclohexan – 1 – ol

To find out no. of

Possible isomers of alkyl alcohols = 2^{n-2}

Possible isomers of alkyl alcohols + ethers = $2^{n-1} - 1$

Possible isomers of ethers = $(2^{n-1} - 1) - (2^{n-2})$

Where, n = No. of Carbon atoms

MCQs

1. IUPAC name of

$$\begin{array}{c} \quad\quad\quad CH_3 \\ \quad\quad\quad | \\ H_3C - C - OH \\ \quad\quad\quad | \\ \quad\quad\quad CH_3 \end{array}$$

a) 2 – Methylpropan – 1 – ol

b) 2 – Methylpropan – 2 – ol

c) 1 – Methylpropan – 3 – ol

d) 1 – Methylpropan – 2 – ol

2. IUPAC name of

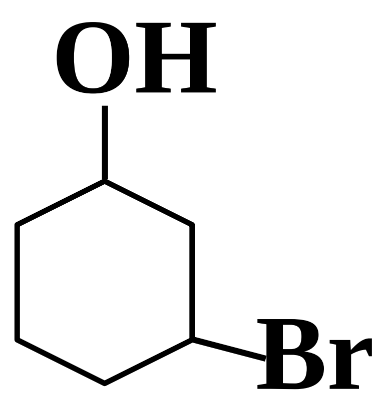
$$\begin{array}{ccccccccc} & & & & & & CH_3 & & \\ & & & & & & | & & \\ H_3C & - & CH & - & CH & - & CH & - & CH_2OH \\ & & | & & | & & & & \\ & & Cl & & CH_3 & & & & \end{array}$$

a) 2 – Chloro –3, 4– dimethylpentan – 5 – ol

b) 4 – Chloro –2, 3 – dimethylpentan – 2 – ol

c) 4 – Chloro –2, 3 – dimethylpentan – 1 – ol

d) None of these

3. IUPAC name of 

a) 1 – Bromocyclohexanol

b) 5 – Bromocyclohexanol

c) 4 – Bromocyclohexanol

d) 3 – Bromocyclohexanol

4. Possible isomers of alkyl alcohols can be given by…

a) 2^{n-1}

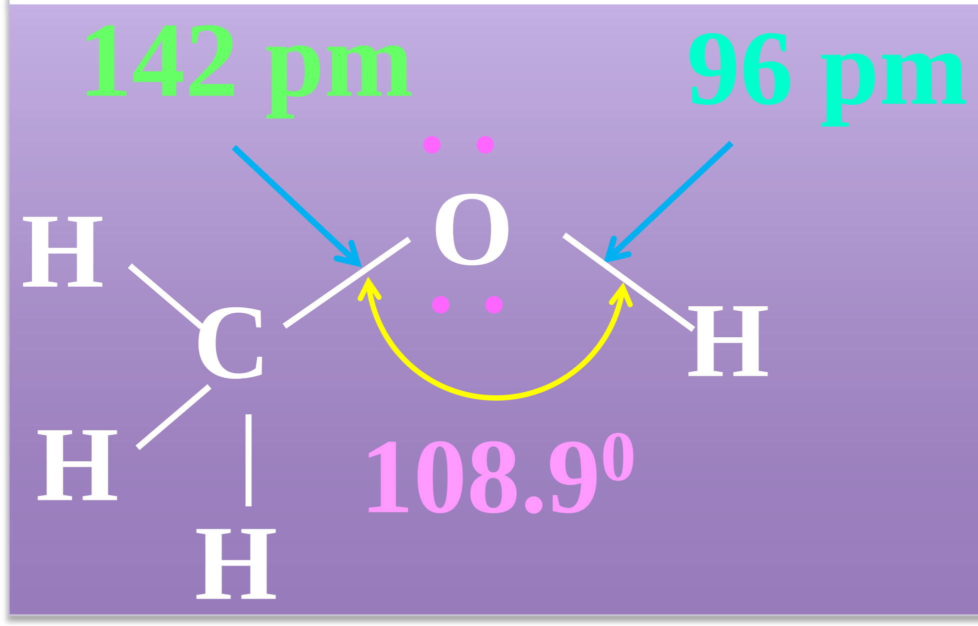
b) 2^{n}

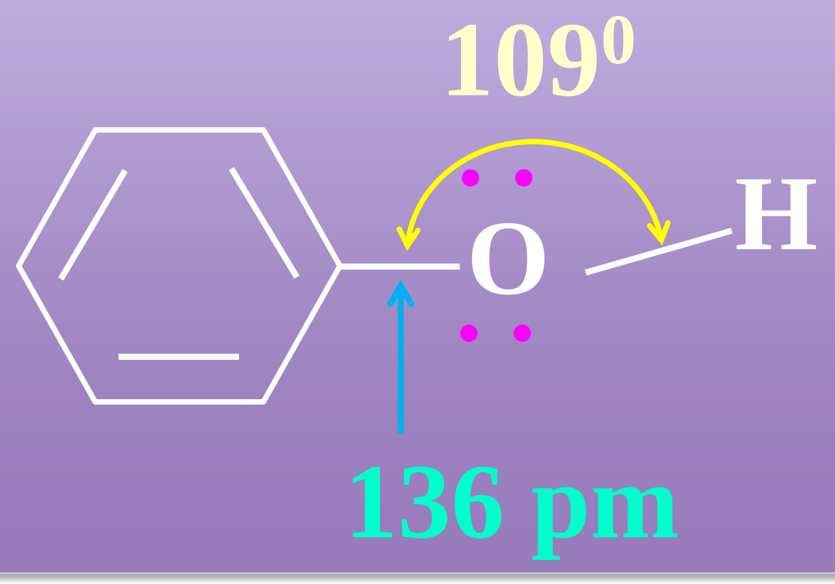
c) 2^{n-2}

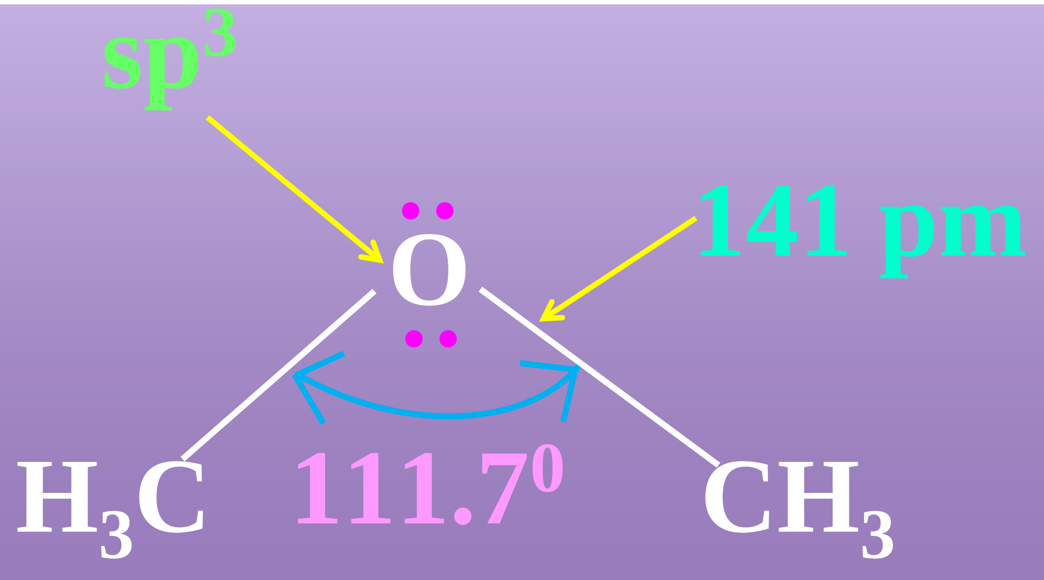
d) $2^{n-1} + 1$

STRUCTURE OF FUNCTIONAL GROUPS

Structure of Methanol	Structure of Phenol	Structure of dimethyl ether







- The bond angle $\angle COH$ in alcohol is slightly less than the tetra hedral bond angle $109^0\,28'$
- It's due to repulsion between the unshared electron pairs of oxygen .
- The carbon – oxygen bond length (136 pm) in phenol is slightly less than that in methanol.
- It’s due to

I. Partial double bond character (by delocalization)

II. SP^2 – carbon attached to – OH group of phenol.

Order of bond angle:-

Alcohol < Phenol < Ether

Due to big size alkyl groups around the oxygen

Order of bond length :-

Alcohol (or) Ether > Phenol

Uses of Methanol

- Industrial solvent for oils , fats, gums etc.
- For dry cleaning & preparation of perfumes.
- As an antifreezing agent.
- To prepare chloromethane, dimethyl sulphate and formaldehyde etc.

Uses of Ethanol :

- As a solvent for dyes, oils, perfumes, cosmetics and drugs
- Mixture of 10 – 20% Ethanol with petrol is used as motor fuel.
- As an alcoholic beverages
- Effective topical antiseptic
- Used to prepare chloroform, iodoform, acetic acid etc.

Note :

- **Rectified spirit = 95.6% ethyl alcohol + 4.4% water (azeotropic mixture)**

- **Power alcohol = 20% Absolute alcohol + 80% petrol**

- **Absolute alcohol = ethyl alcohol containing not more than 1% water (99% Pure ethyl alcohol)**

MCQs

1. Alcohols have high boiling points than that of corresponding alkanes, due to…

a) Metallic bonding

b) Intramolecular hydrogen bonding

c) Intermolecular hydrogen bonding

d) None of these

2. Following is used as an “antifreezing agent”…

a) Methanol

b) Ethanol

c) Propanol

d) None of these

3. Following is used as an alcoholic beverage…

a) Methanol

b) Ethanol

c) Propanol

d) None of these

4. 95.6% ethyl alcohol and 4.4% water is…

a) Power alcohol

b) Rectified spirit

c) Absolute alcohol

d) None of these

5. More CO bond length of CO is observed in ---

a) Alcohols

b) Phenols

c) Both are equal

d) Ethers

6. Bond length of CO in phenol is slightly less than CO of methanol because...

a) partial double bond character

b) sp^2 – carbon attached to –OH group of phenol

c) Both a &b

d) none of these

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