(I) Hydrogen attached to Sp^3 hybrid atom

H-O

→ Alcohol
$(3500-3300\,cm^{-1})$

→ Phenol

→ Carboxylic Acid
$(3000-2500\,cm^{-1})$

H-C
↳ alkanes

St $(2950-2750)\,cm^{-1}$

Bending $1470-1380\,cm^{-1}$

H-N

Amines

- 1° (2 peaks)
  $(3500-3300\,cm^{-1})$
- 2° (1 peak)

- 3° (No peak)

Amides

%.T

$3000 \quad 2500$
$\overline{\nu}$

Amides

Amines

1°   2°

%T

$\bigcup$ broad peak.

$4000 \quad 3500 \quad 3000$
$\overline{\nu}(cm^{-1})$

%.T

strong (s)

medium (m)

weak (w)

$\overline{\nu}\,(cm^{-1})$
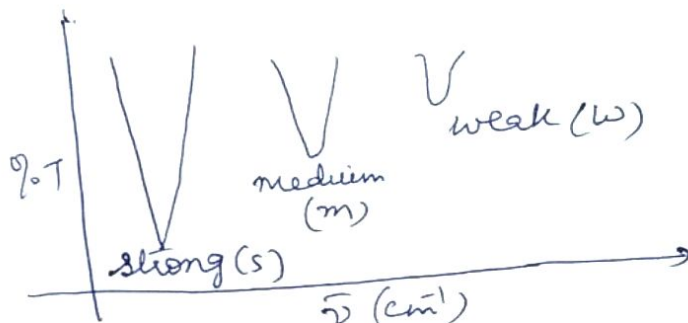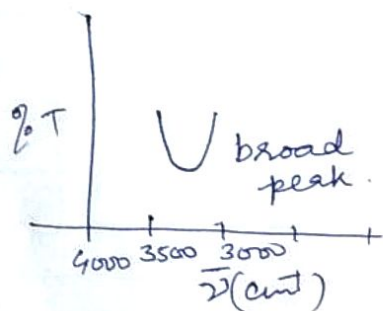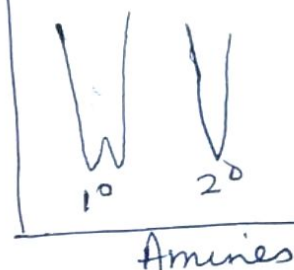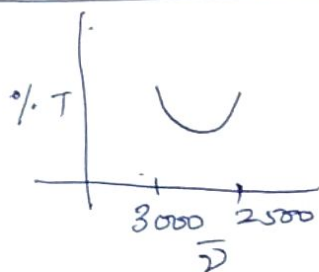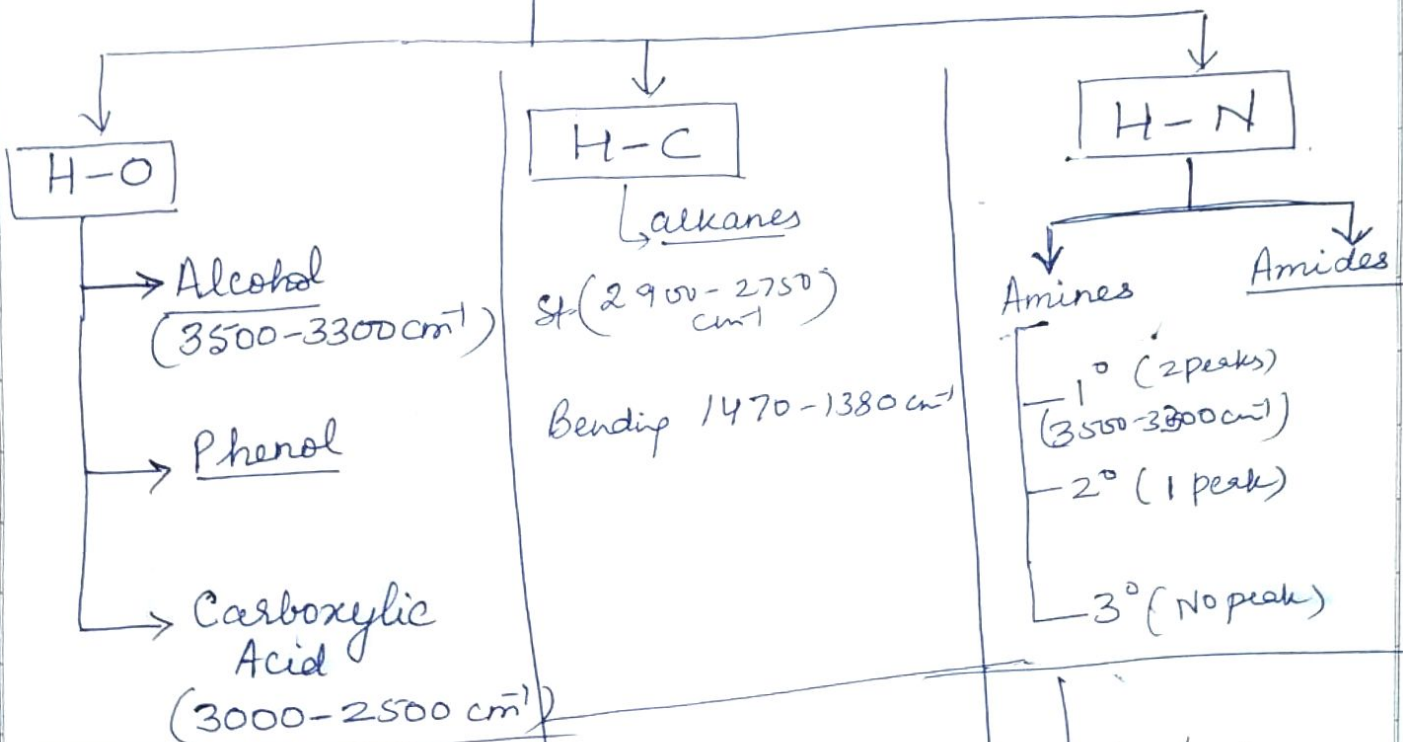
1). ## Hydrogen Attached to sp² hybrid atoms

$$-C \equiv C - H$$

Alkenes	Aromatic	Aldehyde
$3080-3020$ cm⁻¹	$3100-3000$ cm⁻¹	2900 cm⁻¹
$1000-675$ cm⁻¹	$800-675$ cm⁻¹	2700 cm⁻¹

2700 cm⁻¹
2900
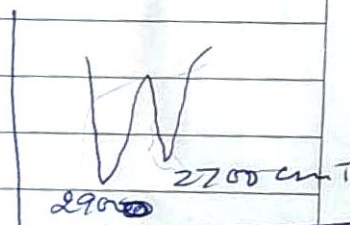
2). ## Hydrogen Attached to sp hybrid atoms

$$H - C \equiv C - H$$

Str — 3300 cm⁻¹

Formula to find No. of double bonds & Rings (NDBAR)

$$C_a H_b X_c N_d O_e S_f$$

$$NDBAR = (a+1) - \left(\frac{b+c-d}{2}\right)$$

(Presence of divalent atoms like O, S are ignored)

eg -

① $\boxed{C_{10} H_{22}}$

$$NDBAR = (10+1) - \frac{22}{2} = 11-11 = 0 \longrightarrow \text{No double bond}$$
$$\qquad \qquad \qquad \qquad \qquad \qquad \quad i.e. \text{ Saturated Comp.}$$

② $\boxed{C_8 H_{16}}$

$$NDBAR = (8+1) - \frac{16}{2} = 9-8 = 1 \Longrightarrow \begin{array}{l} 1 \text{ double bond} \\ \text{or cyclic ring} \end{array}$$

An Organic comp. having molecular formula C_3H_6O and its IR absorption frequency is 1760 cm^{-1}. Determine the structure of compound.

$$NDBAR = (3+1) - \frac{6}{2} = 4-3 = 1$$

⇒ Compound contains 1 double bond.

1760 cm^{-1} ⇒ Indicates the presence of carbonyl group

So our comp. =

$$CH_3 - \underset{\underset{O}{\|}}{C} - CH_3$$

NDBAR = 1 $\Rightarrow$ 1 double bond or 1 ring

NDBAR = 2 $\Rightarrow$ 2 " " or 1 double bond
$+$
1 ring

NDBAR = 3 $\Rightarrow$ 3 1 Triple bond
or
double bonds

⓪r

2 double bond + 1 ring

⓪r

1 double bond + 2 rings

NDBAR = 4 $\Rightarrow$ 4 double bonds

⓪r

3 double bonds + 1 ring

Benzene

Q2. An organic compound having molecular formula C_4H_6 and its IR absorption frequencies are observed at 2260 and 2950 cm^{-1}. Determine the structure.

NDBAR $= (4+1) - \dfrac{6}{2} = 5 - 3 = 2$

i.e. our comp. contains either 2 double bonds or 1 triple bond.

Now, 2260 cm^{-1} $\implies$ Indicates $-C \equiv C -$

2950 cm^{-1} $\implies$ Indicates alkane $-C-H$

So our comp. can be $\boxed{CH_3 - C \equiv C - CH_3}$

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