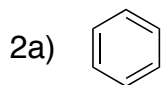


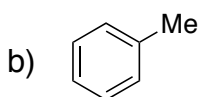
- 1) For C, H, O only, max IHD is observed when the number of H is zero (0).
The number of O atoms will not affect the IHD, as usual.

Thus, max IHD = $n + 1$, where $n = \#$ of C atoms.

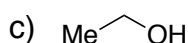
Examples include **carbon dioxide** (CO_2), **diamond** (C_{sp^3}) $_n$, **graphite** (C_{sp^2}) $_n$, and **buckminsterfullerene** (C_{60}), and all other **fullerenes** (e.g., C_{70} , etc.)



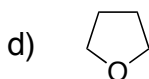
Chemical Formula: C_6H_6
Elemental Analysis: C, 92.26; H, 7.74
MS: 78
IR: only C-H and C=C stretches



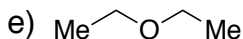
Chemical Formula: C_7H_8
Elemental Analysis: C, 91.25; H, 8.75
MS: 92
IR: only C-H and C=C stretches



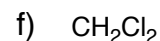
Chemical Formula: $\text{C}_2\text{H}_6\text{O}$
Elemental Analysis: C, 52.14; H, 13.13.
MS: 46
IR: $\sim 3500\text{ cm}^{-1}$ (broad)



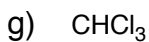
Chemical Formula: $\text{C}_4\text{H}_8\text{O}$
Elemental Analysis: C, 66.63; H, 11.18.
MS: 72
IR: only C-H stretches



Chemical Formula: $\text{C}_4\text{H}_{10}\text{O}$
Elemental Analysis: C, 64.82; H, 13.60.
MS: 74
IR: only C-H stretches



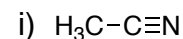
Chemical Formula: CH_2Cl_2
Elemental Analysis: C, 14.14; H, 2.37; Cl, 83.49
MS: 84, 86 (approx 3:1 ratio - remember that Cl is about 3:1 $^{35}\text{Cl} : ^{37}\text{Cl}$)
IR: only C-H stretches



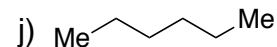
Chemical Formula: CHCl_3
Elemental Analysis: C, 10.06; H, 0.84; Cl, 89.09
MS: 118, 120, 122 (approx 3 : 3 : 1 ratio)
IR: only C-H



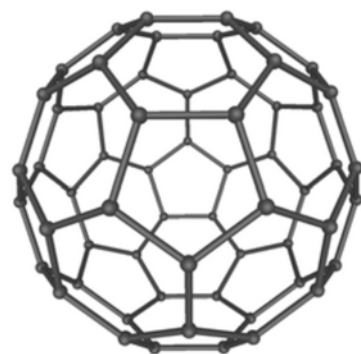
Chemical Formula: CCl_4
Elemental Analysis: C, 7.81; Cl, 92.19
MS: 154, 156 (base peak), 158, 160
IR: "none" (except fingerprint region)



Chemical Formula: $\text{C}_2\text{H}_3\text{N}$
Elemental Analysis: C, 58.51; H, 7.37; N, 34.12
MS: 41
IR: 2267 cm^{-1}



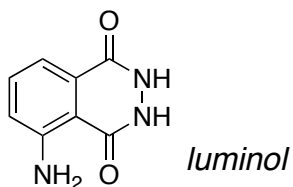
Chemical Formula: C_6H_{14}
Elemental Analysis: C, 83.63; H, 16.37
MS: 86
IR: only C-H



C_{60}
(buckminsterfullerene)

IR data in all cases exclude the Fingerprint Region ($< 1500\text{ cm}^{-1}$), and values for C-H stretches need not be included.

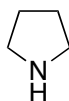
3)



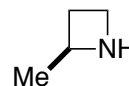
Chemical Formula: $C_8H_7N_3O_2$
 IHD = $8 - (7/2) + (3/2) + 1 = 7$ (2 rings, 5 π -bonds)
 MS: 177
 Elemental Analysis: C, 54.24; H, 3.98; N, 23.72.
 IR: 2950 to 2850 (N-H of NH_2 and NH groups), 1660 (C=O)

4) Given:

Elemental Analysis: C, 67.55; H, 12.75; N, 19.69.
 MS: 71
 IR: 2932 - probably N-H stretches

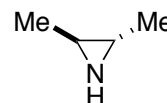
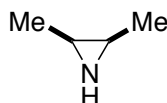


pyrrolidine



(S)-2-methylazetidine

- no oxygen (C+H+N = 100%)
- MF: C_4H_9N
- IHD: $4 - 9/2 + 1/2 + 1 = 1$ (1 ring or 1 π -bond)

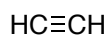


Examples include: *meso*-2,3-dimethylaziridine (*S,S*)-2,3-dimethylaziridine

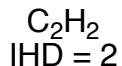
5) Given:

Elemental Analysis: C, 92.26; H, 7.74.

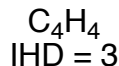
- no oxygen (C+H = 100%)
- Empirical formula: CH
- MF: $(CH)_n$
- IHD = $n - n/2 + 1 = n/2 + 1$



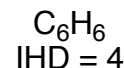
acetylene



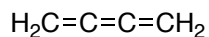
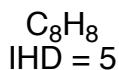
cyclobutadiene



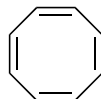
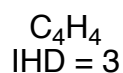
benzene



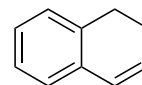
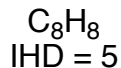
cubane



1,2,3-butatriene
(a cumulene)



cyclooctatetraene



dihydronaphthalene

