

Organic Chemistry

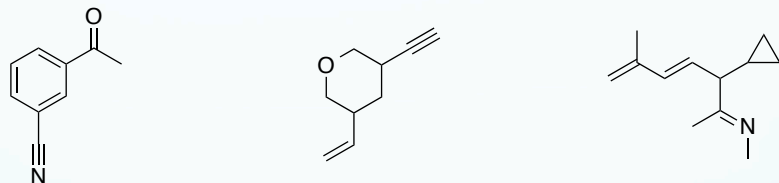
Determining Degrees of Unsaturation

Degrees of Unsaturation from Structure

- A degree of unsaturation corresponds to a deficiency of 2H from a molecule.
- Double Bond = 1 Unsaturation
- Ring = 1 Unsaturation
- Triple Bond = 2 Unsaturation



Degrees of Unsaturation from Structure



Degrees of Unsaturation from Formula

1) Formula containing carbon and hydrogen only.

$$\# \text{ Unsaturations} = \frac{\text{Saturated \# of H} - \text{Unsaturated \# of H}}{2}$$

$$\text{Saturated \# of H: } C_n H_{2n+2}$$

Ex: C_8H_{10}

Degrees of Unsaturation from Formula

- 2) Formula containing halogens.
- Add 1H for each halogen present

Ex: $\text{C}_6\text{H}_{10}\text{Cl}_2$

$$\# \text{Unsaturations} = \frac{\text{Saturated \# of H} - \text{Unsaturated \# of H}}{2}$$

Degrees of Unsaturation from Formula

- 3) Formula containing nitrogen.
- Subtract 1H for each nitrogen present

Ex: $\text{C}_5\text{H}_{11}\text{N}$

$$\# \text{Unsaturations} = \frac{\text{Saturated \# of H} - \text{Unsaturated \# of H}}{2}$$

Degrees of Unsaturation from Formula

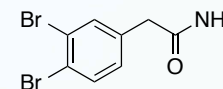
- 4) Formula containing oxygen.
- Just ignore the oxygen

Ex: $\text{C}_{10}\text{H}_{18}\text{O}_2$

$$\# \text{Unsaturations} = \frac{\text{Saturated \# of H} - \text{Unsaturated \# of H}}{2}$$

Combined Example

Ex: $\text{C}_8\text{H}_7\text{NOBr}_2$



$$\# \text{Unsaturations} = \frac{\text{Saturated \# of H} - \text{Unsaturated \# of H}}{2}$$

Summary

Determining Unsaturation from a Structure

Double Bond = 1 Unsaturation

Ring = 1 Unsaturation

Triple Bond = 2 Unsaturation

Determining Unsaturation from a Formula

Use the general formula:

$$\# \text{ Unsaturation} = \frac{\text{Saturated \# of H} - \text{Unsaturated \# of H}}{2}$$

Determine the number of saturated H using:

$$\text{Saturated \# of H: } C_n H_{2n+2}$$

Halogen: add 1H to formula for each halogen.

Nitrogen: subtract 1H from formula for each nitrogen.

Oxygen: just ignore any oxygen in the formula.