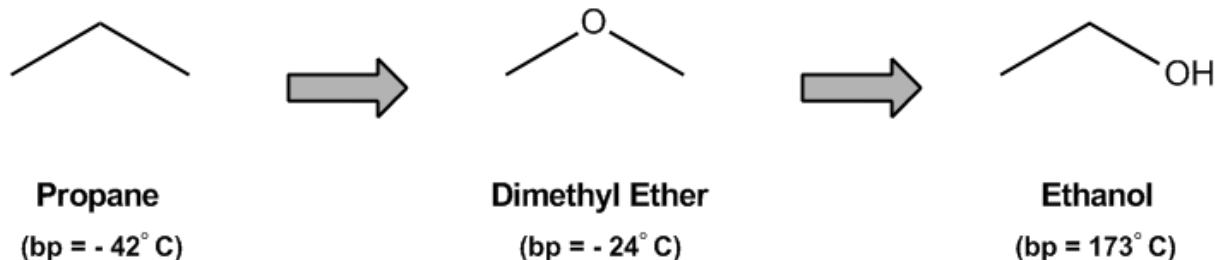


**CLUTCH**

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CONCEPT: INTERMOLECULAR FORCES

- IMF's are what make molecules \_\_\_\_\_. Without them everything would be \_\_\_\_\_



- Boiling point / melting point questions are always directly referring to the strength of \_\_\_\_\_ between molecules.

1. Hydrogen Bonding – (H) Bound to small, highly electronegative atoms: \_\_\_\_\_

2. Dipole-dipole (**net dipole** force)

3. Van der Waals (London Dispersion Forces)

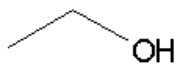
□ Increase with:

a. Size

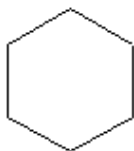
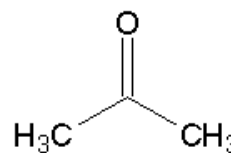
b. Ring > Chain > Branched

**PRACTICE:** Which of the following pairs of molecules would have the highest boiling point?

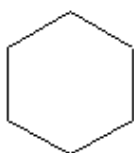
1.

OR

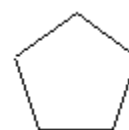
2.

OR

3.

OR

4.

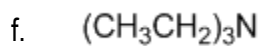
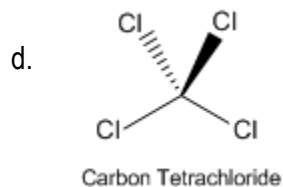
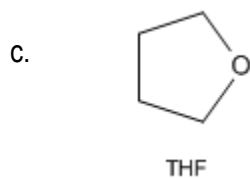
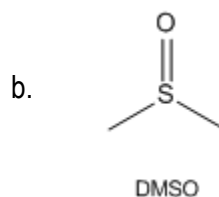
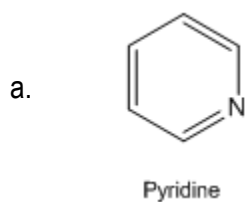
OR

CONCEPT: SOLUBILITY

Only one rule: \_\_\_\_\_ **dissolves** \_\_\_\_\_

**EXAMPLE:**

**PRACTICE:** Circle the following molecules would you expect to be miscible in an aqueous solution?



**CONCEPT: FUNCTIONAL GROUPS**

- We can group several millions of different molecules into subsets of similar \_\_\_\_\_

1. Hydrocarbons

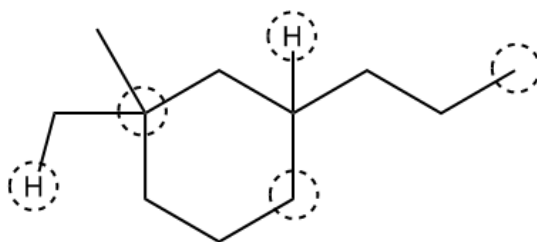
Alkanes	Alkenes	Alkynes
Single Bonds	Double Bonds	Triple Bonds
$\text{H}_3\text{C}-\text{CH}_3$	$\text{H}_2\text{C}=\text{CH}_2$	$\text{HC}\equiv\text{CH}$

- All carbon groups regardless of size can be symbolized using an \_\_\_\_\_ group.
- When an alkane is attached to a greater carbon chain, it is given an \_\_\_\_\_ suffix. (i.e. \_\_\_\_\_ group)



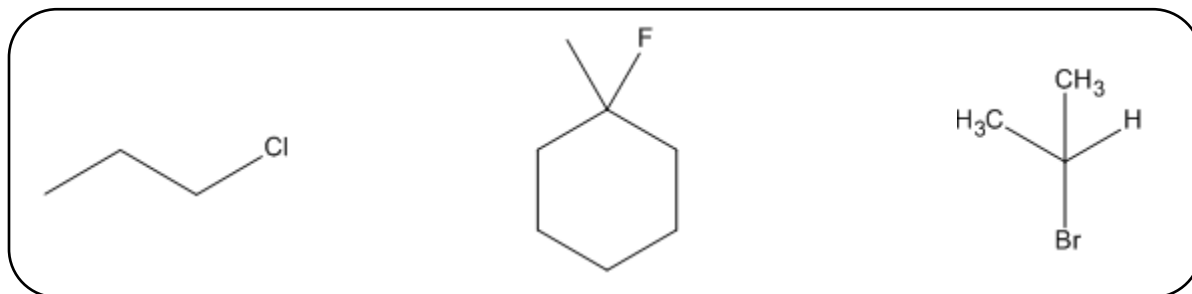
- Carbons are given a “degree” based on how many other \_\_\_\_\_ they are attached to
  - ☐ Hydrogens possess the \_\_\_\_\_ degree as the carbon they are attached to
  - ☐ Degrees are expressed as primary, secondary, tertiary and quaternary ( $1^\circ$ ,  $2^\circ$ ,  $3^\circ$ ,  $4^\circ$ )

**EXAMPLE:** Determine the degree of the indicated carbons and hydrogens



2. Alkyl Halide \_\_\_\_\_

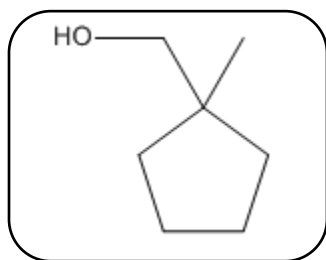
- Any -R group directly attached to a halogen.
- The degree of alkyl halide is determined the same way as \_\_\_\_\_



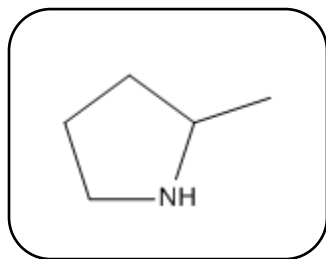
The carbonyl \_\_\_\_\_ is NOT a functional group, but it is a major component of many functional groups

3. Alcohol \_\_\_\_\_

- Degree of alcohol is determined the same way as \_\_\_\_\_

4. Amine \_\_\_\_\_

- ★ Degree of alcohol is determined the same way as \_\_\_\_\_.

5. Ether \_\_\_\_\_6. Carboxylic Acid \_\_\_\_\_ (\_\_\_\_\_)

- The acid of organic chemistry

7. Amide \_\_\_\_\_ (\_\_\_\_\_)

- Degree of alcohol is determined the same way as \_\_\_\_\_.

8. Ester \_\_\_\_\_ (\_\_\_\_\_)

## 9. Carbonyls

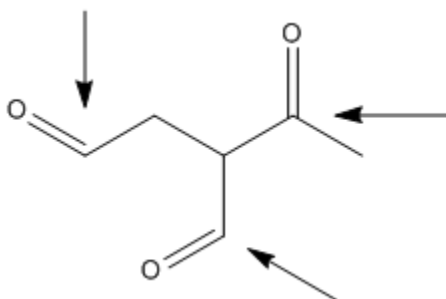
The term "carbonyl" is not the proper name of the functional groups because the functionality of the group depends on its location on the carbon chain.

• Ketone \_\_\_\_\_ (\_\_\_\_\_)

- \_\_\_\_\_ carbonyl group

• Aldehyde \_\_\_\_\_ (\_\_\_\_\_)

- \_\_\_\_\_ carbonyl group

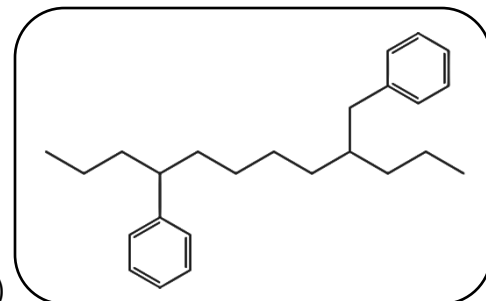


## 10. Nitrile \_\_\_\_\_

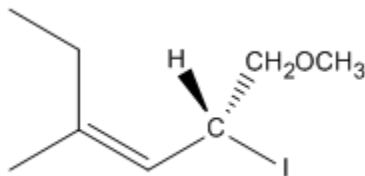
## 11. Benzene

• Directly attached to -R group \_\_\_\_\_ (\_\_\_\_\_) (\_\_\_\_\_)

• Extra CH<sub>2</sub> between -R group \_\_\_\_\_ (\_\_\_\_\_) (\_\_\_\_\_)

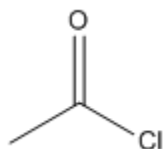


**EXAMPLE:** Identify all the functional groups in the following compound. Show degrees where applicable.

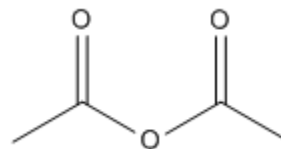


## 12. Other Carbonyl Compounds

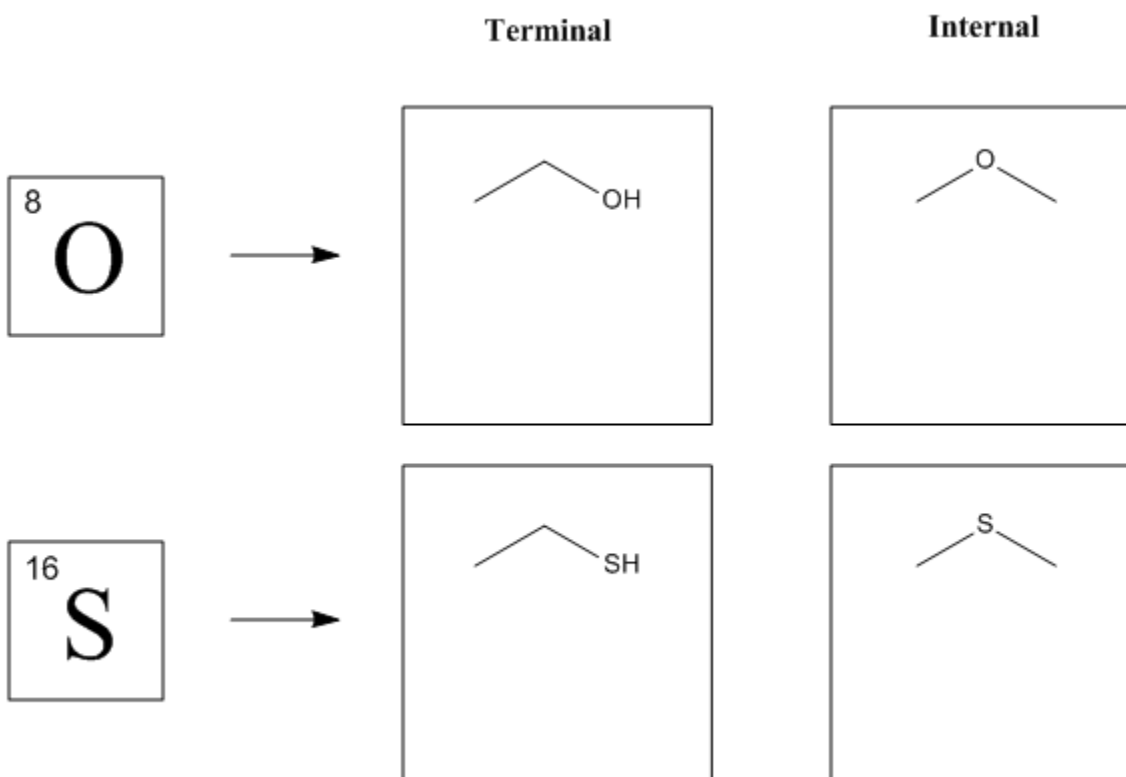
- Acyl Chloride (\_\_\_\_\_)



- Anhydride (\_\_\_\_\_)



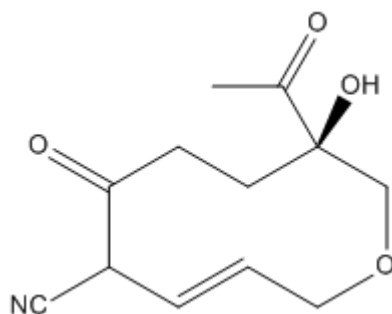
## 13. Sulfur Compounds



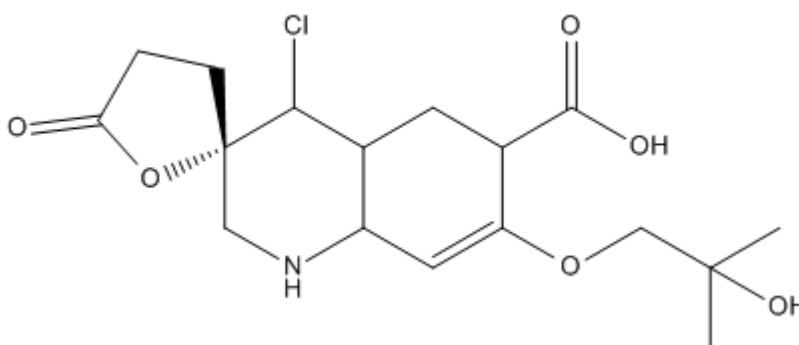


**PRACTICE:** Identify all the functional groups in the following compound. Show degrees where applicable.

a.



b.



c.

