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Chemistry Department

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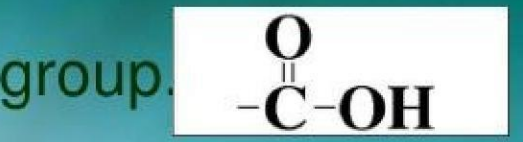
CARBOXYLIC ACID

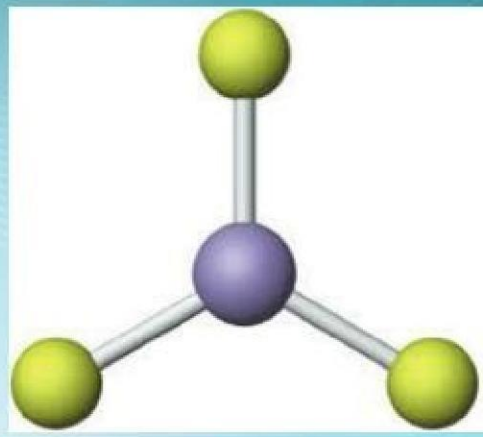
RCOOH

Carboxylic Acid

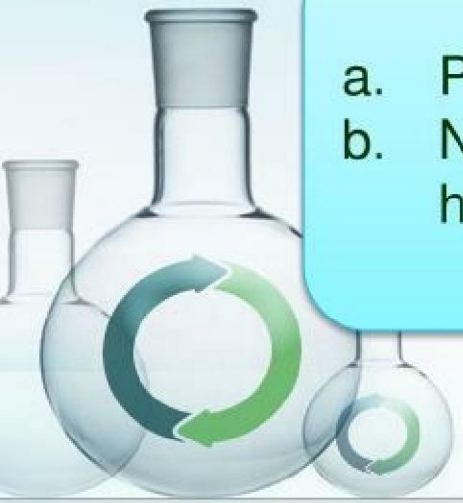
- ✓Organic compounds containing a carboxyl group.

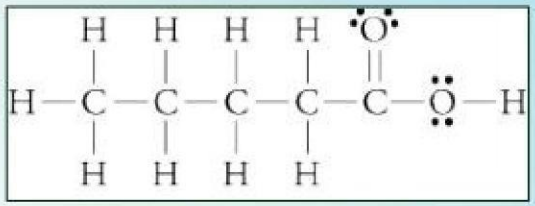


- ✓Trigonal planar, with bond angles of 120^{O}
- ✓Very strong intermolecular hydrogen bonds
- ✓Two regions of different polarity
- ✓Weak acid

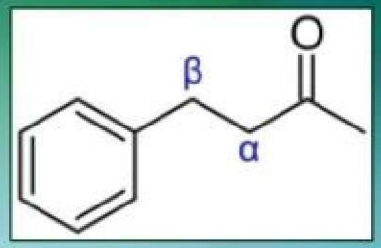


a. Polar hydrophilic carboxyl
b. Nonpolar hydrophobic hydrocarbons



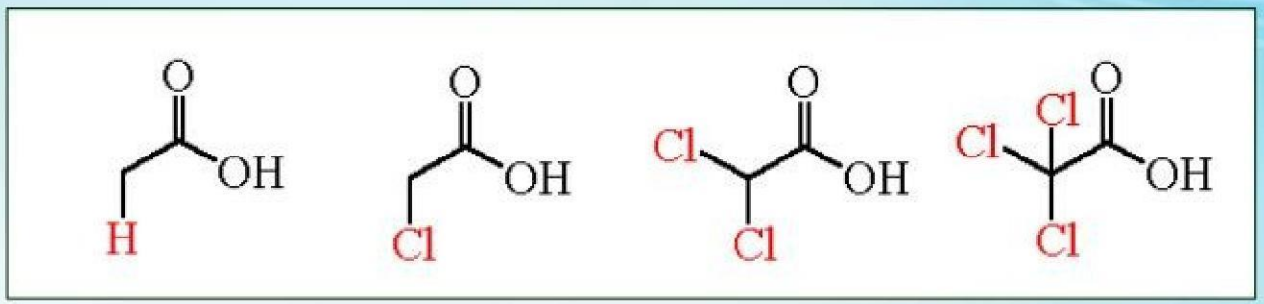


Acidity of Carboxylic Acid



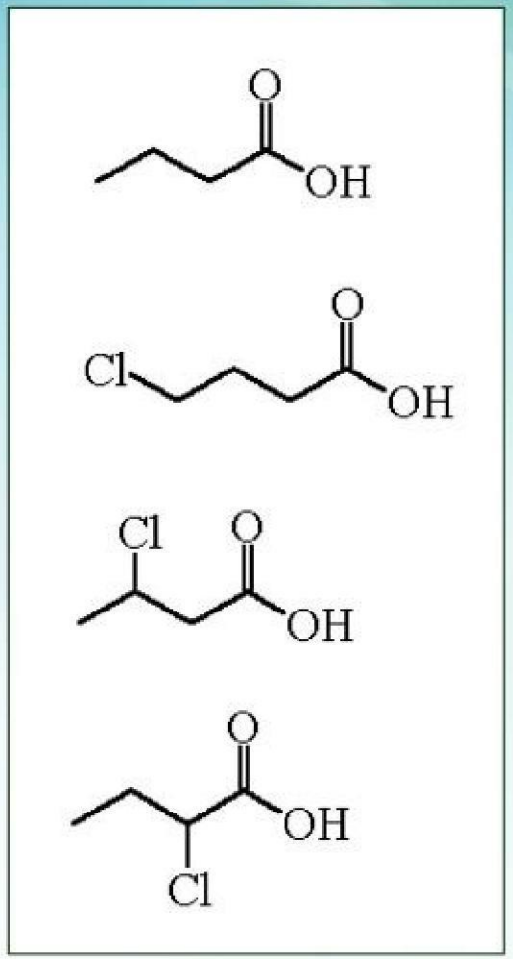
✓More acidic than alcohol.

-substitution at alpha carbon of an atom or a group of atoms higher electronegativity than carbon increases the acidity of acid.



Acidity of Carboxylic Acid

✓Decrease rapidly with increasing distance from the carbonyl group.



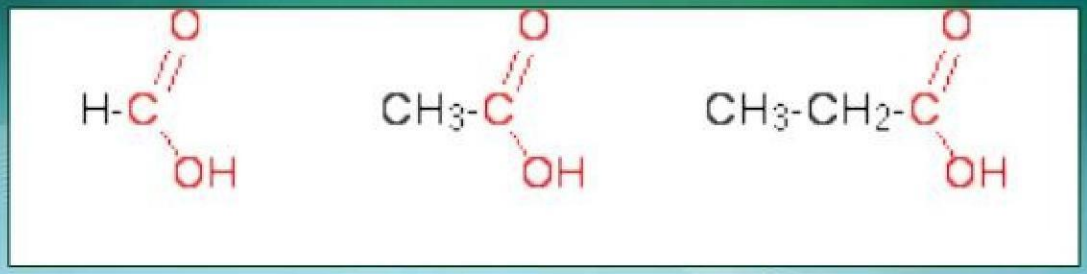
decreasing

Nomenclature of Carboxylic Acid (IUPAC)

RULE 1: We derive the IUPAC name of a carboxylic acid from that of the longest carbon chain which contains the carboxyl group by dropping the final –e from the name of the parent alkane and adding the suffix –oic, followed by the word acid.

RULE 2: If the carboxylic acid contains double bond, we change the infix from -an- to -en- and show the location of double bond by a number.

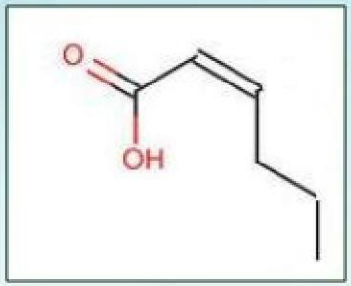
Name the following:



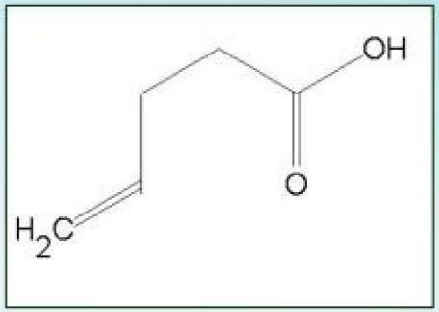
Methanoic acid

ethanoic acid

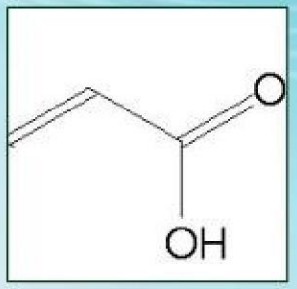
propanoic acid



2-hexenoic acid



4-pentenoic acid



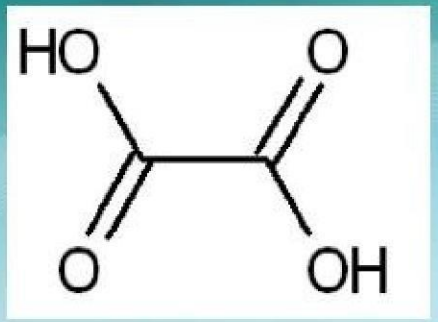
2-propenoic acid

Nomenclature of Carboxylic Acid (IUPAC)

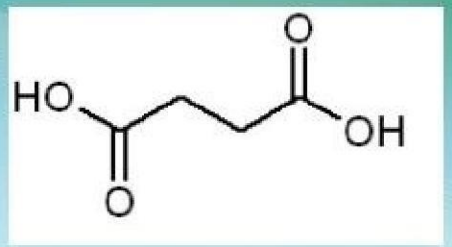
RULE 3: In the IUPAC system, carboxylic acid bears the highest priority over most other functional groups. When the substituent groups such A -OH, $-NH_2$ AND =O are present, these are named as hydroxy-, amino-, and -oxo-, respectively.

RULE 4: Carboxylic acids are named by adding -dioic, then the word acid. Since the two carboxylic acids can be only at the ends of the parent chain, there is no need to number them.

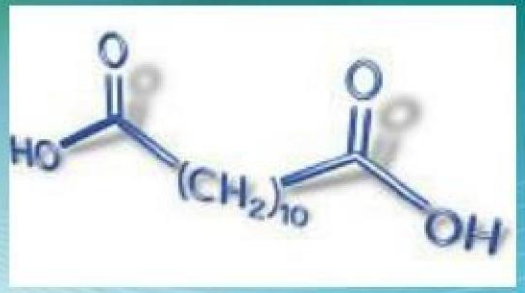
Name the following:



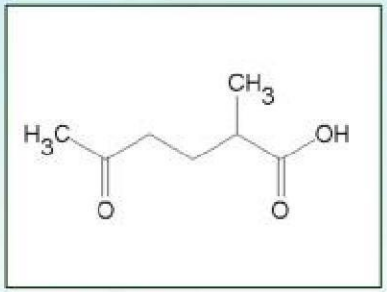
ethanedioic acid



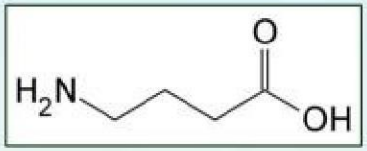
butanedioic acid



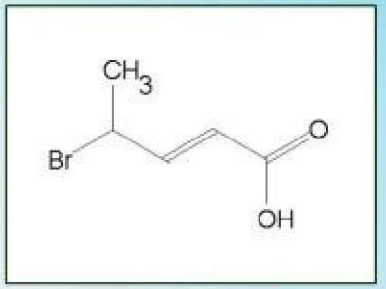
dodecanedioic acid



2-methyl-5-oxohexanoic acid



4-aminobutanoic acid



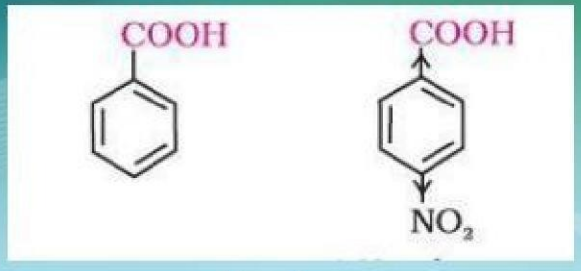
4-bromo-2-pentenoic acid

Nomenclature of Carboxylic Acid (IUPAC)

RULE 5: Compounds that have a carboxylic acid bounded to a ring are named by adding the suffix -carboxylic acid. The carbon bearing carbonyl group is numbered as 1.

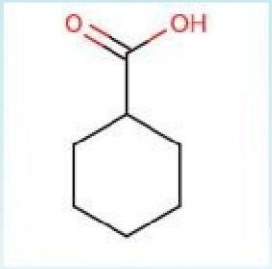
RULE 6: The simplest aromatic carboxylic acid is benzoic acid. If the substituents are present, name the compound by using numbers and prefix to indicate the location of substituents.

Name the following:

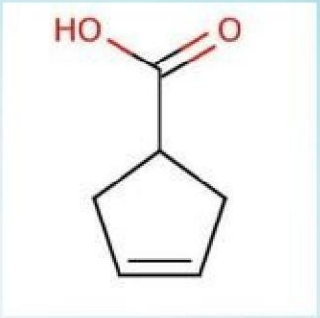


benzoic acid

p-nitrobenzoic acid/
4-nitrobenzoic acid

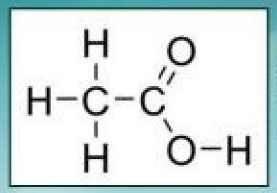


cyclohexanecarboxylic acid

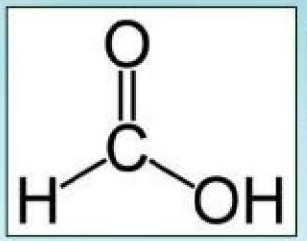


3-cyclopentenecarboxylic acid

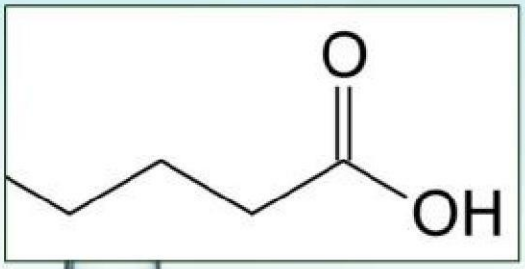
Common Carboxylic Acids Found in Environment



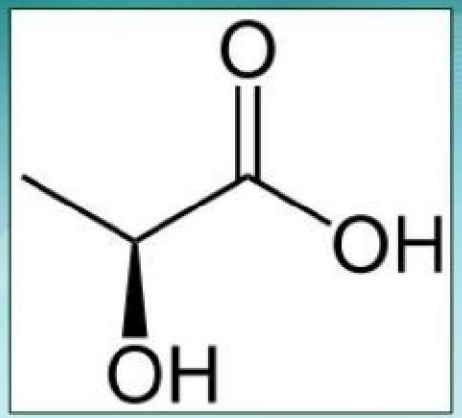
ethanoic acid/ acetic acid - Vinegar



methanoic acid/ formic acid – ants sting



butanoic acid/ butyric acid – rancid butter



2-hydroxypropanoic acid/ lactic acid – spoiled milk.

Examples

1. Ethanol boils at 78^0C and ethanoic acid boils at 118^0C.

2. CH_3COOH is more water-soluble than $CH_3CH_2CH_2COOH$

3. 2-chlorobutanoic acid is more acidic than 3-chlorobutanoic acid.