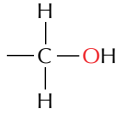


C-O CHEMICAL GROUPS

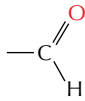
Many biological compounds contain a carbon bonded to an oxygen. For example,

alcohol



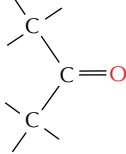
The -OH is called a **hydroxyl** group.

aldehyde

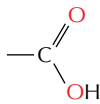


The C=O is called a **carbonyl** group.

ketone



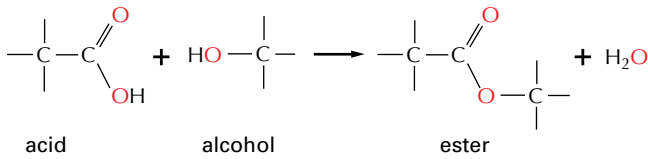
carboxylic acid



The -COOH is called a **carboxyl** group. In water this loses an H⁺ ion to become -COO⁻.

esters

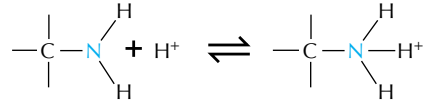
Esters are formed by combining an acid and an alcohol.



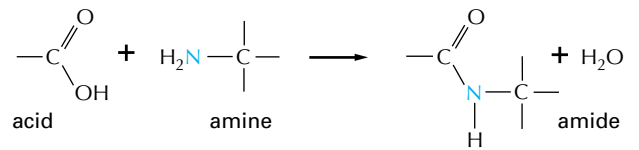
C-N CHEMICAL GROUPS

Amines and amides are two important examples of compounds containing a carbon linked to a nitrogen.

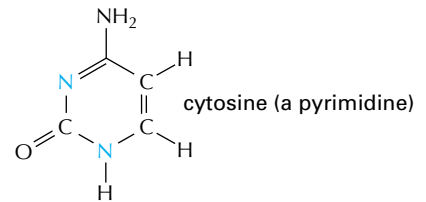
Amines in water combine with an H⁺ ion to become positively charged.



Amides are formed by combining an acid and an amine. Unlike amines, amides are uncharged in water. An example is the peptide bond that joins amino acids in a protein.



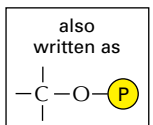
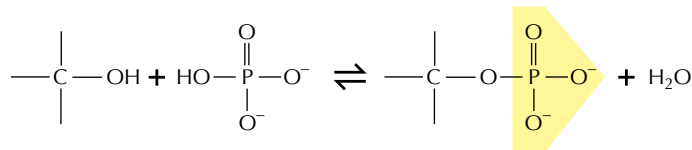
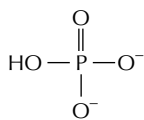
Nitrogen also occurs in several ring compounds, including important constituents of nucleic acids: purines and pyrimidines.



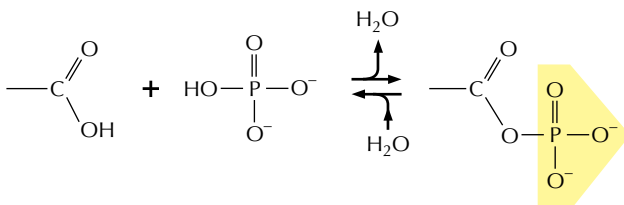
PHOSPHATES

Inorganic phosphate is a stable ion formed from phosphoric acid, H₃PO₄. It is often written as P_i.

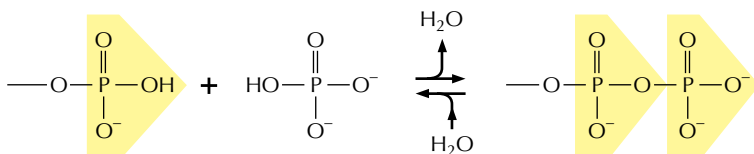
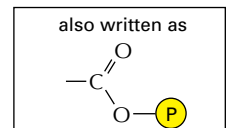
Phosphate esters can form between a phosphate and a free hydroxyl group. Phosphate groups are often attached to proteins in this way.



The combination of a phosphate and a carboxyl group, or two or more phosphate groups, gives an acid anhydride.



high-energy acyl phosphate bond (carboxylic-phosphoric acid anhydride) found in some metabolites



phosphoanhydride—a high-energy bond found in molecules such as ATP

