

## Chemical Bonds and Groups - Part 2

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### C-O COMPOUNDS

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

alcohol



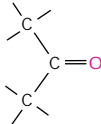
The -OH is called a **hydroxyl** group.

aldehyde



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

ketone



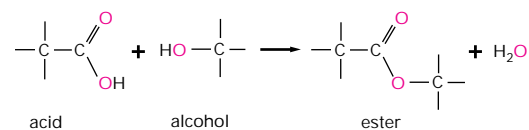
carboxylic acid



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

esters

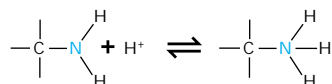
Esters are formed by combining an acid and an alcohol.



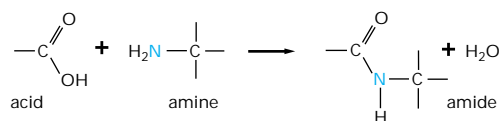
### C-N COMPOUNDS

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

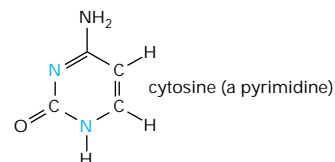
**Amines** in water combine with an H<sup>+</sup> ion to become positively charged.



**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.



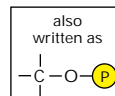
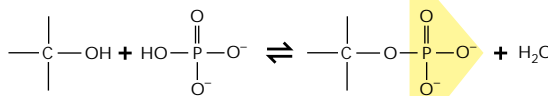
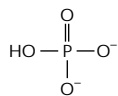
Nitrogen also occurs in several ring compounds, including important constituents of nucleic acids: purines and pyrimidines.



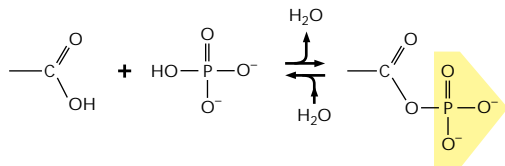
### PHOSPHATES

Inorganic phosphate is a stable ion formed from phosphoric acid, H<sub>3</sub>PO<sub>4</sub>. It is often written as P<sub>i</sub>.

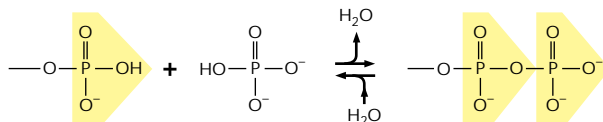
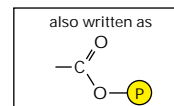
Phosphate esters can form between a phosphate and a free hydroxyl group. Phosphate groups are often attached to proteins in this way.



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

