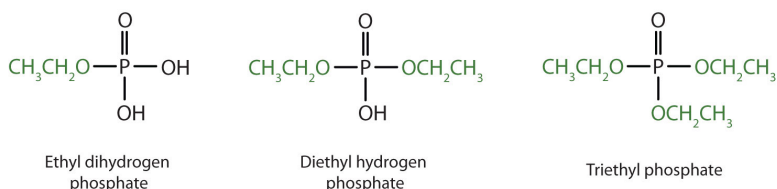


## 17.6: Phosphoric Acid Derivatives

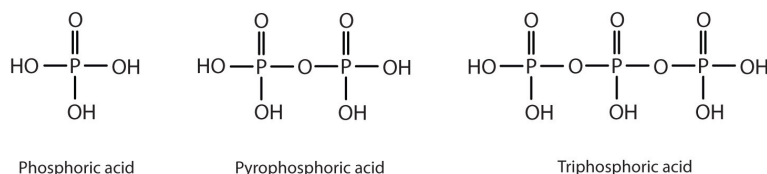
### Learning Objectives

- Objective 1
- Objective 2

Just as carboxylic acids do, inorganic acids such as nitric acid ( $\text{HNO}_3$ ), sulfuric acid ( $\text{H}_2\text{SO}_4$ ), and phosphoric acid ( $\text{H}_3\text{PO}_4$ ) also form esters. The esters of phosphoric acid are especially important in biochemistry. A phosphoric acid molecule can form a monoalkyl, a dialkyl, or a trialkyl ester by reaction with one, two, or three molecules of an alcohol.

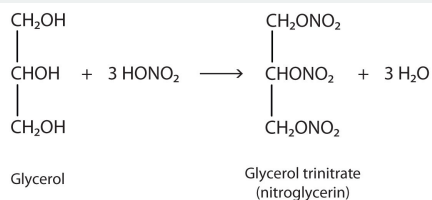


Esters of pyrophosphoric acid and triphosphoric acid are also important in biochemistry.



Esters of these acids are present in every plant and animal cell. They are biochemical intermediates in the transformation of food into usable energy. The bonds between phosphate units in adenosine triphosphate (ATP) are called *phosphoanhydride* bonds. These are high-energy bonds that store energy from the metabolism of foods. Hydrolysis of ATP releases energy as it is needed for biochemical processes (for instance, for muscle contraction). Phosphate esters are also important structural constituents of phospholipids and nucleic acids.

The explosive nitroglycerin (glyceryl trinitrate) is an ester formed from glycerol and nitric acid. It is used in medicine to relieve chest pain in heart disease.



### Summary

Inorganic acids such as  $\text{H}_3\text{PO}_4$  form esters. The esters of phosphoric acid are especially important in biochemistry.

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