

Chapter 16

Reactions of Functional Groups Part 1

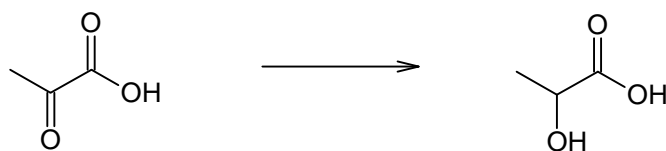
Reactions of Organic Functional Groups Part 1: Intro & Acid-Base Review

Each functional group has unique chemical reactivity.

Biological molecules can become very large – remember to focus on the functional groups.

Most reactions only affect one functional group of a reactant at a time. Recognize the functional groups and look for changes to understand chemical reactivity.

Circle the functional group that changes in the reaction below.



Almost ALL biochemical reactions are catalyzed by enzymes.

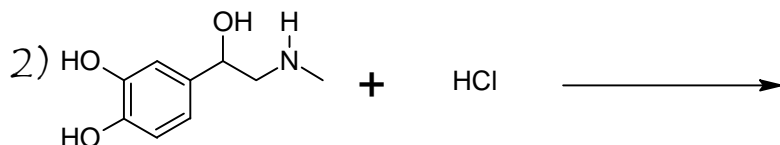
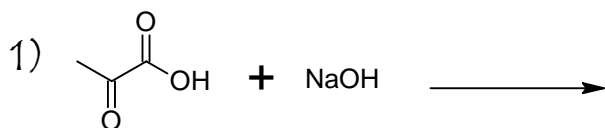
What are catalysts?

Why do our bodies need enzymes?

Draw the Reaction Energy Diagram for a 1-step, exothermic rxn with a large activation energy. Overlay another curve showing the rxn with a catalyst.

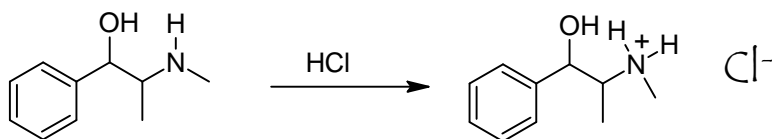
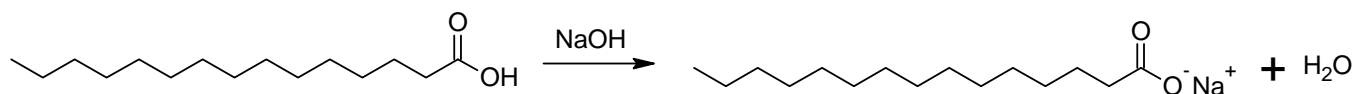
Acid-Base reactions are the most fundamental & frequent biochemical rxn.

Complete the acid-base reactions below.



Solubility and Acid-Base Chemistry

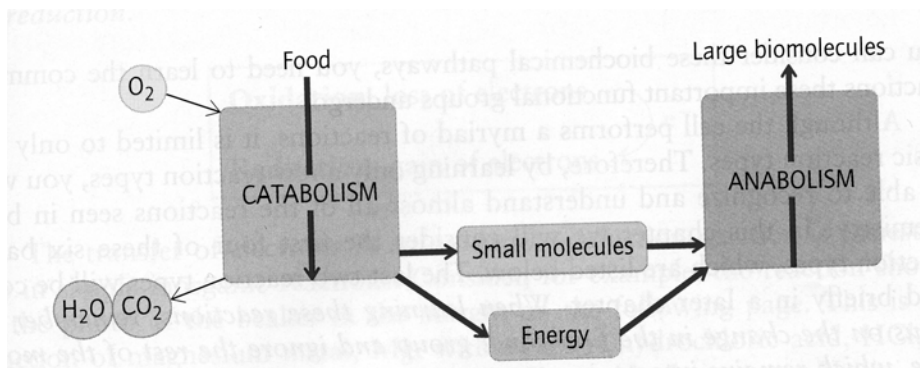
Classify each functional group and predict water solubility for the reactants and products below.



Acid Base Reactions have very low activation energies.

Other Biochemical Reactions have larger activation energies.

Metabolism:



We will study 4 of the biochemical reactions that require catalysts:

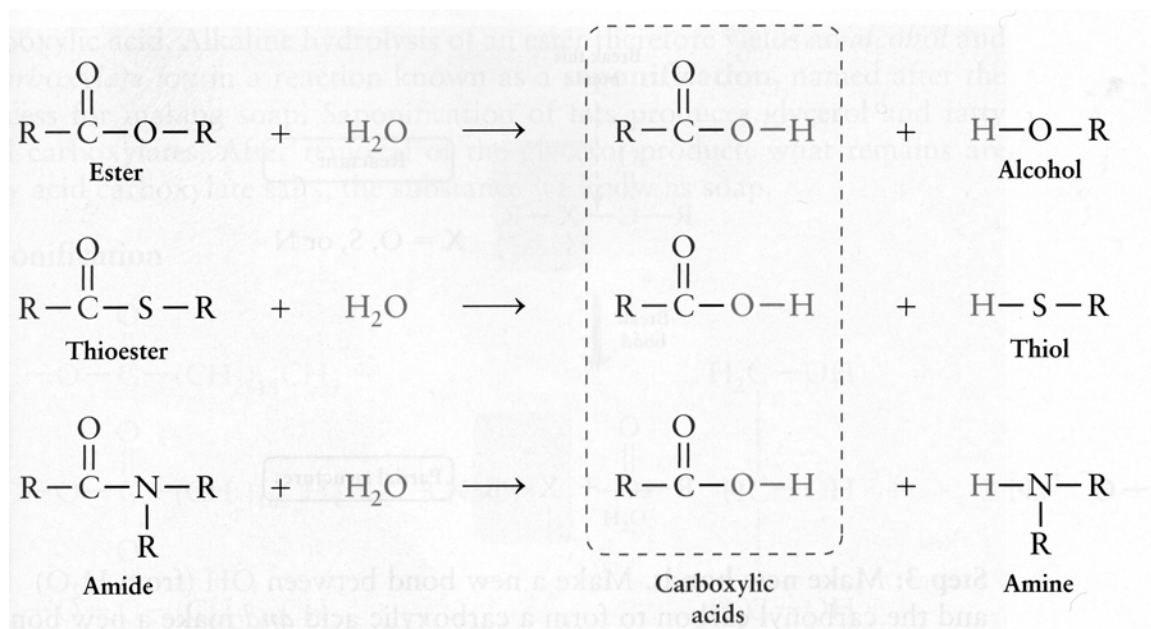
- 1) oxidation-reduction
- 2) hydration-dehydration
- 3) acyl group transfer
- 4) phosphoryl group transfer

Reactions of Organic Functional Groups Part 5: Acyl Transfer

What is an "Acyl Group"?

Acyl Group Transfer Reactions – 2 Pathways Catabolic & Anabolic

Acyl Group Hydrolysis Reactions



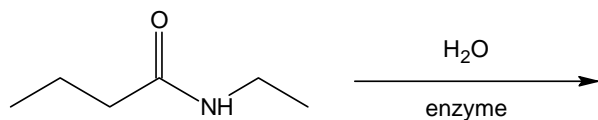
What happens to carboxylic acids at physiological pH? Draw the structure of acetic acid at physiological pH.

The ester for apple flavoring is methyl butanoate. Draw the skeletal-line structure for apple flavoring.

Write the hydrolysis reaction for apple flavoring at physiological pH.

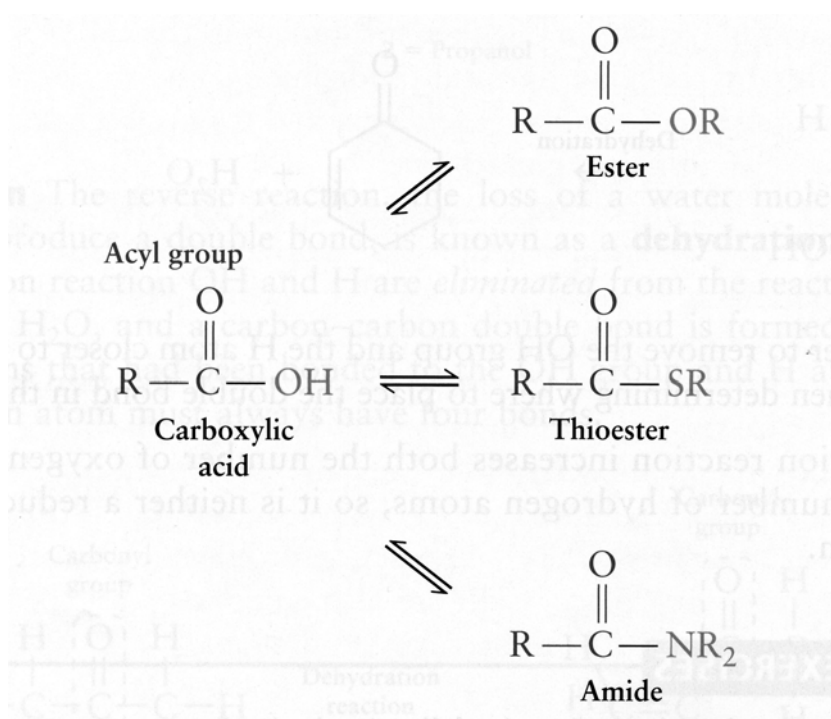
What happens to amines at physiological pH? Draw ethanamine at physiological pH.

Predict the products of the following enzyme catalyzed hydrolysis reactions at physiological pH.



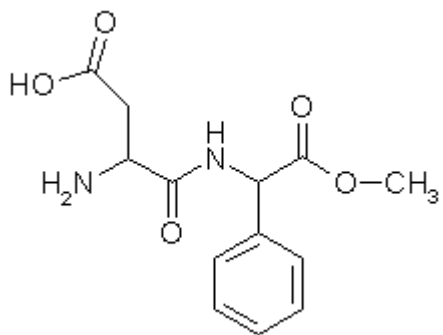
Acyl Derivative Formation

Add the missing reactants.



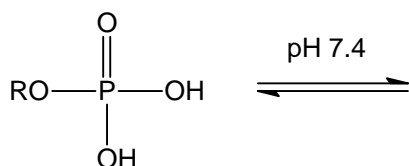
Show the reaction to form rum flavoring (ethyl formate) using acyl derivative formation.

Predict the hydrolysis products of aspartame at physiological pH.



Reactions of Organic Functional Groups Part 6: Phosphoryl Grp Transfer

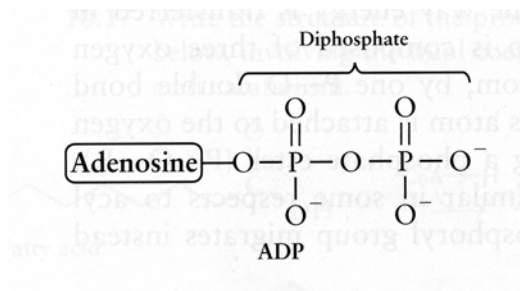
What is the effect of physiological pH on phosphate esters?



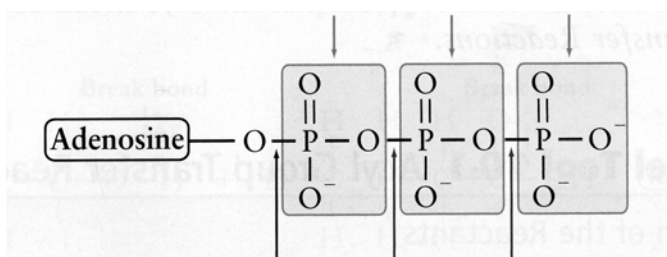
Phosphoryl Group Transfer Reactions

Phosphate esters are formed when 1 or more of the H atoms of phosphoric acid is (are) replaced with 1 or more R groups.

Phosphoanhydride bonds form when the O atoms of one phosphate group bonds with the P atom of another phosphate group.

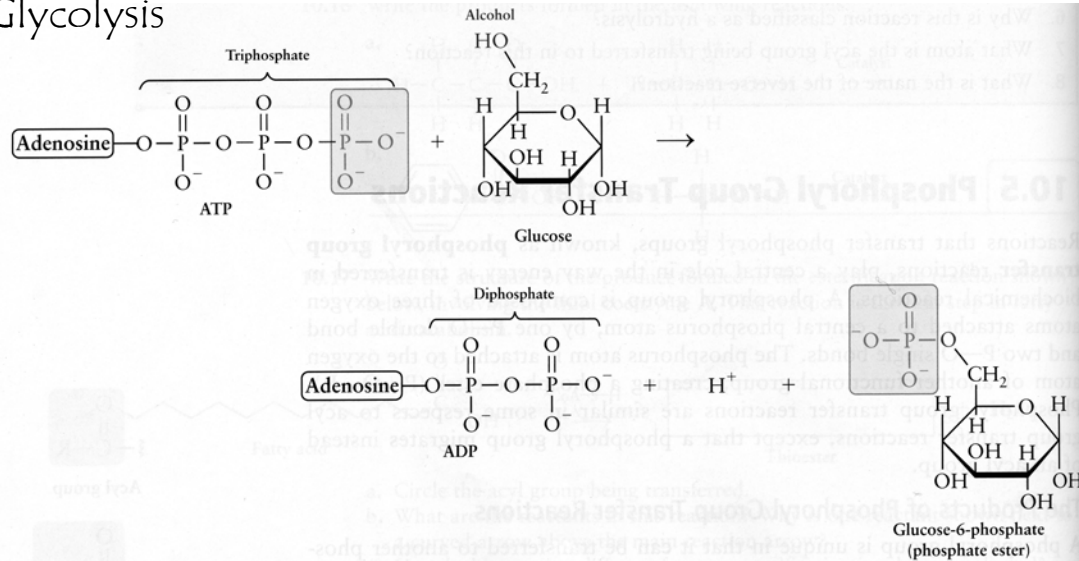


Label the Phosphate groups (Pi), Phosphate ester bonds and Phosphoanhydride bonds in the compound below.



Phosphoryl groups play an important role in glycolysis. Glycolysis is the biochemical pathway that breaks down glucose to produce energy.

1st step of Glycolysis



Phosphoryl groups also play a central role in the way energy is transferred in biochemical reactions. Our body stores and transports energy in the phosphoanhydride bonds of ATP.

Draw an arrow to the phosphoanhydride bond that is broken and reformed as ATP converts back and forth to ADP.

