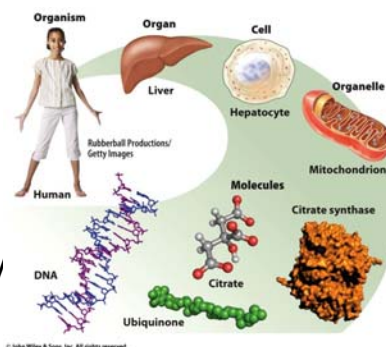


# Intro to Biochemistry

Pratt & Cornely  
Chapter 1

## The Study of Biochemistry

- The Basic Questions
  - What are we made of?
  - How do we store and use energy?
  - How do we pass on genetic information?
- The Language of Chemistry
  - General Chemistry
  - Organic Chemistry



# Fundamentals

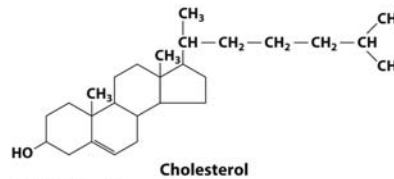
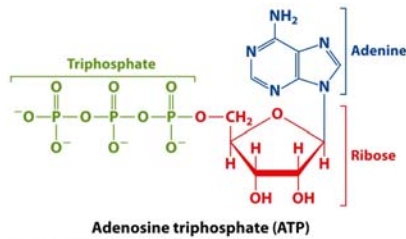
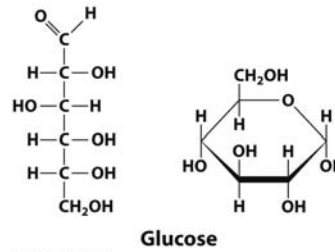
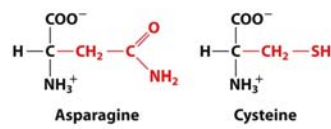
- General Chemistry
  - Thermodynamics
  - Kinetics
- Organic Chemistry
  - Structure
  - Intermolecular forces
  - Reactivity

**TABLE 1-1 Common Functional Groups and Linkages in Biochemistry**

Compound Name	Structure*	Functional Group
Amine <sup>b</sup>	$R-NH_2$ or $RNH_2^+$ $R_2NH$ or $R_2NH_2^+$ $R_3N$ or $R_3NH^+$	$-N-$ or $-NH_2$ (amino group)
Alcohol	$ROH$	$-OH$ (hydroxyl group)
Thiol	$RSH$	$-SH$ (sulfhydryl group)
Ether	$ROH$	$-O-$ (ether linkage)
Aldehyde	$R-C(=O)H$	$-C(=O)H$ (carbonyl group), $R-C(=O)H$ (acyl group)
Ketone	$R-C(=O)R$	$-C(=O)-$ (carbonyl group), $R-C(=O)-$ (acyl group)
Carboxylic acid <sup>b</sup> (Carboxylate)	$R-C(=O)OH$ or $R-C(=O)O^-$	$-C(=O)OH$ (carboxyl group) or $-C(=O)O^-$ (carboxylate group)
Ester	$R-C(=O)OR$	$-C(=O)O-$ (ester linkage)
Amide	$R-C(=O)NH_2$ $R-C(=O)NHR$ $R-C(=O)NR_2$	$-C(=O)NH_2$ (amide group)
Imine <sup>b</sup>	$R=NHR$ or $R=NR_2$ $R=NHR$ or $R=NR_2^+$	$>C=N-$ or $>C=N^+$ (imino group)
Phosphoric acid ester <sup>b</sup>	$R-O-P(=O)(OH)_2$ or $R-O-P(=O)(OH)O^-$	$-O-P(=O)(OH)_2$ (phosphoester linkage) $-O-P(=O)(OH)O^-$ (phosphoryl group, P)
Diphosphoric acid ester <sup>b</sup>	$R-O-P(=O)(OH)_2-O-P(=O)(OH)_2$ or $R-O-P(=O)(OH)O-P(=O)(OH)_2$	$-O-P(=O)(OH)_2-O-P(=O)(OH)_2$ (phosphoanhydride linkage) $-O-P(=O)(OH)O-P(=O)(OH)_2$ (diphosphoryl group, pyrophosphoryl group, PP)

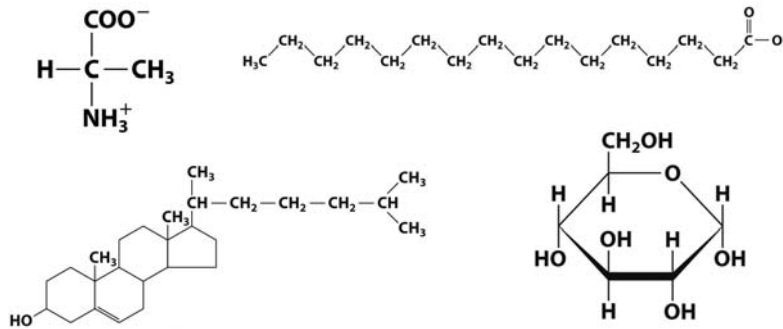
\*R represents any carbon-containing group. In a molecule with more than one R group, the groups may be the same or different.  
<sup>b</sup>Under physiological conditions, these groups are ionized and hence bear a positive or negative charge.  
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# Biomolecules



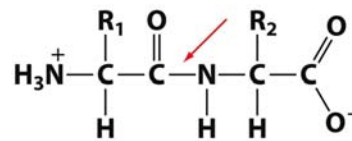
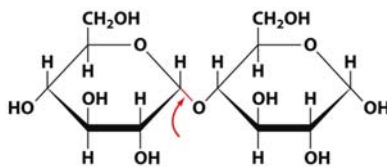
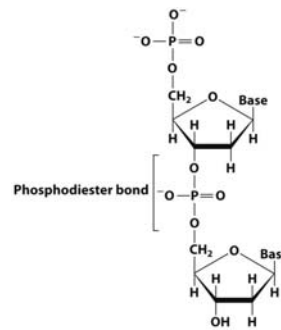
## Problem 17

- Compare the solubilities in water of alanine, glucose, palmitate, and cholesterol. Explain.

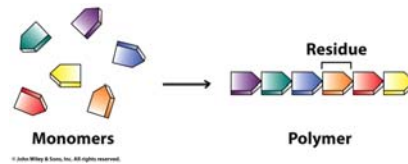


## Biopolymers

- Amino acid → Protein (peptide bond)
- Nucleotide → DNA/RNA (phosphodiester bond)
- Carbohydrate → polysaccharide (glycosidic bond)



## Structure Dictates Function



**[ TABLE 1-2 ] Functions of Biopolymers**

Biopolymer	Encode Information	Carry Out Metabolic Reactions	Store Energy	Support Cellular Structures
Proteins	—	✓	✓	✓
Nucleic acids	✓	✓	—	✓
Polysaccharides	✓	—	✓	✓

✓ major function

✓ minor function

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## Free Energy

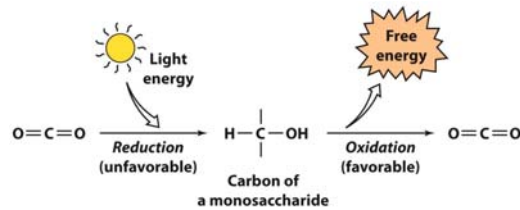
- Enthalpy
- Entropy
- $\Delta G = \Delta H - T\Delta S$
- Spontaneous
- Exergonic
- exothermic

### Problem 35.

Urea dissolves readily in water. The beaker containing the dissolved compound is cold to the touch. What conclusions can you draw about the sign of the enthalpy change and the entropy change for this process?

## Redox Reactions of Carbon

- Oxidation: lose electron(s)
  - Gain C-O/lose C-H
  - Spontaneous
- Reduction: gain electron(s)
  - Gain C-H
  - Nonspontaneous



[ TABLE 1-3 ]

### Oxidation States of Carbon

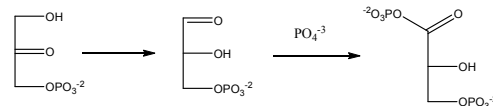
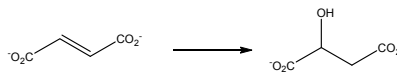
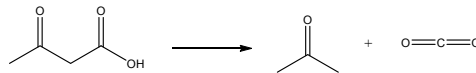
Compound*	Formula
Carbon dioxide most oxidized (least reduced)	O=C=O
Acetic acid	
Carbon monoxide	C≡O
Formic acid	
Acetone	
Acetaldehyde	
Formaldehyde	
Acetylene	H-C≡C-H
Ethanol	
Ethene	
Ethane	
Methane least oxidized (most reduced)	

\*Compounds are listed in order of decreasing oxidation state of the red carbon atom.

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## Oxidation States of Organic Molecules

- Determine Oxidation State of atom
  - +1 for each bond to electronegative atom
  - 0 for bond to same element
  - -1 for bond to hydrogen
- In a reaction, consider all atoms that change
- Oxidation, Reduction, or neither?



# Basic Tour of the Cell

- Prokaryotes vs eukaryotes
- Cellular membranes
  - Environmental equilibrium

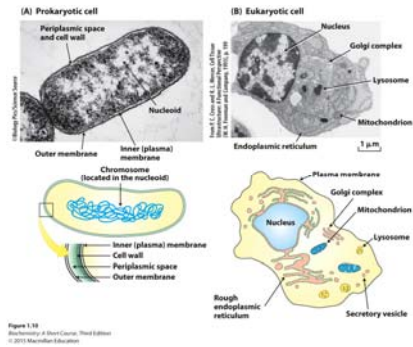
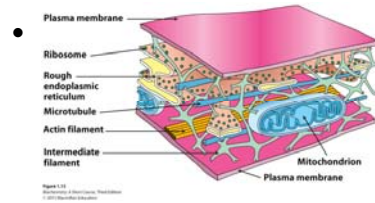


Figure 1.18  
Biology: Principles and Practice, Third Edition  
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