I. METABOLISM – The sum of all chemical reactions within a cell.
   A. Catabolism
   B. Anabolism
   C. Energy Control

II. ENZYMES
   A. Definition
      1. Proteins that are produced by living cells
      2. Catalyze some chemical reactions by lowering the activation energy
      3. Are SPECIFIC for a particular substrate
      4. Not altered themselves
      5. Do not raise the temperature in the cell
   B. Classes Table 5.1
      1. Oxidoreductase – cytochrome oxidase
      2. Transferase – alanine deaminase
      3. Isomerase – glucose-phosphate isomerase
4. Hydrolase – sucrase

5. Lyase – penicillinase

6. Ligase – polymerases

C. Enzyme Components

1. Holoenzyme – The entire enzyme.
   a. apoenzyme – protein portion, largest portion
   b. cofactor
      1) Metal Ion: Iron, Copper, Magnesium, Zinc
      2) Coenzyme: Organic molecule other than protein
         See Table 5.2 – Be sure to look these up.

D. How Enzymes “Work”

1. The substrate ________________________________
2. Complex formed ________________________________
3. The substrate is ________________________________
4. Release of ________________________________

E. Factors Influencing Enzymatic Activity

1. Temperature
   Ideal
2. pH
   Ideal

3. Substrate concentration

4. Inhibitors
   a. competitive
   b. non-competitive

F. Ribozymes
   Unique RNA – Acts as an enzyme on RNA

III. ENERGY PRODUCTION

A. Oxidation-Reduction

B. Metabolic Pathways
   A series of enzymatically catalyzed chemical reactions in which energy is stored in, or released from, organic molecules.

C. Carbohydrate Catabolism – oxidation of carbohydrates

   1. Glucose catabolism
      a. Respiration: The process by which living organisms produce CO₂ and ATP is generated. I.E., organic molecules are oxidized and another molecule is reduced

      1) Glycolysis
         Glucose yields 2 molecules of pyruvic acid and 2ATP
         Glucose is oxidized (gives up electrons and energy)
2) **Kreb’s Cycle – Aerobic**
- Citric acid – 6 carbons
- Each step produces CO$_2$ and ATP
- Has an electron transport chain
- The final electron acceptor is inorganic (O$_2$)
- 38 Total ATP’s for procaryotes
- 36 Total ATP’s for eucaryotes

**Kreb’s Cycle – Anaerobic**
- Not all the steps that are in the aerobic version
- Not as much CO$_2$ and ATP produced
- Final electron acceptor is inorganic but NOT O$_2$
- Growth of organisms is slower

b. **Fermentation**
The enzymatic degradation of carbohydrates in which the final electron acceptor is an organic molecule. Occurs anaerobically (No O$_2$).
- Total ATP produced is less than aerobic respiration
- There is no electron transport system
- The end products are organic:
  - Depend on the organism, enzymes present, and the substrate
- Can use end products to identify organisms

VI. **NUTRITIONAL CLASSIFICATION OF ORGANISMS**

<table>
<thead>
<tr>
<th>Nutritional Type</th>
<th>Energy Source</th>
<th>Carbon Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemoheterotroph</td>
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</tr>
<tr>
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<td></td>
</tr>
<tr>
<td>Photoheterotroph</td>
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<tr>
<td>Photoautotroph</td>
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