I. Laws of Thermodynamics
   A. First: Energy in the universe is a constant
      - cannot be created or destroyed
   B. Second: Entropy increases
      - the universe naturally progresses towards disorder

II. Chemical Reactions
   A. Make or break bonds (Chapter 2.18)
   B. Change molecules
   C. Reactants (substrates)
   D. Products

E. Likelihood of occurrence
   1. depends on energy
      a. is energy input needed?
         - products have more energy than reactants
      b. will the reaction occur spontaneously?
         - products have less energy than reactants
         - energy is “released”

   2. activation energy
      a. energy required to initiate a chemical reaction
      b. high for endergonic reactions, low for exergonic reactions
      c. catalysis
         - process of lowering activation energy
         - can speed up exergonic reaction

II. Enzymes (are catalysts)
   - binds to a molecule in such a way as to make a reaction more likely to occur
   A. Specificity
      1. only specific reactants will fit into enzyme
      2. binding sites (active sites)

   B. Lowers activation energy
1. puts stress on bonds in reactant molecules

2. bring reactants into close proximity or proper orientation

C. Unchanged by reaction
D. Does not alter the nature of the reaction or the end result

II. Control of Enzymatic Reactions
A. Factors influencing rate
   1. temperature

2. pH

3. conc. of cofactors and coenzymes”
   a. cofactors: inorganic
      - metal ions

   b. coenzymes:
      - small organic molecules
      - can transport H atoms from one enzyme to another
      - involved in transfer of electrons

III. ATP
A. Structure
   1. 
   2. 
   3. 

B. Cells dependent on chemical bond energy
   1. this energy is released in exergonic reactions

   2. the “released” energy can be directly transferred to chemical bond energy in products of other endergonic reactions

   3. bond formed between ADP and Pi “conserves” the energy

   4. bond breakage “releases” energy

C. Universal energy carrier
   1. ATP couples the energy release from the breakdown of food to the endergonic processes of the cell
   2. ATP → ADP + Pi
3. used to drive endergonic reactions

IV. Oxidation/Reduction Reactions (Redox)
   Oxidation:

   Reduction: