General

1. The test will cover materials in chapters 33.1-33.6, 34.1-34.7 and 35.1-35.4
2. Understand the concepts of oxidation/reduction and the relationship between the energy storage and transfer molecules.
3. In a reaction be able to identify which steps require energy and which produce energy (from the cell or molecules perspective)
4. Metabolic Pathways
    a. Do not memorize them (they will be given if needed)
    b. Label Anabolic/Catabolic steps
    c. Label energy gain/lose (molecule and cell)
    d. Type of reaction:
        i. Substrate Level Phosphorylation
        ii. Oxidation/Reduction
        iii. Addition/Elimination
        iv. Isomerization
        v. Dehydration/Hydrolysis
        vi. Dehydrogenation
        vii. DO NOT need to know Decarboxylation/Condensation
    e. Functional Groups
    f. Recognize enzymes
    g. Describe what occurs in a reaction

Chapter 33: Bioenergetics

1. Metabolism
2. Anabolism
    a. Builds molecules
    b. Reduce Carbons
    c. Consumes Energy
    d. Examples: Photosynthesis, Gluconeogenesis (Ch 34), Lipogenesis (Ch 35)
3. Catabolism
    a. Breaks molecules down
    b. Oxidize Carbons
    c. Produce Energy
    d. Examples: Digestion, Glycolysis (Ch 34), Citric Acid Cycle (Ch 34), Fatty Acid Oxidation (Ch 35)
4. Oxidation and Reduction
    a. Oxidation: LEO = "Lose electrons oxidation", Gain bonds to O, lose bonds to H, molecule loses energy, energy is a product
    b. Reduction: GER = "Gain electrons reduction", Gain bonds to H, lose bonds to O, molecule gains energy, energy is a reactant
5. Relationship between oxidation number and energy content. Relative energy content of carbohydrates, fatty acids, CH_4, CO_2 and calculate for any other molecules.
6. Energy Diagrams - Recognize how energy flows in various systems.
    a. Energy flow - Figure 33.3
    b. Red/Oxid and Energy Transfer - Figure 33.6

   c. Oxidative Phosphorylation - Figure 33.8
7. Redox coenzymes: NAD^+, $NADP^+$ and FAD
   a. Identify structural features
   b. $\underset{\text{(oxidized form)}}{NAD^+ / NADP^+} + 2e^- + H^+ \underset{\text{release energy}}{\overset{\text{store energy}}{\rightleftharpoons}} \underset{\text{(reduced form)}}{NADH / NADPH}$
   c. $\underset{\text{(oxidized form)}}{FAD} + 2e^- + 2H^+ \underset{\text{release energy}}{\overset{\text{store energy}}{\rightleftharpoons}} \underset{\text{(reduced form)}}{FADH_2}$
8. High Energy Phosphate Bonds (ATP) (Review 31.4 p. 856)
9. Energy Conversion (Phosphorylation)
   a. Substrate-level phosphorylation
      i. Define
      ii. Recognize example in metabolic pathways
      iii. Anaerobic conditions (no O_2)
      iv. Inefficient
      v. Glycolysis (Ch 34)
   b. Oxidative Phosphorylation
      i. Define
      ii. Recognize example in metabolic pathways
      iii. Uses energy directly from redox coenzymes
      iv. Occurs in Mitochondria
      v. Aerobic (Requires O_2)
      vi. Citric Acid Cycle (Ch 34) and Fats (Ch 35)
      vii. FAD $\longrightarrow$ 2 ATP and $NAD/NADP \longrightarrow$ 3 ATP (Figure 33.8)

Chapter 34: Carbohydrate Metabolism

1. Coordination
   a. Energy Usage (ATP, Glycogen, Glucose)
   b. Organs working in concert (Liver, Lungs, Muscle) (Figure 34.2)
   c. Energy Conversion (Glycogen, Glucose, Pyruvate, CAC)(Below Figure 34.2)
2. Glycolysis (ends at lactate)
3. Embden-Meyerhof pathway (ends at pyruvate)
4. $\underset{\text{(oxid. num. = 0)}}{\text{D-Glucose}} + 2\,ADP + 2\,Pi \rightleftharpoons \underset{\text{(oxid. num. = +4)}}{\text{Pyruvate}} + 2\,ATP + 150\,kJ$
5. Very inefficient (only produces 2 ATP, about 2% effecient.)
6. Recycling of pyruvate (BEER!)
7. Pyruvate can enter into the Citric Acid Cycle

Chapter 35: Metabolism of Lipids and Proteins

1. Beta-Oxidation of Fatty Acids (Catabolism)
2. Knoop's theory and the "two-carbon chop"
3. No ATP produced during catabolism.
4. Oxidative because only $FADH_2$ and NADH which are oxidized via mitochondria and oxidative phosphorylation lead to the formation of ATP

5. Yields more energy than glycolysis
6. 147 ATP (Stearic Acid) vs. 111 (3 Glucose)
7. 8.2 ATP/Carbon (Stearic Acid) vs. 6.2 ATP/carbon (Glucose)
8. Fats are used for energy storage
9. Lipogenesis = Biosynthesis of Fatty Acids (Anabolism)
10. Method for converting glucose/proteins to fat for storage
11. Differences between Beta-Oxidation and Lipogenesis
    a. Catabolic vs Anabolic
    b. Beta = Mitochondrria, Lipo = cytoplasm
    c. Different set of enzymes
    d. Beta = CoA, Lipo = ACP
    e. Use of Malnyl-CoA in Lipogenesis