Review Topics Test 4 (Modules 12-14)

1. Recognizing and naming carboxylic acids.
2. Reactions of carboxylic acids:
   a. Ionization in water
   b. Neutralization with a base like NaOH.
   c. Reaction with an alcohol to form an ester (esterification or dehydration)
3. Carboxylic acids with 5 Carbons or less are soluble in water.
4. Recognizing esters.
5. Reactions of esters:
   a. Acid hydrolysis- breaking apart the ester bond while adding water with an acid catalyst, getting back the alcohol and the carboxylic acid.
   b. Base hydrolysis-breaking apart the ester bond while adding NaOH (or KOH), Na to the COO- part and OH to the other side to give an alcohol. This is also called saponification (making soap).
6. Types of lipids:
   a. Saponifiable:
      1. waxes-long chain carboxylic acid and long chain alcohol combine in esterification reaction. A long chain carboxylic acid is also called a fatty acid.
      2. triglycerides or triacyl glycerides-glycerol, a tri alcohol with 3 carbons combines with 3 molecules of fatty acid to form three ester bonds. They can be saturated (fats), or unsaturated (oils).
      3. glycerophospholipids or phosphoglycerides-glycerol combines with 2 molecules of fatty acid to form two ester bonds and the third bond is to a phosphate group which is in turn bonded to an amino alcohol.
   b. Nonsaponifiable: steroids-Contain a steroid nucleus which consists of 3 fused cyclohexane and 1 cyclopentane rings.
7. All lipids are insoluble in water. Their functions vary. They serve as foods (fats and oils), structural elements of cell membranes (glycerophospholipids), protective coatings (waxes), hormones (steroids), Steroids include cholesterol, estrogen and testosterone.
8. Reactions of waxes and triglycerides:
   a. Acid hydrolysis-breaking apart the ester bond while adding water. Obtain fatty acids and alcohols or in the case of triglycerides fatty acids and glycerol.
   b. Base hydrolysis-breaking apart the ester bond while adding NaOH or KOH. Add OH to the part that originally came from the alcohol in the case of waxes or glycerol in the case of triglycerides and the Na+ to the part that came from the fatty acids. This sodium salt of the fatty acids is soap. This reaction is also called saponification.
   c. Hydrogenation of unsaturated triglycerides to eliminate double bond and give saturated triglycerides.
9. The waxes and the triglycerides can be formed from the reaction of the alcohols (glycerol in the case of the triglycerides) and the fatty acids.
10. Fats are saturated (only single bonds), come from animals mostly and are solids at room temperature. They have low melting points. Oils are unsaturated or polyunsaturated (one or more double bonds), come from plants and are liquid at room temperature. They have high melting points. The unsaturated oils are cis. Upon hydrogenation they are mostly converted to saturated (like lard and margarine, which are solids) but some are converted to trans unsaturated , which is unhealthy.
11. The cleaning action of soap is due to the ionic heads (sodium or potassium salt of a fatty acid), which is hydrophilic and therefore dissolves polar and ionic grime and also dissolves in water and the actual C-H part of the fatty acid long chain which is hydrophobic and dissolves nonpolar grime like oils.

12. Glycerophospholipids also have a polar part and a nonpolar part. They are used as the major component of cell membranes and they disallow organic nonpolar substances from entering the cell. They allow some polar ones to enter through tunnels formed utilizing also some proteins that are present.
13. Recognizing amines and amides. Naming amines and recognizing if they are primary, secondary or tertiary.
14. Reactions of amines:
a. Ionization in water due to the fact that they are basic (they are derivatives of ammonia, NH3).
b. Reaction with carboxylic acids to form amides. This is a dehydration reaction similar to esterification.
15. Amines have unpleasant smells while esters have very pleasant smells (perfumes, fruits, etc.).
16. Reaction of amides: Hydrolysis to add water and break amide bond and form the original amine and carboxylic acid. Catalyzed by enzymes.
17. Essential fatty acids (long chain carboxylic acids) have to be consumed from the diet, cannot be synthesized by the body.

These are the review topics for module 15:

1. Functions of proteins.
2. General structure of amino acids: H2NCHRCOOH
3. These are alpha amino acids, the C is the alpha carbon and it is chiral except when R is H in which case you have glycine.
4. There are 20 common amino acids, 10 are essential, must be obtained from the diet.
5. Know the R groups for glycine (H) and alanine)CH3).
6. There are different types of R groups: hydrophobic (C and H only), one of these is aromatic; other aromatic R groups that also contain other elements, N or O; basic (contain amine group), acidic (contain carboxylic acid group), thiol (contain S), amide group, alcohol group.
7. The amino acids are linked together after reacting in a dehydration reaction where the C that has the carbonyl group is bonded to the N of the next amino acid molecule. The bond is a peptide bond and it is also an amide bond.
8. You can have dipeptides, tripeptides, polypeptides or proteins (more than 50 AA).
9. The order of amino acids is the sequence and it makes a difference.
10. Amino acids at the isoelectric point exist as zwitterions. The N of the amine group has gained an H+ and is positive and the O if the OH group of the carboxylic acid group has lost the H+ and is negative.
11. At pH's lower than the isoelectric point (more acidic conditions), the COO- will gain the H+ back and the only charge is on the N of the amine group.
12. At pH's higher than the isolelectric point (more basic conditions), the NH3+ will lose the H+ and will not longer have a + charge. The only charge will be on the COO- group.
13. AA will migrate in an electric field according to the charges they have at a particular pH since + charged ones migrate to the negative pole and vice versa.
14. Proteins have four structures:
a. Primary is the AA sequence.
b. Secondary is a result of H bonding between AA in sequence. This results in alpha helix, beta pleated sheet or triple coil of AA chains. These H bondings are between H on main amino group and O of carbonyl group of the main carboxylic acid group of amino acids
c. Tertiary is a result of interactions of R groups on AA that are attracted to one another and results in a 3 dimensional arrangement that is folded irregularly. The interactions include H-bonding, hydrophobic interactions, salt bridges and disulfide bridges.

d. Quarternary is a result of the same interactions as tertiary but between separate AA chains.

15. Know the factors that can denature a protein.

16. Enzymes are a common type of proteins (one of the functions), and they catalyze chemical reactions in organisms by lowering the energy of activation of the reaction. They usually but not always have ending -ase and they take on the name of the function they are associated with. e.g. sucrase is an enzyme that catalyzes the hydrolysis of sucrose.

16. Know the steps involved in enzyme action:

a. Formation of the E-S complex

b. Transformation to the E-P complex

c. Separation of the E from the S.

17. Be able to distinguish between competitive and noncompetitive inhibitors. (competitive bind to the active site of the enzyme whereas a noncompetitive bind to a position away from the active site of the enzyme).

18. Know the factors that affect the rate with which an enzyme catalyzes a reaction, substrate conc., enzyme conc., temp., and pH.

19. Know what a cofactor is. It is a metal ion activator or an organic compound (in this case it is called a coenzyme). These cofactors combine with a simple protein to generate a more complicated protein called a conjugated protein that acts as an enzyme.