Review Topics Test 3-Modules 9-11

1. Organic compounds-Have C, H and sometimes O, N, or a halogen.
2. Hydrocarbons have C and H only.
3. Hydrocarbons are nonpolar and not soluble in water.
4. Carbon always has 4 bonds: 4 single bonds, 1 double and 2 single bonds, or 1 triple and 1 single bond.
5. Hydrocarbons can be:
   a. alkanes: CnH2n+2 4 single bonds on each carbon.
   b. alkenes: CnH2n 1 double and 2 sigle bonds on one of the carbons only.
   c. alkynes: CnH2n-2 1 triple bond and 1 single bond on one of the carbons only.
   d. cyclic alkanes: CnH2n Only single bonds, ring structure
   e. cyclic alkenes: CnH2n-2 Only one double bond, ring structure.
   f. aromatic hydrocarbons: Three double bonds, 6 carbon ring. They can alternate positions so it is often shown with a circle inside. The basic molecule is called benzene.
6. Know the nomenclature of all of the above. Always look for the longest chain, except in cyclic. Substituents are named alphabetically. Number the carbons so that smallest possible numbers are assigned to substituents. Know the names of the alkyl groups. Remember that if more than one use di-, tri, tetra, etc.. These prefixes don't count for the alphabet. Isopropyl the I is the alphabet letter that counts.
7. If Cl, F, Br or I are present you will have a haloalkane, etc..
8. Cis trans isomers for alkenes. Remember that you have cis trans isomers when neither of the double bonded C has two of the same groups on it.
9. Know the ortho (or o), meta (or m), and para (or p) nomenclature for aromatic hydrocarbons in addition to the numbering method (1,2, 1,3, or 1,4). Also know the names benzene and toluene.
10. Structural isomers. These are those that have the same condensed formula, e.g. $C_4H_4Cl_2$ but different structural formulas.
11. If -OH is attached you have an alcohol. The ending becomes -anol. This takes precedence as being the lowest possible number C. For cyclic alcohols, OH is always C #1. You can have 1^o, 2^o, or 3^o alcohols.
12. If C=O present this is called a carbonyl group. If it is on an end C it is an aldehyde (CHO), will be on C#1 and the ending -al. If not a ketone, ending -one. This C will have lowest possible number. If cyclic it will be C #1.
13. If -COOH (C=O you have a carboxylic acid. The names end in -ic acid. The C will be C #1.
    I
    OH)

14. If C-O-C you have an ether. You don't need to know how to name these.
15. If organic compound contains oxygen the rule of thumb (exceptions are the ethers) is that 5 C or less they are soluble in water. More than 5 they are not soluble in water.
16: Reactions:
   a. alkanes: halogenation only. Need energy in the form of heat (triangle symbol) or UV radiation.
   b. alkenes: all reactions are additions across double bond. You can have addition of H2 (hydrogenation), X2 where X is a halogen (halogenation), HX (hydrohalogenation), or H2O. (hydration). You always get rid of the double bond and you end up with only single bonds. HX and H2O the H adds to the C that has more H's already. (Markovnikov's rule).
   c. alkynes: hydrogenation (add H2) to give alkene, a second one to give alkane.
   d. alcohols: high temperature dehydration to give alkenes (removing -OH and -H from adjacent carbons), oxidation of 1^o alcohols to give aldehydes (mild) or carboxylic acids (complete). Oxidation of 2^o alcohols to give ketones. 3^o alcohol-no oxidation possible.
   e. aldehydes: oxidation to give carboxylic acid.
   f. ketones: no oxidation possible.
   g. Know the reaction of alcohols with aldehydes to form hemiacetals and alcohols with ketones to form hemiketals. This is the same reaction that occurs when the Fisher projection of the monosaccharides become cyclic to form the Hayworth projection.

h. Know reduction reaction of aldehydes and ketones to form alcohols.

17. Carbohydrates are one of the food groups. They have formula Cn(H2O)n. They are also called saccharides or sugars. If only one unit-monosaccharide, two are disaccharides, many are polysaccharides.

18. Know the following about carbohydrates:

a. aldose or ketose

b. triose, tetrose, pentose, hexose depending on the number of carbons. If 5 C and aldehyde group it is an aldopentose, etc..

c. Know that if the -OH on the next to the last C is pointing to the right, it is a D sugar, L if to the left.

d. The three monosaccharides to know are: glucose and galactose (both aldohexoses), and fructose (ketohexose). They are all isomers of each other.

f. Know that two monosaccharides react in a dehydration reaction removal of a water molecule (HOH) to produce a disaccharide. A glycosidic linkage is formed. This is an ether like linkage (-C-O-C-)

g. The disaccharides you need to know are: maltose (2 glucose molecules), lactose (1 galactose and 1 glucose), and sucrose (1 sucrose and 1 fructose).

h. The monosaccharides that have six carbons can also be formed with a Hayworth projection. (The straight chain vertical is a Fisher projection). In the Fisher the first C for aldoses is at the top and is C #1. For ketoses it is C #2. When you form the ring of the Hayworth projection the O in C #5 bonds to C #1 for aldoses and forms a six membered ring (one of the members of the ring is O of carbon 5). For ketoses the O in C#5 bonds to C #2 and a five membered ring is formed. (one of the members of the ring is O here as well). If the OH that is formed in C #1 for aldoses points down once the ring is formed it is an alpha structure. If it points up it is a beta structure.

i. For the disaccharides please be able to identify if you have alpha 1,4, beta 1,2, etc. glycosidic linkages if given the structures. You have to know the numbering of the C atoms in the rings.

j. If you are given the Haworth structures be able to identify if it came from an aldohexose (6 membered ring) of a ketohexose (5 membered ring).

k. If a disaccharide undergoes hydrolysis (adding water, HOH across the glycosidic linkage), then the individual monosaccharides are obtained.

l. Oxidation of aldoses gives a carboxylic acid group instead of the aldehyde group. If it is positive to this it is said to be a positive Benedict's test. Sugars that give positive Benedict's test are reducing sugars.

m. Since fructose can transform itself into glucose it is also capable of giving a positive Benedict's test.

n. The only disaccharide that is negative to Benedict's test is sucrose. After hydrolysis fructose and sucrose are obtained and then it is positive to Benedict's test.

o. Hydrolysis is the reverse reaction of dehydration.

p. All carbohydrates, just as all hydrocarbons, alcohols, etc.. (all organic compounds) can undergo combustion. This is the reaction with oxygen gas to produce carbon dioxide, water and energy.

q. Photosynthesis (occurs in plants) is the opposite reaction to respiration, which is the combustion of glucose (occurs in animals, including humans).

r. Polysaccharides are long chains of glucose molecules, joined by glycosidic linkages. Know the polysaccharides amylose (alpha 1, 4 linkages, component of starch, straight chain), amylopectin (component of starch, branched, alpha 1, 4 and 1,6 linkages), cellulose (straight chain, contains beta 1,4 glycosidic linkages, not digestible by humans), and glycogen (present in muscle, alpha 1,4 and 1,6, more branched than amylopectin).

s. Polysaccharides are all negative to Benedict's test but they are all positive to iodine test. They can be hydrolyzed into glucose molecules and then they are positive to Benedict's test.

t. You can tell that you have a positive Benedict's test when the blue solution turns brick red and forms a solid precipitate.

u. Iodine test turns the solution blue black from the original orange solution. (Only positive for polysaccharides).