SBI4U: Biology, Grade 12, University Preparation

Unit 1: Biochemistry
Activity 1: Chemistry of Life

Teacher Notes

Assignment 1

1. Define the following: atomic mass, atomic number, isotopes, organic chemistry, molecules, and compounds.
   See: http://staff.jccc.net/pdecell/chemistry/chemtext.html

2. Explain the terms: energy levels, orbitals and valence electrons
   See:
   http://www.mhhe.com/physsci/chemistry/carey/student/olc/ch01atoms.html

3. Using electron dot diagrams describe the difference between a covalent bond, ionic bond and polar covalent bond.
   See: http://www.visionlearning.com/library/module_viewer.php?mid=55

4. Give the electron dot diagram for N, O, S, H_2O, and methane.
   See: http://www.visionlearning.com/library/module_viewer.php?mid=55
   + notes from content section

5. Describe intermolecular forces and compare this to intramolecular forces.
   Intermolecular forces – forces between molecules that hold molecules together and intramolecular forces – forces that are inside molecules holding them together such as ionic and covalent bonds.

6. What is electronegativity and the term polarity? How do these affect covalent bonding?
   See: http://en.wikipedia.org/wiki/Chemical_bond

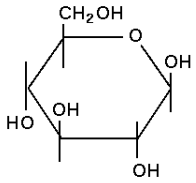
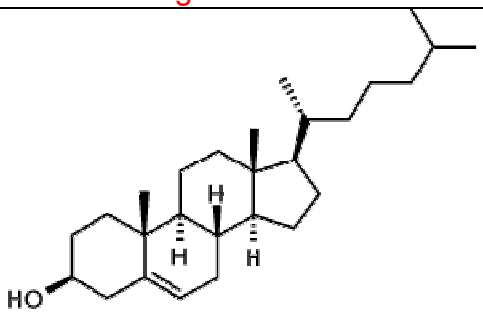
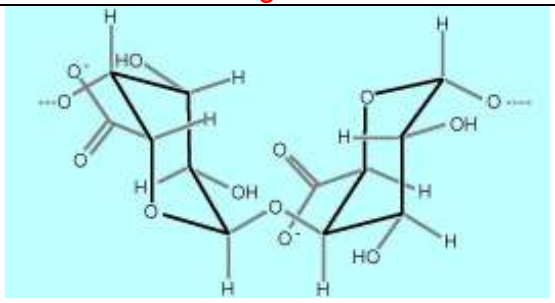
7. Using the term, electronegativity and polarity, explain a hydrogen bond.
   See: http://www.morris.umn.edu/~goochv/CellBio/lectures/water/water.html

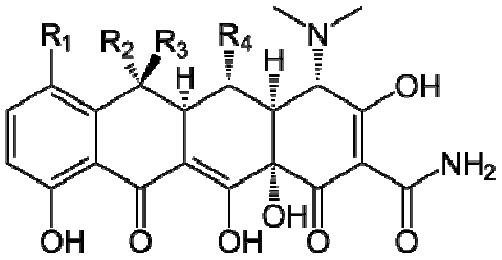
8. Explain why water is considered the universal solvent?
   See: http://www.hbci.com/~wenonah/hydro/h2o.htm

Assignment 2

Questions

1. For the following molecules, circle and name the functional groups

a) Glucose	- ketone - hydroxyl	 D-glucose <<images/glucose.png>> <<alt tag information "A structural diagram of the ring structure of glucose.">>
b) cholesterol (lipid)	- ring structures - hydroxyl	 <<images/cholesterol.png>> <<alt tag information "A structural diagram of cholesterol – a large molecule.">>
c) pectin (polymer)	- ring structures ketones/carbonyls - hydroxyls	 <<images/pectin.jpg>> <<alt tag information "A structural diagram of pectin – a large molecule.">>

d) tetracycline (antibiotic)	- amino group - hydroxyl group - ketone/carbonyl - ring structure - aromatic structure	 <<images/tetracycline.svg>> <<alt tag information "A structural diagram of tetracycline – a large molecule.">>

1. Explain the difference between a hydrocarbon in a ring structure and that of an aromatic compound.
   A ring structure does not have alternating double bonds like in an aromatic compound.

2. Explain why a functional group would increase the solubility of a molecule in water.
   Functional groups have electronegative elements in them, making them polar and able to dissolve in water.

3. Explain the terms monomer and polymer. Give two examples of synthetic and natural polymers and give their monomers.
   Monomers are the repeating unit that makes up a polymer. Answers may vary.

Assignment 3

Identify the following types of reactions. Circle the functional groups.

1. Condensation, Dehydration
2. Reduction
3. Oxidation
4. Reduction
5. Condensation, Dehydration, Esterfication

Assignment 4

1. What functional groups come together when a glycerol connects to a fatty acid?
   carboxyl & hydroxyl groups

2. Distinguish between a saturated and unsaturated fatty acid. Why do polyunsaturated fatty acids tend to be liquids at room temperature?

Saturated fatty acid – no double bonds & solids at room temperature. – animal fats
Unsaturated fatty acid – has 1 or more double bonds & liquid at room temperature – oils
Saturation lowers the melting point

3. Give the biological functions of steroids, proteins, and triglycerides.
   Steriods – hormones & structure of membranes
   Proteins – structure & enzymes
   Triglycerides – for energy storage & insulation

4. What functional groups do all amino acids have in common?
   Amino & carboxyl group

5. Distinguish between a protein and a polypeptide.
   A protein is a biological molecule made of polypeptide chains.
   A polypeptide is a chain of 3 or more amino acids formed by a peptide linkage.

6. Explain what denaturing a protein refers to and how can this happen?
   Denaturation means to destroy a protein's function by destroying its structure.
   Done by heat, temperature, pH, chemicals

7. Egg whites are made from a protein called albumin. Describe the appearance of a raw egg and that of a cooked egg. Account for the difference in appearance before and after cooking.
   A cooked egg is where the albumin is denatured, ultraviolet rays

8. Distinguish between an oligosaccharide and a polysaccharide and give an example of each.
   Oligosaccharides are two or more sugars connected by glycosidic linkages.
   Polysaccharides are many (1000s) of simple sugars linked together – they are complex.

9. Detergents are amphiphilic molecules. This means that one end likes water and the other end of the molecule hates water. Explain how detergents work.
   One end attaches to oil/dirt and the other end attaches to water allowing both to mix.

10. Why is a phospholipid like detergent? Why is its structure important in the cell membrane?
    It is like detergent in that it is amphiphilic. It is the main component of the cell membrane where the hydrophilic heads face out toward the inside and outside of the cell. The hydrophobic tails face each other, not allowing things to pass through.

11. Distinguish between essential and nonessential amino acids. Why is important to have a balanced diet in terms of protein?
    Essential amino acids are ones which your body cannot make while nonessential amino acids are produced by the body. It is important to have all 20 amino acids available to you and some must come through the diet.

12. What type of bonds and forces hold protein structure together. Which is the strongest?
    Peptide linkages or covalent bonds, intermolecular forces between amino acids, disulphide linkages and H-bonds. The strongest is covalent bonds and disulphide linkages.

13. What does the term “like dissolves like” mean?
    Water loving substances dissolve in water (or polar molecules dissolve in polar solvents)
    Water hating substances dissolve in nonpolar solvents

14. What is chitin and some of its uses?
    Chitin is a complex polysaccharide found in the hard shell of insects and also used surgical thread

 **Assignment 5**

Food testing Lab: The answers for the food testing data testing sheet can be found in the doc files (Food_Testing_Data_Sheet_Answers.rtf)