Exercise 3. Biomolecules Answer Key Worksheet

On all of the models, carbon (C) is black, hydrogen (H) is white, oxygen (O) is red, and nitrogen (N) is blue. The connecting rods represent covalent bonds (don’t worry about the color of the bonds). Study the models at each station and answer the questions below.

Station #1
1. Name the general type of molecule shown at this station (both molecule A and molecule B). carbohydrate; monosaccharide or simple sugar

2. Name the specific molecule or type of molecule labeled A. glucose (a hexose)

3. Write the molecular formula of molecule A. C₆H₁₂O₆

4. Is this molecule polar or non-polar? Explain your answer.
   Polar. It has many polar hydroxyl (–OH) groups attached to the carbon atoms of the molecule.

5. What is the primary function of molecule A in body cells?
   Glucose is a major energy source for most body cells and is required by the CNS.

6. Name the specific molecule or type of molecule labeled B. ribose (a pentose)

7. Name one major function of molecule B in body cells (Hint: what larger molecule(s) contain molecule B?)
   Ribose is a component of nucleotides, which are the building blocks of nucleic acids (RNA and DNA; DNA contains deoxyribose). ATP also has a nucleotide structure and contains ribose.

Station #2
1. Name the general type of molecule shown at this station (both molecule C and molecule D). fatty acids

2. Name the specific type of molecule labeled C. a saturated fatty acid

3. Name the specific type of molecule labeled D. an unsaturated fatty acid

4. What is the functional significance of the C=O double bond in molecule D?
   The double bond creates a bend in the fatty acid chain. As a result, unsaturated fats are more liquid than saturated fats at physiological temperatures.

5. List two specific types of larger molecules that contain the molecular units (monomers) represented by molecules C and D. triglycerides and phospholipids

6. List two important functions of these types of molecules in the body.
   Triglycerides function for energy storage, mostly in adipose tissue. Phospholipids are the major structural molecules of cell membranes.
Station #3
1. Name the type of molecule shown at this station. amino acid

2. What class of macromolecules are composed of monomers represented by this molecule? polypeptides or proteins

3. The molecule with the group labeled \( R_1 \) is called glycine. Substitute \( R_1 \) with the group labeled \( R_2 \). This molecule is now called alanine. Is the \( R_2 \) group polar or non-polar? non-polar

4. Substitute \( R_2 \) with the group labeled \( R_3 \). This molecule is called serine. Is the \( R_3 \) group polar or non-polar? polar

5. Explain why the properties of the \( R \) groups (non-polar, polar, or charged) are important in terms of higher-level molecular structure.
   Interactions among the \( R \) groups (such as hydrogen bonds, sulphur–sulphur bonds, and hydrophobic interactions) largely determine the tertiary structure of a protein. The \( R \) groups also affect the shape and charge configuration of functional sites on the protein surface.

Station #4
1. What is the name of this molecule? deoxyribonucleic acid (DNA)

2. Name the general class of the chemical group labeled \( X \). nitrogenous base (purine)

3. Name the four possible specific identities of chemical groups \( X \) and \( Y \), and identify which are purines and which are pyrimidines.
   adenine (A), purine
guanine (G), purine
cytosine (C), pyrimidine
thymine (T), pyrimidine

4. What type of chemical bonds connect group \( X \) with group \( Y \)? hydrogen bonds

5. What is the specific identity of group \( X \)? guanine
   Explain how you can determine this (without knowing the entire molecular structure of \( X \)).
   Since it has 2 rings, it must be a purine, either A or G. Group \( X \) forms 3 hydrogen bonds with its complementary base on the opposite strand, so this must be a G–C base pair (since the A–T base pair forms only 2 hydrogen bonds). Therefore, group \( X \) is guanine.

6. What is the specific identity of group \( Y \)? cytosine
   It is a pyrimidine that forms 3 hydrogen bonds, and is base-paired with G.