

# The Chemistry of Life

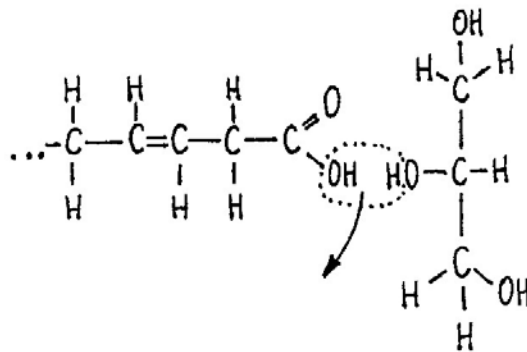
## Part A - Multiple Choice Questions

- Which of these adjectives does **NOT** apply to a water molecule?
  - Bent.
  - Polar.
  - Organic.
  - Covalent.
- The polar nature of water molecules is caused by the
  - its ability to act as a solvent.
  - the cohesiveness among molecules.
  - the unequal sharing of electrons within a molecule.
  - the potential to form hydrogen bonds with neighboring water molecules.
- Which of the following **BEST** describes the “bonds” holding liquid water molecules together?
  - Ionic.
  - Covalent.
  - Adhesion.
  - Hydrogen.
- Which of the following is the **BEST** description of the location of a hydrogen bond?
  - Between the oxygen atoms of two water molecules.
  - Between the hydrogen and oxygen atoms within a water molecule.
  - Between the oxygen of one molecule and the hydrogen of another molecule.
  - Between the hydrogen of one molecule and the hydrogen of another molecule.
- The most abundant molecule in the human body is
  - organic and ionic.
  - inorganic and ionic.
  - organic and covalent.
  - inorganic and covalent.
- When a portion of a molecule attracts and receives electrons from the rest of the molecule, it gains a
  - low pH.
  - high pH.
  - dipole.
  - + dipole.
- The water in an organism’s body helps
  - reactions occur.
  - transport molecules.
  - maintain body temperature.
  - All of the above choices are true.
- Which of the following is **LEAST** related to the water present in humans?
  - Hair growth.
  - Food digestion.
  - Urine excretion.
  - Nutrient distribution.
- Since pure water is neutral, it contains
  - only hydrogen ions.
  - only hydroxide ions.
  - an equal number of hydrogen and hydroxide ions.
  - seven times more hydrogen than hydroxide ions, giving it a pH of 7.

10. The pH of blood is slightly basic. Which of the following is the most probable pH for blood?
- 4.8
  - 6.7
  - 7.3
  - 10.8
11. The higher the pH value, the
- lower the pH number.
  - more basic the solution.
  - more acidic the solution.
  - greater the  $H^{1+}$  concentration.
12. Which of the following **BEST** describes an acidic solution?
- Lots of  $H^{1+}$  present.
  - Lots of  $OH^{1-}$  present.
  - More  $H^{1+}$  than  $OH^{1-}$  present.
  - More  $OH^{1-}$  than  $H^{1+}$  present.
13. A particular organ receives alkaline secretions. It produces a buffer to prevent the pH from rising above 8.3. This buffer **MOST LIKELY**
- releases  $OH^{1-}$ .
  - bonds with  $H^{1+}$ .
  - bonds with  $OH^{1-}$ .
  - dissociates to release both  $H^{1+}$  and  $OH^{1-}$ .
14. Potassium hydroxide dissociates into  $K^{+1}$  and  $OH^{-1}$  and is therefore
- a base.
  - an acid.
  - a neutral substance.
  - a solvent for non-polar substances.
15. Which statement is correct regarding acids and bases?
- Acids combine with bases to form buffers.
  - Acids lower the pH, and bases raise the pH.
  - Acids are harmful but bases are not harmful.
  - Acids combine with  $H^{+1}$ , and bases combine with  $OH^{-1}$ .
16. What do you predict would happen to the pH if a small amount of a weak base were added to a solution that was properly buffered at a pH of 6.0?
- The pH would drop.
  - The pH would not change.
  - The pH would rise sharply.
  - The pH would increase slightly.
17. Which of the following pairs is mismatched?
- Blood; pH = 7.35
  - Gastric juice; pH = 2.5
  - Salivary juice; pH = 10.3
  - Pancreatic juice; pH = 8.5
18. Which of the following **BEST** describes the synthesis of a polymer?
- Amino acids taking up excess hydrogen ions.
  - Joining monosaccharides and removing water.
  - Forming water by combining an acid and a base.
  - Adding water to break a polypeptide into amino acids.

19. A good example of hydrolysis is the reaction of
- RNA into nucleotides with the release of water.
  - two amino acids to form a dipeptide with the utilization of water.
  - two monosaccharides to form a disaccharide with the release of water.
  - a neutral fat to form glycerol and fatty acids with the utilization of water.
20. Which of the following equations shows a synthesis reaction?
- acid + base  $\longrightarrow$  salt + water
  - ATP  $\longrightarrow$  ADP + P + energy
  - protein + water  $\longrightarrow$  amino acids
  - glucose + glucose  $\longrightarrow$  maltose + water
21. Which type of biochemical has this empirical formula:  $\text{CH}_2\text{O}$  ?
- Lipid.
  - Protein.
  - Nucleic acid.
  - Carbohydrate.
22. Which of the following molecules has the empirical formula of  $\text{CH}_2\text{O}$ ?
- ATP
  - DNA
  - Ribose
  - Glycerol.
23. Which of the following is **NOT** a polysaccharide?
- Starch.
  - Glycerol.
  - Cellulose.
  - Glycogen.
24. In order to convert a saturated fatty acid to an unsaturated fatty acid, it is necessary to
- add hydrogen and add double bonds.
  - remove hydrogen and add double bonds.
  - add hydrogen and remove double bonds.
  - remove hydrogen and remove double bonds.

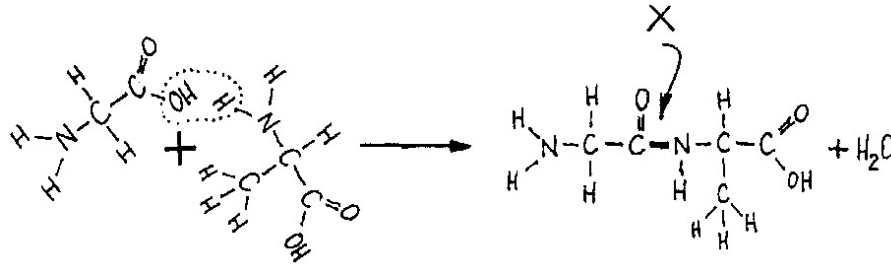
Use the following diagram to answer the next question.



25. What product would be formed if the process illustrated was repeated two more times with the same molecule on the right?
- Tripeptide.
  - Triglyceride.
  - Trinucleotide.
  - Trisaccharide.

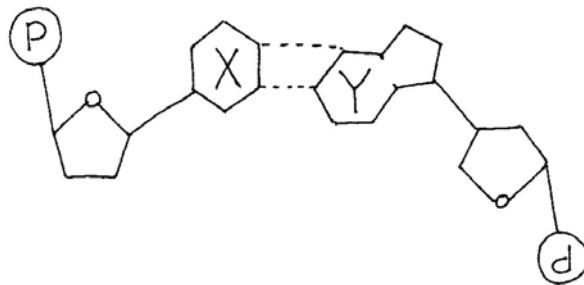
26. The hydrolysis of a neutral fat results in the formation of
- glycerol and fatty acids only.
  - glycerol, fatty acids and water.
  - amino acids and fatty acids only.
  - amino acids, fatty acids and water.
27. Which biochemical would **MOST** likely be found as a component of a cell membrane?
- Hormone.
  - Triglyceride.
  - Disaccharide.
  - Phospholipid.
28. Which type of bond exists between the bases in a DNA molecule?
- Ionic.
  - Peptide.
  - Covalent.
  - Hydrogen.
29. Which of the following is found in plant cell walls and accounts for their strength?
- Cellulose.
  - Glycogen.
  - Cholesterol.
  - Phospholipid.
30. Which of the following molecules is stored in the liver as a polymer and broken down when the body needs energy?
- Starch.
  - Maltose.
  - Glucose.
  - Glycogen.
31. What is a phospholipid composed of?
- cholesterol, glycerol, fatty acids.
  - phosphate group, cholesterol, protein.
  - fatty acids, phosphate group, glycerol.
  - glycerol, amino acids, phosphate group.
32. Which of the following is **NOT** a function of neutral fat in the human body?
- Offset the effect of pH changes.
  - Insulate against temperature loss.
  - Cushion tissues and organs from damage.
  - Storage of chemical energy for potential ATP production.
33. Upon chemical analysis, a particular protein was found to contain 108 amino acids. How many peptide bonds are present in this protein?
- 106
  - 107
  - 108
  - 109
34. When two amino acids are joined together, the resulting molecule is a
- dipeptide.
  - diglyceride.
  - disaccharide.
  - dinucleotide.

Use the following diagram to answer the next question.



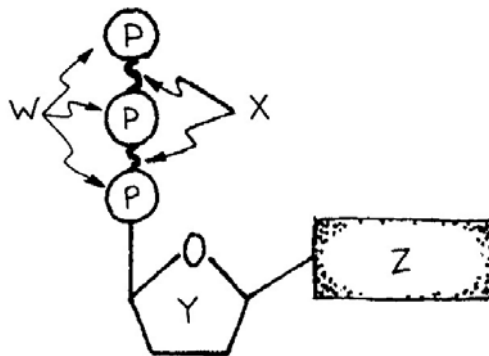
35. The bond marked **X** is produced by this reaction. What type of bond is **X**?
- Ionic.
  - Peptide.
  - Hydrogen.
  - Electrostatic.
36. Which level of protein structure consists of an alpha helix bent and folded into a 3-D shape?
- Primary structure.
  - Secondary structure.
  - Tertiary structure.
  - Quaternary structure.
37. Denaturing a protein is usually a result of the loss of
- primary structure.
  - secondary structure.
  - tertiary structure.
  - quaternary structure.
38. The helical portion of a polypeptide consists of
- a sequence of "R" groups only.
  - ...RCC...RCC...RCC...RCC... etc.
  - ...NCC...NCC...NCC...NCC... etc.
  - ...P – sugar...P – sugar...P – sugar...etc.
39. RNA is composed of a series of
- purines.
  - nucleotides.
  - pyrimidines.
  - amino acids.
40. Which of the following is **FALSE** about RNA and DNA?
- RNA contains uracil, but DNA does not.
  - RNA is single stranded where DNA is double stranded.
  - RNA is a cytoplasmic molecule where DNA is a nuclear molecule.
  - Each sugar molecule in RNA has more oxygen than the ones in DNA.
41. Which of these combinations would be found in a nucleotide?
- base – acid – salt
  - DNA – RNA – water
  - base – sugar – phosphate
  - adenine – thymine – uracil

Use the following diagram to answer the next question.



42. Which of the following could be true?
- X = uracil; Y = adenine.
  - X = adenine; Y = thymine.
  - X = guanine; Y = cytosine.
  - X = cytosine; Y = guanine.

Use the following diagram to answer the next question



43. What part of the molecule above allows it to serve as the “energy currency” in cells?
- W
  - X
  - Y
  - Z
44. ATP is significant in cells because it
- contains adenine
  - stores ribose for RNA.
  - has high energy bonds.
  - is a unit molecule for chromosomes.
45. Which of the following is the **BEST** description of ATP?
- A specialized RNA nucleotide with a purine base.
  - A specialized DNA nucleotide with a purine base.
  - A specialized RNA nucleotide with a pyrimidine base.
  - A specialized DNA nucleotide with a pyrimidine base.

## Part B. Written Answer Questions

1. Describe **ONE** difference between each of the following pairs of terms.
  - a. saturated vs. unsaturated
  - b. ribose vs. deoxyribose
  - c. carboxyl group vs. amine group
2. Explain the significance (or use of) each of the following substances *in the human body*.
  - a. glycine
  - b. glycerol
  - c. glucose
  - d. glycogen
  - e. guanine
3. Define each of the following and give an example that relates to molecules *in the human body*.
  - a. buffer
  - b. dissociate
  - c. polypeptide
  - d. helix
  - e. cohesion
4.
  - a. Describe the structure of a water molecule.
  - b. How does this structure contribute to its unique properties?
  - c. Name three ways that water is important *in a cell*.
5. Metabolism is a combination of synthesis and hydrolysis reactions. Using molecules of your choice, explain the relationship between these two processes.
6. Why is the chemical formula of maltose not a multiple of its empirical formula?
7. Suggest three variables in the structure of neutral fats that contribute to their tremendous diversity.