

Study Guide – Answer Key

Biochemistry

Potential Short Answer Questions

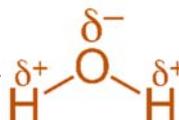
1. Distinguish between ionic and covalent bonds using two criteria.
Ionic bonds form between a metal and a non-metal. Electrons are gained or lost.
Covalent bonds form between two non-metals sharing electrons.

2. What makes a molecule “organic”?
All organic molecules must contain carbon and hydrogen

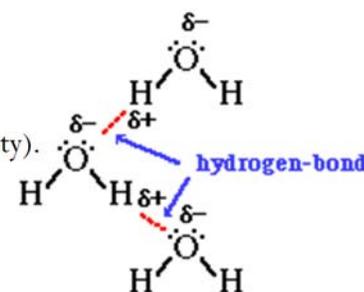
3. Name three terms to describe a water molecule.

Covalent, polar, inorganic

4. Draw and label a water molecule (include atoms and polarity).



5. Use a diagram to show hydrogen bonding between water molecules (include polarity).



6. What type of bond connects water molecules to each other?

Hydrogen

7. Distinguish between adhesion and cohesion.

Cohesion occurs when polar molecules “stick” to each other due to mutual attraction.

Adhesion occurs when molecules “stick” to other substances (e.g. surfaces)

8. Describe three ways that water is important to biological systems.

Choose from 3 of the 6 properties of water AND explain briefly (see Ch.2 booklet Q #13)

- High heat capacity...
- High heat of vaporization...
- Acts as a solvent...
- Cohesion and adhesion...
- Surface tension...
- Solid is less dense than liquid...

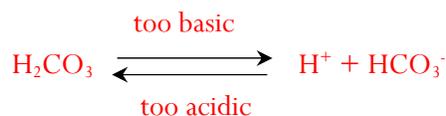
9. Compare an acid and a base using at least two different criteria.

Acid: releases H^+ ions, pH below 7

Base: releases OH^- ions, pH above 7

10. Give an example of a buffer the body uses to regulate blood pH. Bicarbonate ions

- a. Draw the chemical reaction to show how the buffer is able to maintain blood pH within a specific range.



11. Name two groups of biological molecules that provide energy to an organism.

Carbohydrates (quick energy & short-term storage)

Lipids (more energy & long-term storage)

12. Using a general diagram, show how monomers are joined to form polymers and how polymers are broken down into monomers. See Ch.2 booklet Q#25
- Name the two processes and show the role of water in each.
Hydrolysis (water added)
Dehydration synthesis (water removed)
13. What is the difference between dehydration synthesis and hydrolysis?
Hydrolysis: water must be added to separate a polymer into monomers
Dehydration synthesis: water is removed to create a polymer from monomers
14. For each of the four groups of biological molecules, identify the base unit molecule(s) and name at least one specific function.
Carbohydrates (monosaccharides): provides quick energy, polymers act as structural components...
Lipids (glycerol and fatty acids): provides long-term energy storage, insulates body, cushions organs...
Proteins (amino acids): majority of body functions including many enzymes and hormones...
Nucleic acids (nucleotide): transfer of genetic material to offspring, blueprint for protein synthesis...
15. How can you distinguish between a monosaccharide, disaccharide, and a polysaccharide? Use examples and/or diagrams.
Monosaccharide = single glucose molecule
Disaccharide = 2 monosaccharides bonded together (e.g. glucose + glucose = maltose)
Polysaccharide = more than 2 monosaccharides bonded together (e.g. cellulose, starch or glycogen)
16. Name and describe the three types of polysaccharides in terms of structure and function.
Starch: non-branched, or limited branching; storage of glucose in plants
Glycogen: highly branched; storage of glucose in animals
Cellulose: linear; structural material for plants, found in cell walls
17. How does the use of glucose in a plant differ from its function in an animal?
Animals use glucose to perform cellular respiration and obtain energy in the form of ATP
Plants use glucose to form rigid cell walls by converting glucose to cellulose
18. What differences exist between fatty acids from animal tissues and fatty acids from plant tissues?
Animals produce “fats” which are solid at room temperature and often saturated
Plants produce “oils” which are liquid at room temperature and usually unsaturated
19. What is the importance of phospholipids to life as we know it?
Phospholipids form the majority of the cell membrane. Without them, we wouldn't have any cells and therefore no life as we know it.
20. What group of biological molecules do steroids belong to? Give two examples of steroids.
Lipids: cholesterol, estrogen and testosterone
21. What type of bond is a peptide bond? Where can one be found?
Covalent: found between amino acids when forming proteins
22. What are two types of secondary structures in proteins? What causes the formation of these?
Alpha helix or beta pleated sheet. Formed by hydrogen bonding between peptide bonds.
23. What level of structure is destroyed when a protein is denatured?
Tertiary
24. Define “denaturation” by describing what happens to the protein and the overall effect it may cause.
- What level of structure is destroyed when a protein is denatured?
 - Give two causes of denaturation.
Irreversible change to 3D shape of a protein (tertiary level) which makes it unable to function properly.
Caused by extremes in heat or pH

25. How do different amino acids differ from one another?

There are 20 possible functional R-groups for amino acids

26. Contrast the four levels of protein structure in terms of their shape and the bonding that holds the first 3 levels together. Give an example of a protein with the 4th level.

Primary – chain of amino acids; peptide bonds

Secondary – alpha helix or beta pleated sheet; hydrogen bonds between peptide bonds

Tertiary – 3D shape; covalent bonding between R groups

Quaternary – two or more polypeptides joined together; hemoglobin

27. How is RNA similar to DNA? Use a separate criteria to give a difference between them.

Both have adenine, cytosine and guanine nitrogenous bases but RNA has uracil while DNA has thymine

RNA is single stranded and can be found in both the nucleus and cytoplasm

DNA is double stranded and forms a double helix, only found in the nucleus

28. What is the function of ATP?

The universal biological energy “currency” used to power all sorts of biological reactions.

29. Explain the significance of these:

- a. glycerol forms the backbone of lipids
- b. glucose the monomer of carbohydrates
- c. glycogen storage form of glucose in animals
- d. guanine nitrogenous base for RNA & DNA

30. Define and give an example of these:

- a. buffer maintains a stable pH; bicarbonate ions
- b. polypeptide linked amino acids; proteins such as insulin or hemoglobin
- c. helix spiral shape; DNA forms a double helix
- d. cohesion polar molecules sticking together; water molecules forming a rain drop

Hands-on Laboratory Knowledge

- Identifying Organic Molecules
 - Which chemical indicators test for:
 - simple sugar? Benedict's
 - starch? Iodine
 - protein? Biuret