Name _____ Period _____ Date _____

Atoms & Molecules Study Guide

Part A. Atomic Properties

1. Name the most common elements in the human body (p.18) _____
2. Give a brief overview of the structure of atoms. (p.20)

_____

_____

2. Explain the difference between the following: atom, ion, isotope, molecule, compound, (p.20)

_____

_____

_____

3. How are isotopes used in biological research and medicine? (p.21)

_____

_____

4. Distinguish between cations and anions. (p.23)

_____

_____

5. What happens when electrons change energy levels? (p.22)

_____

_____

6. Distinguish between oxidation and reduction reactions; explain using the reactions of photosynthesis and cellular respiration as examples. (lecture notes)

_____

_____

_____

7. What is the connection between valence numbers and chemical reactivity of an atom? (lecture notes)

_____

_____

8. What determines whether an atom forms ionic bonds or covalent bonds? (p.22-23)

_____

_____

9. What is a polar covalent bond? A non-polar covalent bond? Give an example of each. (p.24)

_____

_____

10. What is a hydrogen bond? How does it form and how is it different from a covalent bond? (p.24)

_____

_____

11. Sketch and label 3-4 molecules of water, indicate their polarity, and where hydrogen bonds form (use colors). (p.24)

12. Explain the importance of each of water's properties to living things: (p.25-27)
    a. high heat capacity _____
    b. high heat of vaporization _____
    c. high surface tension or capillary action _____
    d. solid is less dense than liquid _____
    e. universal solvent _____

13. Distinguish between hydrophobic and hydrophilic molecules. (p.26)

_____

_____

14. Explain the pH scale. (p.27)

_____

_____

15. How do buffers work and why are they necessary in biological systems? Give an example. (p.27)

_____

_____

_____

Part B. Macromolecules

1. What are functional groups in organic molecules? (p.35)

_____

_____

2. Name the 4 major groups of organic compounds (macromolecules) studied in biology. (p.36)

_____

3. Define the following: (p.36)

   a. monomer _____

   b. polymer _____

   c. condensation reaction _____

   d. hydrolysis _____

4. What molecules and bonds form proteins? (p.42)

_____

5. List several functions of proteins. (p.42)

_____

6. What are the five groups of amino acids? (p.42)

_____

7. Sketch and label two amino acids side-by-side, circle their functional groups, and show how the two can be joined together by a peptide bond (use colors). (p.42)

8. Describe the four levels of protein structure: (p.43-44)

   a. primary _____

   b. secondary _____

   c. tertiary _____

   d. quaternary _____

9. What is the potential biological significance of improper folding of proteins? What happens to a protein during denaturation? (p.43)

_____

_____

10. What molecules and bonds form nucleotides? (p.47) _____

11. What are the biological roles of nucleic acids? (p.47) _____

12. Besides nucleic acids, in which other biological molecules can nucleotides be found? (notes) _____

13. What characteristic do all lipids have in common? (p.40)_____

14. Sketch a diagram of a cell membrane, include phospholipid interactions and proteins (use colors). (p.40, 79)

15. What makes fats hydrophobic? (p.40) _____

16. State at least two differences between saturated and unsaturated fats. (p.40)

_____

_____

17. What is the common building block of steroids? (p.41) _____

18. What is the biological role of fats? (p.40) _____

19. What molecules and bonds form carbohydrates? (p.37) _____

20. What are the general roles of carbohydrates? (p.37) _____

21. Name the monosaccharides that form each disaccharide: (p.38)

    a. maltose _____

    b. sucrose _____

    c. lactose _____

22. Describe the role of the following polysaccharides. Which particular organisms may each be found in? (p.39)

    a. starch _____

    b. glycogen _____

    c. cellulose _____

    d. chitin _____

Part C. Enzymes

1. Define the following terms: (p.72)

   a. catabolism _____

   b. anabolism _____

   c. kinetic energy _____

   d. potential energy _____

2. Explain the First Law of Thermodynamics. (p.73)

_____

_____

3. Explain the Second Law of Thermodynamics. (p.73)

_____

_____

4. What is meant by a change in free energy? (p.73)

_____

5. Describe the difference between exergonic and endergonic reactions. (p.74)

_____

_____

6. Sketch and label a molecule of ATP. Describe what it means for ATP to "couple reactions"? (p.75-76)

_____

_____

7. How do enzymes affect the activation energy in an energy profile? (p.76)

_____

_____

8. List factors that influence the rate of enzyme reactions. (p.77)

_____

_____

9. Explain the difference between a cofactor and a coenzyme. (p.77)

_____

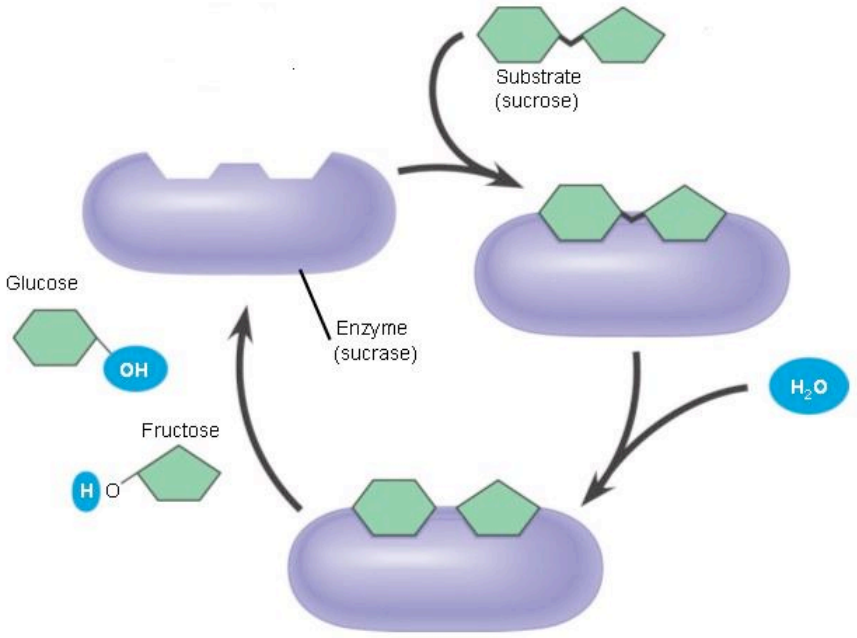
_____

10. How do competitive and noncompetitive inhibitors differ in their enzyme interactions? (p.78)

_____

_____

11. Label the diagram of the catalytic enzyme cycle (sucrase reaction), by describing the steps in the reaction (p.78).



12. What happens during allosteric regulation? Give an example. (p.78)

_____

_____

13. Describe how feedback inhibition works. Give an example. (p.78)

_____

_____

14. Define enzyme cooperativity. Give an example. (notes)

_____

_____