1. True or false: because enzymes are produced by living organisms and because they allow chemical reactions to occur that would not otherwise occur, enzymes represent an exception to the proposition that “life obeys all the laws of chemistry and physics.”

   a. true     b. false

2. A typical bacterial cell could be a sphere 1 μm in diameter; a typical protist cell could be a sphere 100 μm in diameter. In volume, the protist cell would be _______ larger than the bacterial cell.

   a. 10^2 times   b. 10^4 times   c. 10^6 times   d. 10^8 times   e. None of the above answers is correct.

3. Camilla would like to demonstrate to her cell biology class that the nuclear envelope of a fungal cell is connected to the endoplasmic reticulum (e.r.). She found an electron micrograph that showed the nucleus and endoplasmic reticulum, but it did not show any connection between the two organelles. What is the most likely explanation?

   a. The connections are always broken when cells are fixed for electron microscopy.
   b. Only rough e.r. connects to the nucleus, and fungal cells do not have any rough e.r.
   c. The nuclear envelope of fungal cells is a lipid bilayer, and the e.r. is a lipid monolayer.
   d. The connections are small, and a single thin section through a cell is likely not to include one.
   e. The nuclear envelope of a fungal cell connects to the plasma membrane instead of the e.r.

4. Mark ground up some chicken liver tissue with a mortar and pestle until it was a homogeneous suspension. He then put it in a test tube and subjected it to 10-min of centrifugation at 2000 r.p.m. He poured off the supernatant and looked at the material in the pellet under a microscope. He expected to see one round organelle, the largest in the cell. Which one?

   a. nucleus     b. cell wall     c. ribosomes     d. mitochondria     e. chloroplast

5. The electron microscope images of a eubacterial cell and a plant cell can be distinguished because only one of them has ...

   a. a plasma membrane   b. a mitochondrion   c. a cell wall   d. ribosomes   e. The images cannot be distinguished, because a plant cell is a eubacterial cell.
6. The plant cell sketched at the right was observed through a microscope. The volume of the cell was not changing; the cell looked the same over a period of an hour. The arrow points to a place where the plasma membrane has pulled away from the cell wall. Which of the statements below is probably NOT CORRECT?

a. The cell was not turgid (turgor pressure was zero.)
b. The cell was in pure water.
c. The cell was said to be “plasmolyzed.”
d. The volume of the protoplast (area inside the plasma membrane) was less than it would be when the plant is growing normally.
e. There was no net flow of water across the plasma membrane.

7. José discovered a drug that prevents pancreas cells from secreting the enzyme trypsin. The cells do not die, and they continue to make trypsin, but the trypsin cannot be released into the digestive track. Which organelle of the pancreas cells is probably affected by the drug?

a. nucleus    b. mitochondrion    c. Golgi apparatus    d. ribosomes    e. cell wall

8. Some bacterial cells move through the actions of whip-like structures called “flagella.” So do the sperm cells of humans and other mammals. However, the flagella of bacteria and of sperm differ fundamentally, because only one of them...

a. extends into the solution outside the cell.
b. requires energy to move.
c. contains proteins.
d. contains microtubules in a 9+2 formation.
e. is connected directly to the nucleus.
9. If you traveled from the cytosol through the nuclear envelope into the nucleus (missing any nuclear pore), how many layers (monolayers) of phospholipids would you have crossed?
   a. none  b. one  c. two  d. three  e. four

10. An alpha helix is held together by both strong bonds and weak bonds. The weak bonds are...
   a. peptide bonds  b. hydrogen bonds  c. disulfide bridges  
   d. Van der Wall’s interactions  e. ionic bonds

The chemical structures shown below represent answers to the next four questions:

11. Which of the compounds shown above is a fatty acid? a, b, c, d, or e.

12. Which of the compounds shown above is a carbohydrate? a, b, c, d, or e.

13. Which of the compounds shown above is an amino acid whose side chain would most likely have a positive charge in the cell? a, b, c, d, or e.

14. Which of the compounds shown above is an amino acid whose side chain would participate in a disulfide bridge?
   a. All of them  b. Compound b.  c. Compound c.  d. Compound d.
   e. None of them
15. The addition of vinegar (acetic acid) to egg white will cause the egg white proteins to turn semi-solid and opaque, because

a. like ethanol, acetic acid is a hydrophobic solvent.
b. acetic acid hydrolyzes peptide bonds.
c. acetic acid causes disulfide bridges to form.
d. vinegar keeps proteins from sticking together.
e. in acid, proteins accumulate positive charges, which repel each other.

16. Proteins contribute to the function of plasma membranes by...

a. serving as receptors that bind to compounds outside the cell.
b. forming pores through which water can flow.
c. serving as pumps, moving certain ions from a low concentration to a higher concentration.
d. attaching microtubules to the membrane.
e. all of the above.

17. A gradient of electrical charge across the plasma membrane of a fungal cell, produced by the pumping of H\(^+\) ions, can be used most directly to...

a. move the cell toward the North Pole (or, in the Southern Hemisphere, the South Pole).
b. attract positive ions, such as K\(^+\), into the cell.
c. attract negative ions, such as Cl\(^-\), into the cell.
d. pull water into the cell.
e. None of the above: pumping H\(^+\) ions does not produce an electric charge gradient.

18. The activation energy for the enzyme-catalyzed hydrolysis of ATP (ATP + H\(_2\)O \(\rightarrow\) ADP + phosphate), which occurs when the motor protein dynein moves along a microtubule, is provided by...

a. the microtubule.
b. the ATP.
c. the kinetic energy of the solvent molecules.
d. the dynein.
e. NADH.

19. The enzyme-catalyzed hydrolysis of ATP is a spontaneous reaction. Because of this you can predict that the free energy of ATP + H\(_2\)O is ___________ the free energy of ADP + phosphate.

a. greater than  b. less than  c. the same as
d. The answer cannot be determined because it depends on whether or not an enzyme is present.
20. A molecule of hemoglobin is formed from four polypeptide chains. Each chain contains one heme molecule. Each heme molecule can bind to one molecule of \( \text{O}_2 \). Thus, one molecule of hemoglobin can bind to 4 molecules of \( \text{O}_2 \). However, the binding force between heme and \( \text{O}_2 \) is not the same for all four \( \text{O}_2 \)s. Once an \( \text{O}_2 \) is bound, the next \( \text{O}_2 \) is bound more tightly, as inferred from the type of experiment shown at the right. For this reason, hemoglobin is thought to be like an allosteric enzyme. From these statements and your knowledge of regulation of enzyme activity, you can predict that...

a. hemoglobin will never release its \( \text{O}_2 \)s.
b. the binding of \( \text{O}_2 \) causes a change in the tertiary structure of the polypeptide chains.
c. most hemoglobin molecules will have only one \( \text{O}_2 \).
d. most hemoglobin molecules will have 4 \( \text{O}_2 \)s, no matter what the concentration of \( \text{O}_2 \) in the solution.

21. Certain bacteria make enzymes that break down cellulose (a polymer of glucose in the cell wall of plant cells) by hydrolyzing the bond between two glucosyl subunits. Which of the statements below helps explain how the enzyme might speed the hydrolysis?

a. The cellulose molecule fits in a crevice of the enzyme.
b. Hydrogen bonds between the enzyme and the cellulose distort the shape of the glucoses near the bond to be hydrolyzed.
c. Amino acid side chains provide or withdraw hydrogen atoms.
d. Charged amino acid side chains distort the positions of electrons in a covalent bond.
e. Any or all of the above may be true.

22. A biochemist must determine the order of five intermediate compounds in a metabolic pathway. The compounds are named A, B, C, D, and E. The following conditions must be met when determining the pathway:

- B and C can be interconverted—thus B should come immediately before or after C.
- C must come either immediately before or after either E or D.
- D must come immediately before the last compound in the pathway.
What is the product (last compound) of the pathway?