Name: _____ **AP Biology**

Chapter 6 Active Reading Guide
An Introduction to Metabolism

Section 1

1. Define *metabolism*.

2. There are two types of reactions in metabolic pathways: *anabolic* and *catabolic*.
   a. Which reactions release energy? _____
   b. Which reactions consume energy? _____
   c. Which reactions build up larger molecules? _____
   d. Which reactions break down molecules? _____
   e. Which reactions are considered "uphill"? _____
   f. What type of reaction is photosynthesis? _____
   g. What type of reaction is cellular respiration? _____
   h. Which reactions require enzymes to catalyze reactions? _____

3. Contrast *kinetic energy* with *potential energy*.

4. Which type of energy does water behind a dam have? A mole of glucose?

5. What is meant by a *spontaneous process*?

Section 2

6. What is *free energy*? What is its symbol?

7. For an exergonic reaction, is Δ*G* negative or positive?

8. Is cellular respiration an endergonic or an exergonic reaction? What is Δ*G* for this reaction?

9. Is photosynthesis endergonic or exergonic? What is the energy source that drives it?

10. To summarize, if energy is released, Δ*G* must be what?

Section 3

11. List the three main kinds of work that a cell does. Give an example of each.
    a.

    b.

    c.

12. Look at Figure 6.8 of an ATP molecule in your textbook.
    a. which bond is likely to break?

    b. by what process will that bond break?

c. explain the name *ATP* by listing all the molecules that make it up.

d. When the terminal phosphate bond is broken, a molecule of inorganic phosphate P_i is formed, and energy is _____.

e. For this reaction: ATP → ADP + P_i, Δ*G* = _____

f. Is this reaction endergonic or exergonic? _____

FYI: An essay question on the 2009 AP Biology exam asked students to identify the molecules that make up ATP.

13. What is *energy coupling*?

14. In many cellular reactions, a phosphate group is transferred from ATP to some other molecule in order to make the second molecule less stable. The second molecule is said to be _____.

15. Look for this amazing bit of trivia on page 124: If you could not regenerate ATP by phosphorylating ADP, how much ATP would you need to consume each day?

Section 4

16. What is a *catalyst*?

17. What is *activation energy* (E_A)?

18. Refer to Figures 6.12 and 6.13 to answer the following questions
    a. What effect does an enzyme have on E_A?

    b. Is Δ*G* positive or negative? _____

    c. How is Δ*G* affected by the enzyme?

19. Define each of the following terms:
enzyme:

substrate:

active site:

products:

20. What is meant by *induced fit*?

21. Explain how protein structure is involved in enzyme specificity.

22. Enzymes use a variety of mechanisms to lower activation energy. Describe four of these mechanisms.
a.

b.

c.

d.

23. Many factors can affect the rate of enzyme action. Explain each factor listed here.
a. initial concentration of substrate:

b. pH:

c. temperature:

24. Recall that enzymes are globular proteins. Why can extremes of pH or very high temperatures affect enzyme activity?

25. Name a human enzyme that functions well in pH 2. Where is it found?

26. Distinguish between *cofactors* and *coenzymes*. Give examples of each.

27. Compare and contrast *competitive inhibitors* and *noncompetitive inhibitors*.

Section 5

28. What is *allosteric regulation*?

29. How is allosteric regulation somewhat like noncompetitive inhibition? How might it be different?

30. Explain the difference between an allosteric activator and an allosteric inhibitor.

31. Although it is not an enzyme, hemoglobin shows *cooperativity* in binding O_2. Explain how hemoglobin works at the gills of a fish.

32. Refer to Figure 6.19 and answer the following questions:
    a. What is the substrate molecule to initiate this metabolic pathway? _____

    b. What is the inhibitor molecule? _____

    c. What type of inhibitor is it? _____

    d. When does it have the most significant regulatory effect? _____

    e. What is this type of metabolic control called? _____