**Name Period**

**Chapter 8: An Introduction to Metabolism**

***Concept 8.1 An organism’s metabolism transforms matter and energy, subject to the laws of thermodynamics***

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*?

***Concept 8.2 The free-energy change of a reaction tells us whether the reaction occurs spontaneously***

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

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

8. Is cellular respiration an endergonic or an exergonic reaction? What is ∆*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, ∆*G* must be what?

***Concept 8.3 ATP powers cellular work by coupling exergonic reactions to endergonic reactions***

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

a.

b.

c.

12. Draw a molecule of ATP (you can use p 149 to guide you). Label it. Use an *arrow* to show which bond is likely to break.

a. By what process will that bond break?

b. Explain the name *ATP* by listing all the molecules that make it up.

13. When the terminal phosphate bond is broken, a molecule of inorganic phosphate Pi is formed, and energy is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ .

For this reaction: ATP  ADP + Pi, ∆*G* =

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. What are they again?***

14. What is *energy coupling*?

15. 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 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

***Concept 8.4 Enzymes speed up metabolic reactions by lowering energy barriers***

17. What is a *catalyst*?

18. What is *activation energy* (EA)?

19. Copy the figure on p152. Label the *x*-axis of this graph “Progress of the Reaction” and the *y*-axis “Free Energy.” Label EA on this sketch, both with and without an enzyme.

a. What effect does an enzyme have on EA?

b. Label ∆*G*. Is it positive or negative?

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

20. Define each of the following terms:

**enzyme**:

**substrate**:

**active site**:

**products**:

21. What is meant by *induced fit*?

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

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

b.

c.

d.

24. Many factors can affect the rate of enzyme action. Explain each factor listed here.

a.

b. pH:

c. temperature

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

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

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

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

***Concept 8.5 Regulation of enzyme activity helps control metabolism***

29. What is *allosteric regulation*?

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

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

32. Although it is not an enzyme, hemoglobin shows *cooperativity* in binding O2. Explain how hemoglobin works at the gills of a fish.