AP Biology **Name** _____

Chapter 8 Guided Reading: An Introduction to Metabolism
10ed

1. 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?

2. **Contrast** *kinetic energy* with *potential energy*.

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

4. According to the first law of thermodynamics, **what** can and cannot happen to energy?

5. The second law of thermodynamics is sometimes called the “you always lose rule.” **Why** is that an apt expression?

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

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

8. Once we know the value of ΔG for a process, we can use it to predict whether it will be spontaneous. For an exergonic reaction, **is ΔG negative or positive**?

9. Is cellular respiration an **endergonic or exergonic** reaction? **What** is ΔG for this reaction?

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

11. To summarize, if energy is released, ΔG must be positive/negative**. (circle your choice)**

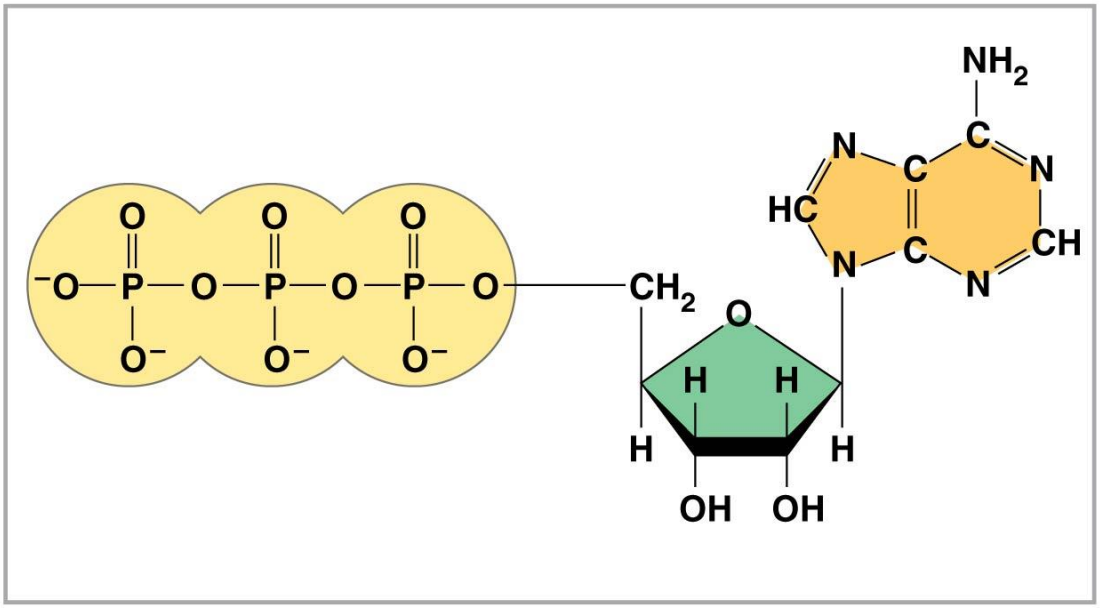
12. **List** the three main kinds of work that a cell does. **Give an example of each.**

    a.

    b.

    c.

13. **Label** the molecule shown below. **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.

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

For this reaction: **ATP → ADP + P_i, ΔG =** _____.

Is this reaction **endergonic or exergonic**? _____.

15. **What** is *energy coupling?*

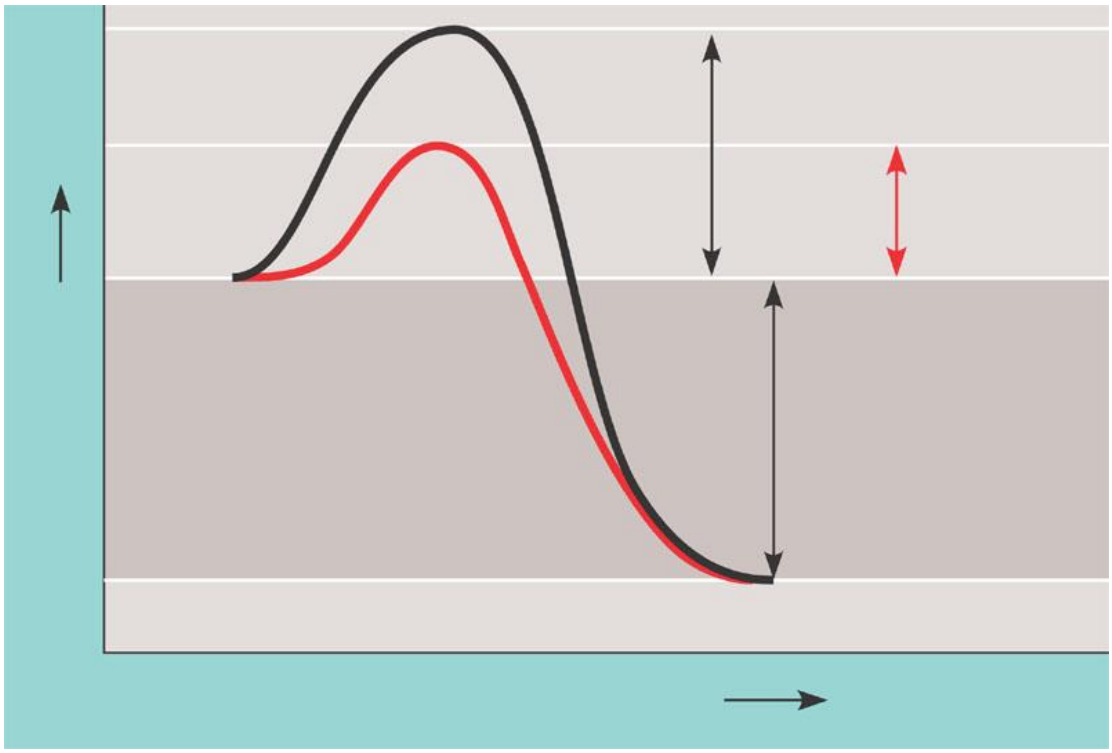
16. In many cellular reactions, a phosphate group is transferred from ATP to some other molecule in order to make the second molecule less stable. **What term** is now used to describe the second molecule?

17. If you could not regenerate ATP by phosphorylating ADP, **how much ATP** would you need to consume each day?

18. **What** is a *catalyst*?

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

20. **Label the x-axis** of this graph "Progress of the Reaction" and **the y-axis** "Free Energy."



Label E_A on this sketch, both **with** and **without an enzyme**.

a. **What effect** does an enzyme have E_A?

b. **Label** ΔG. Is it **positive or negative**?

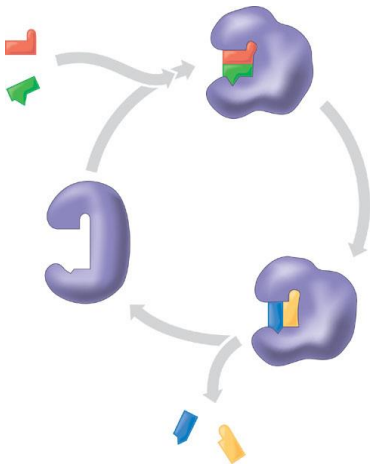
c. **How** is ΔG affected by the enzyme?

21. **Label** this figure while you **define** the following terms:
    a. Substrate

    b. Enzyme

    c. Active site

    d. Products



22. **What** is meant by *induced fit*? **How** is it shown in the figure in question 21?

23. **Explain** how protein structure is involved in enzyme specificity.

24. Enzymes use a variety of mechanisms to lower activation energy. **Describe <u>four</u>** of these mechanisms.
    a.

    b.

    c.

    d.

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

    b. pH

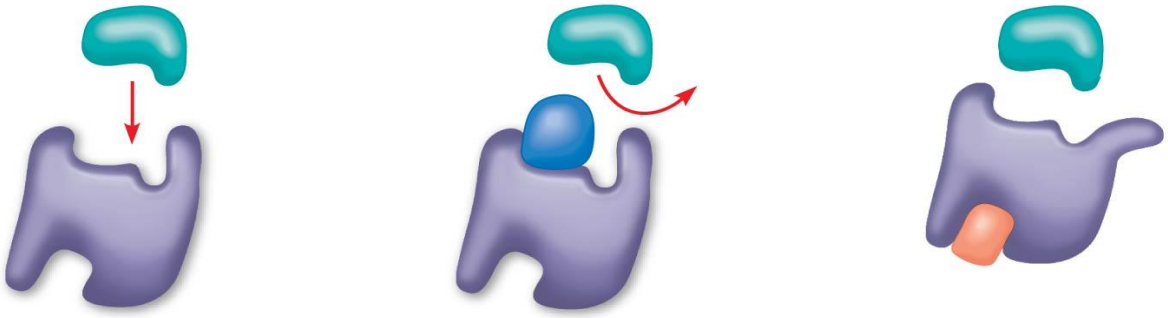
    c. temperature

26. **Why** can extremes of pH or very high temperatures affect enzyme activity.

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

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

29. **Compare and contrast** *competitive inhibitors* and *noncompetitive inhibitors*. **Label** each type of inhibitor in this figure.



30. Many toxins and poisons cause irreversible enzyme inhibition. **Select one example** and **explain** why it is so deadly.

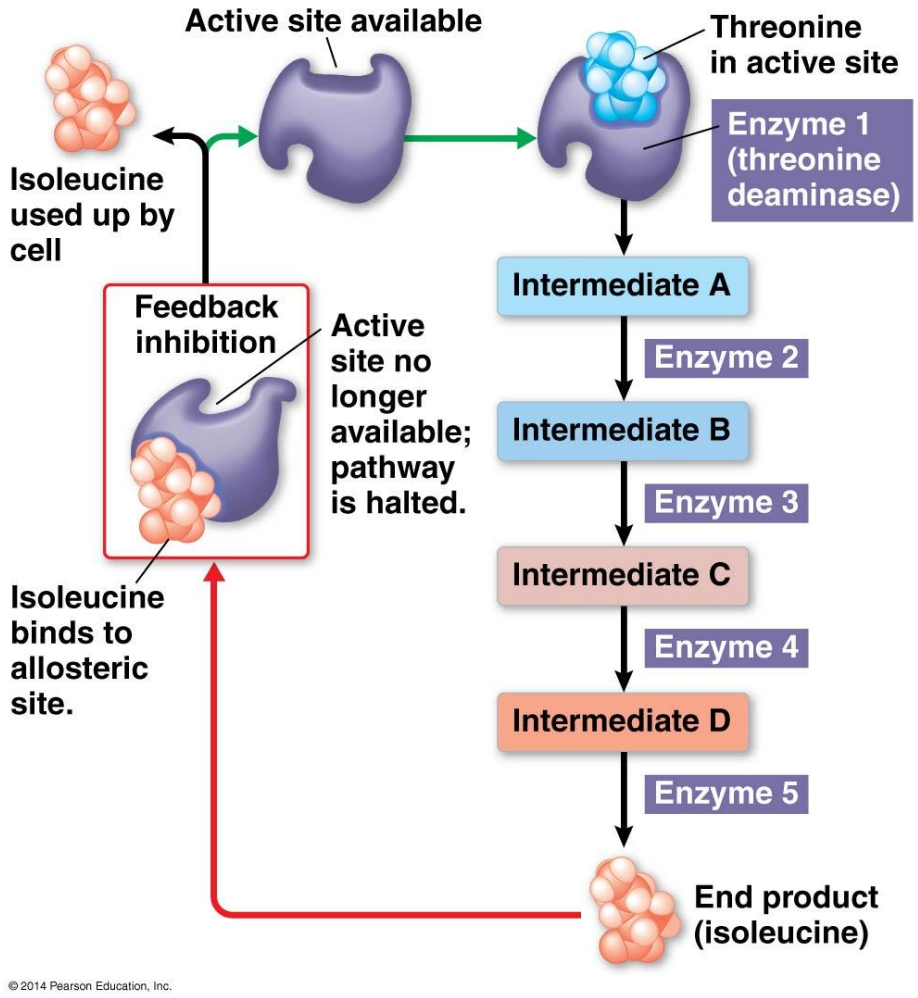
31. **What** is *allosteric regulation*?

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

33. **Explain** the difference between an allosteric activator and an allosteric inhibitor.

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

35. Study this figure from your book (Figure 8.21) and **answer the following questions**.



a. **What** is the substrate molecule that initiates 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?