

Cell Metabolism

1. Each of the significant properties of a cell, its growth, reproduction, and responsiveness to its environment requires _____.
2. The study of _____ is the study of behavior (capture, storage, usage) of energy in living systems.
3. Energy is the capacity to do _____.
4. In bioenergetics, the unit of energy used is the same one as used for heat, the _____.
5. Free energy is the amount of energy available for the cell to carry out its many chemical processes. It is the difference between the internal energy or enthalpy and _____ or disorder.
6. The process of influencing the chemical bonds in a way that lowers the _____ energy needed to speed up a chemical reaction is called catalysis.
7. Catalysts increase the rates of chemical reactions. They participate in the chemical reactions, but are _____ during the product formation.
8. Enzymes work most effectively at their _____ temperature and pH conditions.
9. Certain key molecules can regulate biochemical pathways by controlling the rates of enzymatic reactions by binding at _____ sites.
10. Biochemical _____ are a series of sequential chemical reactions which are maintained in the cell.
11. A chemical reaction which requires energy is called an _____ reaction.
12. A molecule that closely resembles the shape of a substrate for an enzyme might serve as a _____ inhibitor.
13. A chemical reaction which requires an input of energy is a(n) _____ reaction, while a chemical reaction which releases energy is a(n) _____ reaction.
14. Oxidation and reduction reactions are chemical processes that result in a gain or loss in
 - A. atoms
 - B. neutrons
 - C. electrons
 - D. molecules
 - E. protons

15. Reactions that occur spontaneously and release free energy are called
- A. activation reactions
 - B. exergonic reactions
 - C. catabolistic reactions
 - D. thermodynamic reactions
 - E. end-product reactions
16. A chemical reaction in which the products contain less energy than the _____ will tend to proceed spontaneously.
- A. reactants
 - B. enzymes
 - C. coenzymes
 - D. substrates
 - E. cofactors
17. Protein catalysts that speed up the various metabolic biological reactions in an organism are called
- A. substrates
 - B. cofactors
 - C. reactants
 - D. products
 - E. enzymes
18. Enzymes have specific _____ with which they interact.
- A. products
 - B. substrates
 - C. reactants
 - D. atoms
 - E. end-products
19. The specificity of an enzyme is due to its active site. The active site is shaped so that only a certain
- A. substrate molecule can fit into it
 - B. product molecule can fit into it
 - C. reactant molecule can fit into it
 - D. cofactor molecule can fit into it
 - E. histone molecule can fit into it
20. The organic non-protein components that aid in enzyme functioning are called
- A. reactants
 - B. cofactors
 - C. coenzymes
 - D. substrates
 - E. products

21. The inorganic non-protein components that participate in enzyme catalysis are known as
- A. coenzymes
 - B. cofactors
 - C. end-products
 - D. substrates
 - E. reactants
22. The chief energy currency of all cells is a molecule called
- A. cyclic AMP
 - B. NADH
 - C. FADH
 - D. ATP
 - E. ADP
23. The chemistry of living systems representing all chemical reactions is called
- A. catabolism
 - B. anabolism
 - C. metabolism
 - D. enzymology
 - E. thermodynamics
24. A calorie is the commonly used unit of chemical energy. It is also the unit of
- A. light
 - B. magnetism
 - C. sound
 - D. heat
 - E. radioactivity
25. The term oxidation is derived from the name of the element oxygen. This is reasonable, because it
- A. attracts electrons very strongly
 - B. can be oxidized by accepting electrons
 - C. contains more electrons than are needed
 - D. can react chemically readily in its gas state
 - E. is present everywhere
26. When an atom or molecule gains one or more electrons, it is said to be
- A. energized
 - B. oxidized
 - C. polarized
 - D. activated
 - E. reduced

27. An electron transferred in a biological system is usually
- A. boosted to a higher light energy state
 - B. converted into other chemical compounds
 - C. accompanied by a proton
 - D. given off as radiant energy
 - E. lost to the system as heat
28. Life's ultimate source of energy is derived from
- A. the sun
 - B. plants
 - C. water
 - D. air
 - E. cells
29. As energy is being reconverted through the many forms, it is continuously lost as
- A. electricity
 - B. light
 - C. sound
 - D. heat
 - E. chemical energy
30. In reactions of cells the net energy obtained from breaking bonds is called free energy. It is
- A. the bond energies of reactants
 - B. the bond energies of products
 - C. the difference between a and b
 - D. the amount of energy due to the degree of disorder of the system
 - E. the amount after d is subtracted from c
31. Reactions that do not proceed spontaneously because they require energy from an outside source are called
- A. exergonic
 - B. xerogonic
 - C. metabolic
 - D. endergonic
 - E. endocytic
32. Molecules that act as catalysts in biological systems are
- A. ATP
 - B. cofactors
 - C. coenzymes
 - D. enzymes
 - E. genes

33. Enzymes catalyze chemical reactions by lowering the
- A. entropy
 - B. free energy
 - C. activation energy
 - D. enthalpy
 - E. calories
34. RNA molecules that have been recently reported to act also as enzymes are given the name
- A. ribozymes
 - B. deoxyribozymes
 - C. chromosomes
 - D. coenzymes
 - E. metalloenzymes
35. Most protein-enzymes are
- A. fibrous proteins
 - B. hormones
 - C. histones
 - D. metalloenzymes
 - E. globular proteins
36. In an enzyme catalyzed reaction the reactant is called the
- A. ribozyme
 - B. catalyst
 - C. substrate
 - D. end-product
 - E. activator
37. When the substrate is bound to the enzyme, the shape of the enzyme may change slightly, leading to
- A. a better induced fit
 - B. a great range of possible catalytic activities
 - C. a greater supply of activation energy
 - D. more permanent binding through intimate total contact
 - E. more possible products of the reaction
38. Enzymes are very specific in their choices of substrates because each different enzyme has an active site that
- A. depends on unusual amino acids not common in proteins
 - B. has a certain unique amino acid to fit each substrate
 - C. is shaped to fit a certain substrate molecule
 - D. is lined with glycolipids and glycoproteins
 - E. passes electrons from one part of the substrate to another

39. At the conclusion of an enzyme catalyzed reaction
- A. it must be resynthesized from its amino acids
 - B. it frees itself from the product and is ready to be reused
 - C. it must be transported from outside of the cell
 - D. its shape is changed into an active form
 - E. its active site closes up and cannot bind to more substrate
40. The ability of an enzyme to catalyze a reaction can be affected by chemical and physical factors such as
- A. temperature
 - B. pH
 - C. salt concentration
 - D. binding of specific regulatory molecules
 - E. all of the above
41. The sites where molecules other than substrates bind in an enzyme to alter its activity are called
- A. catalytic sites
 - B. allosteric sites
 - C. metabolic sites
 - D. amino acid sites
 - E. activity sites
42. One of the most important coenzymes that accepts electrons/hydrogens is
- A. NAD⁺
 - B. NADH
 - C. ATP
 - D. NADPH
 - E. ribozyme
43. ATP gives up energy when it is converted to
- A. DNA
 - B. NADP
 - C. NADH
 - D. ADP and phosphate
 - E. RNA
44. Under standard conditions, ATP can release for every molecule
- A. less than 1 cal of energy
 - B. 1 to 2 cal of energy
 - C. 7.3 Kcal of energy
 - D. 7.3 cal of energy
 - E. different amounts of energy depending on the cell

45. The regulation of simple biochemical pathways often involves the end-product binding to the allosteric site of the first enzyme in the sequence. This mode of regulation is called
- A. competitive inhibition
 - B. biochemical regulation
 - C. cellular control
 - D. product catalysis
 - E. feedback inhibition
46. In an experiment described in a chemistry lab book, the directions state that after mixing the two chemicals (A and B) and waiting 5 minutes that A will be oxidized. This means that
- A. chemical A has lost electrons to chemical B
 - B. chemical A has gained electrons from chemical B
 - C. chemical A has lost its ability to interact with chemical B
 - D. chemical A has become an isotope and can no longer interact with chemical B
 - E. chemical A has shared electrons from chemical B
47. In an experiment described in a chemistry lab book, the directions state that after mixing the two chemicals (A and B) and waiting 5 minutes that B will be reduced. This means that
- A. chemical B has lost electrons to chemical A
 - B. chemical B has gained electrons from chemical A
 - C. chemical B has lost its ability to interact with chemical A
 - D. chemical B has become an isotope and can no longer interact with chemical A
 - E. chemical B has shared electrons from chemical A
48. The First Law of Thermodynamics simply states that
- A. Energy is constantly being created in the universe.
 - B. Energy is being lost as heat in the universe.
 - C. Energy can be created but not destroyed.
 - D. Energy cannot be created or destroyed, just changed from one form to another.
 - E. Energy can be recycled through the universe.
49. The Second Law of Thermodynamics simply states that
- A. Energy can be recycled through the universe.
 - B. Energy cannot be created or destroyed, just changed from one form to another.
 - C. Energy is constantly being lost as heat in the universe.
 - D. Energy is constantly being created in the universe.
 - E. Energy can be created but not destroyed.

50. In a chemical reaction in a living system, enzymes are used as catalysts. Which of the following statements about enzymes is incorrect?
- A. Enzymes enter reactions and can be reused.
 - B. Enzymes speed up chemical reactions in living systems.
 - C. Enzymes reduce the energy of activation necessary for a chemical reaction to go forward.
 - D. Enzymes increase the energy of activation necessary for a chemical reaction to go forward.
 - E. Enzymes are sometimes referred to as biological catalysts; however, not all biological catalysts are proteins.
51. Which of the following best depicts a diagram of enzymes and substrates when they react? Assume only forward reactions. Use the following to make your choice. E = enzyme, S = substrate, ES = enzyme-substrate complex, P = products
- A. $E + P \rightarrow ES$
 - B. $E + S \rightarrow ES + P$
 - C. $E + S \rightarrow ES \rightarrow E + P$
 - D. $E + ES \rightarrow P + E$
 - E. $E + P \rightarrow EP \rightarrow S + E$
52. A researcher wants to slow down a particular cellular activity by controlling an enzyme that catalyzes that activity. All of the following choices are available except
- A. increasing the temperature of the cell's environment
 - B. decreasing the temperature of the cell's environment
 - C. reducing the pH of the cell's environment
 - D. increasing the pH of the cell's environment
 - E. adding substrate as it is depleted to the cell's environment
53. A new antibiotic has been developed that will use competitive inhibitor enzyme inhibition. This means that the
- A. antibiotic will compete for substrate binding sites on the enzyme
 - B. antibiotic will compete for binding sites on the substrate
 - C. antibiotic will compete for binding sites on the enzyme-substrate complex
 - D. antibiotic will compete for binding sites on the product that is being produced
 - E. antibiotic will only compete for binding sites on the receptor proteins embedded in the phospholipid bilayer

54. A new antibiotic has been developed that will use noncompetitive inhibitor enzyme inhibition. This means that the
- antibiotic will bind to the enzyme and alter the shape of the enzyme
 - antibiotic will bind to the substrate and alter the shape of the substrate
 - antibiotic will bind to the enzyme-substrate complex and alter its shape
 - antibiotic will bind to the product that is being produced and alter its shape
 - antibiotic will bind to the receptor proteins embedded in the phospholipid bilayer, which will in turn close the channels
55. One type of biochemical pathway regulation is referred to as feedback inhibition. This means that as the
- cell produces more quantity of product through a biochemical pathway, the build up of that product will inhibit the activity of that product's production
 - cell produces more quantity of product through a biochemical pathway, the activity will be increased or stimulated by the build up of that product
 - cell produces less quantity of product through a biochemical pathway, the activity will be inhibited by not having enough of that product
 - cell produces less quantity of product through a biochemical pathway, the activity of the substrate will be increased and that it will exceed capacity of the pathway
56. The temperature is raised slightly above the optimum for a specific enzyme. What would you expect to observe as a result of the change in temperature?
- increased enzyme activity
 - decreased enzyme activity
 - no change in enzyme activity
 - enzyme denaturation
 - all of the above
57. Match each of the following.
- | | |
|--|-------------------------------|
| _____ A. The substance on which the enzyme 1. active site works; the raw material of the reaction. | |
| _____ B. One or occasionally more; the main 2. substrate constituent of an enzyme | |
| _____ C. Allosteric inhibitor binds here; changes enzyme shape. | 3. polypeptide |
| _____ D. Spot where raw material binds and is changed to product. | 4. coenzyme |
| _____ E. Part of the complete enzyme; nonprotein, organic component. | 5. non-catalytic binding site |

Answer Key

No. on Test	Correct Answer
1	energy
2	bioenergetics
3	work
4	kilocalorie
5	entropy
6	activation
7	regenerated
8	optimum
9	allosteric
10	pathways
11	endergonic
12	competitive
13	anabolic; catabolic
14	C
15	B
16	A
17	E
18	B
19	A
20	C
21	B
22	D
23	C
24	D
25	A
26	E
27	C
28	A
29	D
30	E
31	D
32	D
33	C
34	A

35	E
36	C
37	A
38	C
39	B
40	E
41	B
42	A
43	D
44	C
45	E
46	A
47	B
48	D
49	C
50	D
51	C
52	E
53	A
54	A
55	A
56	B
57	1-B, 2-C, 3-E, 4-A, 5-D