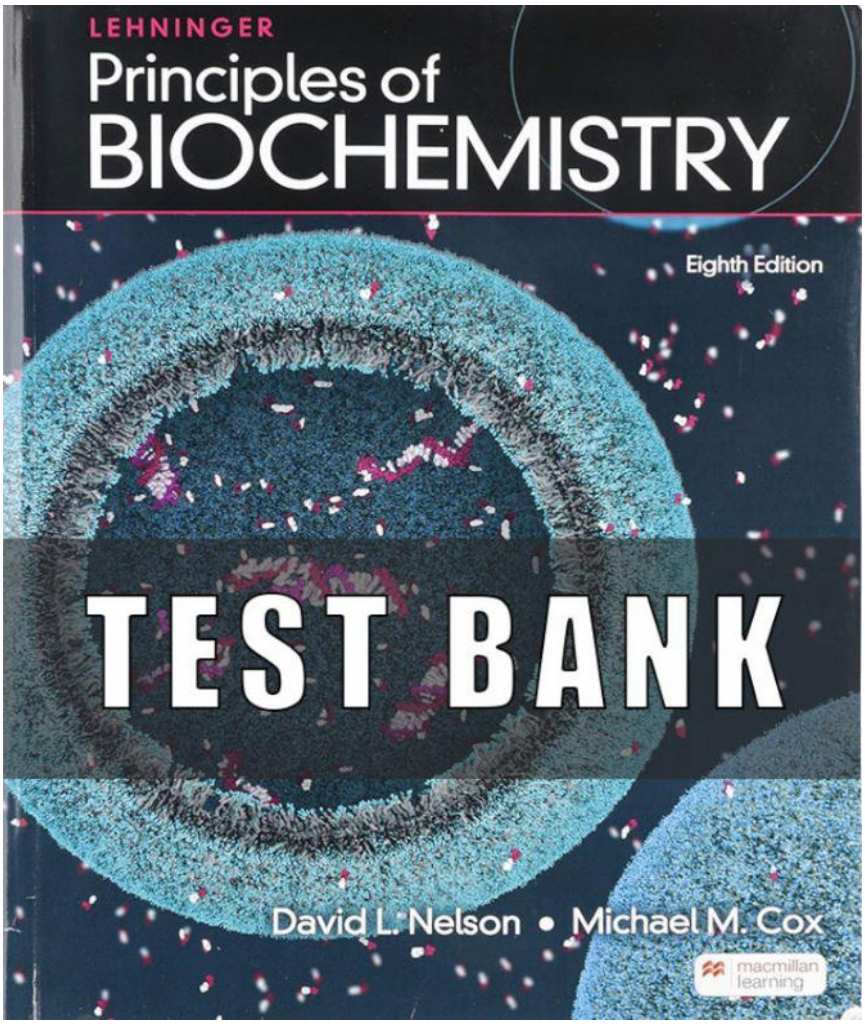
Test Bank

for

Lehninger Principles of Biochemistry

8th Edition



Contents

Chapter 1 The Foundations of Biochemistry

Multiple Choice Questions

1. Cellular foundations
Pages: 3-4 Difficulty: 1 Ans: C
In a bacterial cell, the DNA is in the:

A) cell envelope.
B) cell membrane.
C) nucleoid.
D) nucleus.
E) ribosomes.

2. Cellular foundations
Page: 4 Difficulty: 1 Ans: E
A major change occurring in the evolution of eukaryotes from prokaryotes was the development of:

A) DNA.
B) photosynthetic capability.
C) plasma membranes.
D) ribosomes.
E) the nucleus.

3. Cellular foundations
Page: 4 Difficulty: 1 Ans: B
In eukaryotes, the nucleus is enclosed by a double membrane called the:

A) cell membrane.
B) nuclear envelope.
C) nucleolus.
D) nucleoplasm.
E) nucleosome.

4. Cellular foundations
Page: 4 Difficulty: 1 Ans: C
The dimensions of living cells are limited, on the lower end by the minimum number of biomolecules necessary for function, and on the upper end by the rate of diffusion of solutes such as oxygen. Except for highly elongated cells, they usually have lengths and diameters in the range of:

A) 0.1 μm to 10 μm.
B) 0.3 μm to 30 μm.
C) 0.3 μm to 100 μm.
D) 1 μm to 100 μm.
E) 1 μm to 300 μm.

5. Cellular foundations
Page: 5 Difficulty: 2 Ans: B
The bacterium *E. coli* requires simple organic molecules for growth and energy—it is therefore a:

A) chemoautotroph.
B) chemoheterotroph.
C) lithotroph.
D) photoautotroph.
E) photoheterotroph.

6. Cellular foundations
Page: 10 Difficulty: 2 Ans: B
Which one of the following has the cellular components arranged in order of *increasing* size?

A) Amino acid < protein < mitochondrion < ribosome
B) Amino acid < protein < ribosome < mitochondrion
C) Amino acid < ribosome < protein < mitochondrion
D) Protein < amino acid < mitochondrion < ribosome
E) Protein < ribosome < mitochondrion < amino acid

7. Cellular foundations
Page: 11 Difficulty: 2 Ans: A
The three-dimensional structure of macromolecules is formed and maintained primarily through noncovalent interactions. Which one of the following is *not* considered a noncovalent interaction?

A) carbon-carbon bonds
B) hydrogen bonds
C) hydrophobic interactions
D) ionic interactions
E) van der Waals interactions

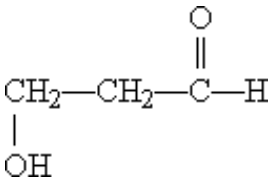
8. Chemical foundations
Page: 12 Difficulty: 2 Ans: E
Which one of the following is *not* among the four most abundant elements in living organisms?

A) Carbon
B) Hydrogen
C) Nitrogen
D) Oxygen
E) Phosphorus

9. Chemical foundations
Page: 13 Difficulty: 1 Ans: B
The four covalent bonds in methane (CH_4) are arranged around carbon to give which one of the following geometries?

A) linear
B) tetrahedral
C) trigonal bipyramidal
D) trigonal planar
E) trigonal pyramidal

10. Chemical foundations
Page: 14 Difficulty: 1 Ans: B
What functional groups are present on this molecule?



A) ether and aldehyde
B) hydroxyl and aldehyde
C) hydroxyl and carboxylic acid
D) hydroxyl and ester
E) hydroxyl and ketone

11. Chemical foundations
Page: 16 Difficulty: 1 Ans: D
The macromolecules that serve in the storage and transmission of genetic information are:

A) carbohydrates.
B) lipids.
C) membranes.
D) nucleic acids.
E) proteins.

12. Chemical foundations
Page: 17 Difficulty: 1 Ans: D
Stereoisomers that are nonsuperimposable mirror images of each other are known as:

A) anomers.
B) cis-trans isomers.
C) diastereoisomers.
D) enantiomers.
E) geometric isomers.

13. Chemical foundations
Page: 20 Difficulty: 3 Ans: E
The enzyme fumarase catalyzes the reversible hydration of fumaric acid to l-malate, but it will not catalyze the hydration of maleic acid, the cis isomer of fumaric acid. This is an example of:

A) biological activity.
B) chiral activity.
C) racemization.
D) stereoisomerization.
E) stereospecificity.

14. Physical foundations
Pages: 21-22 Difficulty: 2 Ans: A
Humans maintain a nearly constant level of hemoglobin by continually synthesizing and degrading it. This is an example of a(n):

A) dynamic steady state.
B) equilibrium state.
C) exergonic change.
D) free-energy change.
E) waste of energy.

15. Physical foundations
Page: 23 Difficulty: 1 Ans: C
If heat energy is absorbed by the system during a chemical reaction, the reaction is said to be:

A) at equilibrium.
B) endergonic.
C) endothermic.
D) exergonic.
E) exothermic.

16. Physical foundations
Page: 23 Difficulty: 2 Ans: D
If the free energy change ΔG for a reaction is -46.11 kJ/mol, the reaction is:

A) at equilibrium.
B) endergonic.
C) endothermic.
D) exergonic.
E) exothermic.

17. Physical foundations
Page: 23 Difficulty: 2 Ans: C
The major carrier of chemical energy in all cells is:

A) acetyl triphosphate.
B) adenosine monophosphate.
C) adenosine triphosphate.
D) cytosine tetraphosphate.
E) uridine diphosphate.

18. Physical foundations
Page: 26 Difficulty: 2 Ans: A
Enzymes are biological catalysts that enhance the rate of a reaction by:

A) decreasing the activation energy.
B) decreasing the amount of free energy released.
C) increasing the activation energy.
D) increasing the amount of free energy released.
E) increasing the energy of the transition state.

19. Physical foundations
Page: 27 Difficulty: 1 Ans: B
Energy requiring metabolic pathways that yield complex molecules from simpler precursors are:

A) amphibolic.
B) anabolic.
C) autotrophic.
D) catabolic.
E) heterotrophic.

20. Genetic foundations
Page: 29 Difficulty: 1 Ans: A
Hereditary information (with the exception of some viruses) is preserved in:

A) deoxyribonucleic acid.
B) membrane structures.
C) nuclei.
D) polysaccharides.
E) ribonucleic acid.

21. Genetic foundations
Page: 29 Difficulty: 2 Ans: C
When a region of DNA must be repaired by removing and replacing some of the nucleotides, what ensures that the new nucleotides are in the correct sequence?

A) DNA cannot be repaired and this explains why mutations occur.
B) Specific enzymes bind the correct nucleotides.
C) The new nucleotides basepair accurately with those on the complementary strand.
D) The repair enzyme recognizes the removed nucleotide and brings in an identical one to replace it.
E) The three-dimensional structure determines the order of nucleotides.

22. Genetic foundations
Page: 30 Difficulty: 2 Ans: E
The three-dimensional structure of a protein is determined primarily by:

A) electrostatic guidance from nucleic acid structure.
B) how many amino acids are in the protein.
C) hydrophobic interaction with lipids that provide a folding framework.
D) modification during interactions with ribosomes.
E) the sequence of amino acids in the protein.

23. Evolutionary foundations
Page: 32 Difficulty: 2 Ans: D
According to Oparin's theory for the origin of life, the prebiotic atmosphere:

A) already contained some primitive RNA molecules.
B) basically was very similar to the atmosphere of today.
C) contained many amino acids.
D) had an abundance of methane, ammonia, and water.
E) was rich in oxygen.

Short Answer Questions

24. Cellular foundations
Pages: 1-2 Difficulty: 1
What six characteristics distinguish living organisms from inanimate objects?

Ans: Living organisms (1) are chemically complex and highly organized; (2) extract, transform, and use energy from their environment; (3) have the capacity to precisely self-replicate and self-assemble; (4) exploit a chemical interplay with their environment; (5) possess programmatically defined functions; and (6) evolve to new forms over many generations.

25. Cellular foundations
Page: 3 Difficulty: 1
All cells are surrounded by a plasma membrane composed of lipid and protein molecules. What is the function of the plasma membrane?

Ans: The plasma membrane acts as a barrier to the free passage of inorganic ions and most other charged or polar compounds into or out of the cell. It contains proteins that can transport specific ions or molecules. Other membrane proteins act as receptors that transmit signals from the outside to the inside of the cell.

26. Cellular foundations
Page: 6 Difficulty: 1
E. coli is known as a gram-negative bacterial species. (a) How is this determined? (b) How do gram-negative bacteria differ structurally from gram-positive bacteria?

Ans: (a) Gram-negative bacteria have little affinity for the dye gentian violet used in Gram's stain, but gram-positive bacteria retain Gram's stain. (b) Gram-negative bacteria have an outer membrane and a peptidoglycan layer; gram-positive bacteria lack an outer membrane and the peptidoglycan layer is much thicker.

27. Cellular foundations
Page: 7 Difficulty: 1
Most cells of higher plants have a cell wall outside the plasma membrane. What is the function of the cell wall?

Ans: The cell wall provides a rigid, protective shell for the cell. It is porous, allowing water and small molecules to pass readily, but it is rigid enough to resist the swelling of the cell caused by the accumulation of water. (See Fig. 1-7, p. 7.)

28. Cellular foundations
Page: 11 Difficulty: 2
(a) List the types of noncovalent interactions that are important in providing stability to the three-dimensional structures of macromolecules. (b) Why is it important that these interactions be noncovalent, rather than covalent, bonds?

Ans: (a) Noncovalent interactions include hydrogen bonds, ionic interactions between charged groups, van der Waals interactions, and hydrophobic interactions. (b) Because noncovalent interactions are weak, they can form, break, and re-form more rapidly and with less energy input than can covalent bonds. This is important to maintain the flexibility needed in macromolecules.