Name: _____ Date: _____

1.	Cyclic AMP (cAMP) is a small molecule that associates with its binding site with a high degree of specificity. Which types of noncovalent interactions are the most important for providing the "hand in a glove" binding of cAMP?
A)	electrostatic interactions
B)	van der Waals interactions
C)	hydrophobic interactions
D)	hydrogen bonds

2.	Select the option that *best* finishes the following statement: "Evolution is a process _____."
A)	by which all present-day cells arose from 4–5 different ancestral cells.
B)	that requires hundreds of thousands of years.
C)	that results from repeated cycles of adaptation over billions of years.
D)	that can be understood based on the principles of mutation and selection.

3.	To study how proteins fold, scientists must be able to purify the protein of interest, use solvents to denature the folded protein, and observe the process of refolding at successive time points. What is the effect of the solvents used in the denaturation process?
A)	The solvents break all noncovalent interactions.
B)	The solvents break some of the noncovalent interactions, resulting in a misfolded protein.
C)	The solvents create a new protein conformation.
D)	The solvents break all covalent interactions.

4.	Which of the following is *not* a feature commonly observed in α helices?
A)	one helical turn every 3.6 amino acids
B)	cylindrical shape
C)	amino acid side chains that point outward
D)	left-handedness

5.	DNA and RNA are different types of nucleic acid polymer. Which of the following is true of DNA but *not* true of RNA?
A)	It contains thymine.
B)	It has 5'-to-3' directionality.
C)	It contains uracil.
D)	It is single-stranded.

6.	Living systems are incredibly diverse in size, shape, environment, and behavior. It is estimated that there are between 10 million and 100 million different species. Despite this wide variety of organisms, it remains difficult to define what it means to say something is alive. Which of the following can be described as the smallest living unit?
A)	protein
B)	DNA
C)	cell
D)	organelle

7.	Polypeptides are synthesized from amino acid building blocks. The condensation reaction between the growing polypeptide chain and the next amino acid to be added involves the loss of _____.

A)	a carboxylic acid group.
B)	a water molecule.
C)	an amino group.
D)	a carbon atom.

8.	Protein folding can be studied using a solution of purified protein and a denaturant (urea), a solvent that interferes with noncovalent interactions. Which of the following is observed after the denaturant is removed from the protein solution?
A)	The polypeptide adopts a new, stable conformation.
B)	The polypeptide returns to its original conformation.
C)	The polypeptide remains denatured.
D)	The polypeptide forms solid aggregates and precipitates out of solution.

9.	Molecular chaperones can work by creating an "isolation chamber." What is the purpose of this chamber?
A)	This chamber serves to protect unfolded proteins from interacting with other proteins in the cytosol, until protein folding is completed.
B)	This chamber serves to transport unfolded proteins out of the cell.
C)	The chamber acts as a garbage disposal, degrading improperly folded proteins so that they do not interact with properly folded proteins.
D)	This chamber is used to increase the local protein concentration, which will help speed up the folding process.

10.	Chemical reactions carried out by living systems depend on the ability of some organisms to capture and use atoms from nonliving sources in the environment. The specific subset of these reactions that break down nutrients in food can be described as _____.
A)	catabolic.
B)	biosynthetic.
C)	metabolic.
D)	anabolic.

11.	The flow of genetic information is controlled by a series of biochemical reactions that result in the production of proteins, each with its own specific order of amino acids. Choose the correct series of biochemical reactions from the options presented here.
A)	replication, translation, transcription
B)	translation, replication, transcription
C)	replication, transcription, translation
D)	translation, transcription, replication

12.	ΔG measures the change of free energy in a system as it converts reactant (Y) into product (X). When [Y] =[X], ΔG is equal to _____.
A)	$\Delta G°$
B)	$\Delta G° + RT$
C)	RT
D)	ln [X]/[Y]

13.	Polar covalent bonds are formed when the electrons in the bond are not shared equally between the two nuclei. Which one of these molecules contains polar bonds?
A)	water
B)	molecular oxygen
C)	methane

D)	propane

14.	Oligosaccharides are short sugar polymers that can become covalently linked to proteins and lipids through condensation reactions. These modified proteins and lipids are called glycoproteins and glycolipids, respectively. Within a protein, which of the amino acids (shown in Figure Q2-48) is the most probable target for this type of modification?

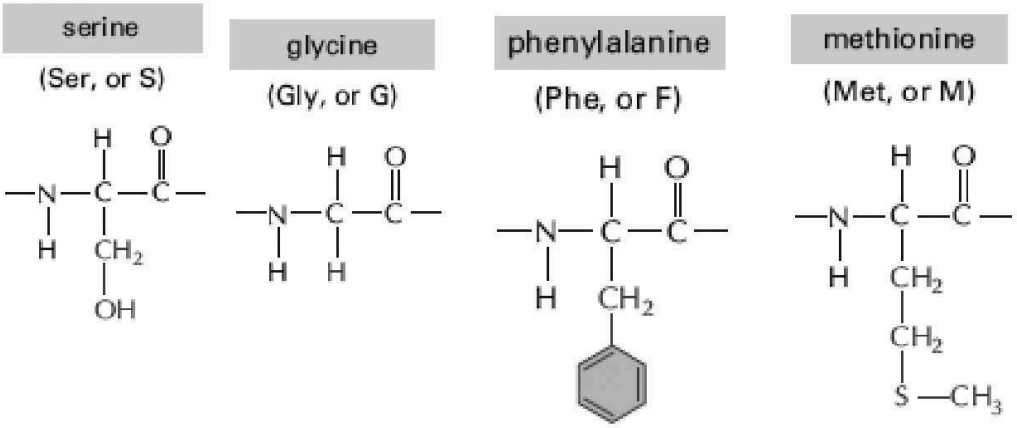


Figure Q2-48

A)	methionine
B)	phenylalanine
C)	serine
D)	glycine

15.	Many types of cells have stores of lipids in their cytoplasm, usually seen as fat droplets. What is the lipid most commonly found in these droplets?
A)	triacylglycerol
B)	cholesterol
C)	palmitic acid
D)	isoprene

16.	Which of the following monomer building blocks is necessary to assemble selectively permeable boundaries around and inside cells?
A)	amino acids
B)	nucleotides
C)	fatty acids
D)	sugars

17.	Which combination of answers best completes the following statement: When atoms are held together by , they are typically referred to as .
A)	double bonds, nonpolar.
B)	ionic interactions, molecules.
C)	hydrogen bonds, molecules.
D)	ionic interactions, salts.

18.	Which of the following globular proteins is used to form filaments as an intermediate step to assembly into hollow tubes?
A)	collagen

B)	tubulin
C)	actin
D)	keratin

19.	Both DNA and RNA are synthesized by covalently linking a nucleoside triphosphate to the previous nucleotide, constantly adding to a growing chain. In the case of DNA, the new strand becomes part of a stable helix. The two strands are complementary in sequence and antiparallel in directionality. What is the principal force that holds these two strands together?
A)	covalent bonds
B)	ionic interactions
C)	van der Waals interactions
D)	hydrogen bonds

20.	Because there are four different monomer building blocks that can be used to assemble RNA polymers, the number of possible sequence combinations that can be created for an RNA molecule made of 100 nucleotides is _____.
A)	4^{100}
B)	4×100
C)	100/4
D)	100^4

21.	A covalent bond between two atoms is formed as a result of the .
A)	transfer of electrons from one atom to the other.
B)	sharing of electrons.
C)	loss of electrons from both atoms.
D)	loss of a proton from one atom.

22.	Choose the answer that best fits the following statement: Cholesterol is an essential component of biological membranes. Although it is much smaller than the typical phospholipids and glycolipids in the membrane, it is a(n) _____ molecule, having both hydrophilic and hydrophobic regions.
A)	oxygen-containing
B)	hydrophobic
C)	amphipathic
D)	polar

23.	Which of the following is *not true* of molecular chaperones?
A)	They can isolate proteins from other components of the cells until folding is complete.
B)	They help streamline the protein-folding process by making it a more efficient and reliable process inside the cell.
C)	They assist polypeptide folding by helping the folding process follow the most energetically favorable pathway.
D)	They can interact with unfolded polypeptides in a way that changes the final fold of the protein.

24.	Protein structures have several different levels of organization. The primary structure of a protein is its amino acid sequence. The secondary and tertiary structures are more complicated. Consider the definitions below and select the one that best fits the term “protein domain.”
A)	a complex of more than one polypeptide chain
B)	a small cluster of α helices and β sheets
C)	a protein segment that folds independently
D)	the tertiary structure of a substrate-binding pocket

25.	Which of the following statements is *true*?
A)	Disulfide bonds stabilize but do not change a protein's final conformation.
B)	Disulfide bonds are formed by the cross-linking of methionine residues.
C)	Agents such as mercaptoethanol can break disulfide bonds through oxidation.
D)	Disulfide bonds are formed mainly in proteins that are retained within the cytosol.

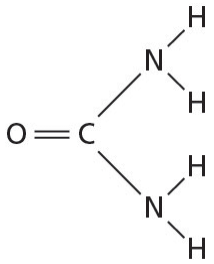
26.	A chemical reaction is defined as spontaneous if there is a net loss of free energy during the reaction process. However, spontaneous reactions do not always occur rapidly. Favorable biological reactions require _____ to selectively speed up reactions and meet the demands of the cell.
A)	enzymes
B)	ions
C)	heat
D)	ATP

27.	Prokaryotic cells are able to evolve very fast, which helps them to rapidly adapt to new food sources and develop resistance to antibiotics. Which of the options below lists the three main characteristics that support the rapid evolution of prokaryotic populations?
A)	aerobic, motile, rapid growth
B)	no organelles, cell wall, can exchange DNA
C)	large population, rapid growth, can exchange DNA
D)	microscopic, motile, anaerobic

28.	Which of the following is *not* a feature commonly observed in β sheets?
A)	extended polypeptide backbone
B)	parallel regions
C)	coiled-coil patterns
D)	antiparallel regions

29.	The correct folding of proteins is necessary to maintain healthy cells and tissues. Unfolded proteins are responsible for such neurodegenerative disorders as Alzheimer's disease, Huntington's disease, and Creutzfeldt–Jakob disease (the specific faulty protein is different for each disease). What is the ultimate fate of these disease-causing, unfolded proteins?
A)	They form protein aggregates.
B)	They are degraded.
C)	They bind a different target protein.
D)	They form structured filaments.

30.	Which of the following choices *best* describes the role of the lysosome?
A)	sorting of transport vesicles
B)	transport of material to the Golgi
C)	the storage of excess macromolecules
D)	clean-up, recycling, and disposal of macromolecules

31.	Larger molecules have hydrogen-bonding networks that contribute to specific, high-affinity binding. Smaller molecules such as urea can also form these networks. How many hydrogen bonds can urea (Figure Q2-36) form if dissolved in water?  Figure Q2-36

A)	5
B)	3
C)	4
D)	6

32.	Each nucleotide in DNA and RNA has an aromatic base. What is the principal force that keeps the bases in a polymer from interacting with water?

A)	hydrogen bonds
B)	van der Waals interactions
C)	hydrophobic interactions
D)	covalent bonds

33.	Fully folded proteins typically have polar side chains on their surfaces, where electrostatic attractions and hydrogen bonds can form between the polar group on the amino acid and the polar molecules in the solvent. In contrast, some proteins have a polar side chain in their hydrophobic interior. Which of the following would *not* occur to help accommodate an internal, polar side chain?

A)	A hydrogen bond forms between a polar side chain and an aromatic side chain.
B)	A hydrogen bond forms between two polar side chains.
C)	Hydrogen bonds form between polar side chains and a buried water molecule.
D)	A hydrogen bond forms between a polar side chain and the protein backbone.

34.	By definition, prokaryotic cells do not possess .

A)	replication machinery.
B)	ribosomes.
C)	membrane bilayers.
D)	a nucleus.

35.	The second law of thermodynamics states that the disorder in any system is always increasing. In simple terms, you can think about dropping NaCl crystals into a glass of water. The solvation and diffusion of ions is favored because there is an increase in _____.

A)	entropy.
B)	stored energy.
C)	pH.
D)	ions.

36.	Which of the following statements is *true*?
A)	The polypeptide backbone is free to rotate about each peptide bond.
B)	The sequence of the atoms in the polypeptide backbone varies between different proteins.
C)	Peptide bonds are the only covalent bonds that can link together two amino acids in proteins.
D)	Nonpolar amino acids tend to be found in the interior of proteins.

37.	The variations in the physical characteristics between different proteins are influenced by the overall amino acid compositions, but even more important is the unique amino acid _____.
A)	sequence.
B)	bond.
C)	orientation.
D)	number.

38.	The mitochondrial proteins found in the inner membrane are involved in the conversion of ADP to ATP, a source of energy for the cell. This process consumes which of the following substances?
A)	carbon dioxide
B)	sulfur
C)	oxygen
D)	nitrogen

39.	Which of the following characteristics would *not* support the idea that the ancestral eukaryote was a predator cell that captured and consumed other cells?
A)	large cell size
B)	ability to move
C)	rigid membrane
D)	dynamic cytoskeleton

40.	Two or three α helices can sometimes wrap around each other to form coiled-coils. The stable wrapping of one helix around another is typically driven by interactions.
A)	van der Waals
B)	hydrophilic
C)	ionic
D)	hydrophobic

41.	Which statement is NOT true about mutations?
A)	A mutation is a change in the DNA that can generate offspring that are as fit for survival as their parents are.
B)	A mutation is a change in the DNA that can generate offspring less fit for survival than their parents.
C)	A mutation can be a result of imperfect DNA duplication.
D)	A mutation is a result of sexual reproduction.

42.	The cytoskeleton provides support, structure, motility, and organization, and it forms tracks to direct organelle and vesicle transport. Which of the cytoskeletal elements listed below is the thickest?
A)	intermediate filaments
B)	actin filaments
C)	microtubules
D)	none of the above (all the same thickness)

43.	Oxidation is a favorable process in an aerobic environment, which is the reason cells are able to derive energy from the oxidation of macromolecules. Once carbon has been oxidized to _____, its most stable form, it can only cycle back into the organic portion of the carbon cycle through _____.
A)	CO_2, respiration.
B)	CO, reduction.
C)	CH_3, combustion.
D)	CO_2, photosynthesis.

44.	The equilibrium constant (*K*) for the reaction YX can be expressed with respect to the concentrations of the reactant and product molecules. Which of the expressions below shows the correct relationship between *K*, [Y], and [X]?
A)	$K = [Y] * [X]$
B)	$K = [X] - [Y]$
C)	$K = [Y]/[X]$
D)	$K = [X]/[Y]$

45.	The energy used by the cell to generate specific biological molecules and highly ordered structures is stored in the form of _____.
A)	heat.
B)	chemical bonds.
C)	Brownian motion.
D)	light waves.

46.	Select the answer that *best* completes the following statement: Chemical reactions in living systems occur in an _____ environment, within a narrow range of temperatures.
A)	organic
B)	aqueous
C)	optimal
D)	extracellular

47.	There are 20^{100} different possible sequence combinations for a protein chain with 100 amino acids. In addition to the amino acid sequence of the protein, what other factors *increase* the potential for diversity in these macromolecules?
A)	the directionality of amino acids being added
B)	free rotation around single bonds during synthesis
C)	the planar nature of the peptide bond
D)	noncovalent interactions sampled as protein folds

48.	Proteins are important architectural and catalytic components within the cell, helping to determine its chemistry, its shape, and its ability to respond to changes in the environment. Remarkably, all of the different proteins in a cell are made from the same 20 _____. By linking them in different sequences, the cell can make protein molecules with different conformations and surface chemistries, and therefore different functions.
A)	amino acids.
B)	nucleotides.
C)	fatty acids.
D)	sugars.

49.	Macromolecules in the cell can often interact transiently as a result of noncovalent interactions. These weak interactions also produce stable, highly specific interactions between molecules. Which of the factors below is the most significant in determining whether the interaction will be transient or stable?
A)	the concentration of each molecule
B)	the rate of synthesis
C)	surface complementarity between molecules
D)	the size of each molecule

50.	Double covalent bonds are both shorter and stronger than single covalent bonds, but they also limit the geometry of the molecule because they _____.
A)	limit the rotation of the bonded atoms.
B)	create a new arrangement of electron shells.
C)	prevent additional bonds from being formed with the bonded atoms.
D)	change the reactivity of the bonded atoms.

Answer Key

1.	D
2.	D
3.	A
4.	D
5.	A
6.	C
7.	B
8.	B
9.	A
10.	A
11.	C
12.	A
13.	A
14.	C
15.	A
16.	C
17.	D
18.	B
19.	D
20.	A
21.	B
22.	C
23.	D
24.	C
25.	A
26.	A
27.	C
28.	C
29.	A
30.	D
31.	D
32.	C
33.	A
34.	D
35.	A
36.	D
37.	A
38.	C
39.	C
40.	D

41.	D
42.	C
43.	D
44.	D
45.	B
46.	B
47.	B
48.	A
49.	C
50.	A