

Name _____

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

- 1) The valence of an atom represents its 1) _____
A) electronegativity.
B) radioactivity.
C) ability to interact with water.
D) ability to interact with other atoms.
E) ability to attract electrons.

Answer: D

Explanation: A)
B)
C)
D)
E)

- 2) Which of the following statements concerning nucleic acids is FALSE? 2) _____
A) Nucleic acid strands are held together by hydrogen bonds between complementary bases.
B) Some viruses have DNA as their genomes.
C) The nucleic acid polymer is composed of peptide bonds.
D) Not all DNA is double stranded.
E) Cytosine is found in all nucleic acid molecules.

Answer: C

Explanation: A)
B)
C)
D)
E)

- 3) Nucleic acids, proteins, and complex carbohydrates are all produced by 3) _____
A) catabolic reactions.
B) hydrolytic reactions.
C) hydrogen bonding.
D) dehydration synthesis.
E) exchange reactions.

Answer: D

Explanation: A)
B)
C)
D)
E)

4) The "backbone" of the DNA molecule is composed of

4) _____

- A) pentoses.
- B) amino acids.
- C) phosphates.
- D) alternating phosphates and pentoses.
- E) nitrogenous bases.

Answer: D

Explanation: A)
B)
C)
D)
E)

5) Organisms use carbohydrates in all of the following ways EXCEPT

5) _____

- A) as a short-term energy source.
- B) as a component of cell walls.
- C) to keep membranes flexible at low temperatures.
- D) as a building block of DNA and RNA molecules.
- E) as a long-term energy source.

Answer: C

Explanation: A)
B)
C)
D)
E)

6) Which of the following is found in nucleic acids?

6) _____

- A) carboxylic acid
- B) amines
- C) R group
- D) glycerol
- E) purines

Answer: E

Explanation: A)
B)
C)
D)
E)

7) Proteins contain both acidic and basic R groups, and can therefore function as

7) _____

- A) buffers.
- B) energy storage macromolecules.
- C) genetic material.
- D) catalysts.
- E) structural macromolecules.

Answer: A

Explanation: A)
B)
C)
D)
E)

8) Which of the following is an INCORRECT pairing?

8) _____

- A) secondary structure; β -pleated sheets
- B) primary structure; amino acid sequence
- C) quaternary structure; two or more polypeptides
- D) tertiary structure; covalent bonds
- E) secondary structure; disulfide bridges

Answer: E

Explanation: A)
B)
C)
D)
E)

9) All of the following bases are found in RNA molecules EXCEPT

9) _____

- A) uracil.
- B) adenine.
- C) guanine.
- D) thymine.
- E) cytosine.

Answer: D

Explanation: A)
B)
C)
D)
E)

10) A protein is a _____ of amino acids.

10) _____

- A) bilayer
- B) decomposition product
- C) monomer
- D) solution
- E) polymer

Answer: E

Explanation: A)
B)
C)
D)
E)

11) Unstable isotopes can be useful

11) _____

- A) in medical diagnosis.
- B) as buffers.
- C) catalysts.
- D) in vitamins.
- E) in the formation of hydrogen bonds.

Answer: A

Explanation: A)
B)
C)
D)
E)

12) Which of the following is a particle found in the nucleus of an atom and that has no electrical charge? 12) _____

- A) isotope B) element C) neutron D) electron E) proton

Answer: C

Explanation: A)
 B)
 C)
 D)
 E)

13) DNA is composed of repeating units of sugars, phosphates, and nucleic acids. This is an example of 13) _____
a

- A) lipid. B) polymer. C) salt. D) micelle. E) monomer.

Answer: B

Explanation: A)
 B)
 C)
 D)
 E)

14) Which of the following is an INCORRECT pairing? 14) _____

- A) electrolytes; anions
B) synthesis; endothermic
C) dehydration; anabolism
D) catabolism; exothermic
E) hydrolysis; hydrogen bonds

Answer: E

Explanation: A)
 B)
 C)
 D)
 E)

15) An acid dissociates in water to release 15) _____

- A) anion(s).
B) hydroxyl group(s).
C) cation(s).
D) hydrogen ion(s).
E) both anions and hydrogen ions.

Answer: E

Explanation: A)
 B)
 C)
 D)
 E)

16) An amine group is removed from an amino acid and bonded to a second compound to form a different amino acid. No other molecules are used or produced. What type of reaction is likely to be involved? 16) _____

- A) a synthesis reaction
- B) a hydrolysis reaction
- C) an exchange reaction
- D) a decomposition reaction
- E) The answer cannot be determined for the available information.

Answer: E

Explanation: A)
B)
C)
D)
E)

17) Tertiary and quaternary structure of proteins involves _____ bonds. 17) _____

- A) ionic
- B) hydrogen
- C) nonpolar covalent
- D) polar covalent
- E) ionic, hydrogen, polar, and nonpolar covalent

Answer: E

Explanation: A)
B)
C)
D)
E)

18) Which of the following would NOT normally be found as a component of a cell's nucleic acids? 18) _____

- A) thymine deoxyribonucleotides
- B) uracil deoxyribonucleotides
- C) adenine ribonucleotides
- D) cytosine ribonucleotides
- E) adenine deoxyribonucleotides

Answer: B

Explanation: A)
B)
C)
D)
E)

19) Lipids found in the membranes of all eukaryotic cells are

19) _____

- A) steroids.
- B) phospholipids.
- C) triglycerides.
- D) polyunsaturated fats.
- E) waxes.

Answer: B

Explanation: A)
B)
C)
D)
E)

20) Decomposition reactions are commonly _____ reactions.

20) _____

- A) anabolic
- B) exchange
- C) dehydration
- D) endothermic
- E) exothermic

Answer: E

Explanation: A)
B)
C)
D)
E)

21) A stable atom has _____ in its valence shell.

21) _____

- A) 10 electrons
- B) 8 electrons
- C) 2 neutrons
- D) 4 electrons
- E) 8 protons

Answer: B

Explanation: A)
B)
C)
D)
E)

22) Which of the following is an example of a polysaccharide?

22) _____

- A) glycogen
- B) sucrose
- C) glucose
- D) fructose
- E) deoxyribose

Answer: A

Explanation: A)
B)
C)
D)
E)

23) Which of the following are examples of pyrimidines?

23) _____

- A) uracil and adenine
- B) cytosine and thymine
- C) cytosine and guanine
- D) thymine and adenine
- E) thymine and guanine

Answer: B

Explanation: A)
B)
C)
D)
E)

24) Which of the following is a property of water?

24) _____

- A) It is liquid in a very narrow temperature range.
- B) It has a high capacity for heat.
- C) It is not a common reactant in metabolic reactions.
- D) It is a nonpolar molecule.
- E) It is not a good solvent.

Answer: B

Explanation: A)
B)
C)
D)
E)

25) A(n) _____ is a compound that dissolves into anions and cations in water.

25) _____

- A) catalyst.
- B) buffer
- C) base
- D) salt
- E) acid

Answer: D

Explanation: A)
B)
C)
D)
E)

26) A polymer composed of simple sugars is a(n)

26) _____

- A) triglyceride.
- B) protein.
- C) glycoprotein.
- D) starch.
- E) amino acid.

Answer: D

Explanation: A)
B)
C)
D)
E)

27) Which of the following statements about proteins is FALSE?

27) _____

- A) They have multiple levels of structural organization.
- B) They can be hydrophobic, hydrophilic, or both.
- C) Their primary function is energy storage.
- D) They are formed by dehydration synthesis reactions.
- E) They are composed of amino acids.

Answer: C

Explanation: A)
B)
C)
D)
E)

28) Adenosine triphosphate (ATP) is a

28) _____

- A) polymer.
- B) lipid.
- C) simple carbohydrate.
- D) bilayer.
- E) monomer.

Answer: E

Explanation: A)
B)
C)
D)
E)

29) Which of the following is NOT a characteristic of saturated fats?

29) _____

- A) They are found in animals.
- B) They are a form of stored energy.
- C) They are usually solid at room temperature.
- D) Their fatty acids pack tightly together.
- E) They contain at least one double bond.

Answer: E

Explanation: A)
B)
C)
D)
E)

30) Amylose is a(n) _____ carbohydrate.

30) _____

- A) nucleotide
- B) polymer
- C) monomer
- D) ionic
- E) simple

Answer: B

Explanation: A)
B)
C)
D)
E)

31) Plant cell walls are composed of _____ held together by _____.

31) _____

- A) fatty acids; polar covalent bonds
- B) peptidoglycan; ionic bonds
- C) polysaccharides; hydrogen bonds
- D) amino acids; peptide bonds
- E) disaccharides; hydrophobic interactions

Answer: C

Explanation: A)
B)
C)
D)
E)

32) Compounds that readily dissociate in water are

32) _____

- A) polar.
- B) ionic.
- C) nonpolar.
- D) either polar or ionic.
- E) never polar or ionic.

Answer: D

Explanation: A)
B)
C)
D)
E)

33) A(n) _____ is an arrangement of atoms found in a variety of macromolecules.

33) _____

- A) functional group
- B) salt
- C) buffer
- D) isotope
- E) stereoisomer

Answer: A

Explanation: A)
B)
C)
D)
E)

34) Anna is conducting an experiment using a pH indicator that is red at low pH, green at neutral pH and purple at high pH. She starts with a green solution. When she adds compound X to her solution it turns purple. Then she adds compound Z to the solution and it turns green. She adds more Z, the solution remains green. These observations suggest X is _____ and Z is _____.

34) _____

- A) a base; a buffer
- B) an acid; a base
- C) a base; a strong acid
- D) a buffer; a base
- E) an acid; a buffer

Answer: A

Explanation: A)
B)
C)
D)
E)

35) Hydrogen bonds are found in all of the following EXCEPT

35) _____

- A) between water molecules.
- B) in the DNA double helix between nucleotides.
- C) between phosphates in ATP.
- D) in α -helices.
- E) between the R groups of amino acids in proteins.

Answer: C

Explanation: A)
B)
C)
D)
E)

36) Matter composed of a single type of atom is known as a(n)

36) _____

- A) element.
- B) compound.
- C) electron.
- D) molecule.
- E) mineral.

Answer: A

Explanation: A)
B)
C)
D)
E)

- 37) The type(s) of bond produced when atoms with somewhat different electronegativities share electrons is/are 37) _____
- A) a hydrogen bond.
 - B) a polar covalent bond.
 - C) a nonpolar covalent bond.
 - D) an ionic bond.
 - E) both nonpolar covalent and ionic bonds.
- Answer: B
- Explanation: A)
B)
C)
D)
E)
- 38) Which of the following types of chemical bonds do carbon atoms generally NOT form? 38) _____
- A) polar covalent bonds
 - B) ionic bonds
 - C) hydrogen bonds
 - D) nonpolar covalent bonds
 - E) neither ionic nor hydrogen bonds
- Answer: E
- Explanation: A)
B)
C)
D)
E)
- 39) Which parts of the atoms interact in a chemical reaction? 39) _____
- A) electrons B) neutrons C) ions D) isotopes E) protons
- Answer: A
- Explanation: A)
B)
C)
D)
E)
- 40) All of the following are associated with ATP molecules EXCEPT 40) _____
- A) formation of coenzymes.
 - B) a recyclable energy supply.
 - C) high-energy bonds.
 - D) three phosphate groups.
 - E) a long-term energy supply.
- Answer: E
- Explanation: A)
B)
C)
D)
E)

41) Which of the following is NOT a characteristic of phospholipids?

41) _____

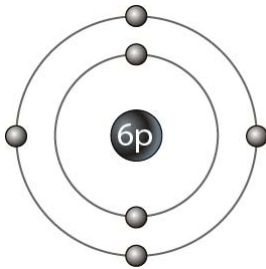
- A) They contain fatty acids that associate with water.
- B) They contain two fatty acids and a phosphate functional group.
- C) They contain a hydrophilic phosphate "head."
- D) They are found in cellular membranes.
- E) They can form micelles and bilayers.

Answer: A

Explanation: A)
B)
C)
D)
E)

42)

42) _____



The outer ring in Figure 2-1 represents

- A) an isotope.
- B) an electron shell.
- C) a neutron.
- D) an electron.
- E) the nucleus.

Answer: B

Explanation: A)
B)
C)
D)
E)

43) The type(s) of bond produced when atoms share electrons equally is/are

43) _____

- A) a nonpolar covalent bond.
- B) an ionic bond.
- C) a hydrogen bond.
- D) a polar covalent bond.
- E) both polar covalent and ionic bonds.

Answer: A

Explanation: A)
B)
C)
D)
E)

44) A hydroxyl _____ acts as a base. 44) _____
A) anion B) salt C) cation D) group E) atom

Answer: A

Explanation: A)
B)
C)
D)
E)

45) The reverse of a dehydration synthesis reaction is a(n) _____ reaction. 45) _____

- A) endothermic
- B) hydrolytic
- C) exchange
- D) metabolic
- E) anabolic

Answer: B

Explanation: A)
B)
C)
D)
E)

46) All of the following are components of an amino acid EXCEPT a(n) 46) _____

- A) α -carbon.
- B) R group.
- C) carboxyl group.
- D) amino group.
- E) pentose group.

Answer: E

Explanation: A)
B)
C)
D)
E)

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

47) The (atoms/isotopes/stereoisomers) of an element vary in the number of neutrons in the nucleus. 47) _____

Answer: isotopes

Explanation:

48) A(n) (catalyst/enzyme) is any molecule that speeds up a chemical reaction. 48) _____

Answer: catalyst

Explanation:

49) The monomer of a nucleic acid is called a (nucleoside/nucleotide/base). 49) _____

Answer: nucleotide

Explanation:

- 50) A chemical reaction in which a water molecule is a reactant is known as a(n) _____
(dehydration/hydrolysis) reaction.
Answer: hydrolysis
Explanation:
- 51) The folding of a polypeptide into a three-dimensional shape is its _____
(secondary/tertiary/quaternary) structure.
Answer: tertiary
Explanation:
- 52) Cell surface markers composed of both carbohydrate and lipid molecules are known as _____
(glycoproteins/glycolipids/LPS).
Answer: glycolipids
Explanation:
- 53) Radioactive iodine is sometimes used to treat thyroid cancer. This is an example of the use _____
of (isotopes/elements/radiation) in medical treatment.
Answer: isotopes
Explanation:
- 54) An atom or molecule becomes a(n) (anion/ion/cation) when it loses an electron to a more _____
electronegative molecule.
Answer: cation
Explanation:
- 55) The DNA double helix is held together by (covalent/ionic/hydrogen) bonds. _____
Answer: hydrogen
Explanation:
- 56) A(n) (indicator/base/buffer) is a substance that maintains the pH even when the amounts _____
of acid and / or base are changing.
Answer: buffer
Explanation:
- 57) A(n) (base/acid) is a molecule that binds with hydrogen ions when it is dissolved in water. _____
Answer: base
Explanation:

58) _____

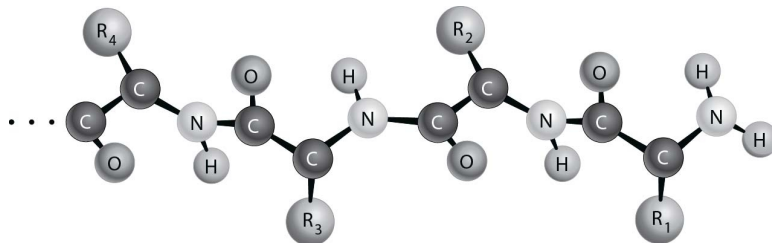


Figure 2.2 depicts the (primary/secondary/tertiary) structure of a protein.

Answer: primary
Explanation:

- 59) The sum of all the chemical reactions within an organism is referred to as its (metabolism/physiology). 59) _____
Answer: metabolism
Explanation:
- 60) The phosphorylation of a protein by ATP is a(n) (exchange/transfer) reaction 60) _____
Answer: exchange
Explanation:
- 61) A chemical reaction that traps energy within newly formed chemical bonds is an (exothermic/endothermic) reaction. 61) _____
Answer: endothermic
Explanation:

TRUE/FALSE. Write 'T' if the statement is true and 'F' if the statement is false.

- 62) Salts are produced from exchange reactions in which acids and bases neutralize each other. 62) _____
Answer: ☒ True False
Explanation:
- 63) The side groups of amino acids can interact with each other and with other molecules. 63) _____
Answer: ☒ True False
Explanation:
- 64) One of the products of dehydration synthesis reactions is water. 64) _____
Answer: ☒ True False
Explanation:
- 65) An organic molecule with the chemical formula $C_4H_5O_1N_3$ is probably a pyrimidine. 65) _____
Answer: ☒ True False
Explanation:
- 66) The long-term chemical energy storage molecules in plants are triglycerides. 66) _____
Answer: True ☒ False
Explanation:
- 67) A molecule composed of carbon and hydrogen is a compound. 67) _____
Answer: ☒ True False
Explanation:
- 68) The smallest chemical units of matter are elements. 68) _____
Answer: True ☒ False
Explanation:
- 69) Denaturation of a protein is always permanent. 69) _____
Answer: True ☒ False
Explanation:

70) The electron shells of atoms hold eight electrons each.

70) _____

Answer: True ☒ False

Explanation:

71) Hydrogen bonds are stronger than covalent bonds.

71) _____

Answer: True ☒ False

Explanation:

ESSAY. Write your answer in the space provided or on a separate sheet of paper.

72) Discuss the importance of hydrogen bonds in the chemistry of the cell.

Answer: The chemistry of the cell would basically be impossible without hydrogen bonds. Water, which is required by all cellular reactions, would not have its unique properties of cohesiveness and polarity without hydrogen bonds. Hydrogen bonds hold the double helix of DNA together and contribute to the overall shape of protein molecules. However, unlike covalent bonds, hydrogen bonds are not permanent bonds, so they can easily and temporarily be broken, a characteristic that is important at certain points in the cell's life cycle (such as during DNA replication).

73) Nitrogen is an essential element for living things, as demonstrated by the fact that nearly all fertilizers contain nitrogenous compounds. Discuss why nitrogen is essential.

Answer: Nitrogen is a component in the structure of two of the four types of organic macromolecules. The amino group of an amino acid is a key reactant in the formation of peptide bonds, or primary structure, of proteins. Nitrogen also participates in hydrogen bonding and thereby contributes to the secondary, tertiary, and quaternary structure of proteins. Nitrogen is a key structural component of the bases in nucleic acids, and its participation in hydrogen bonding results in the formation of the base pairs and therefore the double helix of DNA.

74) Compare and contrast synthesis reactions with decomposition reactions.

Answer: Synthesis and decomposition reactions are often the reverse of each other. Synthesis reactions consume energy (are endothermic), whereas decomposition reactions release energy (are exothermic). Synthesis reactions often release water molecules in a process called dehydration synthesis, whereas decomposition reactions often consume water molecules in a process called hydrolysis. Finally, decomposition reactions break large macromolecules into their component monomers, which can then be used in synthesis reactions to build new macromolecules for use by the cell, whereas synthesis reactions utilize component monomers to build larger molecules.

75) Describe the chemical properties of phospholipids that account for their behavior in water.

Answer: Phospholipids have polar phosphate "heads" and nonpolar fatty acid "tails," which interact in different ways with water molecules. The phospholipid heads are attracted to polar water molecules, but the nonpolar tails of the phospholipid are repelled by water. As the tails are driven away from the water molecules, they congregate together, either in the interior of a ball of lipid (called a micelle) or within the interior of a double layer of phospholipids (called a bilayer). This leaves the phosphate heads "outside," where they can easily interact with the water molecules.

- 76) Max is exploring the properties of various compounds. Some of his explorations involve the use of a pH indicator that is red at low pH, yellow-green at neutral pH and blue to purple at high pH. He sets up several tubes containing water and the pH indicator and then begins to add some of the compounds he is characterizing in various combinations. His results are shown on the Figure 2.3.

Compound	None	1 × L	1 × M	2 × M	5 × M	1 × N	1 × L + 1 × M	1 × L + 5 × M	1 × L + 1 × M + 1 × N
Color	Green	Red	Green	Blue	Purple	Green	Red	Green	Green

What can Max conclude about his compounds based on these results? Describe the likely events in terms of hydrogen and hydroxyl ions.

Answer: Max's results are consistent with L being an acid and M being a weak base. Compound N appears to be a buffer. The green color of the indicator is seen when the concentrations of hydroxyl and hydrogen ions are equal. The red color of the solution indicates the concentration of hydrogen ions is greater than the hydroxyl ion concentration. The data does not provide information for calculating the concentrations. Blue and purple indicator colors show the hydroxyl ion concentrations exceed the hydrogen ion concentrations. The results with the mixes of L and M suggest that L dissolves to release 5 times more hydrogen ions than the concentration of hydroxyl ions produced by the ionization of M. Compound N accepts or releases ions with changing hydrogen ion concentrations to maintain equal concentrations of cations and anions.

Answer Key

Testname: C2

- 1) D
- 2) C
- 3) D
- 4) D
- 5) C
- 6) E
- 7) A
- 8) E
- 9) D
- 10) E
- 11) A
- 12) C
- 13) B
- 14) E
- 15) E
- 16) E
- 17) E
- 18) B
- 19) B
- 20) E
- 21) B
- 22) A
- 23) B
- 24) B
- 25) D
- 26) D
- 27) C
- 28) E
- 29) E
- 30) B
- 31) C
- 32) D
- 33) A
- 34) A
- 35) C
- 36) A
- 37) B
- 38) E
- 39) A
- 40) E
- 41) A
- 42) B
- 43) A
- 44) A
- 45) B
- 46) E
- 47) isotopes
- 48) catalyst
- 49) nucleotide
- 50) hydrolysis

Answer Key

Testname: C2

- 51) tertiary
- 52) glycolipids
- 53) isotopes
- 54) cation
- 55) hydrogen
- 56) buffer
- 57) base
- 58) primary
- 59) metabolism
- 60) exchange
- 61) endothermic
- 62) TRUE
- 63) TRUE
- 64) TRUE
- 65) TRUE
- 66) FALSE
- 67) TRUE
- 68) FALSE
- 69) FALSE
- 70) FALSE
- 71) FALSE
- 72) The chemistry of the cell would basically be impossible without hydrogen bonds. Water, which is required by all cellular reactions, would not have its unique properties of cohesiveness and polarity without hydrogen bonds. Hydrogen bonds hold the double helix of DNA together and contribute to the overall shape of protein molecules. However, unlike covalent bonds, hydrogen bonds are not permanent bonds, so they can easily and temporarily be broken, a characteristic that is important at certain points in the cell's life cycle (such as during DNA replication).
- 73) Nitrogen is a component in the structure of two of the four types of organic macromolecules. The amino group of an amino acid is a key reactant in the formation of peptide bonds, or primary structure, of proteins. Nitrogen also participates in hydrogen bonding and thereby contributes to the secondary, tertiary, and quaternary structure of proteins. Nitrogen is a key structural component of the bases in nucleic acids, and its participation in hydrogen bonding results in the formation of the base pairs and therefore the double helix of DNA.
- 74) Synthesis and decomposition reactions are often the reverse of each other. Synthesis reactions consume energy (are endothermic), whereas decomposition reactions release energy (are exothermic). Synthesis reactions often release water molecules in a process called dehydration synthesis, whereas decomposition reactions often consume water molecules in a process called hydrolysis. Finally, decomposition reactions break large macromolecules into their component monomers, which can then be used in synthesis reactions to build new macromolecules for use by the cell, whereas synthesis reactions utilize component monomers to build larger molecules.
- 75) Phospholipids have polar phosphate "heads" and nonpolar fatty acid "tails," which interact in different ways with water molecules. The phospholipid heads are attracted to polar water molecules, but the nonpolar tails of the phospholipid are repelled by water. As the tails are driven away from the water molecules, they congregate together, either in the interior of a ball of lipid (called a micelle) or within the interior of a double layer of phospholipids (called a bilayer). This leaves the phosphate heads "outside," where they can easily interact with the water molecules.
- 76) Max's results are consistent with L being an acid and M being a weak base. Compound N appears to be a buffer. The green color of the indicator is seen when the concentrations of hydroxyl and hydrogen ions are equal. The red color of the solution indicates the concentration of hydrogen ions is greater than the hydroxyl ion concentration. The data does not provide information for calculating the concentrations. Blue and purple indicator colors show the hydroxyl ion concentrations exceed the hydrogen ion concentrations. The results with the mixes of L and M suggest that L dissolves to release 5 times more hydrogen ions than the concentration of hydroxyl ions produced by the ionization of M. Compound N accepts or releases ions with changing hydrogen ion concentrations to maintain equal concentrations of cations and anions.