

Name_____

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

1) Which of the following is NOT true of the polymerization of macromolecules?

- A) Water is added to join the monomers of the macromolecules.
- B) The polymer chain usually has two different ends.
- C) Macromolecules are synthesized by the stepwise addition of monomers.
- D) Often the energy needed for polymerization is supplied by ATP.
- E) A monomer is usually activated by the coupling of the monomer to a carrier.

1) _____

Answer: A

Explanation: A)

- B)
- C)
- D)
- E)

2) The cell membrane can be described most accurately as

2) _____

- A) permeable to some molecules and impermeable to others.
- B) permeable to all molecules.
- C) permeable to only larger molecules.
- D) permeable to all small molecules and ions, but impermeable to larger ones.
- E) impermeable to all polar molecules.

Answer: A

Explanation: A)

- B)
- C)
- D)
- E)

3) Which of the following was NOT considered part of the "alphabet of biochemistry" by George

3) _____

Wald?

- A) seven proteins
- B) the 20 amino acids
- C) the 5 nucleotide bases
- D) two sugars
- E) three lipids

Answer: A

Explanation: A)

- B)
- C)
- D)
- E)

- 4) Ribose has five carbon atoms, of which three are asymmetric. What is the maximum number of stereoisomers that may exist for ribose? 4) _____
- A) 8 B) 10 C) 2 D) 6 E) 4
- Answer: A
- Explanation: A)
B)
C)
D)
E)
- 5) Why is a selectively permeable membrane so important to living things? 5) _____
- A) The membrane may absorb several times its weight in cholesterol.
B) It provides a good barrier between the inside and outside of the cell.
C) Proteins will avoid a selectively permeable membrane.
D) It allows cells to attach to adjacent tissues.
E) all of the above
- Answer: B
- Explanation: A)
B)
C)
D)
E)
- 6) The polymerization of different types of macromolecules is similar in many respects. Which of the following principles below is LEAST likely to be common to all methods of polymerization of macromolecules? 6) _____
- A) As monomers are added to the polymer, water is removed from the macromolecule.
B) To be added to the polymer, the monomer must be activated.
C) Macromolecules are synthesized by the addition of monomers.
D) Polymerization is passive, requiring little ATP.
E) The polymer is directional.
- Answer: D
- Explanation: A)
B)
C)
D)
E)
- 7) Biologically, which of the following is the *least* important characteristic of water? 7) _____
- A) Water is a good solvent.
B) Water molecules are polar.
C) Water typically contains isotopes of hydrogen.
D) Water has a temperature stabilizing capacity.
E) Water molecules have numerous hydrogen bonds.
- Answer: C
- Explanation: A)
B)
C)
D)
E)

8) Which of the following molecules is involved with assisted assembly?

8) _____

- A) water molecules
- B) helper proteins
- C) tobacco mosaic viruses
- D) molecular chaperones
- E) none of the above

Answer: D

Explanation: A)

- B)
- C)
- D)
- E)

9) Why do polar substances such as NaCl dissolve so readily in water?

9) _____

- A) NaCl is a very dry powder, and the water is able to soak into the salt.
- B) The sodium ions repel the negative end of the water molecule.
- C) Spheres of hydration form between the water and the ions.
- D) The charged ends of the water molecules are able to surround the oppositely charged salt ion.
- E) both C and D

Answer: E

Explanation: A)

- B)
- C)
- D)
- E)

10) Which of the following is NOT a fundamental property of carbon?

10) _____

- A) Carbon-containing molecules form stereoisomers.
- B) Carbon-containing molecules are diverse.
- C) Carbon has a valence of 4.
- D) Carbon atoms are most likely to form ionic bonds with one another.
- E) Carbon-containing molecules are stable.

Answer: D

Explanation: A)

- B)
- C)
- D)
- E)

11) Which of the following is NOT true of hydrocarbons?

11) _____

- A) Many hydrocarbons are used in living systems.
- B) Phospholipids have hydrocarbon tails.
- C) Hydrocarbons are insoluble in water.
- D) Only hydrogen atoms are used to complete the valence requirements of carbon.
- E) Octane is a hydrocarbon.

Answer: A

Explanation: A)

- B)
- C)
- D)
- E)

12) Self-assembly is limited by _____

- A) the time associated with forming solely noncovalent interactions.
- B) the presence of water in the cytosol.
- C) information of pre-existing structures.
- D) the size of the molecule.
- E) all of the above.

Answer: C

Explanation: A)

- B)
- C)
- D)
- E)

13) Which of the following is FALSE regarding water's specific heat? _____

- A) The specific heat of water is similar to most liquids.
- B) Water's high specific heat has a temperature-buffering effect.
- C) The specific heat of water is 1.0 calorie per gram.
- D) Water gains and loses heat more slowly than most other solvents.
- E) Heat applied to water must initially break a number of hydrogen bonds.

Answer: A

Explanation: A)

- B)
- C)
- D)
- E)

14) Which of the following is a unit of energy? _____

- A) calorie
- B) joule
- C) mole
- D) watt
- E) both A and B

Answer: E

Explanation: A)

- B)
- C)
- D)
- E)

15) The cell membrane can be described most accurately as _____

- A) impermeable to all polar molecules.
- B) permeable to only larger molecules.
- C) permeable to most small molecules, but impermeable to larger ones.
- D) permeable to all molecules.
- E) permeable to some molecules and impermeable to others.

Answer: E

Explanation: A)

- B)
- C)
- D)
- E)

16) Which of the following is NOT soluble in water?

16) _____

- A) amino acids
- B) nucleic acids
- C) lipids
- D) sugars
- E) disaccharides

Answer: C

Explanation: A)

- B)
- C)
- D)
- E)

17) Which of the following sequences correctly lists the hierarchical nature of cellular structures, from smallest to largest?

17) _____

- A) macromolecules, organic molecules, supramolecular structures, organelles, cells
- B) organic molecules, supramolecular structures, macromolecules, organelles, cells
- C) organic molecules, macromolecules, supramolecular structures, organelles, cells
- D) organelles, organic molecules, supramolecular structures, macromolecules, cells
- E) organic molecules, macromolecules, organelles, supramolecular structures, cells

Answer: C

Explanation: A)

- B)
- C)
- D)
- E)

18) An enzyme synthesized in the laboratory is found to have little activity when compared to the enzyme extracted from cell culture. Both enzymes were examined and have identical amino acid composition. What is the best explanation for the lack of activity of the synthesized enzyme?

18) _____

- A) The synthetic enzyme was not made of amino acids.
- B) Denaturation of the synthesized enzyme was not complete.
- C) The synthesized enzyme was not folded correctly because molecular chaperones were not present.
- D) The ATP required for self-assembly was present in the cell extract but not in the laboratory synthesis.
- E) The van der Waals radius was altered during laboratory synthesis.

Answer: C

Explanation: A)

- B)
- C)
- D)
- E)

19) Which of the following is NOT a structural polysaccharide?

19) _____

- A) glycogen
- B) chitin
- C) peptidoglycan
- D) cellulose
- E) All of the above are structural polysaccharides.

Answer: A

Explanation: A)

- B)
- C)
- D)
- E)

20) While fishing, a biology student makes the following observations:

20) _____

- 1) Water spiders appear to be able walk on the surface of the water.
- 2) Flat rocks may be made to skip across the water. Which of the following properties of water can explain these observations?

- A) Water molecules create spheres of hydration around solute molecules.
- B) Water is an excellent solvent.
- C) Water molecules are cohesive.
- D) Water molecules are often associated via hydrogen bonds.
- E) both C and D

Answer: E

Explanation: A)

- B)
- C)
- D)
- E)

21) The moon lacks life and varies dramatically in temperature. If we could keep a layer of water spread on the surface of the moon, what effect would it have?

21) _____

- A) The temperatures would drop to the lower extremes.
- B) Physical conditions would remain the same.
- C) Life would be possible, but it would have to withstand these extremes in temperature.
- D) Water would absorb and hold heat and moderate the temperature extremes.
- E) Because water has a high heat of vaporization, the temperatures would rise to the upper extremes.

Answer: D

Explanation: A)

- B)
- C)
- D)
- E)

22) While synthesizing a new blue pigment, a chemist notices that the new compound congregates between an aqueous (water) environment and a hydrophobic environment. When added to a mixture of oil and water, the pigment creates a blue ring around the droplets of oil. Which of the following statements best describes this new pigment?

22) _____

- A) The pigment is a polar molecule and is forming hydrogen bonds with both the water and oil molecules.
- B) The pigment is neither polar or nonpolar, but is apolar.
- C) The pigment is probably hydrophobic and is attempting to bond with the oil.
- D) The pigment is hydrophilic and will not form hydrophobic bonds with the oil.
- E) The pigment is amphipathic, having polar and nonpolar regions.

Answer: E

Explanation: A)

- B)
- C)
- D)
- E)

23) Because membranes usually are not permeable to polysaccharides, nucleic acids, and proteins, how are cells able to incorporate these molecules?

23) _____

- A) These macromolecules are only incorporated into structures outside the membrane.
- B) Macromolecules are broken down extracellularly, and their subunits diffuse through the membrane.
- C) Macromolecules are digested extracellularly, and their subunits move through transport proteins.
- D) Macromolecules are transported via endocytosis and digested within the cell.
- E) both C and D

Answer: E

Explanation: A)

- B)
- C)
- D)
- E)

24) Which of the following is NOT a possible noncovalent interaction?

24) _____

- A) van der Waals interactions
- B) polar covalent bonding
- C) ionic bonding
- D) hydrogen bonding
- E) hydrophobic interactions

Answer: B

Explanation: A)

- B)
- C)
- D)
- E)

25) Which of the following is true of an asymmetric carbon atom?

25) _____

- A) Asymmetric carbon atoms create stereoisomers.
- B) A carbon with hydrogens attached at two locations is usually asymmetric.
- C) Molecules may have only one asymmetric carbon atom.
- D) Methane has an asymmetric carbon.
- E) Only amino acids have asymmetric carbon atoms.

Answer: A

Explanation: A)

- B)
- C)
- D)
- E)

26) Carbon can form _____ covalent bonds.

26) _____

- A) single and double
- B) triple
- C) single
- D) single, double, and triple
- E) double

Answer: D

Explanation: A)

- B)
- C)
- D)
- E)

27) The hierarchical nature of cellular structure is accurately illustrated in which of the following lists of substances (small to large)?

27) _____

- A) nucleotides, nucleus, DNA, chromosome, cell
- B) cellulose, glucose, cell wall, cell
- C) protein, membrane, amino acids, chloroplast, cell
- D) nucleotides, chromosome, DNA, nucleus, cell
- E) nucleotides, DNA, chromosome, nucleus, cell

Answer: E

Explanation: A)

- B)
- C)
- D)
- E)

28) A hypothetical automobile has 100 parts that are to be assembled by four workers. During the car's assembly, each worker constructs 25 parts individually, and then the four resulting components are assembled together. The manner in which the car was assembled is much like which cellular strategy? _____

- A) renaturation
- B) self-assembly
- C) assisted self-assembly
- D) hierarchical assembly
- E) electrostatic assembly

Answer: D

Explanation: A)

- B)
- C)
- D)
- E)

29) What branch of chemistry deals specifically with living systems? _____

- A) inorganic chemistry
- B) organic chemistry
- C) biochemistry
- D) biological chemistry
- E) both C and D

Answer: E

Explanation: A)

- B)
- C)
- D)
- E)

30) Which of the following biological polymers is mismatched with its monomer? _____

- A) DNA - nucleotide
- B) chitin - monosaccharide
- C) enzyme - amino acid
- D) cellulose - amino acid
- E) protein - amino acid

Answer: D

Explanation: A)

- B)
- C)
- D)
- E)

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

31) As a protein is being synthesized, the correct folding of the protein is aided by the movement of nonpolar amino acids toward the inner areas of the protein. How can this phenomenon be explained? _____

Answer: The exclusion of hydrophobic groups from the aqueous surface is called the Hydrophobic Effect.

Explanation:

- 32) _____ aid in the assembly of some biomolecules. 32) _____
Answer: Molecular chaperones
Explanation:
- 33) Due to the directionality of polymer synthesis, proteins have a distinct _____ and _____ end. 33) _____
Answer: amino (-NH₂); carboxyl (-COOH)
Explanation:
- 34) A selectively _____ membrane is one that allows some molecules to pass through but not others. 34) _____
Answer: permeable
Explanation:
- 35) Macromolecules can be assembled into _____ that are components of organelles and other subcellular organelles. 35) _____
Answer: supramolecular structures
Explanation:
- 36) In order to facilitate polymerization, monomers must be _____. 36) _____
Answer: activated
Explanation:
- 37) The purpose of reducing and oxidizing agents in denaturation and renaturation is the breaking and reforming of the _____ bond. 37) _____
Answer: disulfide
Explanation:
- 38) Polymers are synthesized by _____ reactions and broken down into their constituent monomers by _____ reactions. 38) _____
Answer: condensation; hydrolysis
Explanation:
- 39) _____ carbon atoms allow for the formation of _____, which are mirror images of each other. 39) _____
Answer: Asymmetric; stereoisomers
Explanation:
- 40) TMV, or _____, is a rodlike particle with a genome of _____ and a _____ consisting of 2130 copies of a single polypeptide. 40) _____
Answer: tobacco mosaic virus; RNA; protein coat (capsid)
Explanation:
- 41) Because carbon is able to form up to four covalent bonds, it can take on a variety of orientations, including linear, _____, and _____ structures. 41) _____
Answer: branched; ring-containing
Explanation:

42) _____ and _____ groups are negatively charged functional groups of carbon, whereas the _____ group is a positively charged functional group.

42) _____

Answer: Carboxyl; phosphoryl; amino

Explanation:

43) The cell membrane is composed of a _____ bilayer. This molecule has regions that are polar and nonpolar and is therefore _____.

43) _____

Answer: phospholipid; amphipathic

Explanation:

44) The _____ of water is caused by the unequal sharing of electrons between oxygen and hydrogen atoms.

44) _____

Answer: polarity

Explanation:

MATCHING. Choose the item in column 2 that best matches each item in column 1.

Match the choice on the left with the choice on the right.

45) important in renaturation

A) disulfide bonds

45) _____

Answer: A

B) TATA box

Choose the item in column 2 that best matches each item in column 1.

46) molecular chaperone

A) assists in lipid assembly

46) _____

Answer: B

B) assists in protein assembly

Match the interaction or bond on the left with the phrase that best describes it on the right.

47) hydrogen bond

A) noncovalent attraction among water molecules

47) _____

Answer: A

48) ionic bond

B) electrostatic interactions

48) _____

Answer: B

Match the choice on the left with the choice on the right.

49) examples of double bond

A) nitrogen gas

49) _____

Answer: B

B) ethylene and carbon dioxide

Choose the item in column 2 that best matches each item in column 1.

50) structural polysaccharide

A) cellulose

50) _____

Answer: A

B) glycogen

Match the interaction or bond on the left with the phrase that best describes it on the right.

51) hydrophobic interaction

A) association of nonpolar groups

51) _____

Answer: A

Choose the item in column 2 that best matches each item in column 1.

52) informational macromolecule

A) ATP

52) _____

Answer: B

B) nucleic acid

Match the choice on the left with the choice on the right.

53) Heinz Fraenkel-Conrat

A) subassembly

53) _____

Answer: C

B) lipase

54) electrostatic interactions

C) TMV self-assembly

54) _____

Answer: D

D) ionic bond

55) _____

55) condensation reaction

Answer: F

E) ribosome

56) requirement of hierarchical assembly

F) addition of monomer

56) _____

Answer: A

G) disassembly

Choose the item in column 2 that best matches each item in column 1.

57) membrane structure

A) spheres of hydration

57) _____

Answer: B

B) lipid bilayer

Match the interaction or bond on the left with the phrase that best describes it on the right.

58) covalent bonding

A) sharing of electrons

58) _____

Answer: A

Choose the item in column 2 that best matches each item in column 1.

59) important in hydrogen bonding

A) methyl group

59) _____

Answer: B

B) hydroxyl group

Match the interaction or bond on the left with the phrase that best describes it on the right.

60) van der Waals interactions

A) transient interactions at very close range

60) _____

Answer: A

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

- 61) Macromolecules are synthesized by a series of steps. Monomers are systematically added to the growing polymer. From what you have learned about synthesis of macromolecules, can you suggest why people who are trying to lose weight are asked to drink plenty of water?

Answer: Since water is released in the synthesis of polymers like fats (condensation reaction), water will be needed for the breakdown of fat molecules (hydrolysis).

- 62) For each of the three basic macromolecules (proteins, polysaccharides, and nucleic acids), identify the monomer, its activated/cARRIER form, and the directionality of the molecule.

Answer: Proteins: amino acids; charged amino acyl tRNAs; $\text{NH}_2 \rightarrow \text{COOH}$. Polysaccharides: monosaccharides; monosaccharide phosphates; based upon their linkage but typically C1 (or C2) of one monosaccharide to the C2, C3, C4, C5, or C6 of another monosaccharide. Nucleic acids: nucleotides; nucleotide triphosphates (NTPs); $5' \rightarrow 3'$.

- 63) Water has many unique properties. Can you identify the property of water that is responsible for each of the following observations?

- a. Many insects such as the water strider are able to move across the surface of water.
- b. Most people get chilled immediately after taking a shower.
- c. A dime can be made to "float" on the surface of a glass of water.
- d. The dime will sink if salt is added to the water.
- e. On cold days, the water temperature is often warmer than the surrounding air.
- f. Ice forms on the surface of lakes and rivers.
- g. Many salts dissolve in water.
- h. Many oils will not dissolve in water.
- i. The coastal areas of the world have a climate that is more moderate than other areas.
- j. Some springs contain high amounts of arsenic.
- k. The Great Salt Lake contains high quantities of mineral solutes.

- Answer:
- a. Water is cohesive.
 - b. Water has a high heat of vaporization.
 - c. Water is cohesive.
 - d. Water is a good solvent, but a solute reduces its cohesiveness.
 - e. Water has a high specific heat.
 - f. Water forms a less dense crystalline structure when solid.
 - g. Water is a good solvent.
 - h. Water is polar.
 - i. Water has a temperature stabilizing capacity.
 - j. Water is a good solvent.
 - k. Water is a good solvent.

Answer Key
Testname: C2

- 1) A
- 2) A
- 3) A
- 4) A
- 5) B
- 6) D
- 7) C
- 8) D
- 9) E
- 10) D
- 11) A
- 12) C
- 13) A
- 14) E
- 15) E
- 16) C
- 17) C
- 18) C
- 19) A
- 20) E
- 21) D
- 22) E
- 23) E
- 24) B
- 25) A
- 26) D
- 27) E
- 28) D
- 29) E
- 30) D
- 31) The exclusion of hydrophobic groups from the aqueous surface is called the Hydrophobic Effect.
- 32) Molecular chaperones
- 33) amino (-NH₂); carboxyl (-COOH)
- 34) permeable
- 35) supramolecular structures
- 36) activated
- 37) disulfide
- 38) condensation; hydrolysis
- 39) Asymmetric; stereoisomers
- 40) tobacco mosaic virus; RNA; protein coat (capsid)
- 41) branched; ring-containing
- 42) Carboxyl; phosphoryl; amino
- 43) phospholipid; amphipathic
- 44) polarity
- 45) A
- 46) B
- 47) A
- 48) B
- 49) B
- 50) A

Answer Key

Testname: C2

- 51) A
- 52) B
- 53) C
- 54) D
- 55) F
- 56) A
- 57) B
- 58) A
- 59) B
- 60) A

- 61) Since water is released in the synthesis of polymers like fats (condensation reaction), water will be needed for the breakdown of fat molecules (hydrolysis).
- 62) Proteins: amino acids; charged amino acyl tRNAs; $\text{NH}_2 \rightarrow \text{COOH}$. Polysaccharides: monosaccharides; monosaccharide phosphates; based upon their linkage but typically C1 (or C2) of one monosaccharide to the C2, C3, C4, C5, or C6 of another monosaccharide. Nucleic acids: nucleotides; nucleotide triphosphates (NTPs); $5' \rightarrow 3'$.
- 63) a. Water is cohesive.
 - b. Water has a high heat of vaporization.
 - c. Water is cohesive.
 - d. Water is a good solvent, but a solute reduces its cohesiveness.
 - e. Water has a high specific heat.
 - f. Water forms a less dense crystalline structure when solid.
 - g. Water is a good solvent.
 - h. Water is polar.
 - i. Water has a temperature stabilizing capacity.
 - j. Water is a good solvent.
 - k. Water is a good solvent.