

*Vander's Human Physiology, 15e (Widmaier)*

**Chapter 2 Chemical Composition of the Body and Its Relation to Physiology**

- 1) Which correctly describes the structure of an atom?
  - A) There are the same number of protons and neutrons.
  - B) There are the same number of protons and electrons.
  - C) There are the same number of neutrons and electrons.
  - D) The number of protons, neutrons, and electrons never changes.
  - E) There are never the same number of neutrons and protons.
  
- 2) Which of the following is unique to atoms of each element?
  - A) The number of electrons
  - B) The number of neutrons
  - C) The number of protons
  - D) The number of bonds it can form
  - E) The ratio of protons to electrons
  
- 3) Carbon-12 and carbon-14 are isotopes. How are they different from each other?
  - A) They have different numbers of protons.
  - B) They have different numbers of neutrons.
  - C) They have different numbers of electrons.
  - D) They can form different numbers of chemical bonds.
  - E) They have different number of energy shells
  
- 4) Which describes a covalent bond?
  - A) The positive side of one molecule is attracted to the negative side of another
  - B) A bond between water molecules
  - C) A bond between two oppositely charged ions
  - D) A bond between two free radicals
  - E) Two atoms share electrons with each other from their outermost shell
  
- 5) Ions are \_\_\_\_\_.
  - A) electrically neutral
  - B) electrically charged
  - C) formed by the gain or loss of protons from the nucleus
  - D) not soluble in water
  - E) nonpolar atoms
  
- 6) When magnesium loses electrons to become an ion, what does it become?
  - A) A covalent molecule
  - B) A cation
  - C) An anion
  - D) A new element
  - E) A free radical

- 7) If a sports beverage advertises that it replaces the body's electrolytes, what does the drink contain?
- A) Sugars that were broken down for energy
  - B) Ionic forms of mineral elements
  - C) Lipids that form the membranes of cells
  - D) Oxygen and gases used by metabolism
  - E) Vitamins
- 8) Of these major ions found in the body, which one carries a negative charge?
- A) Chloride
  - B) Sodium
  - C) Potassium
  - D) Hydrogen
  - E) Calcium
- 9) Sodium ions have a single positive charge. Table salt is formed by the ionic bond between sodium ions and ions of chloride. Which of the following must be true of chloride?
- A) It is an anion.
  - B) It is a cation.
  - C) It is electrically neutral.
  - D) It is non-polar.
  - E) It is a free radical.
- 10) Which describes a characteristic of free radicals?
- A) They rapidly oxidize other atoms by removing an electron.
  - B) They are inert molecules that don't interact readily with other molecules.
  - C) They contain two electrons in the outermost orbital.
  - D) They have extra neutrons in their nuclei.
  - E) They are found in high quantities in most sports drinks.
- 11) Oxygen forms covalent bonds with two atoms of hydrogen to form H<sub>2</sub>O (water). How many electrons are found in oxygen's outer shell?
- A) 1
  - B) 2
  - C) 4
  - D) 6
  - E) 8
- 12) Muscle cell contraction is facilitated by a small electrical current. Which types of molecules are likely involved?
- A) Free radicals
  - B) Isotopes
  - C) Electrolytes
  - D) Gasses
  - E) Vitamins

13) Which of the following is *not* true of a polar chemical bond?

- A) It is covalent.
- B) It is ionized.
- C) It has opposite electrical charge at each end.
- D) It has no net electrical charge.

14) Which best describes a hydrolysis reaction?

- A) Molecules are broken down into smaller ones by breaking covalent bonds within water molecules and transferring hydrogen atoms and hydroxyl groups to the smaller ones.
- B) Electrically charged molecules separate into ions when they dissolve in water, and then hydrogen ions and hydroxyl groups covalently attach themselves to the oppositely charged ions.
- C) Large molecules are assembled from smaller ones by breaking water into hydrogen and hydroxyl ions.
- D) Dissolving a large molecule in water reduces it to its individual atoms.
- E) The breaking of hydrogen bonds between any two molecules.

15) Oil is spilled into the ocean. What do you expect will happen?

- A) Most of the oil will quickly disperse and mix in with water and form hydrogen bonds.
- B) Most of the oil molecules will clump and exclude water.
- C) Most of the oil will form bonds with the water molecules to form new covalently bonded structures.
- D) Water molecules will absorb the oil molecules and break them apart.
- E) The hydrogen and oxygen atoms within the oil will become water.

16) Molecules that have properties of both polar and nonpolar molecules are called

- A) hydrophobic.
- B) hydrophilic.
- C) amphipathic.
- D) unipolar.
- E) bipolar.

17) You're designing a new drug to treat allergies. You'd like for your therapy to be able to dissolve through the lipid bilayers of cell membranes; therefore, \_\_\_\_\_ molecules will make excellent drug choices.

- A) polar
- B) ionic
- C) electrolyte
- D) non-polar
- E) radioactive

18) The pH of a solution

- A) is a measure of the concentration of hydrogen atoms in the solution.
- B) is a measure of the concentration of hydrogen ions bound to other molecules in the solution.
- C) is a measure of the concentration of free hydrogen ions in the solution.
- D) increases as the acidity of the solution increases.
- E) increases as the free hydrogen ion concentration in the solution increases.

- 19) Most of the body weight of an average human is what substance?
- A) Water
  - B) Protein
  - C) Minerals
  - D) Lipids
  - E) Carbohydrates
- 20) Which chemical group does glucose best fit into?
- A) Monosaccharides
  - B) Disaccharides
  - C) Polysaccharides
  - D) Glycoproteins
  - E) Phospholipids
- 21) Carbohydrates are stored in animal cells in the form of
- A) cellulose.
  - B) starch.
  - C) triacylglycerol.
  - D) glycogen.
  - E) protein.
- 22) Hydrolysis of glycogen will have what effect on blood glucose level?
- A) Increase blood glucose level
  - B) Decrease blood glucose level
  - C) No effect on blood glucose level
- 23) What are the two main atoms in lipids, and what type of bonds connect them?
- A) Carbon and oxygen, connected by polar covalent bonds.
  - B) Carbon and hydrogen, connected by non-polar covalent bonds
  - C) Carbon and hydrogen, connected by ionic bonds
  - D) Carbon and hydrogen, connected by hydrogen bonds
  - E) Oxygen and hydrogen, connected by hydrogen bonds
- 24) Which statement is FALSE with regard to proteins?
- A) Their roles in the body include acting as enzymes, providing structural support, and signaling between cells.
  - B) They make up a greater percentage of body mass than carbohydrates do.
  - C) They are composed of nucleic acids.
  - D) They are macromolecules with subunits linked by polypeptide bonds.
  - E) They are polymers made up of amino acids.

- 25) What best describes the main determinant of the secondary structure of a protein?
- A) The sequence of the various amino acids that make up a polypeptide chain
  - B) The total number of amino acids that make up a polypeptide chain, and its overall resulting length
  - C) The total number of polypeptide chains that combine to determine the overall size of the protein
  - D) Molecular interactions between widely separated regions of a polypeptide, such as disulfide bonds, that stabilize the folded conformation
  - E) Molecular interactions along a polypeptide chain that fold various regions into alpha helices or beta sheets
- 26) Within a single protein, which of the following are you likely to find?
- A) Ionic bonds
  - B) Hydrogen bonds
  - C) Disulfide bridges
  - D) Hydrophobic interactions
  - E) You are likely to find all of these within a single protein.
- 27) Which of the following is NOT a type of molecular interaction that determines the tertiary structure of a protein?
- A) Covalent bonds between purine and pyrimidine bases
  - B) Ionic bonds
  - C) Van der Waals forces
  - D) Covalent bonds between two cysteine amino acids
  - E) Hydrogen bonds
- 28) What is the term describing the covalent bond formed between two amino acids?
- A) Glycosidic bond
  - B) Peptide bond
  - C) Phosphodiester bond
  - D) Ester bond
  - E) Hydrolytic bond
- 29) A single genetic mutation will change a protein at what level of structure?
- A) Primary
  - B) Secondary
  - C) Tertiary
  - D) Quaternary
  - E) A single genetic mutation could change all of these

- 30) Which is a correct description of nucleic acids?
- A) They are polymers of subunits containing glucose and amino acids.
  - B) They are polymers of subunits containing glucose, a phosphate group, and an amino acid.
  - C) They are polymers of subunits containing a phosphate group, a sugar, and a purine or pyrimidine base.
  - D) They are polymers of subunits containing a phosphate group, a sugar, and an amino acid.
  - E) They are long polymers of amino acids, folded into an alpha helix.
- 31) The atomic number of an element is given by the number of electrons in the atom.
- 32) The atomic number of an element refers to the number of particles in its atomic nucleus.
- 33) Trace elements such as zinc and manganese are found in minute quantities in the body but do not serve any known function.
- 34) The number of covalent bonds that can be formed by a given atom depends upon the number of electrons present in the outermost orbit.
- 35) Nitrogen atoms can form a maximum of four covalent bonds with other atoms.
- 36) The shape of a molecule may change as atoms rotate about their covalent bonds.
- 37) All of the physiologically important atoms of the body readily form ions.
- 38) Water molecules can form covalent bonds with other water molecules.
- 39) The carboxyl ion is an anion.
- 40) NaCl is a molecule formed by the covalent bonding of a sodium atom to a chlorine atom.
- 41) All covalent bonds are polar.
- 42) During hydrolysis, hydrogen ions and hydroxyl groups are formed.
- 43) In general, polar molecules will dissolve in polar solvents, while nonpolar molecules cannot.
- 44) Solutes that do not dissolve in water are called hydrophilic.
- 45) Phospholipids are examples of amphipathic molecules.
- 46) Comparing two cups of coffee, one with no sugar added and the other has had a packet of sugar dissolved in it, we can say that the coffee with sugar is more concentrated.
- 47) A solution with a pH of 8 is more acidic than one with a pH of 3.
- 48) A solution with a pH of 8 contains more  $H^+$  ions than a solution with a pH of 3.

- 49) Fatty acids are examples of organic molecules.
- 50) When multiple repeating simple sugar molecules combine to form a larger molecule, it is called a polysaccharide.
- 51) The term "blood sugar level" refers to the concentration of disaccharides in the blood.
- 52) Saturated fats contain carbon atoms linked by double bonds.
- 53) Cholesterol is a phospholipid.
- 54) Glycoproteins are protein molecules with molecules of glycogen attached to the amino acid side chains.
- 55) A molecule composed of two atoms of the same element, such as fluorine ( $\text{F}_2$ ), can be formed by a polar covalent bond.
- 56) The majority of the molecules in the human body are polar.
- 57) The sequence of amino acids in a protein is known as the secondary structure.
- 58) A protein may consist of more than one polypeptide chain.
- 59) If a protein's conformation changes it is likely that its function will change as well.
- 60) Substitution of one amino acid for a different one in a given protein always significantly alters the conformation of that protein.
- 61) In DNA, thymine binds with adenine and cytosine binds with uracil.
- 62) Water is only lost from the body in urine formation.
- 63) Dehydration reactions among glucose monomers will produce polysaccharides such as glycogen.
- 64) Dehydration reactions between carboxyl groups and phosphate groups result in peptide bond formation.
- 65) A 1 molar solution of glucose and 1 molar solution of NaCl have the same number of glucose and NaCl molecules.
- 66) A person experiencing liver failure is likely to have lower levels of triglycerides in their body than a person with a healthy liver.
- 67) Simple macromolecules with fewer numbers of bonds yield more energy to fuel cell processes than large macromolecules.

68) Estrogen is a steroid hormone, therefore it will readily dissolve through a lipid bilayer.

69) Which of the following words can be used to describe water?

- A) Ion
- B) Polar
- C) Molecule
- D) Atom
- E) Lipophilic

70) Hydrogen bonds can break in high temperature conditions. Which of the following molecules is likely to break apart or change shape at high temperatures?

- A) DNA
- B) RNA
- C) Triglycerides
- D) Proteins
- E) Polysaccharides

71) Which of the following contain phosphate groups?

- A) Amino acids
- B) Monosaccharides
- C) Nucleotides
- D) Phospholipids
- E) Cholesterol

72) Dehydration reactions are involved in the production of \_\_\_\_\_.

- A) polysaccharides
- B) monosaccharides
- C) triglycerides
- D) polypeptides
- E) nitrogenous Bases