Chapter 02 The Chemistry of Life Answer Key

Multiple Choice Questions

Many traits of organisms, such as body form and color, are controlled by specific proteins, in turn controlled by the DNA genetic sequence of nucleotides. The genetic control of color, as in aphids, does not usually shift during the life of an organism. Researchers found that some specific aphid populations shift from an original red coloration to a green coloration.

Genetics could be a factor, if some programmed shift could be identified. Environmental conditions of the living and nonliving habitat could be a factor. Either way, the chemistry and observed changes of pigment molecules in the aphids can be studied with the scientific method.

1. What is the link between colored pigment molecules and other organic molecules?

A. All of the answer choices are correct.
B. In the case of the aphids, the pigment molecules of bacteria are genetically passed on to the DNA of infected aphids.
C. The DNA molecule genetic sequence regulates protein molecule function, which can change pigment structure that affects color.
D. Pigment molecules are made up of all four of the other organic molecule groups.
E. This one group of aphids can easily alter the pigment molecule structure by modifying its DNA nucleotide sequence and building new proteins.

Accessibility: Keyboard Navigation
Blooms Level: 4. Analyze
Learning Outcome: 02.05.02 Compare and contrast the structures and functions of the four main classes of organic molecules.
Section: 02.05
Section: 02.06
Topic: Nucleic Acids
Type: Investigating Life

2. The initial experiment of Koga and Fugatsu, in testing for any bacterial cause of aphid color change, involved all of these except

A. the specific amounts of red and green pigment molecules were initially measured as dependent variables.
B. a group of green aphids was grown, then killed in order to produce an extract to test on red aphids.
C. a group of red aphids was treated with the independent variable of *Rickettsiella* bacteria infection from green aphids.
D. a group of red aphids was grown as a control group.
E. a group of aphids infected with *Rickettsiella* bacteria was grown, then killed in order to produce an extract to test on red aphids.

Accessibility: Keyboard Navigation
Blooms Level: 3. Apply
Learning Outcome: 02.06.01 Explain how researchers discovered that some ants defend themselves against the toxins of other ants.
Section: 02.06
Topic: Chemical Bonds
Topic: Nucleic Acids
Type: Investigating Life

3. The observations and research on aphid color changes can most directly be summarized in that

A. Koga and Fugatsu proved that the color change from red to green in aphids was ecologically favorable to survival.
B. the method of paper fiber separation of pigment molecules showed that *Ricketsiella* bacteria were the source of the green coloration of aphids.
C. species of organisms can be chemically diverse and affect each other, even among similar groups of aphids and bacteria.
D. it turned out that the green appearance of aphids was because of the large amount of green *Ricketsiella* bacteria coating their bodies.
E. All of the answer choices are correct.

Accessibility: Keyboard Navigation
Blooms Level: 4. Analyze
Learning Outcome: 02.06.01 Explain how researchers discovered that some ants defend themselves against the toxins of other ants.
Section: 02.06
Topic: Chemical Bonds
Topic: Nucleic Acids
Type: Investigating Life

4. Researchers noted that only a few aphids changed color to green from their original red. This is an unusual observation among any animals. What research question came out of the observations?

A. Is the color shift of certain aphids due to genetics within a select species?
B. Is the color shift of certain aphids due to changes in weather conditions?
C. Is the color shift of certain aphids due to genetics or some other factor?
D. Do other aphids change colors as they age?
E. Will green aphids change their color to red, or remain green as they age?

Accessibility: Keyboard Navigation
Blooms Level: 2. Understand
Learning Outcome: 02.06.01 Explain how researchers discovered that some ants defend themselves against the toxins of other ants.
Section: 02.06
Topic: Nucleic Acids
Type: Investigating Life

5. The four most abundant elements needed by the human body are carbon, hydrogen, oxygen, and nitrogen. Because these are needed in large amounts to support our cells, these are referred to as

A. buffers.
B. bulk elements.
C. essential elements.
D. trace elements.
E. isotopes.

Accessibility: Keyboard Navigation
Blooms Level: 2. Understand
Learning Outcome: 02.01.01 Identify the most abundant essential elements in living organisms.
Learning Outcome: 02.05.02 Compare and contrast the structures and functions of the four main classes of organic molecules.
Section: 02.01
Section: 02.05
Topic: Carbohydrates
Topic: Lipids
Topic: Nucleic Acids
Topic: Proteins

6. In the 1700s, a French scientist, Antoine Lavoisier, gained new experimental information by reacting a metal and an acid. His observation of the results seemed to show that much of the metal had been lost in the chemical reaction. Upon weighing the products, the total amounts of materials had not changed during the reaction.

This research resulted in the law of conservation of mass. This law also applies to biology, because the materials we are made of are_____that change forms, but aren't truly lost through biochemical reactions.

A. matter
B. isotopes
C. energy
D. metals
E. solutions

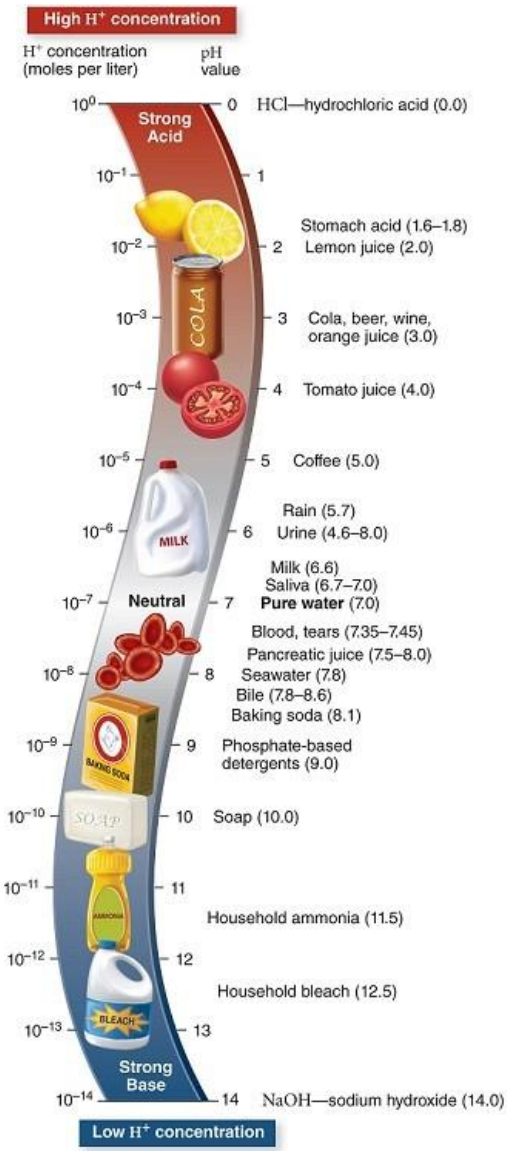
Accessibility: Keyboard Navigation
Blooms Level: 2. Understand
Learning Outcome: 02.00.01 Explain the relationship between chemistry and biology.
Learning Outcome: 02.02.03 Compare and contrast ionic, covalent, and hydrogen bonds.
Section: 02.01
Topic: Atomic Structure

7. Water has unique properties which include its strength as a solvent; its three environmental stages of solid, liquid, and gas; and its temperature regulation. These properties are due to polar covalent bonds between oxygen and hydrogen. The polar covalent bonds are a result of

A. there being a greater number of electrons in oxygen outermost shell than in hydrogen.
B. oxygen being more electronegative and therefore attracting more electrons than hydrogen.
C. hydrogen being an electron donor and oxygen being an electron acceptor.
D. hydrogen and oxygen having equal electronegative strength and therefore have equal sharing of electrons.
E. hydrogen being more electronegative and therefore attracting more electrons than oxygen.

Accessibility: Keyboard Navigation
Blooms Level: 2. Understand
Learning Outcome: 02.02.03 Compare and contrast ionic, covalent, and hydrogen bonds.
Learning Outcome: 02.02.04 Explain the relationship between electronegativity and chemical bond formation.
Learning Outcome: 02.03.01 Explain how the structure of water affects its chemical properties.
Section: 02.02
Section: 02.03
Topic: Properties of Water

Refer to this diagram with common examples of substances and their pH.



8. The correct functions of your lungs contribute to the normal pH level of between 7.35 and 7.45. If your lungs do not exchange and remove carbon dioxide from your blood, the blood pH will change. A pH 6.4 reading of your blood indicates

A. a health problem due to the pH value being 10X higher OH^- concentrations than normal in your body.

B. a health problem due to the pH value being 2X higher OH^- concentrations than normal in your body.

C. a health problem due to the pH value being 2X higher H^+ concentrations than normal in your body.

D. no health risk, as part of normal pH changes in your body that in this case bring it closer to neutral pH.

E. a health problem due to the pH value being 10X higher H^+ concentrations than normal in your body.

Accessibility: Keyboard Navigation
Blooms Level: 3. Apply
Figure: 02.14
Learning Outcome: 02.04.01 Explain how acids and bases affect pH.
Section: 02.04
Topic: Acids and Bases
Topic: Properties of Water

9. Our normal blood pH should be in a fairly narrow range. Imagine you sit down to eat a large meal with cola, tomato-based sauce, and a salad with many citrus fruit slices. Identify the one statement that does not apply as one of the likely outcomes of your meal.

A. Your blood and body fluids will likely become more basic, with a higher pH than the normal range.

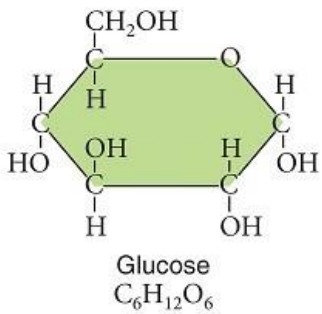
B. The cola, tomato, and citrus fruits will add hydrogen (H^+) to your blood and body fluids.

C. All of the answer choices are correct.

D. Your body will produce buffer molecules to help neutralize acids you ate, so your blood pH doesn't change much.
E. Your blood and body fluids will likely become more acidic, with a lower pH than the normal range.

Accessibility: Keyboard Navigation
Blooms Level: 3. Apply
Figure: 02.14
Learning Outcome: 02.00.01 Explain the relationship between chemistry and biology.
Learning Outcome: 02.04.01 Explain how acids and bases affect pH.
Section: 02.04
Topic: Acids and Bases
Topic: Properties of Water

Examine this image of the glucose molecule.



10. Based on the 1:2:1 proportions of carbon, hydrogen, and oxygen, it can be determined that the glucose molecule is a(n)

A. triglyceride.
B. carbohydrate.
C. polymer.
D. amino acid.
E. disaccharide.

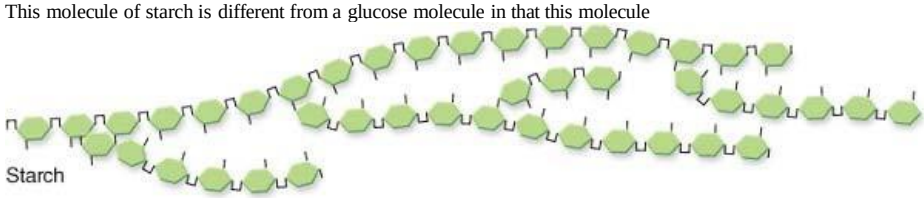
Accessibility: Keyboard Navigation
Blooms Level: 1. Remember
Figure: 02.17
Learning Outcome: 02.05.02 Compare and contrast the structures and functions of the four main classes of organic molecules.
Section: 02.05
Topic: Carbohydrates

11. Starchy foods in our diets, such as rice and potatoes, consist of many glucose molecules covalently bonded together to form

A. a simple sugar.
B. a complex carbohydrate.
C. a fatty acid chain.
D. a triglyceride.
E. a protein.

Accessibility: Keyboard Navigation
Blooms Level: 2. Understand
Figure: 02.17
Learning Outcome: 02.05.02 Compare and contrast the structures and functions of the four main classes of organic molecules.
Section: 02.05
Topic: Carbohydrates

12. This molecule of starch is different from a glucose molecule in that this molecule



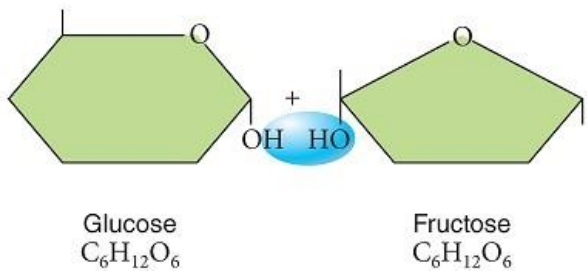
A. is used by cells for long-term storage and release of energy for cell functions.
B. is a complex carbohydrate polymer.
C. has the same characteristics of glucose.

D. is used by cells for quick release of energy for cell functions.
E. can provide structure for cells that contain it.

Accessibility: Keyboard Navigation
Blooms Level: 2. Understand
Figure: 02.17
Learning Outcome: 02.05.02 Compare and contrast the structures and functions of the four main classes of organic molecules.
Section: 02.05
Topic: Carbohydrates

True / False Questions

Examine these two sugars, as shown prior to the chemical reaction that would bond them.



13. These glucose and fructose molecules will bond to form a monosaccharide with the removal of water.

FALSE

Formation of new covalent bonds between monomers results in larger, multiple unit molecules. Read section 2.5 for more information.

Accessibility: Keyboard Navigation
Blooms Level: 1. Remember
Figure: 02.17
Learning Outcome: 02.05.02 Compare and contrast the structures and functions of the four main classes of organic molecules.
Section: 02.05
Topic: Carbohydrates

Multiple Choice Questions
14. The diagram shows the monomers, glucose and fructose, before__occurs, which builds a polymer via the removal of water.

A. reproduction
B. dehydration synthesis
C. oxidation
D. evaporation
E. hydrolysis

Accessibility: Keyboard Navigation
Blooms Level: 2. Understand
Figure: 02.17
Learning Outcome: 02.05.01 Differentiate between dehydration synthesis and hydrolysis.
Section: 02.05
Topic: Carbohydrates
Topic: Chemical Bonds

15. The ring structure of glucose indicates that it is a(n)

A. monosaccharide.
B. fatty acid.
C. disaccharide.
D. amino acid.
E. nucleotide.

Accessibility: Keyboard Navigation
Blooms Level: 1. Remember
Learning Outcome: 02.05.02 Compare and contrast the structures and functions of the four main classes of organic molecules.
Section: 02.05
Topic: Carbohydrates
Topic: Chemical Bonds

16. The primary elements making up living organisms are

A. carbon, hydrogen, iron, sulfur, sodium, and calcium.
B. carbon, hydrogen, oxygen, sulfur, nitrogen, and phosphorus.
C. carbon, hydrogen, oxygen, calcium, iron, and iodine.
D. carbon, oxygen, iron, chlorine, sulfur, and phosphorus.
E. carbon, oxygen, sulfur, calcium, iron, and phosphorus.

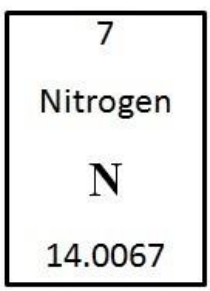
Accessibility: Keyboard Navigation
Blooms Level: 1. Remember
Learning Outcome: 02.01.01 Identify the most abundant essential elements in living organisms.
Section: 02.01
Topic: Atomic Structure

17. The atomic number of an element is the number of

A. protons in the orbitals.
B. electrons in the nucleus.
C. neutrons in the orbitals.
D. protons in the nucleus.
E. neutrons in the nucleus.

Accessibility: Keyboard Navigation
Blooms Level: 1. Remember
Learning Outcome: 02.01.02 Describe the structure of atoms.
Section: 02.01
Topic: Atomic Structure

18. Given this information from one element in the periodic table of elements, the number of neutrons and protons is



A. 7, which is also the atomic mass.
B. unable to be determined with the information provided.
C. 14, which is also the atomic mass.
D. 14, which is also the atomic number.
E. 7, which is also the atomic number.

Accessibility: Keyboard Navigation
Blooms Level: 3. Apply
Learning Outcome: 02.01.02 Describe the structure of atoms.
Section: 02.01
Topic: Atomic Structure

19. The mass number is defined as the total number of_____of an atom.

A. protons
B. protons, neutrons, and electrons
C. neutrons and electrons
D. protons and electrons
E. protons and neutrons

Accessibility: Keyboard Navigation
Blooms Level: 1. Remember
Learning Outcome: 02.01.02 Describe the structure of atoms.
Section: 02.01
Topic: Atomic Structure

20. An ion is an atom that has

A. a net negative charge.
B. a different number of neutrons from the number of protons.
C. a net negative or positive charge, with the number of electrons different from the number of protons.
D. the same number of electrons as it does protons.

E. a net positive charge.

Accessibility: Keyboard Navigation
Blooms Level: 2. Understand
Learning Outcome: 02.01.01 Identify the most abundant essential elements in living organisms.
Section: 02.01
Topic: Atomic Structure

21. The first energy shell of an atom has one orbital. Therefore, it can contain a maximum of_____electron(s).

A. one
B. sixteen
C. eight
D. four
E. two

Accessibility: Keyboard Navigation
Blooms Level: 1. Remember
Learning Outcome: 02.02.02 Use the number of valence electrons in an atom to predict the number of bonds it will form.
Section: 02.02
Topic: Atomic Structure

22. In an oxygen element, each oxygen atom contains eight electrons in its valence shell. The atoms will be

A. highly reactive.
B. not chemically stable.
C. chemically stable.
D. highly likely to combine with other atoms.
E. not inert.

Accessibility: Keyboard Navigation
Blooms Level: 3. Apply
Learning Outcome: 02.01.02 Describe the structure of atoms.
Learning Outcome: 02.02.02 Use the number of valence electrons in an atom to predict the number of bonds it will form.
Section: 02.01
Section: 02.02
Topic: Atomic Structure

23. In a covalent bond, atoms

A. both become highly electronegative.
B. share protons.
C. share electrons.
D. of opposite charges attract each other.
E. lose electrons.

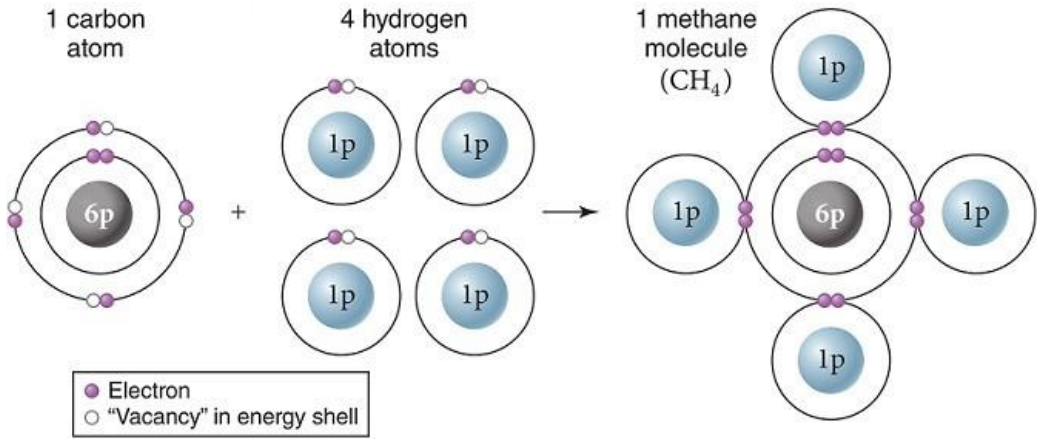
Accessibility: Keyboard Navigation
Blooms Level: 1. Remember
Learning Outcome: 02.02.03 Compare and contrast ionic, covalent, and hydrogen bonds.
Section: 02.02
Topic: Chemical Bonds

24. In an ionic bond,

A. two atoms are attracted by partial positive and negative charges.
B. two atoms are attracted by the same charges.
C. atoms attract each other by sharing electrons to fill their valence shells.
D. atoms, having gained or lost electrons, attract one another with opposite charges.
E. two atoms both become strongly electronegative and attract each other.

Accessibility: Keyboard Navigation
Blooms Level: 1. Remember
Learning Outcome: 02.02.03 Compare and contrast ionic, covalent, and hydrogen bonds.
Section: 02.02
Topic: Chemical Bonds

25. Carbon and hydrogen make up many biologically important molecules. Carbon has an electronegativity of 2.55, whereas hydrogen has an electronegativity of 2.2. Based on the electronegativity difference between the atoms, the carbon and hydrogens shown here have just formed



A. an ionic bond.
B. a hydrogen bond.
C. a polar covalent bond.
D. a nonpolar covalent bond.
E. an element.

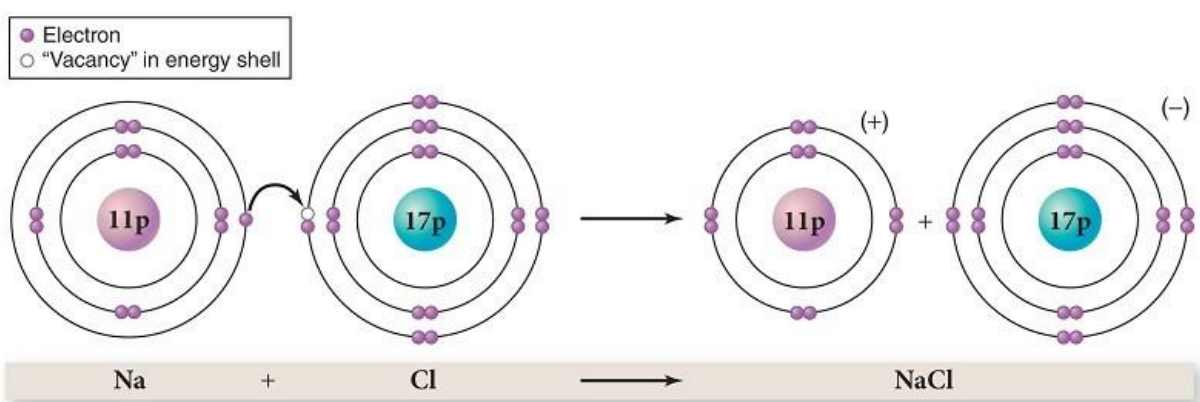
Accessibility: Keyboard Navigation
Blooms Level: 4. Analyze
Figure: 02.07
Learning Outcome: 02.02.03 Compare and contrast ionic, covalent, and hydrogen bonds.
Learning Outcome: 02.02.04 Explain the relationship between electronegativity and chemical bond formation.
Section: 02.02
Topic: Chemical Bonds

26. Which statement summarizes the distinction between nonpolar and polar covalent bonds?

A. The difference in electronegativity of the atoms in a nonpolar covalent bond is very large.
B. The electrons are more evenly and symmetrically distributed in orbit among atoms in a nonpolar covalent bond.
C. The electrons are more evenly and symmetrically distributed in orbit among atoms in a polar covalent bond.
D. Polar covalent bonds are formed when the atoms gain or lose electrons to bond and become oppositely charged ions.

Accessibility: Keyboard Navigation
Blooms Level: 2. Understand
Learning Outcome: 02.02.03 Compare and contrast ionic, covalent, and hydrogen bonds.
Learning Outcome: 02.02.04 Explain the relationship between electronegativity and chemical bond formation.
Section: 02.02
Topic: Chemical Bonds

27. Referring to the ionic bond formation between sodium and chlorine, which of the following is not a true statement?



A. Na is the chemical symbol for sodium.
B. Sodium donates an electron.
C. Chlorine donates an electron.

D. Sodium becomes positively charged.
E. The bond that is formed is stronger than a hydrogen bond.

Accessibility: Keyboard Navigation
Blooms Level: 1. Remember
Figure: 02.06
Learning Outcome: 02.02.03 Compare and contrast ionic, covalent, and hydrogen bonds.
Section: 02.02
Topic: Chemical Bonds

28. Water molecules exhibit cohesive and adhesive properties. What is the chemical bond characteristic that contributes to these and other numerous important properties of water molecules?

A. The covalent bond strengths of water molecules change with pH, temperature, or solute conditions present.
B. The covalent bonds that form water molecules transform to ionic bonds in presence of other molecules, temperature changes, or pH.
C. Hydrogen bonds form between water molecules, not requiring gain, loss, or sharing of electrons.
D. Bonds that form water are of the nonpolar covalent form.
E. Ionic bonds between water molecules create increased surface tension.

Accessibility: Keyboard Navigation
Blooms Level: 2. Understand
Learning Outcome: 02.02.03 Compare and contrast ionic, covalent, and hydrogen bonds.
Learning Outcome: 02.03.01 Explain how the structure of water affects its chemical properties.
Section: 02.02
Section: 02.03
Topic: Chemical Bonds

True / False Questions
29. The property of water demonstrated by a water strider, as it remains on top of the water, is that water molecules are held together by ionic bonds.

FALSE

Water's partial charges allow it to be cohesive, so that the surface tension among molecules can support this light insect. Read section 2.3.A for more information.

Accessibility: Keyboard Navigation
Blooms Level: 1. Remember
Learning Outcome: 02.03.01 Explain how the structure of water affects its chemical properties.
Section: 02.03
Topic: Chemical Bonds

Multiple Choice Questions
30. You can painlessly wade into a pool, but doing a belly flop off of the high diving board hurts because of

A. cohesion in water.
B. water's high boiling point.
C. water's high density.
D. water's neutral pH.
E. adhesion in water.

Accessibility: Keyboard Navigation
Blooms Level: 3. Apply
Learning Outcome: 02.02.03 Compare and contrast ionic, covalent, and hydrogen bonds.
Learning Outcome: 02.03.01 Explain how the structure of water affects its chemical properties.
Section: 02.02
Section: 02.03
Topic: Chemical Bonds
Topic: Properties of Water

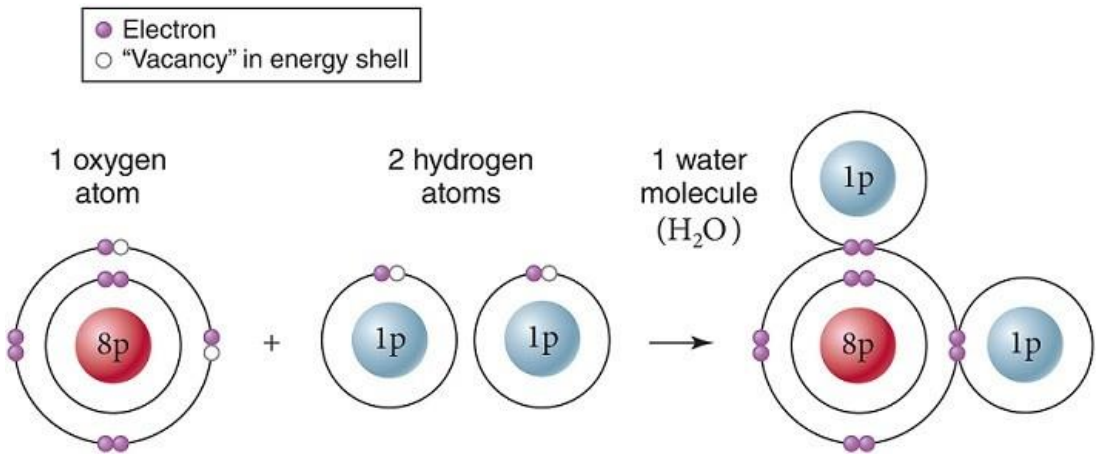
31. Trees are able to transport water from the roots to the top branches because

A. cohesion bonds water molecules to each other strongly.
B. liquid water has a higher density than the air in the plant cells of the roots, trunk, and branches.
C. water acts as a solvent of the tree cells as it moves upwards to the branches.
D. adhesion bonds water molecules to the inside of the plant conducting tubes.
E. leaves are hydrophilic.

Accessibility: Keyboard Navigation
Blooms Level: 1. Remember
Learning Outcome: 02.02.03 Compare and contrast ionic, covalent, and hydrogen bonds.
Learning Outcome: 02.03.01 Explain how the structure of water affects its chemical properties.

Section: 02.03
Topic: Chemical Bonds
Topic: Properties of Water

32. Within a single molecule of water, as shown,_____bonds are formed between oxygen and hydrogen.



A. nuclear
B. hydrophobic
C. hydrogen
D. covalent
E. ionic

Accessibility: Keyboard Navigation
Blooms Level: 1. Remember
Figure: 02.07
Learning Outcome: 02.02.03 Compare and contrast ionic, covalent, and hydrogen bonds.
Section: 02.02
Topic: Atomic Structure
Topic: Chemical Bonds
Topic: Properties of Water

True / False Questions

33. If a molecule is added to a glass of water, and is easily dissolved by the water, the added molecule is described as hydrophilic.

TRUE

In understanding water's function as a solvent, hydrophilic molecules are paired with polar molecules that can be dissolved easily by the polar water molecule. Read section 2.3.B for more information.

Accessibility: Keyboard Navigation
Blooms Level: 1. Remember
Learning Outcome: 02.02.03 Compare and contrast ionic, covalent, and hydrogen bonds.
Learning Outcome: 02.03.01 Explain how the structure of water affects its chemical properties.
Section: 02.02
Section: 02.03
Topic: Properties of Water

Multiple Choice Questions

34. Evaporation of water is a phase of water from

A. a liquid into a vapor.
B. a solid into a vapor.
C. a vapor into a liquid.
D. a vapor into a solid.
E. All of the answer choices are correct.

Accessibility: Keyboard Navigation
Blooms Level: 1. Remember
Learning Outcome: 02.03.01 Explain how the structure of water affects its chemical properties.
Section: 02.03
Topic: Properties of Water

35. You collect and measure samples of ice and surrounding ice water from a stream in the winter. You find that you collected the same number of water molecules in each form. The volume of the ice samples are larger than the ice water samples. This is a result of

A. the ionic bonds between the water molecules being unstable and constantly forming and breaking that increases the volume and decreases the density of the ice.
B. the covalent bonds between the water molecules being unstable and constantly forming and breaking that increases the volume and decreases the density of the ice.
C. the covalent bonds between the water molecules being in a fixed position that increases the volume and decreases the density of the ice.
D. the hydrogen bonds between the water molecules being unstable and constantly forming and breaking that increases the volume and decreases the density of the ice.
E. the hydrogen bonds between the water molecules being in a fixed position that increases the volume and decreases the density of the ice.

Accessibility: Keyboard Navigation
Blooms Level: 2. Understand
Learning Outcome: 02.03.01 Explain how the structure of water affects its chemical properties.
Section: 02.03
Topic: Properties of Water

36. In a chemical equation, which components of a chemical reaction are found on the left side of the arrows?

A. solvents
B. reagents
C. reactants
D. products
E. buffers

Accessibility: Keyboard Navigation
Blooms Level: 1. Remember
Learning Outcome: 02.03.01 Explain how the structure of water affects its chemical properties.
Section: 02.03
Topic: Chemical Reactions

37. An acid

A. has a value above 7 on the pH scale.
B. is a chemical that takes hydrogen ions from a solution.
C. has a value of 7 on the pH scale.
D. is a chemical that adds hydrogen ions to a solution.
E. All of the answer choices are correct.

Accessibility: Keyboard Navigation
Blooms Level: 1. Remember
Learning Outcome: 02.04.01 Explain how acids and bases affect pH.
Section: 02.04
Topic: Acids and Bases

38. A base

A. is a chemical that adds hydrogen ions to a solution.
B. has a value below 7 on the pH scale.
C. is a chemical that absorbs hydrogen ions from a solution.
D. has a value of 7 on the pH scale.
E. All the answer choices are correct.

Accessibility: Keyboard Navigation
Blooms Level: 1. Remember
Learning Outcome: 02.04.01 Explain how acids and bases affect pH.
Section: 02.04
Topic: Acids and Bases

39. Algal phytoplankton are single-celled water organisms that perform photosynthesis like plants. In a lake, summer growth of phytoplankton can change the water pH from pH 7.2 to 6.2. This change indicates all of the following except

A. the water at pH 6.2 has twice the hydrogen (H^+) concentration than before the phytoplankton growth

B. the water at pH 6.2 has 10 times the hydrogen (H^+) concentration as before the phytoplankton growth.

C. the growth of phytoplankton changed the pH of the water.
D. the lake water solution changed from slightly basic to slightly acidic in pH.
E. the water at pH 6.2 is a stronger acid solution than before the phytoplankton growth.

Accessibility: Keyboard Navigation
Blooms Level: 2. Understand
Learning Outcome: 02.04.01 Explain how acids and bases affect pH.
Section: 02.04
Topic: Acids and Bases

40. Organic molecules are defined as chemical compounds that contain_____in distinct ratios and structures.

A. carbon and nitrogen
B. carbon and oxygen
C. carbon
D. carbon and hydrogen
E. carbon, hydrogen, and nitrogen

Accessibility: Keyboard Navigation
Blooms Level: 1. Remember
Learning Outcome: 02.05.02 Compare and contrast the structures and functions of the four main classes of organic molecules.
Section: 02.05
Topic: Carbohydrates
Topic: Chemical Bonds
Topic: Lipids
Topic: Nucleic Acids
Topic: Proteins

41. The four major groups of organic compounds are

A. carbohydrates, proteins, amino acids, and nucleic acids.
B. fats, waxes, carbohydrates, and amino acids.
C. carbohydrates, lipids, steroids, and monosaccharides.
D. carbohydrates, lipids, proteins, and nucleic acids.
E. lipids, fats, waxes, and steroids.

Accessibility: Keyboard Navigation
Blooms Level: 1. Remember
Learning Outcome: 02.05.02 Compare and contrast the structures and functions of the four main classes of organic molecules.
Section: 02.05
Topic: Carbohydrates
Topic: Lipids
Topic: Nucleic Acids
Topic: Proteins

42. In living cells, a process by which cells break polymers down into monomers with the addition of water is

A. hydrolysis.
B. dehydration synthesis.
C. reproduction.
D. All of the answer choices are correct.
E. reduction.

Accessibility: Keyboard Navigation
Blooms Level: 1. Remember
Learning Outcome: 02.05.01 Differentiate between dehydration synthesis and hydrolysis.
Section: 02.05
Topic: Chemical Bonds
Topic: Chemical Reactions

43. Which of the following is not an example of a monosaccharide?

A. glucose
B. ribose
C. fructose
D. cellulose
E. All of the answer choices are correct.

Accessibility: Keyboard Navigation
Blooms Level: 1. Remember
Learning Outcome: 02.05.02 Compare and contrast the structures and functions of the four main classes of organic molecules.
Section: 02.05
Topic: Carbohydrates

44. Blood is closely maintained at a pH of 7.4. A patient whose blood pH drops below 7.35 is suffering from metabolic acidosis and can go into a coma. What happens to the concentration of H^+ ions in a patient with a blood pH of 6.4?

A. H^+ concentration is decreased 10-fold.
B. H^+ concentration is decreased 2-fold.
C. H^+ concentration is increased 10-fold.
D. H^+ concentration is increased 2-fold.
E. H^+ concentration is decreased 4-fold.

Accessibility: Keyboard Navigation
Blooms Level: 2. Understand
Learning Outcome: 02.04.01 Explain how acids and bases affect pH.
Section: 02.04
Topic: Acids and Bases

45. Which is not a lipid?

A. a sterol
B. a phospholipid
C. a triglyceride
D. a starch
E. a wax

Accessibility: Keyboard Navigation
Blooms Level: 1. Remember
Learning Outcome: 02.05.02 Compare and contrast the structures and functions of the four main classes of organic molecules.
Section: 02.05
Topic: Lipids

46. The primary building block (monomer) of proteins is

A. an amino acid.
B. a nucleotide.
C. a fatty acid.
D. a glucose molecule.
E. a group of four interconnected rings.

Accessibility: Keyboard Navigation
Blooms Level: 1. Remember
Learning Outcome: 02.05.02 Compare and contrast the structures and functions of the four main classes of organic molecules.
Section: 02.05
Topic: Proteins

47. An amino acid contains a structural "backbone" chain of

A. nitrogens.
B. phosphorus atoms.
C. carbons.
D. carbon and phosphorus atoms.
E. nitrogens and carbons.

Accessibility: Keyboard Navigation
Blooms Level: 2. Understand
Learning Outcome: 02.05.02 Compare and contrast the structures and functions of the four main classes of organic molecules.
Section: 02.05
Topic: Proteins

48. The bond that builds amino acid monomers into protein polymers is

A. a covalent bond also known as a peptide bond.
B. a denatured hydrogen bond.
C. a covalent bond also know as a glycosidic bond.
D. an ionic bond also known as a peptide bond.
E. a primary structural bond.

Accessibility: Keyboard Navigation
Blooms Level: 1. Remember
Learning Outcome: 02.05.02 Compare and contrast the structures and functions of the four main classes of organic molecules.
Section: 02.05
Topic: Chemical Bonds
Topic: Proteins

49. Many diseases, cancers, and even normal human variations can be caused by mutations and variations in the DNA nucleotide sequence. The most likely immediate result of DNA having a different nucleotide sequence is that

A. the protein resulting from the DNA mutation would be denatured and nonfunctional.
B. the peptide bonds in the protein would by hydrolyzed and the protein would fall apart.
C. no direct result of change in the protein molecule would occur if DNA is mutated.
D. the polypeptide of a protein would be altered.
E. the ability for the cell to make proteins would fail.

Accessibility: Keyboard Navigation
Blooms Level: 3. Apply
Learning Outcome: 02.05.02 Compare and contrast the structures and functions of the four main classes of organic molecules.
Section: 02.05
Topic: Nucleic Acids
Topic: Proteins

50. The primary building block (monomer) of nucleic acids is

A. a group of four interconnected rings.
B. a nucleotide.
C. an amino acid.
D. a glucose molecule.
E. a fatty acid.

Accessibility: Keyboard Navigation
Blooms Level: 1. Remember
Learning Outcome: 02.05.02 Compare and contrast the structures and functions of the four main classes of organic molecules.
Section: 02.05
Topic: Nucleic Acids

51. The three major components in a nucleotide are

A. a carboxyl group, an R group, and an amino group.
B. glucose, a nitrogen base, and a phosphate group.
C. a nitrogen base, a six-carbon sugar, and a phosphate group.
D. a nitrogen base, a five-carbon sugar, and a phosphate group.
E. glucose, a fatty acid, and glycerol.

Accessibility: Keyboard Navigation
Blooms Level: 1. Remember
Learning Outcome: 02.05.02 Compare and contrast the structures and functions of the four main classes of organic molecules.
Section: 02.05
Topic: Nucleic Acids

52. Of the comparisons listed below, which is not true in distinguishing DNA from RNA?

A. DNA is a long double-strand molecule while RNA is a shorter single-strand molecule.
B. All of the answer choices are correct.
C. DNA and RNA are different in that RNA has uracil instead of thymine.
D. DNA has a main function of storing genetic information, while RNA is used to build specific proteins in a cell.
E. DNA is a molecule that stores and regulates our genetics, while RNA is used for cellular energy storage and release for biological functions.

Accessibility: Keyboard Navigation
Blooms Level: 2. Understand
Learning Outcome: 02.05.02 Compare and contrast the structures and functions of the four main classes of organic molecules.
Section: 02.05
Topic: Nucleic Acids

53. The four nitrogen bases found in RNA are

A. adenine, thymine, guanine, and uracil.
B. adenine, cytosine, guanine, and uracil.
C. adenine, thymine, cytosine, and uracil.
D. thymine, cytosine, guanine, and uracil.
E. None of the answer choices is correct.

Accessibility: Keyboard Navigation
Blooms Level: 1. Remember
Learning Outcome: 02.05.02 Compare and contrast the structures and functions of the four main classes of organic molecules.
Section: 02.05
Topic: Nucleic Acids

54. Sugar $(CH_2O)_n$, as a solute, dissolves well in water because sugar forms_____bonds with water.

A. hydrophobic
B. ionic
C. hydrogen
D. covalent
E. nonpolar

Accessibility: Keyboard Navigation
Blooms Level: 1. Remember
Learning Outcome: 02.02.03 Compare and contrast ionic, covalent, and hydrogen bonds.
Learning Outcome: 02.03.01 Explain how the structure of water affects its chemical properties.
Section: 02.02
Section: 02.03
Topic: Chemical Bonds

55. ____bonds are formed between monomers to form a polymer.

A. Hydrogen
B. Nuclear
C. Covalent
D. Hydrophobic

E. Ionic

Accessibility: Keyboard Navigation
Blooms Level: 1. Remember
Learning Outcome: 02.02.03 Compare and contrast ionic, covalent, and hydrogen bonds.
Learning Outcome: 02.05.02 Compare and contrast the structures and functions of the four main classes of organic molecules.
Section: 02.02
Section: 02.05
Topic: Chemical Bonds

56. Saturated fats have long, straight tails of fatty acids and can clump tightly together in cells and animal bodies. Unsaturated fats have kinks in their tails due to double bonds, which prevent them from packing together as tightly.

Animals that are ectotherms (their body temperature fluctuates with the environment) need to keep their membranes fluid at cooler temperature and thus use_____in their membranes.

A. mostly unsaturated fats
B. mostly saturated fats
C. equal amounts of saturated and unsaturated fats
D. carbohydrates
E. proteins

Accessibility: Keyboard Navigation
Blooms Level: 3. Apply
Learning Outcome: 02.00.01 Explain the relationship between chemistry and biology.
Learning Outcome: 02.05.02 Compare and contrast the structures and functions of the four main classes of organic molecules.
Section: 02.05
Topic: Chemical Bonds
Topic: Lipids

57. Saturated fats have long, straight tails of fatty acids, whereas unsaturated fats from vegetables have kinks in their tails due to double bonds. These kinks prevent the fats from packing together as tightly. Hydrogenated vegetable oils, or trans fats, have hydrogens added back to the double bonds and thus behave like

A. proteins.
B. saturated fats.
C. unsaturated fats.
D. carbohydrates.
E. waxes.

Accessibility: Keyboard Navigation
Blooms Level: 2. Understand
Learning Outcome: 02.05.02 Compare and contrast the structures and functions of the four main classes of organic molecules.
Section: 02.05
Topic: Chemical Bonds
Topic: Lipids

58. The group of organic molecule polymers with the most complex and diverse three-dimensional structure is

A. unsaturated fats.
B. proteins.
C. waxes.
D. carbohydrates.
E. saturated fats.

Accessibility: Keyboard Navigation
Blooms Level: 2. Understand
Learning Outcome: 02.05.02 Compare and contrast the structures and functions of the four main classes of organic molecules.
Section: 02.05
Topic: Chemical Bonds
Topic: Proteins

True / False Questions

59. Cohesion is a property of water in which water molecules tend to stick together.

TRUE

Cohesion occurs when molecules of any substance attract other molecules of the same substance, and water does this with hydrogen bonds. Read sections 2.2.D and 2.3 for more information.

Accessibility: Keyboard Navigation
Blooms Level: 1. Remember
Learning Outcome: 02.02.03 Compare and contrast ionic, covalent, and hydrogen bonds.
Learning Outcome: 02.03.01 Explain how the structure of water affects its chemical properties.
Section: 02.02

Section: 02.03
Topic: Chemical Bonds
Topic: Properties of Water

60. A peptide bond is a covalent bond formed between the amino group of one amino acid and the R group of another amino acid.

FALSE

Locations of peptide bonds are not random in building the polymers, but must be located in specific positions. Read section 2.5.C for more information.

Accessibility: Keyboard Navigation
Blooms Level: 1. Remember
Learning Outcome: 02.05.02 Compare and contrast the structures and functions of the four main classes of organic molecules.
Section: 02.05
Topic: Chemical Bonds
Topic: Proteins

61. A substance in which other substances dissolve is called a solute.

FALSE

Liquid solutions, such as our blood plasma, rely on the solvent and solute components to be balanced for our health. Read section 2.3.B for more information.

Accessibility: Keyboard Navigation
Blooms Level: 1. Remember
Learning Outcome: 02.03.01 Explain how the structure of water affects its chemical properties.
Section: 02.03
Topic: Chemical Bonds
Topic: Properties of Water

62. Vegetable oil is an unsaturated fat from multiple plant sources. Because it is unsaturated, it is composed of at least one pair of double-bonded carbons.

TRUE

The economic understanding of food sources we buy can be important as you note differences among the natural and modified fatty acids. Read section 2.5.B for more information.

Accessibility: Keyboard Navigation
Blooms Level: 2. Understand
Learning Outcome: 02.05.02 Compare and contrast the structures and functions of the four main classes of organic molecules.
Section: 02.05
Topic: Chemical Bonds
Topic: Lipids

63. Of the 20 amino acids in all organisms, essential amino acids are obtained by food consumption.

TRUE

There are eight amino acids that humans gain from protein-rich foods. Read section 2.5.C for more information.

Accessibility: Keyboard Navigation
Blooms Level: 1. Remember
Learning Outcome: 02.05.02 Compare and contrast the structures and functions of the four main classes of organic molecules.
Section: 02.05
Topic: Proteins

Multiple Choice Questions

64. Which of these pairs does not correctly match a carbohydrate with its function?

A. Chitin provides an exoskeleton for insects.
B. Glycogen is the storage form of energy in animals.
C. Starch provides long-term energy.
D. Cellulose provides structural support for human hair.
E. Starch is the storage form of energy in plants.

Accessibility: Keyboard Navigation
Blooms Level: 2. Understand
Learning Outcome: 02.05.02 Compare and contrast the structures and functions of the four main classes of organic molecules.
Section: 02.05
Topic: Chemical Reactions
Topic: Proteins

True / False Questions

65. If a protein is denatured, its structure has been changed enough to make the protein nonfunctional.

TRUE

Normal functions of proteins cease if the three-dimensional structure is changed by various conditions. Read section 2.5.C for more information.

Accessibility: Keyboard Navigation
Blooms Level: 1. Remember
Learning Outcome: 02.05.01 Differentiate between dehydration synthesis and hydrolysis.
Section: 02.05
Topic: Proteins

66. Proteins store the genetic information of the cell and transmit it to the next generation.

FALSE

Although proteins have many functions, and have structures determined by the DNA genetic code, protein functions do not include storage and inheritance of genetics. Read section 2.5.C for more information.

Accessibility: Keyboard Navigation
Blooms Level: 2. Understand
Learning Outcome: 02.05.01 Differentiate between dehydration synthesis and hydrolysis.
Section: 02.05
Topic: Proteins

Multiple Choice Questions

67. If a carbohydrate polymer is limited to two monomer units, such as sucrose made from glucose and fructose, it is called

A. an oligosaccharide.
B. a complex carbohydrate.
C. a disaccharide.
D. a polysaccharide.
E. a monosaccharide.

Accessibility: Keyboard Navigation
Blooms Level: 1. Remember
Learning Outcome: 02.05.02 Compare and contrast the structures and functions of the four main classes of organic molecules.
Section: 02.05
Topic: Carbohydrates

68. Having the typical ratio of carbon, hydrogen, and oxygen of carbohydrates, the chemical formula for glucose is

A. $C_{12}H_6O_{12}$.
B. $C_6H_6O_{12}$.
C. $C_{12}H_{22}O_{11}$.
D. $C_6H_{12}O_6$.
E. $C_6H_6O_6$.

Accessibility: Keyboard Navigation
Blooms Level: 2. Understand
Learning Outcome: 02.05.02 Compare and contrast the structures and functions of the four main classes of organic molecules.
Section: 02.05
Topic: Carbohydrates