Chapter 02 - Lifes Chemical Basis

Multiple Choice

1. What is the primary reason for the occurrence of mercury in the human body?
   a. It is biologically inactive and dormant.
   b. It provides vital biological functions in trace amounts.
   c. It is needed to kill bacteria.
   d. It is a byproduct of cellular function.
   e. It is consumed through seafood.

ANSWER: e
DIFFICULTY: Bloom's: Understand
REFERENCES: 2.1 Mercury Rising
LEARNING OBJECTIVES: UDOL.STES.16.2.1 - Discuss how mercury poisoning has affected the natural environment and human society.

2. How much mercury can the average human safely consume per day?
   a. 2 micrograms
   b. 7 micrograms
   c. 12 micrograms
   d. 55 micrograms
   e. 90 micrograms

ANSWER: b
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.1 Mercury Rising
LEARNING OBJECTIVES: UDOL.STES.16.2.1 - Discuss how mercury poisoning has affected the natural environment and human society.

3. What is the smallest unit of an element that retains the properties of that element?
   a. atom
   b. compound
   c. ion
   d. molecule
   e. mixture

ANSWER: a
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.2 Start with Atoms
LEARNING OBJECTIVES: UDOL.STES.16.2.2 - Examine the characteristics of atoms and their radioactive isotopes using examples.

4. Which substance is *not* an element?
   a. chlorine
   b. oxygen
   c. carbon
   d. water
   e. hydrogen

ANSWER: d

DIFFICULTY: Bloom's: Apply
REFERENCES: 2.2 Start with Atoms
LEARNING OBJECTIVES: UDOL.STES.16.2.2 - Examine the characteristics of atoms and their radioactive isotopes using examples.

5. The atomic number of an atom refers to its ____.
   a. mass or weight
   b. number of protons
   c. number of protons and neutrons
   d. number of neutrons
   e. number of electrons

ANSWER: b
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.2 Start with Atoms
LEARNING OBJECTIVES: UDOL.STES.16.2.2 - Examine the characteristics of atoms and their radioactive isotopes using examples.

6. Isotopes of atoms ____.
   a. have the same number of neutrons but a different number of protons
   b. behave the same chemically and physically but differ biologically from other isotopes
   c. are the same physically and biologically but differ from other isotopes chemically
   d. have the same number of protons but a different number of neutrons
   e. are produced when atoms lose electrons

ANSWER: d
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.2 Start with Atoms
LEARNING OBJECTIVES: UDOL.STES.16.2.2 - Examine the characteristics of atoms and their radioactive isotopes using examples.

7. Which subatomic particles have a negative charge?
   a. neutrons only
   b. protons only
   c. electrons only
   d. both neutrons and protons
   e. both protons and electrons

ANSWER: c
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.2 Start with Atoms
LEARNING OBJECTIVES: UDOL.STES.16.2.2 - Examine the characteristics of atoms and their radioactive isotopes using examples.

8. The nucleus of an atom contains ____.
   a. neutrons and protons
   b. neutrons and electrons
   c. protons and electrons

d. protons only
e. neutrons only

ANSWER: a
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.2 Start with Atoms
LEARNING OBJECTIVES: UDOL.STES.16.2.2 - Examine the characteristics of atoms and their radioactive isotopes using examples.

9. The ____ of an atom have a negative charge.
a. nuclei
b. protons
c. neutrons
d. ions
e. electrons

ANSWER: e
DIFFICULTY: Bloom's: Analyze
REFERENCES: 2.2 Start with Atoms
LEARNING OBJECTIVES: UDOL.STES.16.2.2 - Examine the characteristics of atoms and their radioactive isotopes using examples.

10. The ____ of an atom have no charge.
a. electrons
b. protons
c. neutrons
d. ions
e. nuclei

ANSWER: c
DIFFICULTY: Bloom's: Analyze
REFERENCES: 2.2 Start with Atoms
LEARNING OBJECTIVES: UDOL.STES.16.2.2 - Examine the characteristics of atoms and their radioactive isotopes using examples.

11. The mass number of an atom is determined by the combined masses of its ____.
a. neutrons and protons
b. neutrons and electrons
c. protons and electrons
d. protons, neutrons, and electrons
e. neutrons, nucleus, and electrons

ANSWER: a
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.2 Start with Atoms
LEARNING OBJECTIVES: UDOL.STES.16.2.2 - Examine the characteristics of atoms and their radioactive isotopes using examples.

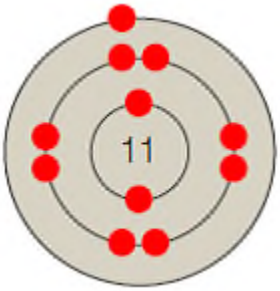

Figure 2.4C

12. Which atom is depicted in the accompanying figure?
    a. hydrogen
    b. sodium
    c. helium
    d. chlorine
    e. oxygen

ANSWER: b
DIFFICULTY: Bloom's: Apply
REFERENCES: 2.2 Start with Atoms
PREFACE NAME: Figure 2.4C
LEARNING OBJECTIVES: UDOL.STES.16.2.2 - Examine the characteristics of atoms and their radioactive isotopes using examples.

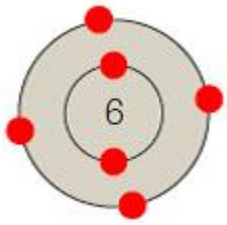

Figure 2.4B

13. Which atom is depicted in the accompanying figure?
    a. hydrogen
    b. helium
    c. carbon
    d. nitrogen
    e. oxygen

ANSWER: c
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.2 Start with Atom
PREFACE NAME: Figure 2.4B
LEARNING OBJECTIVES: UDOL.STES.16.2.2 - Examine the characteristics of atoms and their radioactive isotopes using examples.

Figure 2.4A

14. Based on its outer shell, the atom in the accompanying figure would be characterized as ____.
    a. very stable
    b. somewhat stable
    c. somewhat unstable
    d. very unstable
    e. radioactive

ANSWER: a
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.3 Why Electrons Matter
PREFACE NAME: Figure 2.4A
LEARNING OBJECTIVES: UDOL.STES.16.2.4 - Examine the characteristics of electrons and their orbitals.

15. All isotopes of an element have a different number of ____.
    a. electrons
    b. protons
    c. neutrons
    d. orbital shells
    e. atoms

ANSWER: c
DIFFICULTY: Bloom's: Understand
REFERENCES: 2.2 Start with Atoms
LEARNING OBJECTIVES: UDOL.STES.16.2.2 - Examine the characteristics of atoms and their radioactive isotopes using examples.

16. In the chemical shorthand, ^{14}C, the 14 represents the number of ____.
    a. excess neutrons
    b. protons plus neutrons
    c. electrons
    d. protons plus electrons
    e. radioactive particles

ANSWER: b
DIFFICULTY: Bloom's: Apply
REFERENCES: 2.2 Start with Atoms
LEARNING OBJECTIVES: UDOL.STES.16.2.2 - Examine the characteristics of atoms and their radioactive isotopes using examples.

17. Isotopes of an element are differentiated by their ____.
    a. atomic weight
    b. number of orbital shells

c. element name
d. mass number
e. electron profile

ANSWER: d
DIFFICULTY: Bloom's: Understand
REFERENCES: 2.2 Start with Atoms
LEARNING OBJECTIVES: UDOL.STES.16.2.2 - Examine the characteristics of atoms and their radioactive isotopes using examples.

18. Radioactive isotopes have ____.
a. excess electrons
b. excess protons
c. excess neutrons
d. insufficient neutrons
e. insufficient protons

ANSWER: c
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.2 Start with Atoms
LEARNING OBJECTIVES: UDOL.STES.16.2.2 - Examine the characteristics of atoms and their radioactive isotopes using examples.

19. Tracers are elements that ____.
a. are used in minute amounts in plants
b. can be monitored through biochemical reactions
c. must be inert
d. have an unbalanced electrical charge
e. must have a stable nucleus

ANSWER: b
DIFFICULTY: Bloom's: Understand
REFERENCES: 2.2 Start with Atoms
LEARNING OBJECTIVES: UDOL.STES.16.2.2 - Examine the characteristics of atoms and their radioactive isotopes using examples.

20. The radioisotope ^{14}C can be used as a research tracer because it ____.
a. decays to ^{12}C
b. has a different number of protons than ^{12}C
c. has fewer neutrons than ^{12}C
d. behaves the same chemically as ^{12}C
e. has six carbons and six neutrons

ANSWER: d
DIFFICULTY: Bloom's: Analyze
REFERENCES: 2.2 Start with Atoms
LEARNING OBJECTIVES: UDOL.STES.16.2.2 - Examine the characteristics of atoms and their radioactive isotopes using examples.

21. The radioactive decay of ^{14}C produces ____.
    a. carbon 12
    b. carbon 13
    c. more carbon 14
    d. nitrogen 14
    e. oxygen 14

ANSWER: d
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.2 Start with Atoms
LEARNING OBJECTIVES: UDOL.STES.16.2.2 - Examine the characteristics of atoms and their radioactive isotopes using examples.

22. Argon has 18 protons. How many electrons are in its third energy level?
    a. 2
    b. 4
    c. 6
    d. 8
    e. 10

ANSWER: d
DIFFICULTY: Bloom's: Apply
REFERENCES: 2.3 Why Electrons Matter
LEARNING OBJECTIVES: UDOL.STES.16.2.3 - Explain how electrons populate atoms using the shell model.

23. Atoms with a(n) ____ are more likely to form chemical bonds.
    a. filled outer orbital shell
    b. unfilled outer orbital shell
    c. filled inner orbital shell
    d. unfilled inner orbital shell
    e. large number of orbital shells

ANSWER: b
DIFFICULTY: Bloom's: Analyze
REFERENCES: 2.3 Why Electrons Matter
LEARNING OBJECTIVES: UDOL.STES.16.2.4 - Examine the characteristics of electrons and their orbitals.

24. Atoms become ____ in order to achieve a full outer orbital shell.
    a. free radicals
    b. ions
    c. unstable
    d. radioactive
    e. covalents

ANSWER: b
DIFFICULTY: Bloom's: Analyze
REFERENCES: 2.3 Why Electrons Matter

LEARNING OBJECTIVES: UDOL.STES.16.2.4 - Examine the characteristics of electrons and their orbitals.

25. Nitrogen, with an atomic number of 7, has ____ electron(s) in the first energy level and ____ electrons in the second energy level.

a. one; six
b. two; five
c. three; four
d. four; three
e. five; two

ANSWER: b
DIFFICULTY: Bloom's: Apply
REFERENCES: 2.3 Why Electrons Matter
LEARNING OBJECTIVES: UDOL.STES.16.2.4 - Examine the characteristics of electrons and their orbitals.

26. Carbon dioxide is an example of a(n) ____.

a. atom
b. ion
c. compound
d. mixture
e. element

ANSWER: c
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.4 Chemical Bonds: From Atoms to Molecules
LEARNING OBJECTIVES: UDOL.STES.16.2.5 - Examine chemical bonds using an example.

27. Which statement is *false*?

a. A molecule must be made of at least two atoms.
b. Compounds are made of elements.
c. Two atoms of oxygen make a molecule of oxygen.
d. Chemical bonds form between molecules of solute and solvent.
e. Elements are found in compounds and molecules.

ANSWER: d
DIFFICULTY: Bloom's: Analyze
REFERENCES: 2.4 Chemical Bonds: From Atoms to Molecules
LEARNING OBJECTIVES: UDOL.STES.16.2.5 - Examine chemical bonds using an example.

28. A molecule consists of ____.

a. radioactive compounds
b. two or more atoms of the same element
c. electrically charged elements
d. elements with one or more extra neutrons
e. atoms held together by chemical bonds

ANSWER: e
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.4 Chemical Bonds: From Atoms to Molecules

LEARNING OBJECTIVES: UDOL.STES.16.2.5 - Examine chemical bonds using an example.

29. The bond in table salt (NaCl) is ____.
    a. polar
    b. ionic
    c. covalent
    d. double
    e. nonpolar

ANSWER: b
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.4 Chemical Bonds: From Atoms to Molecules
LEARNING OBJECTIVES: UDOL.STES.16.2.6 - Differentiate between ionic and covalent bonds.

30. In ____ bonds, both atoms exert the same pull on shared electrons.
    a. triple covalent
    b. polar covalent
    c. double covalent
    d. nonpolar covalent
    e. coordinate covalent

ANSWER: d
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.4 Chemical Bonds: From Atoms to Molecules
LEARNING OBJECTIVES: UDOL.STES.16.2.6 - Differentiate between ionic and covalent bonds.

31. In covalent bonds, ____.
    a. atoms share electrons
    b. atoms give up electrons
    c. atoms accept electrons
    d. electrons cannot be shared equally
    e. electrons are always shared equally

ANSWER: a
DIFFICULTY: Bloom's: Analyze
REFERENCES: 2.4 Chemical Bonds: From Atoms to Molecules
LEARNING OBJECTIVES: UDOL.STES.16.2.6 - Differentiate between ionic and covalent bonds.

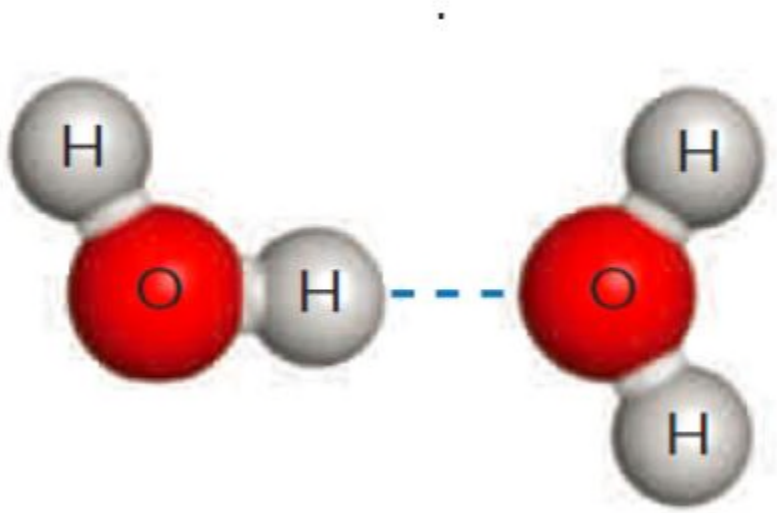

Figure 2.9B

32. The dashed line in the accompanying figure represents a(n) ____.
    a. covalent bond
    b. ionic bond
    c. hydrogen bond
    d. polar covalent bond
    e. hydrophobic interaction

ANSWER: c
DIFFICULTY: Bloom's: Understand
REFERENCES: 2.5 Hydrogen Bonds and Water
PREFACE NAME: Figure 2.9B
LEARNING OBJECTIVES: UDOL.STES.16.2.7 - Identify the properties of hydrogen bonds.

33. A hydrogen bond is an attraction between a(n) ____ hydrogen atom and another hydrogen atom taking part in ____.
    a. covalently bonded; the same polar covalent bond
    b. ionically bonded; the same polar covalent bond
    c. covalently bonded; a separate polar covalent bond
    d. ionically bonded; a separate nonpolar covalent bond
    e. nonpolar covalently bonded; a separate nonpolar covalent bond

ANSWER: c
DIFFICULTY: Bloom's: Analyze
REFERENCES: 2.5 Hydrogen Bonds and Water
LEARNING OBJECTIVES: UDOL.STES.16.2.7 - Identify the properties of hydrogen bonds.

34. Water is important to the interactions of biological molecules because it ____.
    a. is a good buffer
    b. destabilizes temperature
    c. is a poor solvent for polar and ionic substances
    d. has weak cohesive properties
    e. promotes hydrophobic and hydrophilic interactions

ANSWER: e
DIFFICULTY: Bloom's: Understand
REFERENCES: 2.5 Hydrogen Bonds and Water
LEARNING OBJECTIVES: UDOL.STES.16.2.8 - Describe the properties that hydrogen bonding gives to liquid water.

35. The most likely reason that glucose dissolves in water is that it is ____.
    a. an ionic compound
    b. a polysaccharide
    c. polar and forms many hydrogen bonds with the water molecules
    d. an extremely unstable molecule
    e. highly nonpolar

ANSWER: c
DIFFICULTY: Bloom's: Understand
REFERENCES: 2.5 Hydrogen Bonds and Water
LEARNING OBJECTIVES: UDOL.STES.16.2.8 - Describe the properties that hydrogen bonding gives to liquid water.

36. The solvent, cohesive, and temperature stabilization properties of water are primarily due to its ____.
    a. ability to promote hydrophilic interactions
    b. ionic bonds
    c. hydrogen bonds
    d. ability to promote hydrophobic interactions
    e. nonpolar nature

ANSWER: c
DIFFICULTY: Bloom's: Evaluate
REFERENCES: 2.5 Hydrogen Bonds and Water
LEARNING OBJECTIVES: UDOL.STES.16.2.8 - Describe the properties that hydrogen bonding gives to liquid water.

37. The column of water extending in tubes from plant roots to leaves is maintained by ____.
    a. hydrophilic interactions
    b. ionic bonds
    c. covalent bonds
    d. hydrophobic interactions
    e. cohesion between water molecules

ANSWER: e
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.5 Hydrogen Bonds and Water
LEARNING OBJECTIVES: UDOL.STES.16.2.8 - Describe the properties that hydrogen bonding gives to liquid water.

38. When exposed to water, sodium chloride (NaCl) ____.
    a. dissolves into Na^+ and Cl^- ions
    b. crystallizes into a solid
    c. dissolves into Na^- and Cl^+ ions
    d. crystallizes into a liquid
    e. forms a hydrophobic compound

ANSWER: a
DIFFICULTY: Bloom's: Analyze
REFERENCES: 2.5 Hydrogen Bonds and Water
LEARNING OBJECTIVES: UDOL.STES.16.2.8 - Describe the properties that hydrogen bonding gives to liquid water.

39. A salt will dissolve in water to form ____.
    a. acids
    b. only hydrogen and oxygen bonds
    c. ions other than H^+ and OH^-
    d. bases
    e. buffers

ANSWER: c
DIFFICULTY: Bloom's: Understand
REFERENCES: 2.5 Hydrogen Bonds and Water
LEARNING OBJECTIVES: UDOL.STES.16.2.8 - Describe the properties that hydrogen bonding gives to liquid water.

40. "Acidic" is an appropriate description for four of the following. Which one is the exception?
    a. excess hydrogen ions
    b. the contents of the stomach
    c. magnesium hydroxide
    d. HCl
    e. a pH less than 7

ANSWER: c
DIFFICULTY: Bloom's: Analyze
REFERENCES: 2.6 Acids and Bases
LEARNING OBJECTIVES: UDOL.STES.16.2.9 - Examine the role played by acids and bases in the normal functioning of biological systems.

41. A solution with a pH of 9 has ____ times fewer hydrogen ions than a solution with a pH of 6.
    a. two
    b. four
    c. 10
    d. 100
    e. 1,000

ANSWER: e
DIFFICULTY: Bloom's: Apply
REFERENCES: 2.6 Acids and Bases
LEARNING OBJECTIVES: UDOL.STES.16.2.9 - Examine the role played by acids and bases in the normal functioning of biological systems.

42. Blood pH is kept near a value of 7.3 - 7.5 because of ____.
    a. salts
    b. buffers
    c. acids
    d. bases

e. water

ANSWER: b
DIFFICULTY: Bloom's: Understand
REFERENCES: 2.6 Acids and Bases
LEARNING OBJECTIVES: UDOL.STES.16.2.9 - Examine the role played by acids and bases in the normal functioning of biological systems.

Completion

43. Water surface tension is caused by _____ bonds.
ANSWER: hydrogen
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.5 Hydrogen Bonds and Water
LEARNING OBJECTIVES: UDOL.STES.16.2.8 - Describe the properties that hydrogen bonding gives to liquid water.

44. The sharing of two pairs of electrons between two atoms is called a(n) _____.
ANSWER: double bond
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.4 Chemical Bonds: From Atoms to Molecules
LEARNING OBJECTIVES: UDOL.STES.16.2.5 - Examine chemical bonds using an example.

45. ^{14}Cis a radioactive isotope, and it turns into _____ when it decays.
ANSWER: nitrogen
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.2 Start with Atoms
LEARNING OBJECTIVES: UDOL.STES.16.2.2 - Examine the characteristics of atoms and their radioactive isotopes using examples.

46. The predictable rate of _____ allows tracers to be used in research studies.
ANSWER: decay
radioactive decay
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.2 Start with Atoms
LEARNING OBJECTIVES: UDOL.STES.16.2.2 - Examine the characteristics of atoms and their radioactive isotopes using examples.

47. The ability of a solution to resist changes in pH depends on its _____ capacity.
ANSWER: buffering
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.6 Acids and Bases
LEARNING OBJECTIVES: UDOL.STES.16.2.9 - Examine the role played by acids and bases in the normal functioning of biological systems.

Matching

Classification. The various energy levels in an atom of magnesium (^{24}Mg) have different numbers of electrons. Use the

numbers below to answer the following questions.
a. 1
b. 2
c. 3
d. 6
e. 8
DIFFICULTY: Bloom's: Apply
REFERENCES: 2.3 Why Electrons Matter
LEARNING OBJECTIVES: UDOL.STES.16.2.3 - Explain how electrons populate atoms using the shell model.

48. The number of electrons in the first energy level
ANSWER: b

49. The number of electrons in the third energy level
ANSWER: b

50. The number of electrons in the second energy level
ANSWER: e

Classification. The following are types of chemical bonds. Answer the questions below by matching the descriptions with the most appropriate bond type.
a. hydrogen
b. ionic
c. covalent
d. polar covalent
e. double bond
DIFFICULTY: Bloom's: Understand
REFERENCES: 2.4 Chemical Bonds: From Atoms to Molecules
LEARNING OBJECTIVES: UDOL.STES.16.2.6 - Differentiate between ionic and covalent bonds.

51. The bond between the atoms of table salt (NaCl)
ANSWER: b

52. The bond type holding several molecules of water together
ANSWER: a

53. The bond between the oxygen atoms of oxygen gas (O_2)
ANSWER: e

54. The bond that breaks when salts dissolve in water
ANSWER: b

55. A bond in which connected atoms share electrons
ANSWER: c

56. A bond in which connected atoms unequally share electrons
ANSWER: d

Classification. The following are important terms relating to water's special properties. Answer the questions below by matching the descriptions with the most appropriate word.

a. hydrophobic

b. hydrophilic

c. salt

d. solute

e. solvent

DIFFICULTY: Bloom's: Understand

REFERENCES: 2.5 Hydrogen Bonds and Water

LEARNING OBJECTIVES: UDOL.STES.16.2.7 - Identify the properties of hydrogen bonds.

57. A dissolved substance
ANSWER: d

58. A substance that dissolves in water
ANSWER: b

59. A liquid that dissolves other substances
ANSWER: e

60. A compound that releases ions when dissolved in water
ANSWER: c

61. A substance that does not dissolve in water
ANSWER: a

Classification. The following are important terms relating to acids and bases. Answer the questions below by matching the descriptions with the most appropriate word.

a. pH

b. acid

c. base

d. buffer

DIFFICULTY: Bloom's: Understand

REFERENCES: 2.6 Acids and Bases

LEARNING OBJECTIVES: UDOL.STES.16.2.9 - Examine the role played by acids and bases in the normal functioning of biological systems.

62. Substance that accepts, but does not release, H^+
ANSWER: c

63. Lemon juice
ANSWER: b

64. Substance that releases, but does not accept, H^+
ANSWER: b

65. Set of chemicals that stabilizes pH

Chapter 02 - Lifes Chemical Basis

ANSWER: d

66. Measure of H^+ in a fluid
ANSWER: a

67. Toothpaste
ANSWER: c