# Test Bank for Biology Concepts and Applications 10th Edition by Starr

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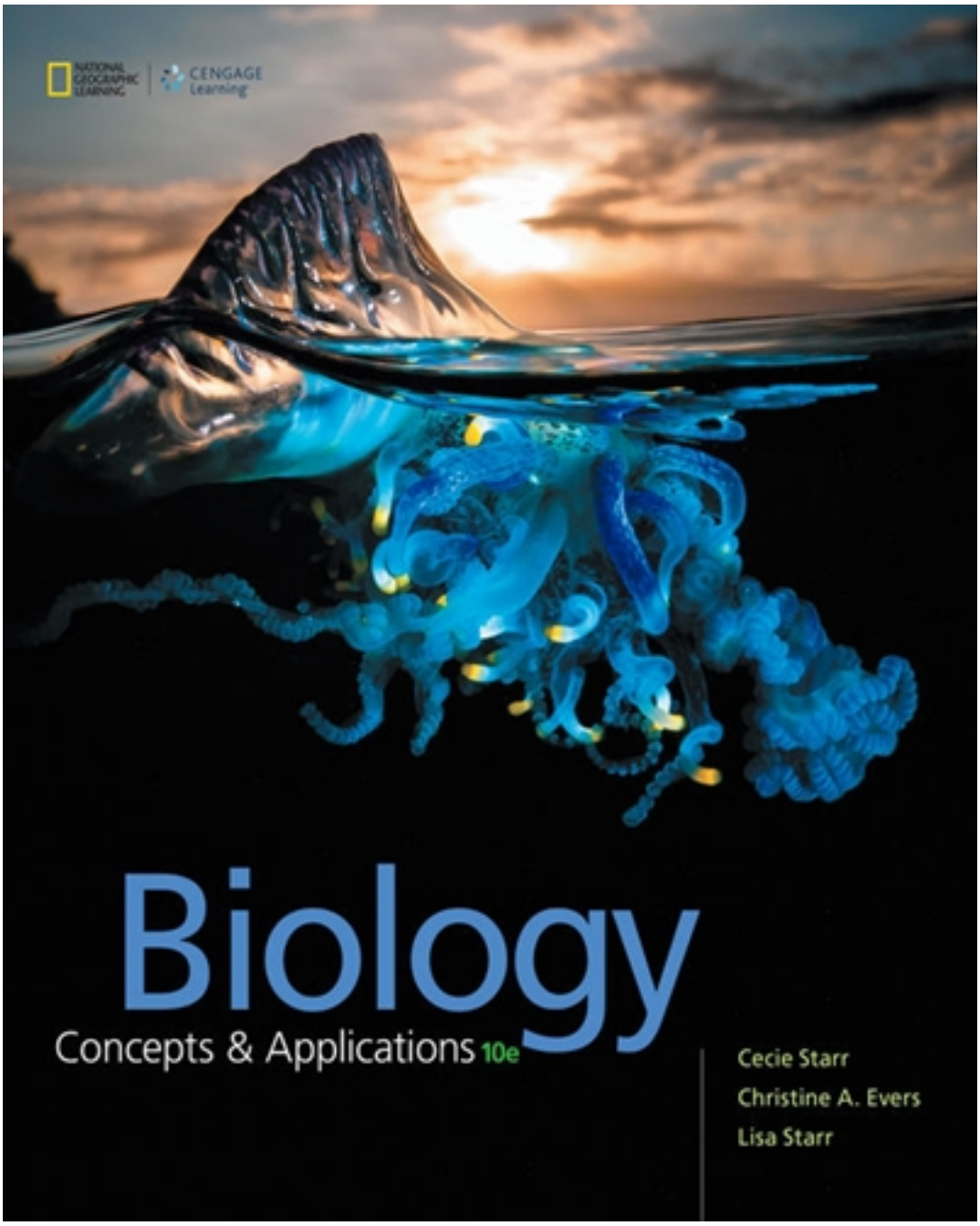



# Test Bank

# SHORT RESPONSE

1 : Refer to chemical equation shown here to explain why carbon dioxide dissolved in water acts as a buffer.H2O + CO2 H2CO3 H+ + HCO3

Correct Answer : The equation below shows what happens when CO2 dissolves in water:?H2O + CO2 ?? H2CO3 ?? H+ + HCO3??H+ ions are produced with increased levels of CO2. If there is excess H+, HCO3? absorbs it to form carbonic acid, and if excess carbonic acid forms, CO2 bubbles out of solution.

2 : Explain why atoms such as helium (atomic number 2), neon (atomic number 10), and argon (atomic number 18) do not react with other atoms.

Correct Answer : In these atoms, the outermost energy level has no vacancies; therefore, they do not have to take, share, or lose electrons to fill any vacancies.

3 : What causes ocean acidification? What are some effects of ocean acidification?

Correct Answer : Burning of fossil fuels releases a lot of carbon dioxide. More than a third of this CO2 ends up in the oceans, where it combines with water molecules to form carbonic acid. The carbonic acid releases hydrogen ions into the water, thus lowering its pH. Ocean acidification is already harming sea-dwelling life worldwide, for example by dissolving shells of marine animals.

4 : How can radioisotopes be used as tracers to study biological processes?

Correct Answer : Isotopes of an element differ in the number of neutrons while the number of protons remains the same. Therefore, all isotopes of an element generally have the same chemical properties and organisms will use atoms of one isotope the same way that they use atoms of another. Therefore a detectable radioactive isotope of an element can be used as a tracer when delivered into a biological system such as a cell, body, or ecosystem. The tracer can be followed as it moves through the system with instruments that detect radiation emitted during decay.

5 : A water molecule is polar but has no charge. What makes water molecules polar and how does this polarity contribute to hydrogen bonding?

Correct Answer : Each of the hydrogen atoms in a water molecule bears a slight positive charge and the oxygen atom carries a slight negative charge, making water polar. This happens due to polar covalent bonds between oxygen and hydrogen. Oxygen is a slightly more electronegative than hydrogen. It pulls the electrons a little more toward its side of the bond, so that atom bears a slight negative charge. Therefore, the hydrogen bears a slight positive charge.?The polarity of individual water molecules attracts them to one another. The slight positive charge of a hydrogen atom in one water molecule is drawn to the slight negative charge of an oxygen atom in another. This type of interaction is called a hydrogen bond.

6 : What makes water an excellent solvent?

Correct Answer : The polarity of the water molecule and its ability to form hydrogen bonds make water an excellent solvent.?Ionic solids dissolve in water because the slight positive charge on each hydrogen atom in a water molecule attracts negatively charged ions and the slight negative charge on the oxygen atom attracts positively charged ions. Hydrogen bonds among many water molecules are collectively stronger than an ionic bond between two ions, so the

solid dissolves as water molecules tug the ions apart and surround each one.

7 : What is the difference between strong and weak acids?

Correct Answer : Acids give up hydrogen ions when they dissolve in water, so they lower the pH of fluids and make them acidic (below pH 7). Strong acids ionize completely in water to give up all of their H+ ions while weak acids give up only some of them. The more H+ ions released by strong acids, the lower the pH becomes, making fluid even more acidic.

# MULTIPLE CHOICE

8 : What are the fundamental building blocks of all matter?
A : atoms
B : compounds
C : ions
D : molecules
E : electrons

Correct Answer : A

9 : Negatively charged subatomic particles are known as ____.
A : neutrons
B : protons
C : electrons
D : elements
E : atoms

Correct Answer : C

10 : Atoms with unpaired electrons, known as ____, are dangerous because they ____.
A : free radicals; damage biological molecules
B : ions; are unstable
C : radioisotopes; damage electron orbitals
D : free radicals; are inert
E : radioisotopes; cannot fill their electron shells

Correct Answer : A

11 : Which statement describes the arrangement or properties of electrons in an atom?
A : Electrons furthest from the nucleus are at the lowest energy level.
B : The first energy level can hold up to eight electrons.
C : Electrons cannot move out of their assigned orbital space.
D : The innermost orbital holds two electrons.
E : At the second energy level, there are two possible orbitals with a total of eight electrons.

Correct Answer : D

12 : An atom of which element possesses electrons in only the first and second energy levels? (The number in parentheses indicates the number of electrons in an atom of that element.)
A : sodium (11)
B : magnesium (12)

C : chlorine (17)
D : neon (10)
E : argon (18)

Correct Answer : D

13 : Which feature of water allows sheets of ice to form on the surface of lakes, thereby insulating the water below and protecting aquatic organisms during winter?
A : Water has surface tension.
B : Water is an excellent solvent.
C : Water has cohesion.
D : Evaporation requires energy.
E : Water is less dense when solid.

Correct Answer : E

14 : Why does the evaporation of sweat effectively cool the body?
A : As sweat cools, the distance between water molecules increases, which further reduces the temperature.
B : Since evaporation requires energy to overcome cohesion, heat energy is removed from the body surface.
C : Water in sweat insulates the skin and absorbs heat from the body before evaporation.
D : Water absorbs heat from skin oils, which is removed from the body during evaporation.
E : Breaking the bonds holding water molecules together releases energy, which is absorbed by the solutes present in sweat.

Correct Answer : B

15 : The pH of black coffee is about 5, while the pH of lemon juice is about 2. A change of one unit on the pH scale corresponds to a tenfold change in the amount of hydrogen ions. Lemon juice is therefore approximately ____ times more acidic than black coffee.
A : 3
B : 2
C : 10
D : 100
E : 1,000

Correct Answer : E

16 : The atomic number is determined by the number of ____ in an atoms nucleus.
A : neutrons and protons
B : neutrons and electrons
C : protons and electrons
D : protons only
E : neutrons only

Correct Answer : D

17 : All atoms of a given element contain the same number of ____.
A : ions
B : protons only
C : neutrons only
D : electrons and neutrons

E : protons and neutrons

Correct Answer : B

18 : The nucleus of an atom contains ____.
A : neutrons and protons
B : neutrons and electrons
C : protons and electrons
D : protons only
E : neutrons only

Correct Answer : A

19 : The mass number of an atom is determined by the number of ____.
A : neutrons and protons
B : neutrons and electrons
C : protons and electrons
D : protons only
E : neutrons only

Correct Answer : A

20 : An atom of sodium has an atomic number of 11 and a mass number of 23. How many neutrons does it have?
A : 11
B : 12
C : 23
D : 34
E : 35

Correct Answer : B

21 : Carbon has several isotopes including 12C and 14C. These isotopes differ in the number of ____.
A : electrons only
B : neutrons only
C : protons only
D : electrons and protons
E : protons and neutrons

Correct Answer : B

22 : Which type of chemical bond joins the oxygen (atomic number 8) and carbon (atomic number 6) atoms in carbon dioxide ($CO_2$)?
A : single covalent
B : double covalent
C : triple covalent
D : ionic
E : hydrogen

Correct Answer : B

23 : According to the atomic shell model, the second shell can hold up to ____ electrons.

A : one
B : two
C : four
D : six
E : eight

Correct Answer : E

24 : For an atom to be electrically neutral, it must have the same number of ____.
A : electrons and neutrons only
B : electrons and protons only
C : neutrons and protons only
D : neutrons only
E : electrons, neutrons, and protons

Correct Answer : B

25 : Which subatomic particles are arranged in various energy levels or orbitals?
A : electrons only
B : protons only
C : neutrons only
D : electrons and protons
E : protons and neutrons

Correct Answer : A

26 : Water is an example of a(n) ____.
A : atom
B : ion
C : compound
D : solution
E : element

Correct Answer : C

27 : A molecule is ____.
A : a combination of two or more atoms
B : less stable than its constituent atoms separated
C : always electrically charged
D : a carrier of one or more extra neutrons
E : another term for an atom

Correct Answer : A

28 : Magnesium has 12 protons. How many electrons are in its third energy level?
A : two
B : four
C : six
D : eight
E : ten

Correct Answer : A

29 : Calcium has an atomic number of 20. An atom of calcium has ____ electrons in its first energy level and ____ electrons in its second energy level.
A : two; eight
B : four; four
C : six; six
D : eight; two
E : two; ten

Correct Answer : A

30 : Why is pH stability important for homeostasis?
A : There is no mechanism for buffering pH changes in blood.
B : Excess H+ disrupts hydrogen bonds, thereby converting hydrophilic molecules to hydrophobic ones.
C : The bicarbonate/carbonic acid buffer system only works properly within a narrow pH range of 8.0-8.2.
D : Most biological molecules function optimally only within a narrow pH range.
E : Excess H+ facilitates hydrogen bonds, which disrupt the structural integrity of biological molecules.

Correct Answer : D

31 : An atom of which element is the least reactive?
A : hydrogen (atomic number 1)
B : lithium (atomic number 3)
C : chlorine (atomic number 17)
D : argon (atomic number 18)
E : scandium (atomic number 21)

Correct Answer : D

32 : What is formed when an atom loses or gains an electron?
A : a new element
B : an ion
C : a molecule
D : a bond
E : an isotope

Correct Answer : B

33 : A molecule of sodium chloride (NaCl) is ____ because each ion retains its respective charges as they participate in a(n) ____ bond.
A : polar; hydrogen
B : polar; ionic
C : nonpolar; single covalent
D : nonpolar; double covalent
E : polar; covalent

Correct Answer : B

34 : Which type of bond is formed whenever atoms share one pair of electrons?
A : single covalent
B : hydrogen

C : ionic
D : double covalent
E : nonpolar ionic

Correct Answer : A

35 : Which chemical interaction(s) is/are the weakest?
A : hydrogen bonds only
B : ionic bonds only
C : covalent bonds only
D : both hydrogen and covalent bonds
E : both ionic and covalent bonds

Correct Answer : A

36 : A hydrogen bond is a(n) ____.
A : shared pair of electrons between a hydrogen and an oxygen nucleus
B : shared pair of electrons between a hydrogen nucleus and either an oxygen or a nitrogen nucleus
C : attraction between a covalently bonded hydrogen atom and another atom taking part in a separate polar covalent bond
D : attraction between an ionically bonded hydrogen atom and another atom taking part in a separate polar covalent bond
E : a strong chemical bond between two ions that are each bonded to other polar compounds

Correct Answer : C

37 : Which chemical interactions is/are classified as true chemical bonds?
A : hydrogen bonds only
B : ionic bonds only
C : covalent bonds only
D : ionic and covalent bonds
E : hydrogen, ionic, and covalent bonds

Correct Answer : D

38 : Hydrophobic molecules are ____ water.
A : attracted to
B : absorbed by
C : repelled by
D : suspended by
E : dissolvable in

Correct Answer : C

39 : Why does ice float on water?
A : Ice is hydrophobic and repels water.
B : Water molecules have less mass as they become colder.
C : Water molecules are spaced farther apart in ice than in liquid water.
D : Vibrating electrons in liquid water push ice to the surface.
E : Hydrogen bonds are weaker in ice.

Correct Answer : C

40 : A salt will dissolve in water to form ____.
A : acids
B : gases
C : ions
D : bases
E : polar solvents

Correct Answer : C

41 : According to the pH scale, which substance is the most acidic?
A : hydrochloric acid, pH=1
B : orange juice, pH=3
C : butter, pH=6
D : pure water, pH=7
E : seawater, pH=8

Correct Answer : A

42 : Cellular pH is kept near a value of seven due to the action of ____ that can ____.
A : salts; dissolve readily in water
B : buffers; alternately donate and accept H+
C : buffers; donate H+ when the pH decreases
D : bases; donate OH- when pH rises
E : water; stabilize temperature

Correct Answer : B

43 : Substances that are ____ give up hydrogen ions when they dissolve in water.
A : basic
B : acidic
C : neutral
D : hydrophobic
E : buffered

Correct Answer : B

44 : Elements are arranged in the ____ according to their ____.
A : periodic table; size
B : pH scale; charge
C : pH scale; mass number
D : periodic table; atomic number
E : orbitals; electronegativity

Correct Answer : D

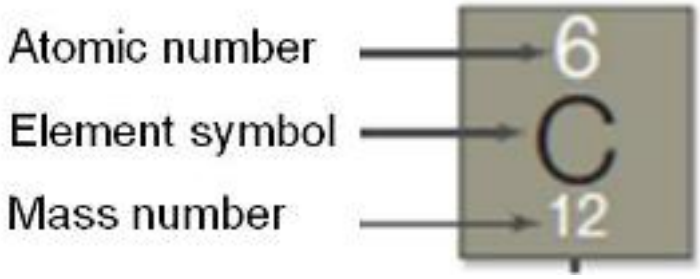
45 : The measure of an atoms ability to pull electrons away from another atom is called ____.
A : electronegativity
B : polarity
C : charge
D : concentration
E : atomic number

Correct Answer : A

46 : When dissolved in water, a(n) _____ donates H+, while a(n) _____accepts H+.
A : acid; base
B : base; acid
C : buffer; solute
D : base; buffer
E : solvent; solute

Correct Answer : A

47 : Figure 2.1




According to the accompanying figure, an atom of carbon has ____ neutrons and ____ protons.
A : six; twelve
B : three; three
C : six; six
D : six; eighteen
E : twelve; six

Correct Answer : C

48 : Due to their instability, free radicals ____.
A : are excellent solvents in biological systems
B : are excellent buffers in biological systems
C : forcibly donate or remove electrons from other molecules
D : can be used as tracers for clinical diagnostic procedures
E : will readily form ionic bonds with polar ions

Correct Answer : C

49 : The process by which a nucleus of an atom breaks up and emits subatomic particles and/or energy is known as ____.
A : radioactive decay
B : radioactive isotoping
C : electronegativity
D : neutron release
E : free radical release

Correct Answer : A

50 : Molecular oxygen is composed of two oxygen atoms that share four electrons. How many covalent bonds exist between the two oxygen atoms?
A : none
B : one
C : two
D : four

E : eight

Correct Answer : C

51 : Sodium (Na) atoms often lose the single electron that is in their outermost shell. How does losing the electron affect sodiums charge?
A : It becomes neutral.
B : It becomes positively charged.
C : It becomes negatively charged.
D : Its electronegativity increases.
E : Its charge is not affected by the loss of an electron.

Correct Answer : B

52 : Water molecules consist of one oxygen atom covalently bonded to two hydrogen atoms. In these covalent bonds, the electrons are pulled toward the oxygen side of the covalent bond, making one side of the molecule slightly negative and the other side of the molecule slightly positive. This characteristic of water is called ____.
A : polarity
B : ionic
C : electronegativity
D : hydrophobicity
E : cohesion

Correct Answer : A

53 : Hydrogen bonds in water collectively exert a continuous pull on its individual molecules; therefore, water molecules resist separating from each other. This property is called ____.
A : ionic bonding
B : solvency
C : polarity
D : hydrophilic tension
E : cohesion

Correct Answer : E

54 : What is the pH of a solution in which the number of H+ ions equals the number of OH ions?
A : 0-2
B : 3-6
C : 7
D : 8-10
E : 11-14

Correct Answer : C

55 : When nonionic solids dissolve in water, they ____.
A : act as buffers
B : accept hydrogen ions
C : release hydrogen ions
D : do not dissociate into atoms
E : dissociate into atoms

Correct Answer : D

# MATCHING

56 : Chlorine has an atomic number of 17. Use this information to answer the following questions. Not all choices will be used.

| | |
|---|---|
| A : Number of electrons in the first energy level | A : 1 |
| B : Number of electrons in the second energy level | B : 2 |
| C : Number of electrons in the third energy level | C : 3 |
| | D : 7 |
| | E : 8 |

Correct Answer :
A : B

B : E

C : D

57 : Match the terms with their most suitable description.

| | |
|---|---|
| A : hydrophilic | A : number of protons > number of electrons |
| B : atomic number | B : number of protons in the atomic nucleus |
| C : mass number | C : polar; easily dissolves in water |
| D : temperature | D : number of protons < number of electrons |
| E : neutral | E : number of protons = number of electrons |
| F : negative charge | F : measure of molecular motion |
| G : positive charge | G : number of protons and neutrons in the atomic nucleus |

Correct Answer :
A : C

B : B

C : G

D : F

E : E

F : D

G : A

58 : Match the following terms with the best description.

| | |
|---|---|
| A : separation of charge into positive and negative regions of a molecule | A : compound |
| B : an atoms ability to pull electrons away from another atom | B : polarity |

C : a type of molecule that has atoms of two or more elements
C : electronegativity
D : a charged atom
D : ion

Correct Answer :
A : B

B : C

C : A

D : D

59 : Match the chemical bond descriptions with the type of bond listed below. Each answer may be used more than once.
A : forms between atoms with little to no difference in electronegativity
A : ionic bond
B : sharing of electrons between two atoms
B : covalent bond
C : links ions of opposite charge
C : hydrogen bond
D : stabilizes the characteristic structures of biological molecules such as DNA and proteins
E : ions retain their respective charges
F : attraction between a covalently bonded hydrogen atom and another atom taking part in a separate covalent bond
G : single, double, or triple bonds can exist between two atoms

Correct Answer :
A : B

B : B

C : A

D : C

E : A

F : C

G : B

60 : Imagine that you are pouring some table salt (NaCl) into a glass of water and stirring it until the salt has dissolved. Given this scenario, match the following terms with the best description.
A : the water containing dissolved salt
A : solvent
B : the water
B : solute
C : the salt
C : solution

Correct Answer :
A : C

B : A

C : B

61 : Match the role of water in sustaining life with its appropriate property.

| | |
|---|---|
| A : allows biochemical reactions to take place within narrow, optimal, temperature ranges | A : excellent solvent |
| B : allows water to travel from the roots to the leaves in plants, in the absence of a pump | B : cohesion |
| C : since most substances dissolve in water, biochemical reactions can take place in the body | C : stabilization of temperature |

Correct Answer :
A : C

B : B

C : A

# ESSAY

62 : Alchemists were medieval scholars and philosophers who were the forerunners of modern-day chemists. Many tried repeatedly to transform lead (atomic number 82) into gold (atomic number 79). Explain why they never succeeded.

Correct Answer : Medieval alchemists understood the transformative processes of heat and other simple chemical reactions but lacked a fundamental understanding of matter at the atomic level. Specifically, they were attempting to remove protons from lead (Pb) to create gold (Au), a process that would be incredibly difficult and require massive quantities of energy as lead represents a particularly stable element.

63 : Draw a shell model of an uncharged nitrogen atom (atomic number 7).

Correct Answer : The shell model for an uncharged nitrogen atom would have two electrons in the first orbital, and five electrons in the second orbital.

64 : Polonium is a rare element with 33 radioisotopes. The most common one, 210Po, has 82 protons and 128 neutrons. When 210Po decays, it emits an alpha particle, which is a helium nucleus (two protons and two neutrons). 210Po decay is tricky to detect because alpha particles do not carry very much energy compared to other forms of radiation. They can be stopped by, for example, a sheet of paper or a few inches of air. That is one reason that authorities failed to discover toxic amounts of 210Po in the body of former KGB agent Alexander Litvinenko until after he died suddenly and mysteriously in 2006. What element does an atom of 210Po change into after it emits an alpha particle?

Correct Answer : When 210Po emits an alpha particle, it is losing two protons. Po contains 82 protons, and investigation of the periodic table finds that the element with two less protons is Pb

(lead).

65 : We all know the saying Its not the heat, its the humidity. Why is the cooling effect of sweat ineffective on humid days?

Correct Answer : ?Sweat, which is more than 99 percent water, cools the skin as it evaporates. Why? Evaporation is the process in which molecules escape from the surface of a liquid and become vapor. The evaporation of water is resisted by hydrogen bonding among individual water molecules. In other words, overcoming water's cohesion takes energy. Thus, evaporation sucks energy (in the form of heat) from liquid water, and this lowers the water's surface temperature. During humid days, evaporation is inhibited by the high concentration of water vapor already in the air; therefore, if evaporation cannot occur, heat energy cannot be removed from the skin.