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ICMR - LIFESCIENCE

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CHAPTER 1

BIOCHEMISTRY

Section - 1: Atom, Molecule, Bonds & Interaction

Previous Year Questions

[2018]

1. Valency of carbon is
   (1) One (2) Two
   (3) Three (4) Four

[2018]

2. The energy-producing groups in the Adenosine Triphosphate
   (1) Purine groups (2) Sugar groups
   (3) Phosphate groups (4) Nitrogen groups

[2019]

3. Which of the following molecule yields the maximum number of ATPs upon oxidation?
   (1) Glutamate (2) Pyruvate
   (3) Palmitate (4) Glucose

[2022]

4. Which of the following fractions of petroleum has the lowest boiling point?
   (1) Diesel (2) Kerosene
   (3) Gasoline (4) Heavy oil

[2022]

5. Two ice cubes are pressed over each other until they unite to form one block. The force mainly responsible for holding them together is:
   (1) Van der Waals force
   (2) Dipole-dipole interaction
   (3) Hydrogen bonding
   (4) Covalent bonding

[2022]

6. All types of chemical forces are involved in an antigen-antibody interaction, EXCEPT:
   (1) Van der Waal forces (2) Hydrogen bonds
   (3) Hydrophobic bonds (4) Covalent bonds

Practice Questions

7. Which of the following is the smallest unit of an element that retains the properties of that element?
   (1) Ion (2) Atom
   (3) Molecule (4) Compound

8. Which of the following elements has the smallest atomic size?
   (1) Lithium (2) Sodium
   (3) Potassium (4) Rubidium

9. Which of the following statements about covalent bonds is true?
   (1) Covalent bonds involve the transfer of electrons between atoms.
   (2) Covalent bonds are stronger than ionic bonds.
   (3) Covalent bonds are formed between two nonmetals.
   (4) Covalent bonds are formed between a metal and a nonmetal.

10. Which of the following statements about ionic bonds is true?
    (1) Ionic bonds involve the sharing of electrons between atoms.
    (2) Ionic bonds are stronger than covalent bonds.
    (3) Ionic bonds are formed between two nonmetals.
    (4) Ionic bonds are formed between a metal and a nonmetal.

11. Which of the following elements has the highest electronegativity?
    (1) Carbon (2) Nitrogen
    (3) Oxygen (4) Fluorine

12. Which of the following is not a type of intermolecular force?
    (1) Ionic bonding
    (2) London dispersion forces
    (3) Dipole-dipole forces
    (4) Hydrogen bonding

13. Which of the following statements is true regarding hybridization?
    (1) Hybridization is the mixing of atomic orbitals to form new hybrid orbitals.
    (2) Hybridization only occurs in molecules that have double or triple bonds.

(3) Hybrid orbitals have different shapes than the original atomic orbitals.
(4) All of the above.

14. Which of the following types of bonds is the most polar?
(1) C-C bond (2) C-N bond
(3) C-O bond (4) C-F bond

15. Which of the following types of intermolecular forces is the strongest?
(1) London dispersion forces (2) Dipole-dipole forces
(3) Hydrogen bonding (4) Van der Waals forces

16. Which type of bond results from the transfer of electrons from one atom to another?
(1) Ionic bond (2) Covalent bond
(3) Metallic bond (4) Hydrogen bond

17. Which of the following molecules has the shortest bond length?
(1) H2 (2) O2
(3) N2 (4) F2

18. Which of the following molecules has the highest dipole moment?
(1) CO2 (2) CH4
(3) NH3 (4) H2O

19. Which of the following bonds is the weakest?
(1) Covalent bond (2) Ionic bond
(3) Hydrogen bond (4) Van der Waals force

20. What type of bond is responsible for the secondary structure of proteins?
(1) Covalent bond (2) Ionic bond
(3) Hydrogen bond (4) Van der Waals force

21. Which of the following bonds is most likely to have a significant ionic character?
(1) H-Cl bond (2) H-F bond
(3) C-Cl bond (4) C-F bond

22. Which of the following types of bonds is responsible for the absorption of infrared radiation by molecules?
(1) Covalent bond
(2) Ionic bond
(3) Hydrogen bond
(4) Dipole-dipole interaction

23. What is the relationship between the frequency and wavelength of electromagnetic radiation?
(1) They are inversely proportional.
(2) They are directly proportional.
(3) They are unrelated.
(4) The relationship depends on the type of radiation

24. Which of the following bond is most difficult to break?
(1) C-O (2) C-P
(3) C-N (4) C-S

25. The solubility of gases in water depends on their interaction with water molecules. Four gases i.e. carbon dioxide, oxygen, sulphur dioxide and ammonia are dissolved in water. In terms of their solubility which of the following statements is correct?
(1) Ammonia > Oxygen > Sulphur dioxide > Carbon dioxide
(2) Oxygen > Carbon dioxide > Sulphur dioxide > Ammonia
(3) Sulphur dioxide > Oxygen > Ammonia > Carbon dioxide
(4) Ammonia > Sulphur dioxide > Carbon dioxide > Oxygen

Answer Key									
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
(4)	(3)	(4)	(3)	(1)	(4)	(2)	(4)	(3)	(4)
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
(4)	(1)	(1)	(4)	(3)	(1)	(4)	(4)	(4)	(3)
21	**22**	**23**	**24**	**25**					
(2)	(4)	(1)	(1)	(4)					

Answer with Explanations

Atom, Molecule, Bonds, and Interaction

1. **Correct Answer is (4):** The valency of carbon is 4. This means that carbon can form four covalent bonds with other atoms. This is due to the fact that carbon has four valence electrons in its outermost energy level, and it can share these electrons with other atoms to form stable molecules. Carbon's ability to form multiple covalent bonds with other atoms is a key factor in the diversity and complexity of organic molecules, which are compounds that contain carbon.

2. **Correct Answer is (3):** The energy in ATP is stored in the bonds between its phosphate groups. ATP consists of three phosphate groups, a ribose sugar, and an adenine base. The three phosphate groups are attached to the ribose sugar and are arranged in a linear fashion. The bond between the second and third phosphate groups is a high-energy bond, which, when broken, releases energy that can be used by the cell. The energy-producing groups in ATP are the phosphate groups. When ATP is hydrolyzed (broken down) into adenosine diphosphate (ADP) and inorganic phosphate (Pi), the high-energy bond between the second and third phosphate groups is broken, releasing energy that can be used by the cell for various processes such as active transport, and synthesis of biomolecules.

3. **Correct Answer is (4):** Glucose is a commonly used molecule for energy production in cells, and it is metabolized through the process of cellular respiration to generate ATP. Under aerobic conditions, glucose can yield a maximum of 38 ATP molecules through the complete oxidation of glucose via cellular respiration. During glycolysis, glucose is broken down into two pyruvate molecules, producing a net gain of 2 ATP molecules. The pyruvate is then transported into the mitochondria, where it enters the citric acid cycle which generates 2 ATP molecules. The majority of the ATP is generated through oxidative phosphorylation, which occurs in the electron transport chain. Here, electron carriers such as NADH and FADH2 generated in glycolysis and the citric acid cycle donate their electrons to the electron transport chain, generating a proton gradient across the membrane, which is used to produce ATP. The complete oxidation of glucose through oxidative phosphorylation can yield a maximum of 34 ATP molecules. Therefore, glucose yields the maximum number of ATP molecules upon oxidation compared to other molecules such as fatty acids or amino acids.

4. **Correct Answer is (3):** Petroleum is a complex mixture of hydrocarbons that are separated into different fractions based on their boiling points through a process called fractional distillation. The fractions with lower boiling points have fewer carbon atoms in their molecules and are more volatile, meaning they evaporate more easily. The fraction of petroleum with the lowest boiling point is the gas fraction, also known as natural gas. It is composed mainly of methane (CH4) and ethane (C2H6) and has a boiling point range of approximately -160°C to -10°C (-256°F to 14°F). The gas fraction is usually the first fraction to be separated during fractional distillation as it has the lowest boiling point, followed by other fractions such as naphtha, kerosene, diesel, and heavy fuel oil.

5. **Correct Answer is (1):** The force responsible for holding the two ice cubes together after they have been pressed over each other is known as the "van der Waals force." This force is a type of intermolecular force that arises due to temporary dipoles that occur when electrons in the atoms or molecules shift around. In the case of the two ice cubes, when they are pressed together, the surfaces of the ice cubes come into close proximity. At this point, the electrons in the atoms of one ice cube interact with the electrons in the atoms of the other ice cube, creating a temporary dipole. This dipole induces a corresponding dipole in the neighboring molecule, creating a weak attraction between the two molecules. These van der Waals forces are relatively weak and become weaker as the distance between the two objects increases. However, when many such forces act over a large area, they can add up and become strong enough to hold the ice cubes together in a solid block.

6. **Correct Answer is (4):** Covalent bonds involve the sharing of electrons between atoms and are much stronger than non-covalent bonds, so they are not typically involved in antigen-antibody interactions, which require a degree of flexibility and reversibility.

7. **Correct Answer is (2):** Atom Explanation: An atom is the smallest unit of an element that retains the properties of that element. It is made up of protons, neutrons, and electrons

8. **Correct Answer is (4):** Rubidium Explanation: The atomic size decreases as you move from left to right across a period of the periodic table. Rubidium is the last element in Period 5, and thus it has the smallest atomic size among the given options.

9. **Correct Answer is (3):** Covalent bonds are formed between two nonmetals. Explanation: Covalent bonds are formed by the sharing of electrons between two nonmetal atoms. They are usually weaker than ionic bonds, which involve the transfer of electrons between a metal and a nonmetal.

10. **Correct Answer is (4)**: Ionic bonds are formed between a metal and a nonmetal. Explanation: Ionic bonds are formed by the transfer of electrons from a metal atom to a nonmetal atom. They are usually stronger than covalent bonds.

11. **Correct Answer is (4):** Fluorine Explanation: Electronegativity is a measure of an atom's ability to attract electrons toward itself. Fluorine has the highest electronegativity among the given options, as it is the most reactive nonmetal.

12. **Correct Answer is (1):** Ionic bonding Explanation: Ionic bonding is a type of bond that occurs between ions, not between molecules. The other options are all types of intermolecular forces.

13. **Correct Answer is (1)**: Hybridization is the mixing of atomic orbitals to form new hybrid orbitals. Explanation: Hybridization is a process that involves mixing atomic orbitals to form new hybrid orbitals. This process is important in understanding the bonding and geometry of molecules, and it occurs in all types of molecules, not just those with double or triple bonds.

14. **Correct Answer is (4):** C-F bond Explanation: The C-F bond is the most polar of the given options because fluorine is the most electronegative element, and carbon is less electronegative than oxygen or nitrogen.

15. **Correct Answer is (3):** Hydrogen bonding Explanation: Hydrogen bonding is a special type of dipole-dipole force that occurs when a hydrogen atom is covalently bonded to a highly electronegative atom such as nitrogen, oxygen, or fluorine. It is stronger than the other types of intermolecular forces listed.

16. **Correct Answer is (1):** An ionic bond is formed when electrons are transferred from one atom to another, typically between a metal and a nonmetal.

17. **Correct Answer is (4):** F2 has the shortest bond length due to the strong electronegativity of fluorine, which results in a strong attraction between the two atoms.

18. **Correct Answer is (4):** H2O has the highest dipole moment due to its polar covalent bond and bent shape, which results in a separation of charge and a net dipole moment.

19. **Correct Answer is (4):** Van der Waals force. Van der Waals forces are the weakest of all intermolecular forces and are caused by the temporary dipoles that occur when electrons move randomly around a molecule.

20. **Correct Answer is** (3): The hydrogen bonds between amino acid residues in a protein are responsible for the secondary structure, such as alpha helices and beta sheets.

21. **Correct Answer is (2):** H-F bond. Fluorine is the most electronegative element, and the electronegativity difference between hydrogen and fluorine is the greatest among the options, indicating a high ionic character

22. **Correct Answer is (4):** Dipole-dipole interaction. Infrared radiation can be absorbed by the stretching or bending of bonds that result in a change in dipole moment

23. **Correct Answer is (1):** They are inversely proportional. The frequency and wavelength of electromagnetic radiation are related by the equation $c = \lambda\nu$, where c is the speed of light, λ is the wavelength, and ν is the frequency. As the frequency increases, the wavelength decreases, and vice versa.

24. **Correct Answer is (1):** Carbon is common in all the options. The strength of covalent bonds is depending on the size of atoms and the polarity of bonds. Polar covalent bonds are stronger than non-polar covalent bonds. The difference between the electronegativity of nitrogen and oxygen is quite large. Therefore, the polar covalent bond C-O is more stable than another.

25. **Correct Answer is (4):** Solubility depends on the hydrogen bonding of water molecules. The ability of the H bond is depending on the polarity. If the difference between electronegativity is more the polarity is more. CO2 is more soluble in water the O2. Out of these the ammonia has the highest solubility as the difference between N and H is maximum.

Section – 2: Solution, pH and Buffer

Previous Year Questions

1. The molecular weight of NaCl is 58. How many mg is in 50 µmol of NaCl? [2018]
   (1) 290 mg (2) 29 mg
   (3) 2.9 mg (4) 29 g

Practice Questions

2. Which of the following is a solution?
   (1) Pure water (2) Sugar
   (3) Air (4) All of the above

3. A buffer is a solution that:
   (1) Resists changes in pH
   (2) Increases the pH of a solution
   (3) Decreases the pH of a solution
   (4) None of the above

4. Which of the following is a weak acid?
   (1) Hydrochloric acid (2) Acetic acid
   (3) Sulfuric acid (4) Nitric acid

5. Which of the following has the highest buffering capacity?
   (1) A solution with a pH of 4.0
   (2) A solution with a pH of 7.0
   (3) A solution with a pH of 10.0
   (4) All have the same buffering capacity

6. Which of the following is a true statement about solutions?
   (1) Solutions can be made by mixing a solute and a solvent
   (2) Solutions only contain one substance
   (3) Solutions are always solids
   (4) Solutions cannot conduct electricity

7. What is the pH scale used for?
   (1) To measure the amount of solute in a solution
   (2) To measure the acidity or basicity of a solution
   (3) To measure the amount of solvent in a solution
   (4) To measure the concentration of water in a solution

8. Which of the following is a buffer?
   (1) A solution with a pH of 12
   (2) A solution with a pH of 7
   (3) A solution that can resist changes in pH when acid or base is added
   (4) A solution that can only dissolve solids

9. How does a buffer work?
   (1) By completely neutralizing an acid or base added to it
   (2) By converting an acid or base into a different chemical
   (3) By absorbing an acid or base and releasing an opposite ion
   (4) By increasing the concentration of the solute in the solution

10. A student prepares a buffer solution using a weak acid and its conjugate base. The buffer has a pH of 4.5. Which of the following statements is true?
    (1) The buffer will not change its pH when a strong acid is added to it
    (2) The buffer will not change its pH when a strong base is added to it
    (3) The buffer will maintain its pH when a small amount of strong acid or base is added to it
    (4) The buffer will only maintain its pH if the weak acid and its conjugate base are added in equal amounts

11. Which of the following statements about solutions, pH, and buffers is true?
    (1) A solution with a pH of 7 is acidic.
    (2) Adding a strong acid to a buffer will significantly change its pH.
    (3) Buffers are solutions that resist changes in pH.
    (4) The pH scale ranges from 1 to 14, with 7 being the most acidic. E) Adding a strong base to a buffer will not change its pH.

12. What is the equation for pH?
    (1) pH = -log[H+] (2) pH = log[H+]
    (3) pH = [H+]/log (4) pH = [H+]

13. Which of the following is NOT a buffer solution?
    (1) Acetic acid and sodium acetate
    (2) Hydrochloric acid and sodium chloride
    (3) Ammonium chloride and ammonium hydroxide
    (4) Carbonic acid and sodium bicarbonate

14. Which of the following is a characteristic of a buffer solution?
    (1) It has a high concentration of H+ ions
    (2) It resists changes in pH when small amounts of acid or base are added
    (3) It has a low concentration of OH- ions
    (4) It is a strong acid or base

15. Which equation represents the dissociation of acetic acid?
    (1) CH3COOH + H2O ↔ CH3COO- + H3O+
    (2) HCl + NaOH → NaCl + H2O
    (3) NH4OH + HCl → NH4Cl + H2O
    (4) CO2 + H2O ↔ H2CO3

16. What is the pH of a solution with a hydrogen ion concentration of 1 x 10^-5 M?
    (1) 5 (2) 6
    (3) 7 (4) 8

17. Which of the following statements about buffer solutions is TRUE?
    (1) A buffer solution has a pH of exactly 7
    (2) A buffer solution can be made from any weak acid and its conjugate base
    (3) A buffer solution can be made from any strong acid and its conjugate base
    (4) A buffer solution cannot resist changes in pH

18. What is the Henderson-Hasselbalch equation?
    (1) pH = -log[H+]
    (2) pH = pKa + log([A-]/[HA])
    (3) [H+] = 10^-pH
    (4) [OH-] = Kw/[H+]

19. Which of the following is a common buffer system in the human body?
    (1) Carbonic acid and bicarbonate
    (2) Hydrochloric acid and sodium chloride
    (3) Sulfuric acid and potassium hydroxide
    (4) Nitric acid and sodium nitrate

20. What is the pH of a buffer solution made from 0.1 M acetic acid and 0.1 M sodium acetate with a pKa of 4.76?
    (1) 4.76 (2) 5.00
    (3) 5.24 (4) 5.48

21. Which of the following is NOT a property of buffer solutions?
    (1) They can resist changes in pH
    (2) They contain a weak acid and its conjugate base or a weak base and its conjugate acid
    (3) They have a pH of exactly 7
    (4) They are important in maintaining the pH of biological systems

Answer Key									
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
(3)	(4)	(1)	(2)	(2)	(2)	(2)	(3)	(3)	(3)
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
(3)	(3)	(2)	(2)	(1)	(1)	(2)	(2)	(1)	(1)
21									
(3)									

Answer with Explanations

Solution, pH, and buffer

1. **Correct Answer is (3):** The molecular weight of NaCl is actually 58.44, but we can use 58 as an approximate value for this calculation. To convert 50 µmol of NaCl to milligrams (mg), we need to use the following steps: Calculate the number of moles of NaCl: 50 µmol / 1000 = 0.05 mmol. Convert moles to mass using the molecular weight: 0.05 mmol x 58 g/mol = 2.9 mg. Therefore, 50 µmol of NaCl is equivalent to 2.9 mg of NaCl.

2. **Correct Answer is (4):** A solution is a homogeneous mixture of two or more substances. Pure water, sugar, and air are all examples of solutions.

3. **Correct Answer is (1):** A buffer is a solution that resists changes in pH when small amounts of acid or base are added. Buffers are able to do this because they contain a weak acid and its conjugate base or a weak base and its conjugate acid.

4. **Correct Answer is (2):** A weak acid is an acid that only partially dissociates in water, meaning it does not release all of its hydrogen ions (H+) into the solution. Acetic acid is a weak acid, while hydrochloric acid, sulfuric acid, and nitric acid are all strong acids.

5. **Correct Answer is (2):** A solution with a pH of 7.0 is neutral, meaning it has an equal concentration of hydrogen ions (H+) and hydroxide ions (OH-). This allows it to effectively buffer against small changes in pH. Solutions with pH values far from 7.0 have less buffering capacity because they have either a higher concentration of H+ or OH-, which makes it harder for the buffer system to resist changes in pH.

6. **Correct Answer is (2):** A solution is a mixture of two or more substances, with the solute being the substance that dissolves in the solvent. Solvents can be liquids, gases, or solids, but solutions are typically liquids.

7. **Correct Answer is (2):** The pH scale is a measure of the acidity or basicity (alkalinity) of a solution, with a range of 0-14. A pH of 7 is considered neutral, while a pH below 7 is acidic and a pH above 7 is basic.

8. **Correct Answer is (3):** A buffer is a solution that can resist changes in pH when an acid or a base is added to it. Buffers are typically composed of a weak acid and its corresponding conjugate base or a weak base and its corresponding conjugate acid.

9. **Correct Answer is (3):** Buffers work by absorbing excess H+ or OH- ions that are added to the solution, and releasing an opposite ion to maintain a relatively constant pH. This is achieved through the presence of a weak acid and its corresponding conjugate base, or a weak base and its corresponding conjugate acid, in the solution.

10. **Correct Answer is (3):** The buffer will maintain its pH when a small amount of strong acid or base is added to it. Explanation: A buffer solution resists changes in pH when small amounts of strong acid or base are added to it. In this case, the buffer solution has a pH of 4.5, indicating that the weak acid and its conjugate base are present in roughly equal amounts. When a small amount of strong acid or base is added to the solution, the buffer will absorb the H+ or OH- ions and release an opposite ion to maintain a relatively constant pH. However, if large amounts of strong acid or base are added, the buffer may become overwhelmed and unable to maintain its pH.

11. **Correct Answer is (3):** Buffers are solutions that resist changes in pH. They can do this because they contain a weak acid and its conjugate base, or a weak base and its conjugate acid. When a small amount of an acid or base is added to a buffer solution, the buffer components react with the added species to minimize the change in pH.

12. **Correct Answer is (3):** The equation for pH is: pH = -log[H+]. Where [H+] represents the concentration of hydrogen ions in a solution, and the logarithm function is base 10.

13. **Correct Answer is (2):** Hydrochloric acid and sodium chloride. Hydrochloric acid is a strong acid and sodium chloride is a salt, but not a weak acid and its conjugate base, which are the components necessary to form a buffer solution.

14. **Correct Answer is (2):** It resists changes in pH when small amounts of acid or base are added. A buffer solution is a solution that contains a weak acid and its conjugate base or a weak base and its conjugate acid, and is able to resist changes in pH when small amounts of acid or base are added to it. Buffers work by neutralizing the added acid or base through the reaction of the weak acid or base with H+ or OH- ions, respectively, thus preventing significant changes in pH.

15. **Correct Answer is (1):** CH3COOH + H2O ↔ CH3COO- + H3O+. This is a reversible reaction that shows the weak acid acetic acid (CH3COOH) donating a proton (H+) to water (H2O) to form the acetate ion (CH3COO-) and the hydronium ion (H3O+).

16. **Correct Answer is (1):** The pH of a solution with a hydrogen ion concentration of 1 x 10^-5 M can be calculated using the pH equation: pH = -log[H+]. Substituting the given concentration value, we get: pH = -log[1 x 10^-5]
pH = -(-5)
pH = 5
Therefore, the pH of the solution is 5.

17. **Correct Answer is (2):** A buffer solution is a solution that can resist changes in pH when small amounts of acid or base are added to it. A buffer solution is made by combining a weak acid and its conjugate base, or a weak base and its conjugate acid. These components are able to neutralize added acid or base without significantly changing the pH of the solution. Strong acids or bases cannot be used to make a buffer solution because they completely dissociate in water, and do not have a conjugate base or acid to react with added acid or base. A buffer solution does not necessarily have a pH of exactly 7.

18. **Correct Answer is (2):** pH = pKa + log ([A-] / [HA]) where: pH is the pH of the buffer solution pKa is the negative logarithm of the acid dissociation constant (Ka) of the weak acid in the buffer solution. [A-] is the concentration of the conjugate base of the weak acid in the buffer solution. [HA] is the concentration of the weak acid in the buffer solution.

19. **Correct Answer is (1):** The common buffer system in the human body is (a) Carbonic acid and bicarbonate. This buffer system helps to regulate the pH of the blood by maintaining it within a narrow range of 7.35 to 7.45. Carbonic acid (H2CO3) is a weak acid and bicarbonate (HCO3-) is its conjugate base. When the blood becomes too acidic, carbonic acid donates a proton (H+) to bicarbonate to form more carbon dioxide, which is then exhaled from the lungs, raising the pH of the blood. When the blood becomes too basic, bicarbonate donates a proton to carbonic acid to form more H+ ions, which are then removed by the kidneys, lowering the pH of the blood.

20. **Correct Answer is (1):** To calculate the pH of the buffer solution, we can use the Henderson-Hasselbalch equation: pH = pKa + log ([A-] / [HA])
pH = 4.76 + log (0.1 / 0.1)
pH = 4.76 + log (1)
pH = 4.76 + 0
pH = 4.76
Therefore, the pH of the buffer solution made from 0.1 M acetic acid and 0.1 M sodium acetate with a pKa of 4.76 is approximately 4.76.

21. **Correct Answer is (3):** The property of buffer solutions that is NOT correct is (c) They have a pH of exactly 7. Buffer solutions can have a pH that is acidic, basic, or neutral, depending on the values of the concentrations of the weak acid and its conjugate base (or weak base and its conjugate acid) and the pKa of the weak acid (or pKb of the weak base) used to create the buffer. The pH of a buffer solution is typically within one pH unit of the pKa (or pKb) of the weak acid (or weak base). Buffers are important in maintaining the pH of biological systems and can resist changes in pH by neutralizing added acids or bases through the reaction of the weak acid or weak base with the added species.

Section - 3: Enzymes

Previous Year Questions

[2018]

1. Inhibition of succinic dehydrogenase by malonic acid is
   (1) Non-competitive inhibition
   (2) Competitive inhibition
   (3) Un-competitive inhibition
   (4) Feedback inhibition

[2018]

2. What does uncompetitive inhibition in the enzyme-substrate reaction tells us
   (1) Inhibitor binds already formed enzyme-substrate complex
   (2) Inhibitor binds to another site than the active site of enzyme
   (3) Inhibitor competes with the substrate in binding the active site of enzyme
   (4) Inhibitor does not participate in the enzymesubstrate reaction

[2018]

3. The main role of an enzyme in a chemical reaction is to
   (1) Reduce the energy of a reaction
   (2) Increase the energy of a reaction
   (3) Reaction goes to completion without changing energy
   (4) Reduce the substrate binding characteristics

[2018]

4. What does graph which substrate concentration velocity curve indicate?
   (1) Zero order kinetics
   (2) Michelis-Mentons equation
   (3) Inverse relation
   (4) All of the above

[2019]

5. Which of the following type of enzyme inhibition is also called as end-product inhibition?
   (1) Substrate regulation
   (2) Feedback inhibition
   (3) Competitive inhibition
   (4) Non-competitive inhibition

[2019]

6. Which is true about enzymes?
   (1) All enzymes are proteins
   (2) All enzymes are vitamins
   (3) All enzymes are not proteins
   (4) All proteins are enzymes

[2020]

7. Both the affinity of a drug for its receptor and its intrinsic activity are determined by its:
   (1) Chemical structure
   (2) Dissociation constant
   (3) Allosteric antagonism
   (4) Stereoisomeric properties

[2020]

8. The proteinaceous molecule that joins a nonprotein prosthetic group to form a functional enzyme, is called:
   (1) Apoenzyme (2) Co-factor
   (3) Isoenzyme (4) Holoenzyme

Practice Questions

9. Which of the following parameters affects the rate of an enzyme-catalyzed reaction?
   (1) Enzyme concentration
   (2) Substrate concentration
   (3) pH
   (4) All of the above

10. The Michaelis-Menten equation describes the relationship between which two variables?
    (1) Enzyme concentration and substrate concentration
    (2) Substrate concentration and reaction rate
    (3) Enzyme concentration and reaction rate
    (4) None of the above **Answer**:

11. Which of the following is NOT a possible unit of measurement for the rate constant (k) of an enzyme-catalyzed reaction?
    (1) M/s (2) s^{-1}
    (3) min^{-1} (4) mL

12. The turnover number (kcat) of an enzyme is defined as:
    (1) The ratio of the maximum reaction rate to the enzyme concentration
    (2) The ratio of the enzyme concentration to the maximum reaction rate
    (3) The maximum reaction rate divided by the Michaelis constant (Km)
    (4) The maximum reaction rate divided by the total enzyme concentration

13. The Lineweaver-Burk plot is used to determine:
    (1) The Michaelis constant (Km) of an enzyme-catalyzed reaction
    (2) The turnover number (kcat) of an enzyme
    (3) The reaction rate at different substrate concentrations
    (4) All of the above