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SECTION-I

BIOLOGY

TOPIC

"BIOCHEMISTRY"

CHAPTER-1
BIOCHEMISTRY

STRUCTURE OF ATOMS, MOLECULES, BONDS, INTERACTIONS

PREVIOUS YEAR EXAM QUESTIONS

[IIT JAM BT]

(IIT JAM BT - 2014)

1. Aqueous environment in a spherical endosome – a closed vesicle of 100 nm diameter, is at a pH 5.0, in order to denature and hydrolyze the material internalized by a cell. Assuming Avogadro's number to be 6×10^{23}, the number of free protons in an endosome is closest to
   (1) 24 (2) 3
   (3) 2400 (4) 300

(IIT JAM BT - 2014)

2. The number of water molecules present in a 300 residue soluble protein of spherical shape (diameter = 2nm) having 20% (V/V) water is closest to *Assume:* density of water = 1000 kg/m^3, Avogadro's number = 6×10^{23}
   (1) 224 (2) 9
   (3) 140 (4) 28

(IIT JAM BT - 2016)

3. Which of the following statements are TRUE for hydrogen bonds? Strength of hydrogen bond is
   (1) low in a solvent of high dielectric constant
   (2) low in a solvent of low dielectric constant
   (3) lower in water as compared to organic solvents
   (4) higher in water as compared to organic

(IIT JAM BT - 2022)

4. The correct statement/s for bimolecular nucleophilic substitution reactions is/are
   (1) It goes through a carbocation formation
   (2) There is an inversion of configuration if the reacting center is chiral
   (3) Reaction is enhanced when carried out in polar solvents
   (4) The reaction intermediate is trigonal bipyramidal

(IIT JAM BT - 2022)

5. What is the maximum number of hydrogen bonds that a water molecule can make in the liquid state?

Answer Key				
1	2	3	4	5
2	4	1,3	2,3	4

[GAT-B]

(GAT-B 2020)

1. Which of the following INCORRECTLY describes a molecule with a mass 1,000 times that of water?
   (1) 18 kDa (2) Mr 18,000
   (3) 18,000 Daltons (4) Mr 18,000 Daltons

(GAT-B 2023)

2. The distance between each turn in the helical strand of DNA is
   (1) 20 Å (2) 34 Å
   (3) 28 Å (4) 42 Å

(GAT-B 2023)

3. The approximate length of the open reading frame coding for a 55 kDa bacterial protein will be
   (1) 5000 nucleotides (2) 5500 nucleotides
   (3) 1500 nucleotides (4) 3000 nucleotides

(GAT-B 2023)

4. Trihydroxypropane is commonly known as
   (1) Glycine (2) Glyceride
   (3) Glycerol (4) Glycolide

Answer Key			
1	2	3	4
4	2	3	3

[CUET-PG ZOOLOGY]

[CUET-PG 2023]

1. In the formation of agarose gel, which one of the following bonds is involved?
   (1) Van der Waals interaction
   (2) Intra-chain hydrogen bonding
   (3) Inter and Intra-chain hydrogen bonding
   (4) Disulphide bond

Answer Key
1
3

[CUET-PG LIFE SCIENCE]

[CUET PG 2023]

1. Given below are two statements: One is labelled as Assertion (A) and the other is labelled as Reason (R).
   Assertion (A): In tertiary structure of protein hydrophbic side chains are held interior while the hydrophilc groups are on the surface of the protein molecule.
   Reasons (R): Other than hydrogen bonds disulfide bonds (SS), ionic interaction (Electrostatic), hydrophobic interaction and Vander Waals forces also contribute to the tertiary structure of protein.
   In the light of the above statements, choose the most appropriate answer from the options give below:
   (1) Both (A) and (R) are true and (R) is the correct explanation of (A)
   (2) Both (A) and (R) are true but (R) is NOT the correct explanation of (A)
   (3) (A) is true but (R) is false
   (4) (A) is false but (R) is true

Answer Key
1
4

[CUET PG BIOCHEMISTRY]

[CUET-PG 2022]

1. Peptide bond is a:
   (1) Covalent bond (2) Ionic bond
   (3) Metallic bond (4) Hydrogen bond

[CUET-PG 2023]

2. Watson and Crick base pairing is?
   (1) Hydrogen bonding in a single DNA strand.
   (2) Non-covalent hydrogen bonding between two DNA strands.
   (3) Van der Waal's forces between bases.
   (4) Phorphodiester bonds between nitrogenous bases of opposite strands

[CUET-PG 2023]

3. A phosphodiester bond forms:
   (1) Polypeptides
   (2) Polynucleotides
   (3) Lipoproteins
   (4) Oligomers of carbohydrates and lipids

Answer Key		
1	2	3
1	2	2

CHAPTER-2
BIOCHEMISTRY

ACID, pH, BUFFER & SOLUTIONS

PREVIOUS YEAR EXAM QUESTIONS

[IIT JAM BT]

(IIT JAM BT - 2011)

1. An aqueous solution contains 0.01 mol of formic acid (pK_a = 3.8) and 0.1 mol of sodium formate. The pH of the solution is
   (1) 3.8 (2) 4.8
   (3) 2.8 (4) 1.8

(IIT JAM BT - 2012)

2. pK_a of acetic acid is 4.80. A 10mL of 1M solution of acetic acid is mixed with 5mL of 1M solution of NaOH. The *pH* of the resulting solution is
   (1) 3.2 (2) 7.0
   (3) 4.8 (4) 2.4

(IIT JAM BT - 2014)

3. The pH at the equivalence point when 50mL of 0.1M Acetic acid is titrated against 0.1M NaOH is closest to
   (1) 6.0 (2) 7.0
   (3) 8.0 (4) 9.0

(IIT JAM BT - 2015)

4. The pH of a 0.1M solution of monosodium succinate (pKa_1= 4.19 and pKa_2 = 5.57) is ___.

(IIT JAM BT - 2017)

5. The $[H^+]$ of 0.1 N acetic acid solution is 1.33×10^{-3}. The pH of the solution (correct to two decimal places) is_____.

(IIT JAM BT - 2021)

6. The molar concentration of water in pure water is _____ M (rounded -off to 1 decimal).

(IIT JAM BT - 2021)

7. 1.45 g of sucrose ($C_{12}H_{22}O_{11}$) is dissolved in 30.0 ml of water. Molality (rounded off to 3 decimals) of the resulting solution is _____ m.

Answer Key						
1	**2**	**3**	**4**	**5**	**6**	**7**
3	3	4	4.80-4.90	2.86-2.89	55.7	0.141

[GAT-B]

(GAT-B 2020)

1. The molarity of the solution prepared by dissolving 8 g NaOH in 250 mL of water will be
   (1) 4M (2) 0.25 M
   (3) 0.4 M (4) 0.8 M

(GAT-B 2020)

2. How much NaCl is required to make 10 ml of 2 M NaCl solution?
   (1) 17 gm (2) 38.5 gm
   (3) 7.7 gm (4) 3.85 gm

(GAT-B 2021)

3. The molarity of pure water is
   (1) 18 (2) 1
   (3) 54 (4) 55.55

(GAT-B 2021)

4. What are the number of moles in 100 ml water (density=1 g/ml) and in 100 ml heavy water (density=1.11 g/ml), respectively?
   (1) 4.44 and 4.44 (2) 4.44 and 5.55
   (3) 5.55 and 4.44 (4) 5.55 and 5.55

(GAT-B 2021)

5. Aqueous Organic solvents will have:
   (1) Higher dielectric constant than pure water
   (2) Same dielectric constant as pure water
   (3) Lower ionizing capacity than pure water
   (4) More ionizing capacity than pure water

(GAT-B 2023)

6. Calculate the molality of 3.0 g acetic acid in 100 g of benzene.
   (1) 0.05 mol kg^{-1} (2) 0.5 mol kg^{-1}
   (3) 2.0 mol kg^{-1} (4) 0.2 mol kg^{-1}

(GAT-B 2023)

7. You are supplied with a pain-relieving drug (MW 300) formulation at 5mg/ml. A patient with a plasma volume of 2.5 L needs an initial dose of $20\mu M$ for immediate relief. How much solution do you need to inject to the patient?
   (1) 1 ml (2) 2 ml
   (3) 3 ml (4) 4 ml

(GAT-B 2023)

8. How much protein will you need to make 100 microlitres of 15 micromolar solution of a 95 kDa protein?

(1) 0.1425 mg (2) 1.425mg
(3) 0.01425 mg (4) 14.25 mg

Answer Key							
1	2	3	4	5	6	7	8
4	1	4	4	3	2	3	1

[TIFR]

(TIFR - 2012)

1. A student conducted an experiment where CO_2 and N_2were bubbled through water in beakers A and B respectively. He recorded the pH in each of the solutions every 5 min. What is the most valid conclusion the student could draw from these results:

	pH reading	
Time (min)	A	B
5	7.5	7.5
10	7.2	7.3
15	7.0	7.5
20	6.8	7.4

(1) The change in pH was too small to be significant
(2) Bubbling CO_2 through water makes it more acidic
(3) Bubbling N_2 through water makes it more acidic
(4) Both CO_2 and N_2 make water more acidic

(TIFR - 2021)

2. 700 ml of colourless solution is present in each of two bottles, A and B. The label on A reads, 1 M $NaCl$, while that on B reads 1 mole NaCl. Which of the following statements is correct?
(1) The amount of $NaCl$ in in each bottle is the same
(2) The concentration of $NaCl$ in each bottle is the same
(3) Bottle A has less amount of $NaCl$ than Bottle B
(4) The concentration of $NaCl$ is more in Bottle A than in Bottle B

(TIFR - 2021)

3. The pKa of a monobasic organic acid is 4.2. The pH at which 95% of the acid will be in ionized form is:
(1) 5.02 (2) 5.38
(3) 2.92 (4) 3.71

Answer Key		
1	2	3
2	3	2

[CUET-PG BOTANY]

[CUET PG 2023]

1. Given below are two statements:
Statement I: The chemical potential of an uncharged solute S, in a given medium can be defined as in equation
$\mu_s = \mu_s^\circ + RT\ Ina$
Statement II: μ_s° = standard chemical potential is at 1M concentration
R = Gas constant
T = Temperature
a = Natural logarithm of the activity a of the solvent
In the light of the above statements, choose the most appropriate answer from the options given below:
(1) Both Statement I and Statement II are true
(2) Both Statement I and Statement II are false
(3) Statement I is true but Statement II is false
(4) Statement I is false but Statement II is true

Answer Key
1
4

[CUET-PG LIFE SCIENCE]

[CUET PG 2022]

1. The pH at which net charge of protein becomes zero under an electrical field at room temperature is known as
(1) Isoelectric potential (2) Isothermal point
(3) Isomeric point (4) Isoelectric point

Answer Key
1
2

[CUET PG BIOCHEMISTRY]

[CUET-PG 2022]

1. Calculate the pH of a 2.0 L solution containing 10 ml of 5M acetic acid and 10 ml of 1 M sodium acetate (pk, of acetic acid = 4.76)?
(1) 2.08 (2) 4.06
(3) 5.08 (4) 7.00

[CUET-PG 2023]

2. Match List I with List II

LIST I	LIST II
A. Histidine	I. $Pk_a 6.0$
B. Lysine	II $Pk_a 10.6$
C. Tyrosine	III. $Pk_a 4.1$
D. Aspartic acid	IV. $Pk_a 2.8$

Choose the correct answer from the options given below:

(1) A-I, B-II, C-IV, D-III (2) A-II. B-IV, C-III, D-I

(3) A-III. B-II, C-IV, D-I (4) A-I, B-II, C-III, D-IV

[CUET-PG 2023]

3. Given below are two statements: One is labelled as Assertion A and the other is labelled as Reason R:

Assertion A: While the pK, of a free lysine is 10.5, the pK, of lysine decreases to 6.6 when present in the active site of Acetoacetate decarboxylase.

Reason R: The decreased pK, of lysine in the active site is due to the electrostatic effect of nearby positive charges.

In the light of the above statements, choose the most appropriate answer from the options given below:

(1) Both A and R are correct and R is the correct explanation of A

(2) Both A and R are correct but R is NOT the correct explanation of A

(3) A is correct but R is not correct

(4) A is not correct but R is correct

Answer key		
1	**2**	**3**
2	4	1