



Previous Year Solved Question Paper
of

G.A.T.E. (XL) 2013

LIFE SCIENCES

XL: I Biochemistry

Examination

(Original Question Paper with Answer Key)

GRADUATE APTITUDE TEST IN ENGINEERING



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GATE XL 2013

I: BIOCHEMISTRY

Q. 1 – Q. 10 carry one mark each.

- Q.1 Which one of the following statements is **TRUE** when a cell is kept in a hypotonic solution?
- (A) Water moves out of the cell
(B) Size of the cell remains same
(C) No movement of water takes place
(D) Size of the cell increases
- Ans. D
- Q.2 Which one of the following amino acids has a higher propensity for *cis* peptide bond formation?
- (A) Histidine
(B) Cysteine
(C) Glycine
(D) Proline
- D
- Q.3 The length of an α -helix composed of 36 amino acid residues is
- (A) 10 Å
(B) 54 Å
(C) 27 Å
(D) 360 Å
- B
- Q.4 The order n for a given substrate concentration in an enzyme catalyzed reaction following Michaelis-Menten kinetics, is
- (A) $n = 1$ (B) $n = 0$ (C) n is not defined (D) $0 \leq n \leq 1$
- D
- Q.5 Which one of the following amino acid residues is specifically recognised by chymotrypsin during peptide bond cleavage?
- (A) Phe
(B) Leu
(C) Val
(D) Asp
- A
- Q.6 The terminal electron acceptor during mitochondrial respiration is
- (A) O_2 (B) FAD^+ (C) NAD^+ (D) ATP
- A

Q.7 During the biosynthesis of urea in the urea cycle, the two nitrogen atoms are derived from

- (A) Two free ammonium groups
- (B) Free ammonium group and aspartate
- (C) Both nitrogen atoms are derived from arginine
- (D) One nitrogen atom is derived from citrulline and one from glutamate.

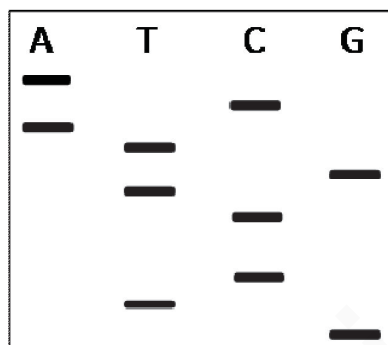
B

Q.8 An enzyme has two binding sites for an inhibitor molecule. When the inhibitor binds to the first site, the dissociation constant of the inhibitor for the second site increases, leading to negative co-operativity. The Hill coefficient for such an inhibitor is

- (A) equal to one
- (B) greater than one
- (C) less than one
- (D) less than zero

C

Q.9 An oligonucleotide was sequenced by the dideoxy method of Sanger and the following autoradiogram was obtained



The sequence of the oligonucleotide is

- (A) 3'-GTCCTGTACA-5'
- (B) 5'-GTCCTGTACA-3'
- (C) 5'-ACATGTCCTG-3'
- (D) 3'-AATTTCCCGG-5'

B

Q.10 In different types of tissue transplantations, the rate of graft rejection in decreasing order is

- (A) Isograft > Xenograft > Allograft
- (B) Allograft > Isograft > Xenograft
- (C) Xenograft > Autograft > Allograft
- (D) Xenograft > Allograft > Isograft

D

Q. 11 - Q. 20 carry two marks each.

Q.11 You have prepared 1.0 liter of 0.5 M acetate buffer (pH=5.0). The dissociation constant of acetic acid is 1.7×10^{-5} M. What would be the acetate ion concentration in the buffer?

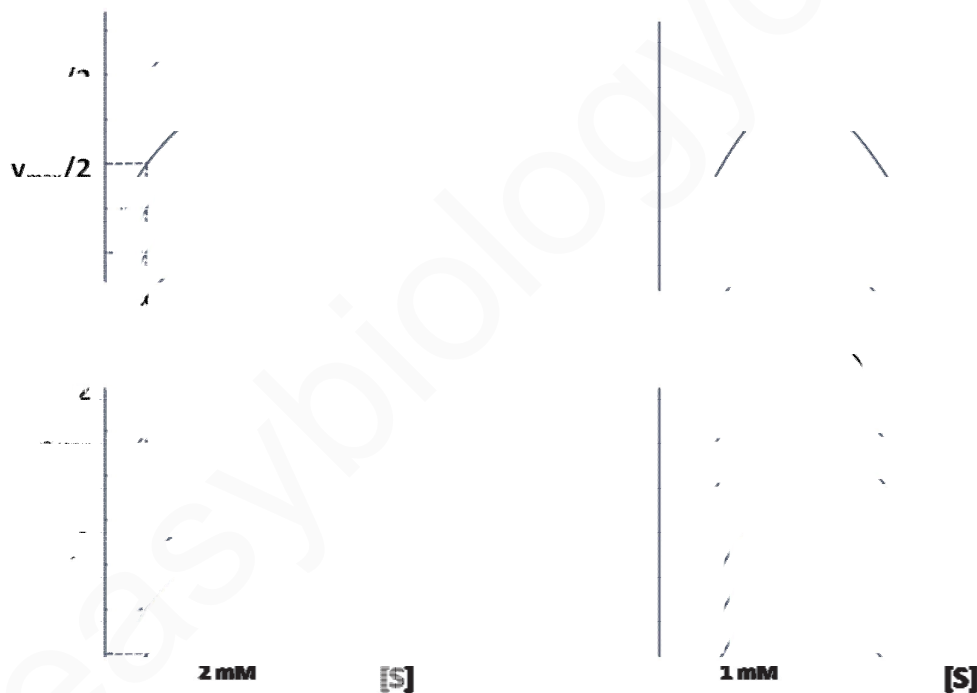
- (A) 0.1M
- (B) 0.25 M
- (C) 0.315 M
- (D) 0.415 M

C

Q.12 The following figures show the plot of reaction rate versus substrate concentration (mM) for an enzyme catalyzed reaction in the presence and absence of an inhibitor. Match the possible reaction types with the plots.

- (P) Competitive inhibition
- (R) Michaelis-Menten

- (Q) Substrate inhibition
- (S) Non-competitive inhibition



- (A) P – i, Q – iii, R – ii, S – iv
- (B) P – iii, Q – ii, R – i, S – iv
- (C) P – iii, Q – iv, R – i, S – ii
- (D) P – iv, Q – ii, R – i, S – iii

B

Q.13 Arrange the following in the decreasing order of their permeability coefficients across a lipid bilayer membrane.

- (i) Urea
- (ii) Glucose
- (iii) H_2O
- (iv) Na^+
- (v) Tryptophan

(A) (i), (iii), (v), (ii), (iv)

(B) (iii), (v), (ii), (iv), (i)

(C) (iii), (i), (v), (ii), (iv)

(D) (i), (iii), (iv), (v), (ii)

C

Q.14 Arrange the following in the increasing order of amount of ATP generated by metabolism of one molecule of the following compounds.

- (i) Anaerobic catabolism of starch with 300 glucose units
- (ii) Aerobic catabolism of glucose
- (iii) Aerobic catabolism of acetate
- (iv) Aerobic catabolism of palmitate

(A) (ii), (iv), (iii), (i)

(B) (iii), (ii), (i), (iv)

(C) (iv), (ii), (i), (iii)

(D) (iii), (ii), (iv), (i)

D

Q.15 Match the following enzymes with their regulatory mechanism

- | | |
|----------------------------|--------------------------------|
| (a) Phosphofructokinase | 1. Product inhibition |
| (b) Glycogen synthase | 2. Control of enzyme synthesis |
| (c) β -galactosidase | 3. Allosteric interaction |
| (d) Lactate dehydrogenase | 4. Covalent modification |

(A) (a)-3, (b)-2, (c)-1, (d)-4

(B) (a)-3, (b)-4, (c)-2, (d)-1

(C) (a)-4, (b)-3, (c)-1, (d)-4

(D) (a)-4, (b)-1, (c)-2, (d)-3

B

Q.16 A researcher wants to clone 3 DNA fragments of sizes 1.1 Mb, 0.097 Mb and 0.045 Mb. The choice of the vectors for cloning each of the fragments are

- (A) Cosmid, bacteriophage λ , bacteriophage P1
- (B) Yeast artificial chromosome, bacteriophage P1, cosmid
- (C) Bacterial artificial chromosome, bacteriophage λ , yeast artificial chromosome
- (D) Only plasmids

B

Q.17 Which of the four restriction enzymes given below cut the following DNA sequence?

5'-CCGATATCTCGAGGGC-3'

- (P) BamH1 (3'-CCTAG[^]G-5')
- (Q) XhoI (3'-GAGCT[^]C-5')
- (R) EcoRI (3'-CTTAA[^]G-5')
- (S) EcoRV (3'-CTA[^]TAG-5')

- (A) P & Q (B) P, R & S (C) Q & S (D) P & R

C

Q.18 You have expressed the following protein that has an isoelectric point of 6.0. The best order of protein purification methodologies to obtain a pure protein is?



- (A) Gel filtration chromatography, Anion exchange chromatography at pH=4.0, Ammonium sulphate precipitation
- (B) Cation exchange chromatography at pH=9.0, Ni-affinity chromatography, Gel filtration chromatography
- (C) Anion exchange chromatography at pH=8.0, Ni-affinity chromatography, Gel filtration chromatography
- (D) Ammonium sulphate precipitation, Anion exchange chromatography at pH=4.0, Ni-affinity chromatography

C

Q.19 An enzyme of 40 kDa is added to a substrate solution in a molar ratio of 1:3. The concentration of the enzyme in the mixture is 12 mg/ml. What would be the corresponding substrate concentration?

- (A) 0.4 mM (B) 0.12 mM (C) 0.9 mM (D) 0.3 mM

C

Q.20 A patient suffering from pneumonia and tuberculosis was found to have very low CD4⁺ T cells. In all probability the **PRIMARY** causative infectious agent belongs to

- (A) Klebsiella family
- (B) Mycobacterium family
- (C) Retrovirus family
- (D) Streptococcus family

C

END OF SECTION - I

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