GATE 2012 BT

EE25BTECH11014 - BHOOMIKA LOKESH

I. Q.1-Q.5 CARRY ONE MARK EACH

1) In mismatch correction repair, the parental DNA strand is distinguished from the daughter strand by

   a) acetylation   b) phosphorylation   c) methylation   d) glycosylation

   (GATE 2012 BT)

2) The basis for blue-white screening with pUC vectors is

   a) intraallelic comple-mentation   b) intergenic comple-mentation   c) intragenic suppres-sion   d) extragenic suppres-sion

   (GATE 2012 BT)

3) Idiotypic determinants of an antibody are associated with the

   a) constant region of the heavy chains   c) variable region
   b) constant region of the light chains   d) constant regions of light and heavy chains

   (GATE 2012 BT)

4) Identification of blood groups involves

   a) precipitation   b) neutralization   c) opsonization   d) agglutination

   (GATE 2012 BT)

5) B-lymphocytes originate from the bone marrow whereas T-lymphocytes originate from

   a) thymus   b) bone marrow   c) spleen   d) liver

   (GATE 2012 BT)

6) A humanized antibody is one in which the

   a) heavy and light chains are from human   from mouse
   b) heavy chain is from human and light chain is   d) CDRs are from mouse, and the rest is from
        from mouse   human
   c) light chain is from human and heavy chain is

   (GATE 2012 BT)

7) Dimethyl sulfoxide (DMSO) is used as a cryopreservant for mammalian cell cultures because

   a) it is an organic solvent   water
   b) it easily penetrates cells   d) it is also utilized as a nutrient
   c) it protects cells by preventing crystallization of

   (GATE 2012 BT)

8) Nude mice refers to

a) mice without skin b) mice without thymus c) knockout mice d) transgenic mice

<div align="right">(GATE 2012 BT)</div>

9) Heat inactivation of serum is done to inactivate

a) prions b) mycoplasma c) complement d) pathogenic bacteria

<div align="right">(GATE 2012 BT)</div>

10) Choose the correct signal transduction pathway.
   a) $Hormone \rightarrow 7TMreceptor \rightarrow Gprotein \rightarrow cAMP \rightarrow PKA$
   b) $Hormone \rightarrow Gprotein \rightarrow 7TMreceptor \rightarrow cAMP \rightarrow PKA$
   c) $Hormone \rightarrow 7TMreceptor \rightarrow Gprotein \rightarrow PKA \rightarrow cAMP$
   d) $Hormone \rightarrow 7TMreceptor \rightarrow cAMP \rightarrow Gprotein \rightarrow PKA$

<div align="right">(GATE 2012 BT)</div>

11) A protein is phosphorylated at a serine residue. A phosphomimic mutant of the protein can be generated by substituting that serine with

a) glycine b) alanine c) aspartate d) threonine

<div align="right">(GATE 2012 BT)</div>

12) A truncated polypeptide is synthesized due to a nonsense mutation. Where would you introduce another mutation to obtain a full-length polypeptide?

a) Ribosomal protein gene c) DNA repair gene
b) Transfer RNA gene d) Ribosomal RNA gene

<div align="right">(GATE 2012 BT)</div>

13) Protein-DNA interactions in vivo can be studied by

a) gel shift assay c) chromatin immunoprecipitation assay
b) Southern hybridization d) fluorescence in situ hybridization assay

<div align="right">(GATE 2012 BT)</div>

14) The direction of shell coiling in the snail Limnaea peregra is a classic example of

a) chromosomal inheritance c) chromosomal translocation
b) extra-chromosomal inheritance d) homologous recombination

<div align="right">(GATE 2012 BT)</div>

15) During photorespiration under low CO_2 and high O_2 levels, O_2 reacts with ribulose 1,5- bisphosphate to yield
   a) one molecule each of 3-phosphoglycerate and 2-phosphoglycolate
   b) two molecules of 3-phosphoglycerate
   c) two molecules of 2-phosphoglycolate
   d) one molecule each of 3-phosphoglycerate and glyoxylate

<div align="right">(GATE 2012 BT)</div>

16) Which one of the following is **NOT** a protoplast fusion inducing agent?

a) Inactivated Sendai virus c) Polyethylene glycol
b) Ca^{2+} at alkaline pH d) Colchicine

(GATE 2012 BT)

17) The activity of an enzyme is expressed in International Units (IU). However, the S.I. unit for enzyme activity is Katal. One Katal is

a) 1.6610^4 IU   b) 60 IU   c) 610^7 IU   d) 10^6 IU

(GATE 2012 BT)

18) Identify the statement that is NOT applicable to an enzyme catalyzed reaction.
   a) Enzyme catalysis involves propinquity effects
   b) The binding of substrate to the active site causes a strain in the substrate
   c) Enzymes do not accelerate the rate of reverse reaction
   d) Enzyme catalysis involves acid-base chemistry

(GATE 2012 BT)

19) An example of a derived protein structure database is

a) Pfam   b) SCOP   c) GEO   d) Prosite

(GATE 2012 BT)

20) An example of a program for constructing a phylogenetic tree is

a) phylip   b) phrap   c) prodom   d) PHDsec

(GATE 2012 BT)

21) Synteny refers to

a) gene duplication from a common ancestor   c) the extent of similarity between two sequences
b) a tree representation of related sequences   d) local conservation of gene order

(GATE 2012 BT)

22) While searching a database for similar sequences, E value does NOT depend on the
   a) sequence length
   b) number of sequences in the database
   c) scoring system
   d) probability from a normal distribution

(GATE 2012 BT)

23) In transmission electron microscopy, electron opacity is greatly enhanced by treating the specimen with

a) ferrous ammonium sulfate   c) sodium chloride
b) uranium acetate   d) basic fuchsin

(GATE 2012 BT)

24) The molarity of water in a water : ethanol mixture (15 : 85, v/v) is approximately

a) 0.85   b) 5.55   c) 8.5   d) 55.5

(GATE 2012 BT)

25) The helix content of a protein can be determined using

a) an infrared spectrometer

b) a fluorescence spectrometer

c) a circular dichroism spectrometer

d) a UV-Visible spectrophotometer

II. Q. 26 to Q. 55 carry two marks each.

26) Which one of the following DNA sequences carries an invert repeat?

a) ATGAGCCCCGAGTA TACTCGGGGCTCAT

b) ATGAGCCGAGCCTA ACTCGGCTCGGAT

c) ATGAGCCGGCTCTA TACTCGGCCGAGAT

d) ATGAGCCTATGGTA TACTCGGATACCAT

27) In zinc finger proteins, the amino acid residues that coordinate zinc are

a) Cys and His   b) Asp and Glu   c) Arg and Lys   d) Asp and Arg

28) Match the entries in Group I with those in Group II.

Group I	Group II
P. MTT	1. Dihydrofolate reductase
Q. Annexin V	2. Succinate dehydrogenase
R. Methotrexate	3. Microtubules
S. Taxol	4. Phosphatidylserine

a) P-3, Q-1, R-4, S-2   b) P-2, Q-4, R-1, S-3   c) P-2, Q-3, R-4, S-1   d) P-4, Q-2, R-1, S-3

29) In an exponentially growing batch culture of Saccharomyces cerevisiae, the cell density is 20 gl^{-1} (DCW), the specific growth rate (μ) is $0.4h-1$ and substrate uptake rate (μ) is 16 $gl^{-1}h^{-1}$. The cell yield coefficient $Y_{x/s}$ will be

a) 0.32   b) 0.64   c) 0.80   d) 0.50

30) A single base pair of DNA weighs 1.110^{-21} grams. How many picomoles of a plasmid vector of length 2750 bp are contained in 1 μg of purified DNA?

a) 0.30   b) 0.55   c) 0.25   d) 0.91

31) Match the terms in Group I with the ploidy in Group II.

Group I	Group II
P. Disome	1. 2n + 1
Q. Monosome	2. 2n − 1
R. Nullisome	3. n − 1
S. Trisome	4. n + 1

a) P-4, Q-2, R-3, S-1

b) P-4, Q-3, R-1, S-2

c) P-2, Q-3, R-4, S-1

d) P-1, Q-4, R-3, S-2

32) What is the rank of the following matrix?

$$A = \begin{pmatrix} 5 & 3 & -1 \\ 6 & 2 & -4 \\ 14 & 10 & 0 \end{pmatrix}$$

33) Match the products in Group I with the applications in Group II.

Group I	Group II
P. Digoxin	1. Muscle relaxant
Q. Stevioside	2. Anti-cancer agent
R. Atropine	3. Cardiovascular disorder
S. Vinblastine	4. Sweetener

a) P-1, Q-4, R-3, S-2

b) P-3, Q-2, R-1, S-4

c) P-3, Q-4, R-1, S-2

d) P-2, Q-3, R-1, S-4

(GATE 2012 BT)

34) Determine the correctness or otherwise of the following Assertion (a) and Reason (r).

Assertion: The production of secondary metabolites in plant cell cultures is enhanced by the addition of elicitors.

Reason: Elicitors induce the expression of enzymes responsible for the biosynthesis of secondary metabolites.

a) Both (a) and (r) are true but (r) is not the correct reason for (a)

b) Both (a) and (r) are true and (r) is the correct reason for (a)

c) (a) is true but (r) is false

d) (a) is false but (r) is true

35) Determine the correctness or otherwise of the following Assertion (a) and Reason (r).

Assertion: Plants convert fatty acids into glucose.

Reason: Plants have peroxisomes.

a) Both (a) and (r) are true but (r) is not the correct reason for (a)

b) Both (a) and (r) are true and (r) is the correct reason for (a)

c) (a) is true but (r) is false

d) (a) is false but (r) is true

36) Determine the correctness or otherwise of the following Assertion (a) and Reason (r).

Assertion: In direct somatic embryogenesis, embryos are developed without going through callus formation.

Reason: This is possible due to the presence of pre-embryonically determined cells.

a) Both (a) and (r) are true but (r) is not the correct reason for (a)

b) (a) is false but (r) is true

c) (a) is true but (r) is false

d) Both (a) and (r) are true and (r) is the correct reason for (a)

37) Match the entries in Group I with the process parameters in Group II.

Group I	Group II
P. Clark electrode	1. Liquid level
Q. Redox probe	2. Dissolved oxygen concentration
R. Load cell	3. Vessel pressure
S. Diaphragm gauge	4. pH (anaerobic process)

a) P-2, Q-1, R-3, S-4

b) P-4, Q-2, R-3, S-1

c) P-2, Q-4, R-1, S-3

d) P-2, Q-1, R-4, S-3

38) Match the downstream processes in Group I with the products in Group II.

Group I	Group II
P. Solvent extraction	1. Lactic acid
Q. Protein-A linked affinity chromatography	2. Penicillin
R. Extractive distillation	3. Monoclonal antibody
S. Salting out	4. Lipase

a) P-2, Q-3, R-1, S-4

b) P-4, Q-1, R-2, S-3

c) P-4, Q-1, R-3, S-2

d) P-2, Q-4, R-1, S-3

39) Determine the correctness or otherwise of the following Assertion (a) and Reason (r).

Assertion: Cell mass yield of a methylotrophic yeast is more on methanol compared to glucose.
Reason: Methanol has a greater degree of reductance compared to glucose.

a) Both (a) and (r) are correct and (r) is the correct reason for (a)

b) (a) is correct, (r) is false

c) (a) is false, (r) is correct

d) Both (a) and (r) are correct but (r) is not the correct reason for (a)

40) A disease is inherited by a child with a probability of 1/4. In a family with two children, the probability that exactly one sibling is affected by this disease is

a) $\frac{1}{4}$

b) $\frac{3}{8}$

c) $\frac{7}{16}$

d) $\frac{9}{16}$

41) Match the organisms in Group I with the entries in Group II.

Group I	Group II
P. Clostridium	1. Rods with teichoic acid in the cell wall
Q. Escherichia	2. Rods with endospores
R. Vibrio	3. Helical rods with flagella
S. Bacillus	4. Rods with LPS in the outer membrane
	5. Curved rods with polar flagella

a) P-2, Q-4, R-5, S-1   b) P-2, Q-1, R-5, S-4   c) P-5, Q-4, R-2, S-3   d) P-3, Q-2, R-1, S-4

42) Match the entries in Group I with the methods of sterilization in Group II.

Group I	Group II
P. Serum	1. Autoclave
Q. Luria broth	2. Membrane filtration
R. Polypropylene tubes	3. UV irradiation
S. Biological safety cabinets	4. Gamma irradiation
	5. Dry heat

a) P-5, Q-3, R-1, S-4   b) P-1, Q-4, R-5, S-3   c) P-2, Q-1, R-4, S-3   d) P-4, Q-1, R-3, S-5

43) Match the high energy compounds in Group I with the biosynthetic pathways for the molecules in Group II.

Group I	Group II
P. GTP	1. Fatty acid
Q. UTP	2. Phospholipid
R. CTP	3. Protein
S. Acyl coenzyme A	4. Peptidoglycan

a) P-3, Q-2, R-4, S-1   b) P-2, Q-4, R-3, S-1   c) P-4, Q-3, R-1, S-2   d) P-3, Q-4, R-2, S-1

44) Match the vitamins in Group I with the processes/reactions in Group II.

Group I	Group II
P. Pantothenic acid	1. Electron transport
Q. Vitamin B2	2. Transfer of 1-C units
R. Vitamin B6	3. Decarboxylation
S. Folic acid	4. Fatty acid metabolism
	5. Hydrolysis

a) P-5, Q-2, R-4, S-1   b) P-4, Q-1, R-3, S-2   c) P-4, Q-2, R-1, S-3   d) P-2, Q-1, R-3, S-5

45) Consider the data set $14, 18, 14, 14, 10, 29, 33, 31, 25$. If you add 20 to each of the values, then

a) both mean and variance change
b) both mean and variance are unchanged
c) the mean is unchanged, variance changes
d) the mean changes, the variance is unchanged

46) An enzymatic reaction is described by the following rate expression.

$$v = \frac{V_m S}{k_m + S + S^2/k_s}$$ Which one of the following curves represents this expression?

a)

b)

c)

d)
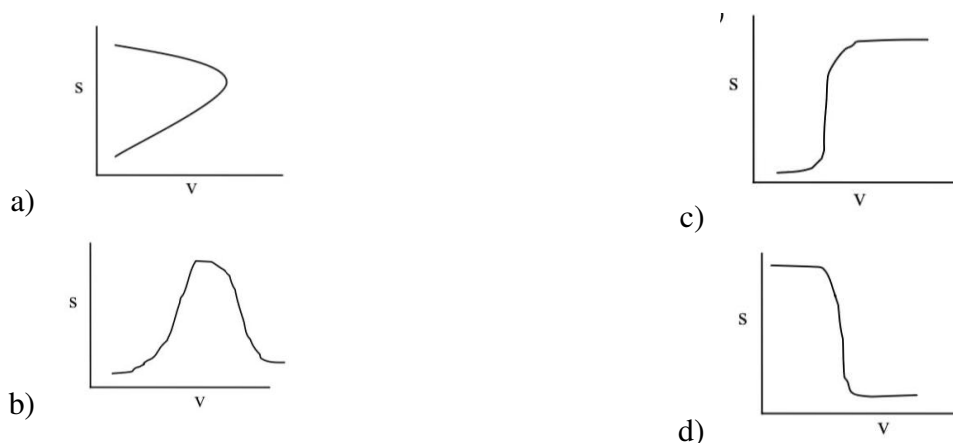
47) A bacterial culture ($200\mu l$ containing $1.8 10^9$ cells) was treated with an antibiotic Z ($50\mu g$ per ml) for 4 h at $37°C$. After this treatment, the culture was divided into two equal aliquots. Set A: 100 μl was plated on Luria agar. Set B: 100 μl was centrifuged, the cell pellet washed and plated on Luria

agar. After incubating these two plates for 24h at $37°C$, Set A plate showed no colonies, whereas the Set B plate showed 0.9×109 cells. This experiment showed that the antibiotic Z is

a) bacteriostatic

b) bacteriocidal

c) bacteriolytic

d) apoptotic

<div align="right">(GATE 2012 BT)</div>

III. Common Data Questions

Common Data for Questions 48 and 49 :

In a muscle, the extracellular and intracellular concentrations of Na^+ are 150 mM and 12 mM, and those of K^+ are 2.7 mM and 140 mM, respectively. Assume that the temperature is $25°C$ and that the membrane potential is -60 mV, with the interior more negatively charged than the exterior. $(R = 8.314 Jmol^{-1}K^{-1}; F = 96.45 kJmol^{-1}V^{-1})$

48) The free energy change for the transport of three Na+ out of the cell is

a) +1.5 kJ/mol   b) +17.4kJ/mol   c) +18.9 kJ/mol   d) +36.3 kJ/mol

<div align="right">(GATE 2012 BT)</div>

49) The free energy change for the transport of two K+ into the cell is

a) +8.0 kJ/mol   b) +11.6 kJ/mol   c) +19.6 kJ/mol   d) +31.2 kJ/mol

<div align="right">(GATE 2012 BT)</div>

Common Data for Questions 50 and 51:

The purification data for an enzyme is given below:

	Step	Volume(ml)	Total protein (mg)	Total activity(Units)	Specific activity(Units/mg
P	Cell-free extract	17	177	102	0.58
Q	Q- Sepharose	14	18.8	72	3.83
R	Phenyl Sepharose	26	9.2	45	4.89
S	Sephacryl S-200	7	4.1	30	7.32

50) The fold purification for each step is

a) P-0.1, Q- 0.66, R-0.84,S- 1.26

b) P-1.0, Q-0.52, R-0.67, S-0.8

c) P-1, Q-6.6, R-8.4, S-12.6

d) P-100, Q-66, R-84, S-12

<div align="right">(GATE 2012 BT)</div>

51) The yield (%) for each step is

a) P-10, Q-7.2, R-4.5, S-2.0

b) P-34, Q-24, R-15, S-1

c) P-3.4, Q-2.4, R-1.5, S-0.1

d) P-100, Q-71, R-44, S-29

<div align="right">(GATE 2012 BT)</div>

Linked Answer Questions

Statement for Linked Answer Questions 52 and 53: An *E. coli* cell of volume $10^{-12} cm^3$ contains 60 molecules of lac-repressor. The repressor has a binding affinity (Kd) of 10-8 M and 10^{-9} M with and without lactose respectively, in the medium.

52) The molar concentration of the repressor in the cell is

a) 0.1 nM

b) 1 nM

c) 10 nM

d) 100 nM

53) Therefore the lac-operon is

a) repressed and can only be induced with lactose.

b) repressed and cannot be induced with lactose.

c) not repressed.

d) expressed only when glucose and lactose are present.

Statement for Linked Answer Questions 54 and 55:

β Galactosidase bound to DEAE-cellulose is used to hydrolyze lactose to glucose and galactose in a plug flow bioreactor with a packed bed of volume 100 liters and a voidage (ϵ) of 0.55. The K'_m and $V'_m ax$ for the immobilized enzyme are 0.72 gl^{-1} and $18gl^{-1}h^{-1}$, respectively. The lactose concentration in the field stream is $20gl^{-1}$, and a fractional conversion of 0.90 is desired. Diffusional limitations may be ignored.

54) The residence time required for the steady state reactor operation will be

a) 0.1 h

b) 0.4 h

c) 1.0 h

d) 1.1 h

55) The feed flow rate required for the above bioconversion will be

a) $50lh^{-1}$

b) $55lh^{-1}$

c) $137lh^{-1}$

d) $550lh^{-1}$

IV. GENERAL APTITUDE (GA) QUESTIONS

Q.56– Q. 60 carry one mark each.

56) The cost function for a product in a firm is given by $5q^2$, where q is the amount of production. The firm can sell the product at a market price of Rs.50 per unit. The number of units to be produced by the firm such that the profit is maximized is

a) 5

b) 10

c) 15

d) 25

57) Choose the most appropriate alternative from the options given below to complete the following sentence:

Suresh's dog is the one_____ **was hurt in the stampede.**

a) that

b) which

c) who

d) whom

58) Choose the grammatically **INCORRECT** sentence:

a) They gave us the money back less the service charges of Three Hundred rupees.

b) This country's expenditure is not less than that of Bangladesh.

c) The committee initially asked for a funding of Fifty Lakh rupees, but later settled for a lesser sum.

d) This country's expenditure on educational reforms is very less.

59) Which one of the following options is the closest in meaning to the word given below? **Mitigate**

a) Diminish   b) Divulge   c) Dedicate   d) Denote

60) Choose the most appropriate alternative from the options given below to complete the following sentence:

Despite several_____the mission succeeded in its attempt to resolve the conflict.

a) attempts   b) setbacks   c) meetings   d) delegations

Q.61- Q. 65 carry two marks each.
61) **Wanted Temporary, Part-time persons for the post of Field Interviewer to conduct personal interviews to collect and collate economic data. Requirements: High School-pass, must be available for Day, Evening and Saturday work. Transportation paid, expenses reimbursed.**
Which one of the following is the best inference from the above advertisement?

a) Gender-discriminatory   c) Not designed to make the post attractive
b) Xenophobic   d) Not gender-discriminatory

62) Given the sequence of terms, AD CG FK JP, the next term is

a) OV   c) PV
b) OW   d) PW

63) Which of the following assertions are **CORRECT**?
P: Adding 7 to each entry in a list adds 7 to the mean of the list
Q: Adding 7 to each entry in a list adds 7 to the standard deviation of the list R: Doubling each entry in a list doubles the mean of the list
S: Doubling each entry in a list leaves the standard deviation of the list unchanged

a) P, Q   b) Q, R   c) P, R   d) R, S

64) An automobile plant contracted to buy shock absorbers from two suppliers X and Y. X supplies 60% and Y supplies 40% of the shock absorbers. All shock absorbers are subjected to a quality test. The ones that pass the quality test are considered reliable. Of X's shock absorbers, 96% are reliable. Of Y's shock absorbers, 72% are reliable.

The probability that a randomly chosen shock absorber, which is found to be reliable, is made by Y is

a) 0.288   b) 0.334   c) 0.667   d) 0.720

65) A political party orders an arch for the entrance to the ground in which the annual convention is being held. The profile of the arch follows the equation $y = 2x - 0.1x^2$ where y is the height of the arch in meters. The maximum possible height of the arch is

a) 8 meters   b) 10 meters   c) 12 meters   d) 14 meters

(GATE 2012 BT)

END OF THE QUESTION PAPER