gate

AI25btech11022 - Narshitha

2014
BT:Biotechnology

1) Choose the most appropriate word from the options given below to complete the following sentence. A person suffering from Alzheimer's disease _____ short-term memory loss. **(GATE EE 2025)**
   a) experienced
   b) has experienced
   c) is experiencing
   d) experiences

2) Choose the most appropriate word from the options given below to complete the following sentence. _____ is the key to their happiness; they are satisfied with what they have. **(GATE EE 2025)**
   a) Contentment
   b) Ambition
   c) Perseverance
   d) Hunger

3) Which of the following options is the closest in meaning to the sentence below?
   "As a woman, I have no country." **(GATE EE 2025)**
   a) Women have no country.
   b) Women are not citizens of any country.
   c) Women's solidarity knows no national boundaries.
   d) Women of all countries have equal legal rights.

4) In any given year, the probability of an earthquake greater than Magnitude 6 occurring in the Garhwal Himalayas is 0.04. The average time between successive occurrences of such earthquakes is ___ years. **(GATE EE 2025)**
   a) 3–4 years
   b) 4–5 years
   c) 5–6 years
   d) 6–7 years

5) The population of a new city is 5 million and is growing at 20% annually. How many years would it take to double at this growth rate? **(GATE EE 2025)**
   a) 3–4 years
   b) 4–5 years
   c) 5–6 years
   d) 6–7 years

6) In a group of four children, Som is younger to Riaz. Shiv is elder to Ansu. Ansu is youngest in the group. Which of the following statements is/are required to find the eldest child in the group?
   Statements:
   1. Shiv is younger to Riaz.
   2. Shiv is elder to Som.
   (GATE EE 2025)

a) Statement 1 by itself determines the eldest child.
b) Statement 2 by itself determines the eldest child.
c) Statements 1 and 2 are both required to determine the eldest child.
d) Statements 1 and 2 are not sufficient to determine the eldest child.

7) Moving into a world of big data will require us to change our thinking about the merits of exactitude. To apply the conventional mindset of measurement to the digital, connected world of the twenty-first century is to miss a crucial point. As mentioned earlier, the obsession with exactness is an artefact of the information-deprived analog era. When data was sparse, every data point was critical, and this great care was taken to avoid letting any point bias the analysis.
From "BIG DATA" Viktor Mayer-Schonberger and Kenneth Cukier
The main point of the paragraph is: **(GATE EE 2025)**

a) The twenty-first century is a digital world
b) Big data is obsessed with exactness
c) Exactitude is not critical in dealing with big data
d) Sparse data leads to a bias in the analysis

8) The total exports and revenues from the exports of a country are given in the two pie charts below. (Pie charts show percentage distribution of quantity and revenue of exported items.)
The total quantity of exports of all the items is 5 lakh tonnes and the total revenues are 250 crore rupees. What is the ratio of the revenue generated through export of Item 1 per kilogram to the revenue generated through export of Item 4 per kilogram?

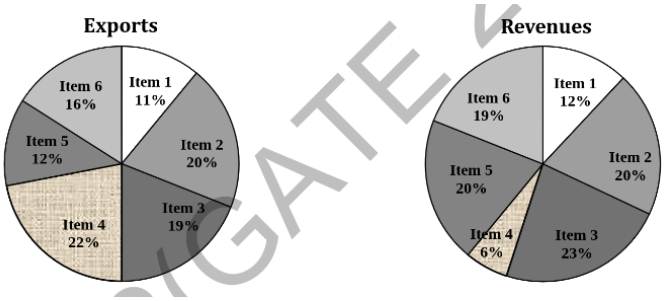

Fig. 8.

(GATE EE 2025)

a) 1:2
b) 2:1
c) 1:4
d) 4:1

9) X is 1 km northeast of Y. Y is 1 km southeast of Z. W is 1 km west of Z. P is 1 km south of Q. Q is 1 km east of P. What is the distance between X and Q in km? **(GATE EE 2025)**

a) 1
b) $\sqrt{2}$
c) $\sqrt{3}$
d) 2

10) 10% of the population in a town is HIV^+. A new diagnostic kit for HIV detection is available; this kit correctly identifies HIV^+ individuals 95% of the time, and HIV^- individuals 95% of the time. A particular patient is tested using this kit and is found to be positive. The probability that the individual actually is positive is ___. **(GATE EE 2025)**

11) The eigenvalues of

$A = \begin{pmatrix} 1 & -4 \\ 2 & -3 \end{pmatrix}$

are **(GATE EE 2025)**

a) $2 \pm i$
b) $-1, -2$
c) $-1 \pm 2i$
d) non-existent

12) If an unbiased coin is tossed 10 times, the probability that all outcomes are same will be $\_\_\_ \times 10^{-3}$ **(GATE EE 2025)**

13) The solution for the following set of equations is,

$$5x + 4y + 10z = 13$$
$$x + 3y + z = 7$$
$$4x - 2y + z = 0$$

(GATE EE 2025)

a) $x = 2, y = 1, z = 1$
b) $x = 1, y = 2, z = 0$
c) $x = 1, y = 0, z = 2$
d) $x = 0, y = 1, z = 2$

14) The limit of the function $e^{-2t}\sin(t)$ as $t \to \infty$, is $\_\_\_$ **(GATE EE 2025)**

15) The solution to the following set of equations is,

$$2x + 3y = 4$$
$$4x + 6y = 0$$

(GATE EE 2025)

a) $x = 0, y = 0$
b) $x = 2, y = 0$
c) $2x = 4y = 6x$
d) No solution

16) The unit for specific substrate consumption rate in a growing culture is **(GATE EE 2025)**

a) $\frac{g}{L\,h}$
b) $\frac{g}{g\,h}$
c) $\frac{g}{g\,h^2}$
d) $\frac{gmoles}{L\,h}$

17) If the dissociation constant for solute-adsorbent binding is K_D, the retention time of the solute in a chromatography column **(GATE EE 2025)**

a) increases with increasing K_D
b) decreases with increasing K_D
c) passes through minimum with increasing K_D
d) is independent of K_D

18) In a batch culture of Penicillium chrysogenum, the maximum penicillin synthesis occurs during the **(GATE EE 2025)**

a) lag phase
b) exponential phase
c) stationary phase

d) death phase

19) The most plausible explanation for a sudden increase of the respiratory quotient (RQ) of a microbial culture is that **(GATE EE 2025)**

a) cells are dying
b) yield of biomass is increasing
c) the fermentation rate is increasing relative to respiration rate
d) the maintenance rate is decreasing

20) Which of the following is employed for the repeated use of enzymes in bioprocesses? **(GATE EE 2025)**

a) polymerization
b) immobilization
c) ligation
d) isomerization

21) Since mammalian cells are sensitive to shear, scale-up of a mammalian cell process must consider, among other parameters, the following (given N = rotations/time, D = diameter of impeller) **(GATE EE 2025)**

a) πND
b) $\pi N^2 D$
c) πND^2
d) none of these

22) The degree of reduction of ethanol is _____ **(GATE EE 2025)**

23) Gram-positive bacteria are generally resistant to complement-mediated lysis because **(GATE EE 2025)**

a) thick peptidoglycan layer prevents insertion of membrane attack complex into the inner membrane
b) Gram-positive bacteria import the membrane attack complex and inactivate it
c) membrane attack complex is degraded by the proteases produced by the Gram-positive bacteria
d) Gram-positive bacteria cannot activate the complement pathway

24) A bacterium belonging to cocci group has a diameter of $2\,\mu m$. The numerical value of the ratio of its surface area to volume (in μm^{-1}) is _____ **(GATE EE 2025)**

25) Which of the following essential element(s) is/are required as major supplement to enhance the bioremediation of oil spills by the resident bacteria? **(GATE EE 2025)**

a) Sulfur
b) Nitrogen and phosphorus
c) Iron
d) Carbon

26) The 4-amino or 4-keto group of pyrimidine bases is located in the **(GATE EE 2025)**

a) major groove of the double stranded DNA
b) minor groove of the double stranded DNA
c) minor groove of the B form DNA but not the A form DNA
d) major groove of the B form DNA but not the A form DNA

27) The product(s) resulting from the hydrolysis of maltose is/are **(GATE EE 2025)**

a) A mixture of α-D-Glucose and β-D-Glucose
b) A mixture of D-Glucose and L-Glucose
c) α-D-Glucose only
d) β-D-Glucose only

28) Amino acid residue which is most likely to be found in the interior of water-soluble globular proteins is **(GATE EE 2025)**

a) Threonine
b) Aspartic acid
c) Valine
d) Histidine

29) The 5' ends of the mature forms of the prokaryotic mRNAs and tRNAs are **(GATE EE 2025)**
a) a triphosphate group in mRNAs and a monophosphate group in tRNAs
b) triphosphate groups in both mRNAs and tRNAs
c) monophosphate groups in both mRNAs and tRNAs
d) a monophosphate group in mRNAs and a triphosphate group in tRNAs

30) Prior exposure of plants to pathogens is known to increase resistance to future pathogen attacks. This phenomenon is known as **(GATE EE 2025)**
a) systemic acquired resistance
b) hypersensitive response
c) innate immunity
d) antibody mediated response

31) Reactions between antibodies and antigens that are detected by precipitate formation in an agar gel are referred as **(GATE EE 2025)**
a) immunoprecipitation assay
b) immunodiffusion assay
c) immunoaggregation assay
d) immunofixation assay

32) The algorithm for BLAST is based on **(GATE EE 2025)**
a) Dynamic Programming
b) Hidden Markov Model
c) K-tuple analysis
d) Neural Network

33) The statistical frequency of the occurrence of a particular restriction enzyme cleavage site that is 6 bases long can be estimated to be **(GATE EE 2025)**
a) once every 24 bases
b) once every 256 bases
c) once every 1024 bases
d) once every 4096 bases

34) The reactions leading to the formation of amino acids from the TCA cycle intermediates are **(GATE EE 2025)**
a) carboxylation
b) isomerization
c) transamination
d) decarboxylation

35) The growth medium for mammalian cells contains serum. One of the major functions of serum is to stimulate cell growth and attachment. However, it must be filter sterilized to **(GATE EE 2025)**
a) remove large proteins
b) remove collagen only
c) remove mycoplasma and microorganisms
d) remove foaming agents

36) The concentration profile of a chemical at a location x and time t, denoted by $c(x,t)$, changes as per the following equation,

$$c(x,t) = \frac{c_0}{\sqrt{2\pi Dt}} \exp\left(-\frac{x^2}{2Dt}\right)$$

where D and c_0 are assumed to be constant. Which of the following is correct? **(GATE EE 2025)**

a) $\frac{\partial c}{\partial t} = D\frac{\partial^2 c}{\partial x^2}$

b) $\frac{\partial c}{\partial t} = 2D\frac{\partial^2 c}{\partial x^2}$

c) $\frac{\partial^2 c}{\partial t^2} = D\frac{\partial^2 c}{\partial x^2}$

d) $\frac{\partial c}{\partial t} = \frac{\partial^2 c}{\partial x^2}$

37) If $y = x^x$, then $\frac{dy}{dx}$ is **(GATE EE 2025)**

a) $x^x(x-1)$

b) x^{x-1}

c) $x^x(1+\log x)$

d) $e^x(1+\log x)$

38) Which of the following statements is true for the series given below?

$$s_n = 1 + \frac{1}{\sqrt{2}} + \frac{1}{\sqrt{3}} + \cdots + \frac{1}{\sqrt{n}}$$

(GATE EE 2025)

a) s_n converges to $\log(\sqrt{n})$

b) s_n converges to $\sqrt{n}$

c) s_n converges to $\exp(\sqrt{n})$

d) s_n diverges

39) The graph of the function $F(x) = \frac{1}{k_1 x^2 + k_2 x + 1}$ for $0 < x < \infty$ is **(GATE EE 2025)**

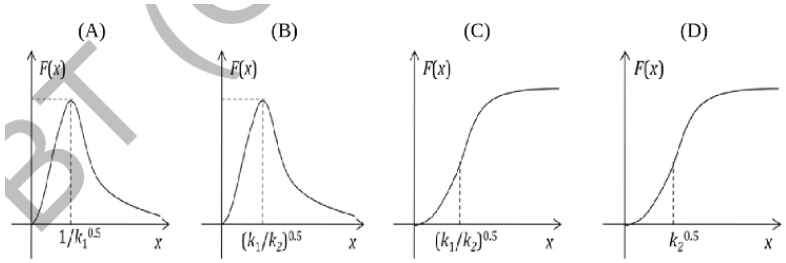

Fig. 39.

40) A T-flask is seeded with 10^5 anchorage-dependent cells. The available area of the T-flask is 25 cm^2 and the volume of the medium is 25 ml. Assume that the cells are rectangles of size $5\,\mu m \times 2\,\mu m$. If the cells grow to monolayer confluence after 50 h, the growth rate in number of cells/(cm^2·h) is $\_\_\_ \times 10^3$. **(GATE EE 2025)**

41) Consider a continuous culture provided with a sterile feed containing 10 mM glucose. The steady state cell density and substrate concentration at three different dilution rates are given in the table below:

Dilution rate (h^{-1})	Cell density (g/L)	Substrate conc. (mM)
0.05	0.248	0.067
0.5	0.208	1.667
5	0.0	10.0

The maximum specific growth rate μ_m (in h^{-1}), will be ___. **(GATE EE 2025)**

42) Cholera toxin increases cAMP levels by
   a) modifying G protein
   b) modifying GTP
   c) binding to adenylate cyclase
   d) activating cAMP phosphodiesterase

43) Triose phosphate isomerase converts dihydroxy acetone phosphate (DHAP) to glyceraldehyde-3-phosphate (G-3-P) in a reversible reaction. At 298 K and pH 7.0, the equilibrium mixture contains 40 mM DHAP and 4 mM G-3-P. Assume that the reaction started with 44 mM DHAP and no G-3-P. The standard free-energy change in kJ/mol for the formation of G-3-P (R = 8.315 J/molÂ·K) is __. **(GATE EE 2025)**

44) The plasmid DNA was subjected to restriction digestion using the enzyme EcoRI and analysed on an agarose gel. Assuming digestion has worked (the enzyme was active), match the identity of DNA bands shown in the image in Group I with their identity in Group II.

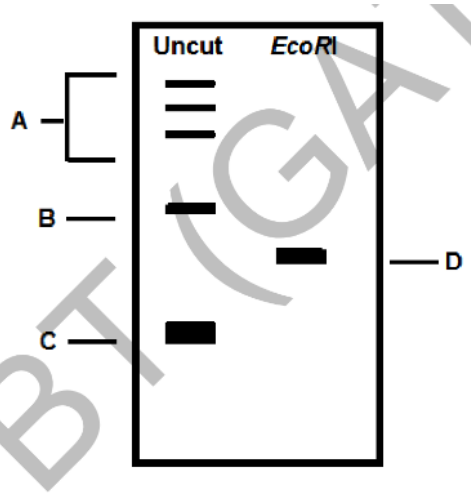

Fig. 44.

Group I	Group II
P. Band labeled as A	1. Nicked
Q. Band labeled as B	2. Supercoiled
R. Band labeled as C	3. Concatemers
S. Band labeled as D	4. Linear

(GATE EE 2025)

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

45) In a relatively large but finite and closed population of sexually reproducing diploid organisms, the frequency of homozygous genotype PP changes from 0.40 to 0.50 and that of Pp changes from 0.40 to 0.41 in a span of 10 generations. Which of the following is the most likely cause for the above change in frequency of the PP genotype? **(GATE EE 2025)**
   a) Non-random mating
   b) Random genetic drift
   c) Selection
   d) Combination of non-random mating and random genetic drift

46) Topological winding number of a 2.0 kb covalently closed circular DNA was found to be 191 with a writhing number of -4. Hence, its LINKING NUMBER and the NUMBER OF BASE PAIR PER TURN when the molecule is laid flat on the surface is _____ and _____, respectively. **(GATE EE 2025)**

a) 187, 10.69
b) 195, 10.25
c) 200, 10.00
d) 187, 10.50

47) Consider a population of 10,000 individuals, of which 2500 are homozygotes (PP) and 3000 are heterozygotes (Pp) genotype. The frequency of allele p in the population is _____. **(GATE EE 2025)**

48) Match the following photoreceptors with their prosthetic groups and spectral specificity

Photoreceptor	**Moiety that absorbs light**	**Absorption (nm)**
P. Phototropin	1.Chromobilin	a. 400–500
Q. Cryptochrome	2. FAD	b. 600–800
R. Phytochrome	3. FMN	c. 500–600

(GATE EE 2025)

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

49) Match the following plant sources with their secondary metabolites and medical uses

Source plant	**Secondary metabolites**	**Medical uses**
P. Belladonna	1. Menthol	a.Cancer treatment
Q. Foxglove	2. Atropine	b. Heart disease
R. Pacific	3. Digitalin	c. Eye treatment
S. Eucalyptus	4. Taxol	d. Cough

(GATE EE 2025)

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

50) The pungency of mustard seeds is primarily due to secondary metabolites such as isothiocyanate and nitrile. The pungency is usually felt only when the seeds are crushed. This is because of **(GATE EE 2025)**

a) the coat of the intact seeds blocks the pungent volatiles from being released
b) the pungent chemicals are stored as inactive conjugates and compartmentalized from the enzymes that convert them into active chemicals
c) the pungent chemicals are formed only after the reaction with atmospheric oxygen
d) the pungent chemicals are formed only after the reaction with atmospheric carbondioxide

51) In a mouse genome, the numbers of functional V_α, J_α, V_β, D_β, J_β gene segments are 79, 38, 21, 2 and 11, respectively. The total number of possible combinations for $\alpha\beta$ T cell receptors are _____ $\times 10^6$. **(GATE EE 2025)**

52) The percentage SIMILARITIES and IDENTITIES, respectively, between the two peptide sequences given below will be _____ % and _____ %.
Peptide I : Ala-Ala-Arg-Arg-Gln-Trp-Leu-Thr-Phe-Thr-Lys-Ile-Met-Ser-Glu
Peptide II: Ala-Ala-Arg-Glu-Gln-Tyr-Ile-Ser-Phe-Thr-Lys-Ile-Met-Arg-Asp
(GATE EE 2025)

a) 80, 80
b) 80, 60
c) 60, 60

d) 90, 60

53) In an affine gap penalty model, if the gap opening penalty = 20, gap extension penalty = 4 and gap length is 8, the gap score is _____. **(GATE EE 2025)**

54) For their efficient translation, eubacterial mRNAs possess a Shine-Dalgarno sequence for its recognition by an anti-Shine-Dalgarno sequence (ASD) in the ribosomes. The correct statement is **(GATE EE 2025)**

a) ASD is present in 5S rRNA
b) ASD is present in 23S rRNA
c) ASD is present in 16S rRNA
d) ASD is formed by the interaction of the 16S rRNA with the 23S rRNA upon docking of the 50S subunit on the 30S subunit of the ribosomes

55) Match the items in Group I with Group II **(GATE EE 2025)**

Group I	Group II
P. Receptor tyrosine kinase	1. Inactivation of G-proteins
Q. Cyclic GMP (cGMP)	2. Reception of insulin signal
R. GTPase activating protein (GAP)	3. Thyroid hormone
S. Nuclear receptor	4. Receptor guanylyl cyclase

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

56) Match the immunoglobulin class in Group I with its properties in Group II **(GATE EE 2025)**

Group I	Group II
P. IgG	1. Major antibody in external secretions such as bronchial mucus
Q. IgA	2. Protects against parasites
R. IgE	3. Antibody that appears first in serum after exposure to an antigen
S. IgM	4. Antibody present in highest concentration in serum

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

57) In a genetic cross between the genotypes WWXX and wwxx, the following phenotypic distributions were observed among the F_2 progeny: WX, 562; wx, 158; Wx, 38; and wX, 42. Likewise, a cross between XXYY and xxyy yielded the following results: XY, 675; xy, 175; Xy, 72; and xY, 78. Similarly, a cross between WWYY and wwyy yielded: WY, 292; wy, 88; Wy, 12; and wY, 8. In all the genotypes, capital letters denote the dominant allele. Assume that the F_1 progeny were self-fertilized in all three crosses. Also, double cross-over does not occur in this species. Which of the following is correct? **(GATE EE 2025)**

a) Relative position W-X-Y Distances: W-X = 5 map units, X-Y = 17 map units
b) Relative position X-Y-W Distances: X-Y = 15 map units, Y-W = 11 map units
c) Relative position Y-W-X Distances: Y-W = 5 map units, W-X = 11 map units
d) Relative position X-W-Y Distances: X-W = 5 map units, W-Y = 10 map units

58) The length of the minimum unique stretch of DNA sequence that can be found only once in a 3 billion base pairs long genome is **(GATE EE 2025)**

a) 14
b) 15
c) 16
d) 18

59) Lysine is being produced in a lab-scale reactor by a threonine auxotroph. After 2 weeks of operation it was observed that the concentration of lysine in the reactor was gradually decreasing. Microbiological assays of reactor samples showed absence of contamination and reactor condition showed no change in the operating conditions. The most probable reason for decrease in lysine concentration may be attributed to **(GATE EE 2025)**

a) accumulation of ethanol
b) growth of revertants
c) production of citric acid
d) utilization of lysine for cell growth

60) If a tumor is shifted to cold temperature, which of the following changes would take place in its membrane? **(GATE EE 2025)**

a) Ratio of unsaturated to saturated fatty acids would increase
b) Ratio of unsaturated to saturated fatty acids would decrease
c) Absolute amount of both fatty acids would increase keeping the ratio same
d) Absolute amount of both fatty acids would remain unchanged

61) If protoplasts are placed in distilled water, they swell and burst as a result of endosmosis. The plot representing the kinetics of burst is **(GATE EE 2025)**

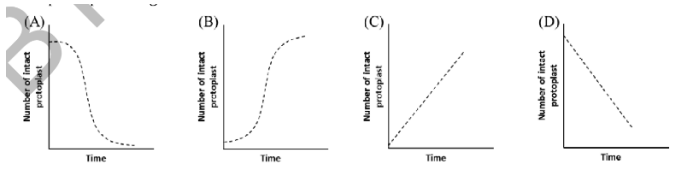

Fig. 61.

62) Which of the following statements with respect to the orientation of the nitrogenous bases to the deoxyribose sugars, and the puckering of the sugar, is correct? **(GATE EE 2025)**

a) Anti, and 2′-endo in A form DNA
b) Anti, and 2′-endo in B form DNA
c) Syn, and 3′-endo in A form DNA
d) Syn, and 3′-endo in B form DNA

63) A dioecious plant has XX sexual genotype for female and XY for male. After double fertilization, what would be the genotype of the embryos and endosperm? **(GATE EE 2025)**

a) 100% ovules will have XXX endosperm and XX embryo
b) 100% ovules will have XXY endosperm and XY embryo
c) 50% ovules will have XXY endosperm and XY embryo, while other 50% will have XXY endosperm and YY embryo
d) 50% ovules will have XXX endosperm and XX embryo, while the other 50% will have XXY endosperm and XY embryo

64) The amino acid substitution matrices in decreasing order of stringency for comparing protein sequences are **(GATE EE 2025)**

a) PAM250, PAM120, PAM100
b) PAM100, PAM120, PAM250
c) PAM250, PAM100, PAM120
d) PAM120, PAM250, PAM100

65) The active site in the alpha/beta barrel structures is usually located **(GATE EE 2025)**

a) inside the barrel

b) at the amino side of the strands
c) at the carboxy side of the strands
d) at any arbitrary site