GENERAL APTITUDE

Q.No. 1- 5 Carry One Mark Each

1. Which one of the following options is the closest in meaning to the word given below?

Pacify

(A) Excite (B) Soothe (C) Deplete (D) Tire

Answer: (B)

---

2. Choose the most appropriate pair of words from the options given below to complete the following sentence:

The high level of ___ of the questions in the test was ___ by an increase in the period of time allotted for answering them.

(A) difficulty, compensated (B) exactitude, magnified

(C) aptitude, decreased (D) attitude, mitigated

Answer: (A)

---

3. Choose the grammatically CORRECT sentence:

(A) He laid in bed till 8 o'clock in the morning.

(B) He layed in bed till 8 o'clock in the morning.

(C) He lain in bed till 8 o'clock in the morning.

(D) He lay in bed till 8 o'clock in the morning.

Answer: (D)

---

4. Which one of the parts (A, B, C, D) in the sentence contains an ERROR?

No sooner had the doctor seen the results of the blood test, than he suggested the patient to see the specialist.

(A) no sooner had (B) results of the blood test

(C) suggested the patient (D) see the specialist

Answer: (D)

---

5. Ten teams participate in a tournament. Every team plays each of the other teams twice. The total number of matches to be played is

(A) 20 (B) 45 (C) 60 (D) 90

Answer: (D)

Q. 6- Q.10 Carry Two marks each

6. A value of x that satisfies the equation $\log x + \log(x-7) = \log(x+11) + \log 2$ is

(A) 1 (B) 2 (C) 7 (D) 11

Answer: (D)

---

7. Let $f(x) = x - [x]$, where $x \geq 0$ and $[x]$ is the greatest integer not larger than x. Then f(x) is a

(A) monotonically increasing function

(B) monotonically decreasing function

(C) linearly increasing function between two integers

(D) linearly decreasing function between two integers

Answer: (C)

---

8. Ravi is taller than Arun but shorter than Iqbal. Sam is shorter than Ravi. Mohan is shorter than Arun. Balu is taller than Mohan and Sam. The tallest person can be

(A) Mohan (B) Ravi (C) Balu (D) Arun

Answer: (C)

---

9. A smuggler has 10 capsules in which five are filled with narcotic drugs and the rest contain the original medicine. All the 10 capsules are mixed in a single box, from which the customs officials picked two capsules at random and tested for the presence of narcotic drugs. The probability that the smuggler will be caught is

(A) 0.50 (B) 0.67 (C) 0.78 (D) 0.82

Answer: (C)

---

10. The documents expose the cynicism of the government officials – and yet as the media website reflects, not a single newspaper has reported on their existence.

Which one of the following inferences may be drawn with the greatest accuracy from the above passage?

(A) Nobody other than the government officials knew about the existence of the documents

(B) Newspapers did report about the documents but nobody cared

(C) Media reports did not show the existence of the documents

(D) The documents reveal the attitude of the government officials.

Answer: (D)

BIOTECHNICAL ENGINEERING

Q. No. 1 – 25 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

Answer: (C)

---

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

(A) Intraallelic complementation (B) Intergenic complementation

(C) Intragenic suppression (D) Extragenic suppression

Answer: (A)

---

3. Idiotypic determinants of an antibody are associated with the

(A) Constant region of the heavy chains

(B) Constant region of the light chains

(C) Variable region

(D) Constant regions of light and heavy chains

Answer: (C)

---

4. Identification of blood groups involves

(A) Precipitation (B) Neutralization

(C) Opsonization (D) Agglutination

Answer: (D)

---

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

(A) Thymus (B) Bone marrow (C) Spleen (D) Liver

Answer: (B)

6. A humanized antibody is one in which the

(A) Heavy and light chains are from human

(B) Heavy chain is from human and light chain is from mouse

(C) Light chain is from human and heavy chain is from mouse

(D) CDRs are from mouse, and the rest is from human

Answer: (D)

---

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

(A) It is an organic solvent

(B) It easily penetrates cells

(C) It protects cells by preventing crystallization of water

(D) It is also utilized as a nutrient

Answer: (C)

---

8. Nude mice refers to

(A) Mice without skin

(B) Mice without thymus

(C) Knockout mice

(D) Transgenic mice

Answer: (B)

---

9. Heat inactivation of serum is done to inactivate

(A) Prions

(B) Mycoplasma

(C) Complement

(D) Pathogenic bacteria

Answer: (C)

---

10. Choose the correct signal transduction pathway

(A) Hormone $\rightarrow$ 7TM receptor $\rightarrow$ G protein $\rightarrow$ cAMP $\rightarrow$ PKA

(B) Hormone $\rightarrow$ G protein $\rightarrow$ 7TM receptor $\rightarrow$ cAMP $\rightarrow$ PKA

(C) Hormone $\rightarrow$ 7TM receptor $\rightarrow$ G protein $\rightarrow$ PKA $\rightarrow$ cAMP

(D) Hormone $\rightarrow$ 7TM receptor $\rightarrow$ cAMP $\rightarrow$ G protein $\rightarrow$ PKA

Answer: (A)

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

Answer: (C)

---

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 (B) Transfer RNA gene

(C) DNA repair gene (D) Ribosomal RNA gene

Answer: (B)

---

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

(A) Gel shift assay

(B) Southern hybridization

(C) Chromatin immunoprecipitation assay

(D) Fluorescence in situ hybridization assay

Answer: (C)

---

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

(A) Chromosomal inheritance (B) Extra-chromosomal inheritance

(C) Chromosomal translocation (D) Homologous recombination

Answer: (B)

---

15. During photorespiration under low CO2 and high O2 levels, O2 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

Answer: (A)

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

(A) Inactivated Sendai virus (B) Ca2+ at alkaline pH

(C) Polyethylene glycol (D) Colchicine

Answer: (D)

---

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) 1.66×10^{4} IU (B) 60 IU (C) 6×10^{7} IU (D) 10^{6} IU

Answer: (C)

---

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

Answer: (C)

---

19. An example of a derived protein structure database is

(A) Pfam (B) SCOP (C) GEO (D) Prosite

Answer: (B)

---

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

(A) Phylip (B) Phrap (C) Prodom (D) PHDsec

Answer: (A)

---

21. Synteny refers to

(A) Gene duplication from a common ancestor

(B) A tree representation of related sequences

(C) The extent of similarity between two sequences

(D) Local conservation of gene order

Answer: (A)

---

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

Answer: (C)

---

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

(A) Ferrous ammonium sulfate (B) Uranium acetate

(C) Sodium chloride (D) Basic fuchsin

Answer: (A)

---

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

Answer: (C)

---

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

Answer: (C)

Q. No. 26 – 55 Carry Two Marks Each

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

(A) ATGAGCCCCGAGTA
TACTCGGGGCTCAT

(B) ATGAGCCGGCTCTA
TACTCGGCCGAGAT

(C) ATGAGCCGAGCCTA
ACTCGGCTCGGAT

(D) ATGAGCCTATGGTA
TACTCGGATACCAT

Answer: (A)

---

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

Answer: (D)

---

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

Answer: (D)

---

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

(A) 0.32 (B) 0.64 (C) 0.80 (D) 0.50

Answer: (D)

30. A single base pair of DNA weighs 1.1×10^{-21} grams. How many picomoles of a plasmid vector of length 2750 bp are contained in $1\mu g$ of purified DNA?

(A) 0.30 (B) 0.55 (C) 0.25 (D) 0.91

Answer: (A)

---

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

Answer: (A)

---

32. What is the rank of the following matrix?

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

(A) 0 (B) 1 (C) 2 (D) 3

Answer: (C)

---

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

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

Answer: (C)

---

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

Answer: (A)

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)

Answer: (D)

---

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

Answer: (C)

---

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

Answer: (A)

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

Assertion: Cell mass yield of 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)

Answer: (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) 1/4 (B) 3/8 (C) 7/16 (D) 9/16

Answer: (B)

---

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

Answer: (C)

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) $P-4, Q-1, R-3, S-5$

Answer: (C)

---

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

Answer: (D)

---

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) $P-2, Q-1, R-3, S-5$

Answer: (B)

---

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

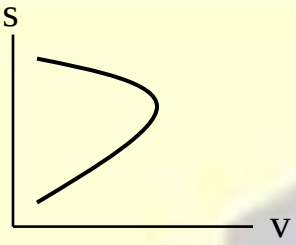
Answer: (D)

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

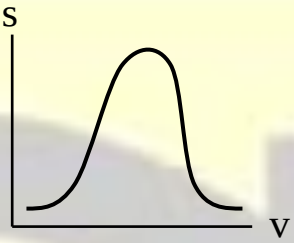
$$v = \frac{v_m s}{k_m + s + s^2 / k_s}$$

Which one of the following curves represents this expression?

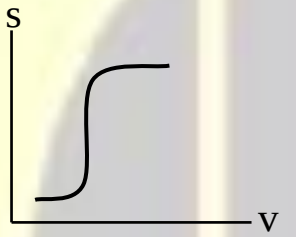
(A)



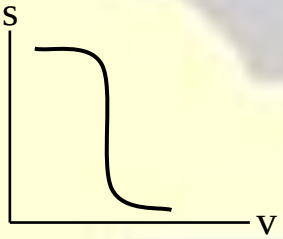
(B)



(C)



(D)



Answer: (A)

---

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 37oC. After this treatment, the culture was divided into two equal aliquots.

Set A: $100\mu l$ was plated on Luria agar.

Set B: $100\mu l$ was centrifuged, the cell pellet washed and plated on Luria agar.

After incubating these two plates for 24 h at 37°C, Set A plate showed no colonies, whereas the Set B plate showed 0.9×10^9 cells. This experiment showed that the antibiotic Z is

(A) Bacteriostatic
(B) Bacteriocidal
(C) Bacteriolytic
(D) Apoptotic

Answer: (C)

Common Data Questions: 48 & 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 25oC and that the membrane potential is –60mV, with the interior more negatively charged than the exterior. $\left(R = 8.314\,J\ mol^{-1}K^{-1};\ F = 96.45\,kJ\ mol^{-1}V^{-1}\right)$

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

(A) +1.5 kJ / mol (B) +17.4 kJ / mol

(C) +18.9 kJ / mol (D) +36.3 kJ / mol

Answer: (D)

---

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

Answer: (A)

Common Data Questions: 50 & 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) $P-100, Q-66, R-84, S-12$

Answer: (C)

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

Answer: (D)

Statement for Linked Answer Questions: 52 & 53

An E. coli cell of volume $10^{-12}\,cm^3$ contains 60 molecules of lac-repressor. The repressor has a binding affinity (K_d) 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

Answer: (D)

---

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 & 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 $V_{max}^{'}$ for the immobilized enzyme are $0.72\,gl^{-1}$ and $18\,gl^{-1}h^{-1}$, respectively. The lactose concentration in the field stream is $20\,gl^{-1}$, 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

Answer: (D)

---

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

(A) 50 lh^{-1} (B) 55 lh^{-1} (C) 137 lh^{-1} (D) 550 lh^{-1}

Answer: (A)