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

Explanation: The mismatch repair deals with correcting mismatch of the normal bases using BER or NER enzyme systems. The system assumes that the parental strands are methylated and the freshly synthesized daughter strands are non methylated.

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

Explanation: Both pUC and the bacterial own genome produce a faulty gene product of Lac Z gene. The *lac Z* fragment, whose synthesis can be induced by IPTG, is capable of intra-allelic complementation with a defective form of β-galactosidase enzyme encoded by host chromosome (mutation lacZDM15)

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

Explanation: Immunoglobulin idiotypes are serologically defined determinants associated with the variable (V) region of antibody molecules

4. Identification of blood groups involves
   (A) Precipitation
   (B) Neutralization
   (C) Opsonization
   (D) Agglutination

Answer: D

Explanation: All the blood grouping reactions are agglutination reactions. In these the antibodies against A and B antigens when added, they bind to the cell surface and result in clumping of cells. These clumps or settling down of cells is referred to as agglutination.

5. B-lymphocytes originate from the bone marrow whereas T-lymphocytes originate from
   (A) Thymus   (B) Bone marrow   (C) Spleen   (D) Liver

Answer: B

Explanation: All T cells originate from haematopoietic stem cells in the bone marrow. B cells undergo their complete maturation in the thymus while, T cells during their early stages of maturation migrate to the thymus and then undergo a process of maturation. They are released as competent and mature T cells from Thymus.

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

Explanation: A humanized chain is a chain in which the complementarity determining regions (CDR) of the variable domains are foreign (originating from one species other than human, or synthetic) whereas the remaining chain is of human origin.

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

Explanation: DMSO is used in cell freezing media to protect cells from ice crystal induced mechanical injury.

8. Nude mice refers to
   (A) Mice without skin   (B) Mice without thymus
   (C) Knockout mice   (D) Transgenic mice

Answer: B

Explanation: A **nude mouse** is a laboratory mouse from a strain with a genetic mutation that causes a deteriorated or absent thymus, resulting in an inhibited immune system due to a greatly reduced number of T cells.

9. Heat inactivation of serum is done to inactivate
   (A) Prions   (B) Mycoplasma   (C) Complement   (D) Pathogenic bacteria

Answer: C

Explanation: Heat-inactivation (heating to 56°C for 30 minutes) of serum is done to inactivate complement, a group of proteins present in sera that are part of the immune response.

10. Choose the correct signal transduction pathway
    (A) Hormone $\rightarrow$ 7 TM receptor $\rightarrow$ Gprotein $\rightarrow$ cAMP $\rightarrow$ PKA
    (B) Hormone $\rightarrow$ Gprotein $\rightarrow$ 7 TM receptor $\rightarrow$ cAMP $\rightarrow$ PKA
    (C) Hormone $\rightarrow$ 7 TM receptor $\rightarrow$ Gprotein $\rightarrow$ PKA $\rightarrow$ cAMP
    (D) Hormone $\rightarrow$ 7 TM receptor $\rightarrow$ cAMP $\rightarrow$ G protein $\rightarrow$ PKA

Answer: A

Explanation: In the G protein associated signal cascade system, binding of hormone to a cell surface receptor, like the 7TM (a 7 transmembrane alpha helices) which is a part of G protein. This will activate production of second messengers like cAMP by the enzyme adenylate cyclase. The cAMP in turn binds and activates down stream signal proteins line cAMP dependent protein kinase A (PKA).

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

Explanation: To investigate the effect of serine 78 phosphorylation on p21 activity, replacement of serine 78 with aspartic acid is done, creating the phosphomimic p21^{S78D}.

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

Explanation: Non sense mutations causes premature stop to be introduced that would lead to truncated or incomplete protein synthesis. If the protein synthesis has to be continued, another mutation in t-RNA gene would continue be advised to get full length polypeptide

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

Explanation: The strength of ChIP assays is their ability to capture a snapshot of specific protein: DNA interactions occurring in a system and to quantitate the interactions using quantitative polymerase chain reaction (qPCR).

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

Explanation: The direction of shell coiling in snail is a classical example for extra chromosomal inheritance, as in this it is determined by maternal gene effects and not that of the offspring.

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

Answer: A

Explanation: During photo respiration under low CO_2 and high O_2 reacts with ribulose – 1, 5 bisphosphate to yield- one molecule each of 3-phosphoglycerate and 2-phosphoglycolate.

16. Which one of the following is NOT a protoplast fusion inducing agent?
    (A) Inactivated Sendai virus   (B) Ca^{2+} at alkaline pH
    (C) Polyethylene glycol   (D) Colchicine

Answer: D

Explanation: Colchicines is not a protoplast fusion inducing agent instead it functions as mitotic inhibitor

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

Explanation: One katak is 6×10^7 IU units

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

Explanation: Enzymes accelerate the rate of the reverse reaction as well as the forward reaction, it would be helpful to ignore any back reaction by which E1P might form ES. The velocity of this back reaction would be given by $v = k_{-2}[E][P]$.

19. An example of a derived protein structure database is
    (A) Pfam   (B) SCOP   (C) GEO   (D) Prosite

Answer: B

Explanation: Protein structural database: Primary database: PDB
        Secondary database: SCOP, CATH

20. An example of a program for constructing a phylogenetic tree is
    (A) Phylip   (B) Phrap   (C) Prodom   (D) PHDsec

Answer: A

Explanation: A program for constructing phylogenetic tree is PHYLIP. It is a Phylogeny Inference Package. It is a free computational phylogenetic package which has programs for inferring evolutionary tree constructions.

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

Explanation: Synteny refers to – gene duplication from a common ancestor. This is the condition in which two or more gene loci are present on the same chromosome. During evolution rearrangements may cause the loss of synteny else it will be retained. Translocations can cause gain of synteny.

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

Explanation: E value does not depend on scoring system.

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

Explanation: In transmission electron microscope, electron opacity is greatly enhanced by treating the specimen with ferrous ammonium sulphate particles as coat on carbonaceous material and increases their opacity.

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

Explanation: 18gm water in 100ml ethanol is 10M. Hence 15gm in 85ml is approximately- 8.5.

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

Explanation: The helix content of a protein can be determined using – circular dichromism spectroscopy. CD spectrum of unknown protein = A * [% alpha-helical] + B * [% beta-sheet] + C * [% random coil]

Q. No. 26 – 51 Carry Two Marks Each

26. Which one of the following DNA sequences carries an invert repeat?
    (A) ATGAGCCCCGAGTA   (B) ATGAGCCGGCTCTA
         TACTCGGGGCTCAT   TACTCGGCCGAGAT
    (C) ATGAGCCGAGCCTA   (D) ATGAGCCTATGGTA
         ACTCGGCTCGGAT   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: A

Explanation: Zinc fingers coordinate zinc ions with a combination of cysteine and histidine residues. They can be classified by the type and order of these zinc coordinating residues (e.g., Cys_2His_2, Cys_4, and Cys_6).

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: B

Explanation: MTT- binds to succinate dehydrogenase

Annexin V- specifically binds to phosphatidyl serine

Methotrexate- allosterically inhibits dihydrofolate reductase

Taxol- suppresses microtubule dynamics

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 $Y_{x/s}$ will be

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

Answer: D

Explanation: Yield coefficient = mass of new cells formed/ mass of substrate consumed

New cells mass formed = cell density x specific growth rate = 20 x 0.4 = 8

Substrate consumed = 16 g/l/h

Yield coefficient = 8/16 = 0.5.

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

Explanation: DNA single bp = 1.1×10^{-21} gm.

2750bp wt = 3025×10^{-21} gm

Pico moles = $3025 \times 10^{-21} / 10^{-12}$

Into microgram conversion = multiply above by 10^6 = 0.3

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

Explanation: $|A| = 5(0 + 40) - 3(0 + 56)$

$-1(60 - 28) = 200 - 200$

$|A| = 0$

But $\begin{pmatrix} 5 & 3 \\ 6 & 2 \end{pmatrix} \neq 0$

Hence rank is 2

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

Answer: C

Explanation: Digoxin- cardiovascular disorder

Stevioside- sweetener

Atropine- Muscle relaxant

Vinblastine- anticancer agent

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

Explanation: Plants can make glucose from fatty acids, but this is only because they are able to use the glyoxylate cycle instead of the Krebs cycle.

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

Explanation: Somatic embryogenesis can be initiated either directly without going through the callus phase from predetermined embryonic cells or indirectly through callus proliferation and differentiation into embryonic cells within the callus tissue

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

Explanation: Given , $P(E) = \dfrac{1}{4}$, $P(\bar{E}) = \dfrac{3}{4}$

$$P(x = 1) = 2\,C_1 \times \left(\dfrac{1}{4}\right) \times \left(\dfrac{3}{4}\right)$$

$$P(x = 1) = \dfrac{3}{8}$$

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: A

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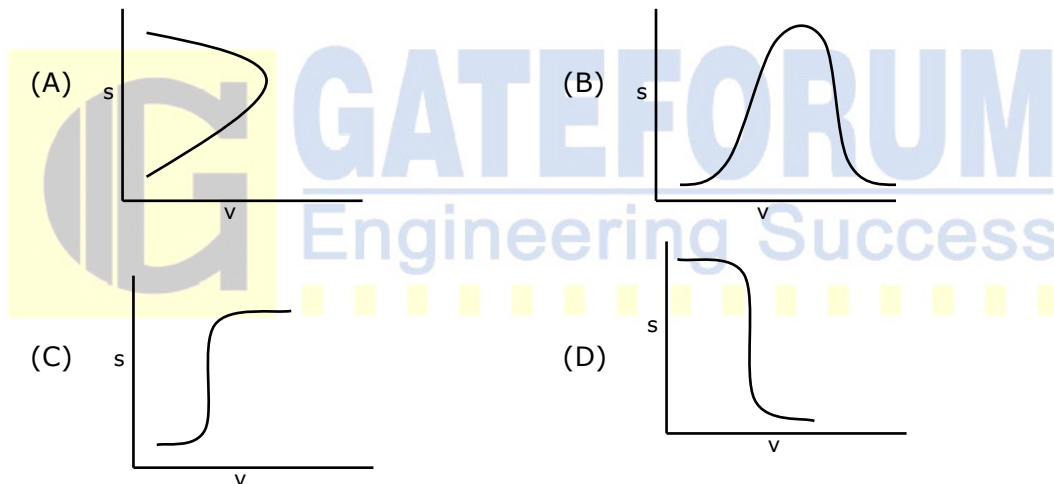
Answer: B

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?

Answer:

47. A bacterial culture $\left(200 \, \mu l \text{ containing } 1.8 \times 10^9 \text{ cells}\right)$ was treated with an antibiotic Z $\left(50 \, \mu g \text{ per ml}\right)$ for 4 h at 37^oC. 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 25^oC and that the membrane potential is $-60mV$, with the interior more negatively charged than the exterior. $\left(R = 8.314\,J\,mol^{-1}K^{-1};\ F = 96.45kJ\,mol^{-1}V^{-1}\right)$

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:

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:

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:

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:

Linked Answer Questions: Q.52 to Q.55 Carry Two Marks Each
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 $\left(K_d\right)$ 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:

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.

Answer:

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:

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:

Q. No. 56 – 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

Answer: A

Explanations: $P = 50q - 5q^2$

$$\frac{dp}{dq} = 50 - 10q$$

$$\frac{d^2p}{dq^2} < 0$$

$\therefore$ p is maximum at $50 - 10q = 0$ or, $q = 5$

Else check with options

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

Answer: A

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

Answer: D

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

Answer: A

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

Answer: B

Q. No. 61 – 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
    (B) Xenophobic
    (C) Not designed to make the post attractive
    (D) Not gender-discriminatory

Answer: C

Explanation: Gender is not mentioned in the advertisement and (B) clearly eliminated

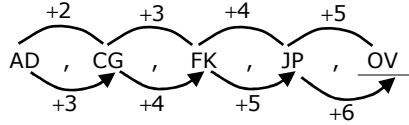62. Given the sequence of terms, AD CG FK JP, the next term is

    (A) OV   (B) OW   (C) PV   (D) PW

Answer: A

Explanation:

$$\text{AD} \xrightarrow{+2} \text{CG} \xrightarrow{+3} \text{FK} \xrightarrow{+4} \text{JP} \xrightarrow{+5} \underline{\text{OV}}$$
$$\text{AD} \xrightarrow{+3} \text{CG} \xrightarrow{+4} \text{FK} \xrightarrow{+5} \text{JP} \xrightarrow{+6} \text{OV}$$

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

Answer: C

Explanation: P and R always holds true

Else consider a sample set {1, 2, 3, 4} and check accordingly

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

Answer: B

Explanation:

	x	y
Supply	60%	40%
Reliable	96%	72%
Overall	0.576	0.288

$$\therefore P(x) = \frac{0.288}{0.576 + 0.288} = 0.334$$

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

Answer: B

Explanation: $y = 2x - 0.1x^2$

$$\frac{dy}{dx} = 2 - 0.2x$$

$$\frac{d^2y}{dx^2} < 0 \therefore y \text{ max imises at } 2 - 0.2x = 0$$

$$\Rightarrow x = 10$$

$$\therefore y = 20 - 10 = 10\,m$$