Section J: Biotechnology

Q. 1 – Q. 10 carry one mark each.

Q.1 Cells of meristemoid are best described as

(A) differentiated and non dividing
(B) dedifferentiated and dividing
(C) differentiated and dividing
(D) dedifferentiated and non dividing

Q.2 Ultrafiltration process can not be used for

(A) fractionation of proteins
(B) desalting
(C) harvesting of cells
(D) selective removal of solvents

Q.3 The number of replicons in a typical mammalian cell is

(A) 40-200 (B) 400 (C) 1000-2000 (D) 50000-100000

Q.4 What product will result from complete hydrolysis of soluble dextran?

(A) Sucrose only
(B) Fructose only
(C) Glucose and fructose only
(D) Glucose only

Q.5 Aeration in a biorector is provided by

(A) impeller (B) baffles (C) sparger (D) all of the above

Q.6 The transplastomic plants bear no risk for gene transfer through pollens as

(A) the pollens degenerate before fertilization
(B) the transformed mitochondrial DNA is lost during pollen maturation
(C) the transformed chloroplast DNA is lost during pollen maturation
(D) the transformed genomic DNA are inherited maternally

Q.7 The mobility of DNA in agarose gel electrophoresis is solely based on its

(A) charge
(B) conformation
(C) size
(D) none of the above

Q.8 Which of the following fluorescent probes is used to monitor the progress of amplification in Real time PCR?

(A) SYBR green (B) Rhodamine 6 (C) FITC (D) Cyan blue

Q.9 Expression of which of the following reporter genes does not require addition of specific substrate for detection?

(A) Luciferase.
(B) β-Glucuronidase
(C) β-Glucosidase
(D) Green fluorescent protein

Q.10 Cibacron Blue dye affinity chromatography can be used for affinity purification of

(A) NADPH dehydrogenase
(B) glucoamylase
(C) subtilisin
(D) caspase

Q. 11 – Q. 26 carry two marks each

Q.11 A linear DNA fragment is 100% labeled at one end and has 5 restriction sites for *Eco*RI. If it is partially digested by *Eco*RI so that all possible fragments are produced, how many of these fragments will be labeled and how many will not be labeled?

(A) 4 labeled; 6 unlabeled
(B) 4 labeled; 4 unlabeled
(C) 3 labeled; 5 unlabeled
(D) 3 labeled; 3 unlabeled

Q.12 Match the following products with their starting substrates

a) Sake	1) apple juice
b) cider	2) grape juice
c) wine	3) barley
d) lager	4) rice

(A) a→4, b→1, c→2, d→3
(B) a→1, b→4, c→2, d→3
(C) a→2, b→3, c→1, d→4
(D) a→3, b→4, c→2, d→1

Q.13 Identify the following antibiotics with their modes of action.

Antibiotic	Mode of action
a) Ampicillin	1) inhibition of protein synthesis
b) Tetracycline	2) inhibition of cell wall synthesis
c) Nystatin	3) damage to cytoplasmic membrane
d) Anthramycin	4) damage to DNA structure

(A) a→1, b→2, c→4, d→3
(B) a→2, b→1, c→3, d→4
(C) a→1, b→2, c→3, d→4
(D) a→3, b→4, c→2, d→1

Q.14 In a bioreactor baffles are incorporated to

(A) prevent vortex and to improve aeration efficiency
(B) maintain uniform suspension of cells
(C) minimize the size of air bubble for greater aeration
(D) maintain uniform nutrient medium

Q.15 Somatic embryo from cotyledon explant would develop in the following sequential stages.

(A) cotyledonary→ heart → globular→ torpedo
(B) globular→ torpedo→ heart → cotyledonary
(C) globular→ heart → torpedo → cotyledonary
(D) cotyledonary→ globular→ heart → torpedo

16 Though the right border (RB) and left border (LB) of T-DNA are identical, the DNA transfer is specific for the DNA left of the RB (the T-DNA), rather than for the DNA left of the LB because

(A) the sequence context at the RB defines the direction of transfer
(B) the sequence context at the LB defines the direction of transfer
(C) the nuclear location sequence (NLS) of VirD2 protein drives the excised T-strand
(D) the endonuclease activity of VirD2 protein allows nicking at RB

Q.17 Determine the correctness or otherwise of the following **Assertion** [a] and Reason [r]
Assertion: An antigen recognized by one immunoglobulin subtype is not recognized by any other subtype.
Reason : Immunoglobulin subtypes differ from each other both in the variable and in the constant regions.

(A) Both [a] and [r] are true and [r] is the correct reason for [a]
(B) Both [a] and [r] are true but [r] is not the correct reason for [a]
(C) Both [a] and [r] are false
(D) [a] is true but [r] is false

Q.18 Identical sized RNA transcript is detected by Northern blot analysis of UDP glucuronosyl transferase obtained from human liver and kidney. Microarray analysis of the same samples shows equal spot intensity, whereas Western blot detects a 55kDa strong band in liver, but a very faint band in kidney of same size. The regulation of UDP glucuronosyl transferase is

(A) transcriptionally controlled
(B) post-transcriptionally controlled
(C) translationally controlled
(D) post-translationally controlled

Q.19 Match the items on the left column with those on the right

Left	Right
P. Programmed cell death at site of infection	1. TMV coat protein
Q. Hormone upregulated during flooding stress	2. EPSP synthase
R. Target for herbicide glyphosate	3. Hypersensitive response
S. Pathogen-derived resistance	4. Ethylene

(A) P-1, Q-2, R-4, S-3 (B) P-3, Q-4, R-2, S-1
(C) P-1, Q-4, R-2, S-3 (D) P-3, Q-2, R-4, S-1

Q.20 Using the Hill equation for an enzyme $[S]_o = (v_o K_m / V_{max} - v_o)^{1/n}$ and the plot of $\log_{10} (v_o / V_{max} - v_o)$ vs $\log_{10} [S]_o$ one can find out
(P) V_{max} from the intercept on the ordinate
(Q) K_m from the intercept on the ordinate
(R) 'n' from the slope
(S) K_m from the intercept on the abscissa

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

Q.21 Expression in poor amount and in inactive form of cDNA of a eukaryotic protein in *Escherichia coli* using its expression vector is due to
(P) the absence of capping mechanism of mRNA
(Q) codon bias
(R) absence of polyadenylation
(S) absence of proper glycosylation

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

Common Data Questions

Common Data for Questions 22, 23, 24:
A recombinant SV40 virus delivers c-myc cDNA, which has a unique *Sal* I site, into muscle cells. Southern analysis of *Sal* I digested total genomic DNA of the muscle cells using c-myc cDNA probe generates a smear.

Q.22 The DNA smear obtained on Southern blot is due to

(A) head to head concatamer of viral DNA
(B) head to tail concatamer of viral DNA
(C) tail to tail concatamer of viral DNA
(D) random integration of viral DNA

Q.23 Western blot analysis of c-myc expression of such transformed cells last for

(A) transiently (B) upto five generations
(C) upto 10 generations (D) more than 100 generations

Q.24 Which of the following types of cancer will be observed in such transformed cells?

(A) Adenoma (B) Melanoma (C) Sarcoma (D) Hepatoma

Common Data for Questions 25, 26:
Normal primary hepatocytes can be artificially immortalized. Certain spontaneous mutants of immortalized hepatocytes are sensitive to ionizing radiation.

Q.25 Which of the following genes are involved in Immortalization of primary hepatocytes?

(A) Telomerase and Cyclin D (B) NFκB and Thymidine kinase
(C) Cyclin D and myc (D) Telomerase and Ras

Q.26 What would happen to the mutant cells by ionizing radiation?

(A) Apoptosis (B) Necrosis
(C) Cell growth arrest (D) Cell proliferation

Linked Answer Questions: Q27a to Q28b carry two marks each

Statement for Linked Answer Questions 27a & 27b
An aliquot of competent *E. coli* cells were used for determination of cell density by plate count method and another aliquot was used for transfomation by plasmid DNA.

Q.27a *E. coli* cell culture (1ml) was diluted 1:1000000 and 200µl of this was used for plating. After 12h incubation of the plate, the number of colony forming units (CFU) was 150. What is the total CFU per ml in the original culture?

(A) 7.5×10^8 (B) 1.5×10^8 (C) 1.5×10^6 (D) 3.0×10^6

Q.27b Isolated plasmid DNA (5ng) was used for transformation of 100µl competent *E. coli* cells to which 900µl of SOC medium was added. An aliquot of 50µl was plated on a selective plate. After overnight incubation, 300 colonies were observed. Calculate the efficiency of transformation and the percentage of transformed cells per ml of parent culture

(A) 6.0×10^5 colonies per µg of plasmid DNA, 0.01%
(B) 1.2×10^5 colonies per µg of plasmid DNA, 0.02%
(C) 1.2×10^6 colonies per µg of plasmid DNA, 0.008%
(D) 6.0×10^6 colonies per µg of plasmid DNA, 0.1%

Statement for Linked Answer Questions 28a & 28b.
HMGCoA reductase that binds HMGCoA, is the major rate limiting step in the cholesterol biosynthetic pathway. Several inhibitors of this enzyme are used as potential drugs. The assay of the enzyme is based on labeling the enzyme with radiolabeled HMGCoA and counting (cpm) the labeled enzyme-substrate complex in the presence (test) and in the absence (control) of the inhibitor. A blank is set up that contains no enzyme.

Q.28a The per cent inhibition for this enzyme is calculated from the equation

(A) {[cpm (control) – cpm (test)]/ [cpm (control) – cpm (blank)]} x 100
(B) {[cpm (control) – cpm (test)]/ [cpm (blank) – cpm (control)]} x 100
(C) {[cpm (test) – cpm (control)]/ [cpm (control) – cpm (blank)]} x 100
(D) {[cpm (control) – cpm (blank)]/ [cpm (test) – cpm (control)]} x 100

Q.28b An inhibitor is considered active if it causes more than 65% inhibition. The cpm values respectively of control, test and blank samples for inhibitors W, X, Y and Z are given below. State which of the inhibitors is active.

(A) X – 8000, 4000 and 100 (B) W – 7000, 1400 and 135
(C) Y – 7500, 5000 and 90 (D) Z – 7200, 2800 and 200