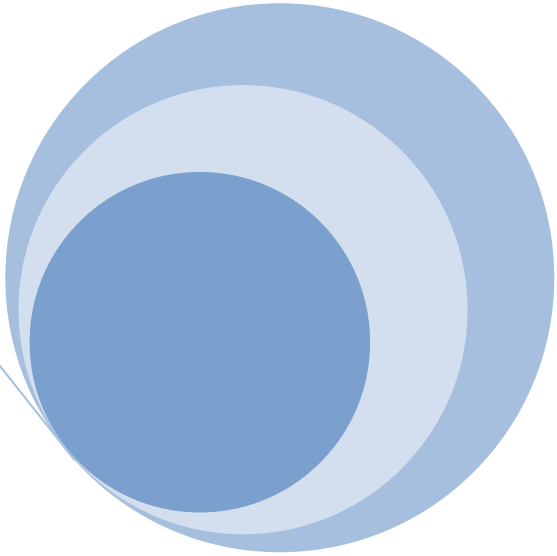

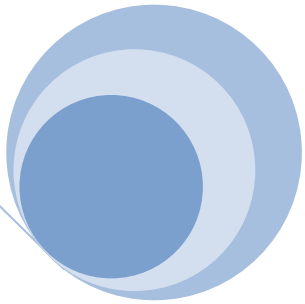

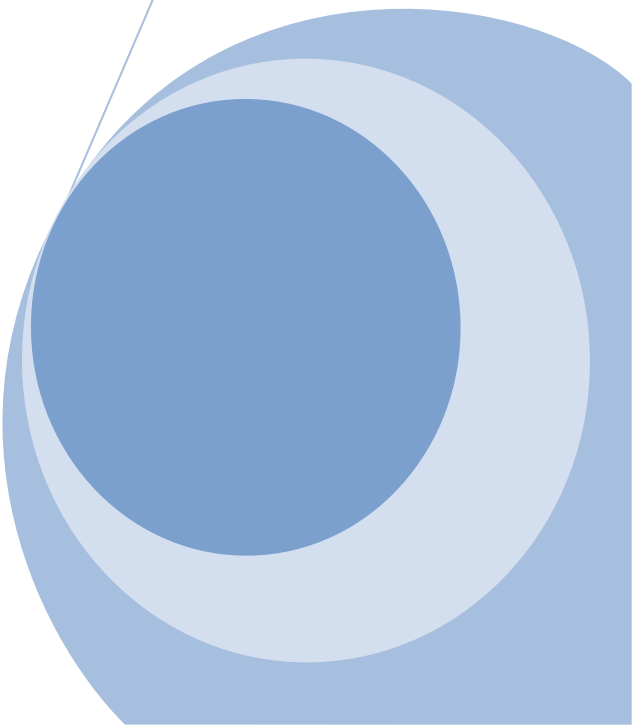

BIOTECHNOLOGY 2010

1 – 25 carry one mark each.

1. Hybridoma technology is used to produce
(A) monoclonal antibodies
(B) polyclonal antibodies
(C) both monoclonal and polyclonal antibodies
(D) B cells

2. Ames test is used to determine
(A) the mutagenicity of a chemical
(B) carcinogenicity of a chemical
(C) both mutagenicity and carcinogenicity of a chemical
(D) toxicity of a chemical

3. The bacteria known to be naturally competent for transformation of DNA is
(A) *Escherichia coli* (B) *Bacillus subtilis*
(C) *Mycobacterium tuberculosis* (D) *Yersinia pestis*

4. Antibiotic resistance marker that CANNOT be used in a cloning vector in Gram negative bacteria is
(A) Streptomycin (B) Ampicillin
(C) Vancomycin (D) Kanamycin

5. Program used for essentially local similarity search is
(A) BLAST (B) RasMol
(C) ExPASY (D) SWISS-PROT

6. Pepjtidyl transferase activity resides in
(A) 16S rRNA (B) 23S rRNA
(C) 5S rRNA (D) 28S rRNA

7. In transgenics, alterations in the sequence of nucleotide in genes are due to
(P) Substitution
(Q) Deletion
(R) Insertion
(S) Rearrangement

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

8. During transcription
(A) DNA Gyrase introduces negative supercoils and DNA
(B) DNA Topoisomerase I introduces negative supercoils and DNA Gyrase removes negative supercoils
(C) both DNA Gyrase and DNA topoisomearse I introduce negative supercoils
(D) both DNA Gyrase and DNA Topoisomearse I remove negative nupercoils

9. Under stress conditions bacteria accumulate
(A) ppGpp (Guanosine tetraphosphate)
(B) pppGpp (Guanosine pentaphosphate)
(C) both ppGpp and pppGpp
(D) either ppGpp or pppGpp

10. An example for template independent DNA polymerase is
(A) DNA Polymerase I (B) RNA polymerase
(C) Terminal deoxynucleotidyl (D) DNA polymerase III

Transferase

11. Which one of the following DOES NOT belong to the domain of Bacteria?
(A) Cyanobacteria (B) Proteobacteria
(C) Bacteroids (D) Methanobacterium

12. Interferon-β is pruduced by
(A) bacteria infected cells
(B) Virus infected cells
(C) both virus and bacteria infected cells
(D) fungi infected cells

13. A culture of bacteria is infected with bacteriophage at a multiplicity of 0.3. the probability of a single cells infected with 3 phages is
(A) 0.9 (B) 0.27
(C) 0.009 (D) 0.027

14. A neonatally thymctomized mouse, immunized with protein antigen shows
(A) both primary and secondary responses to the antigen
(B) only primary response to the antigen
(C) delayed type hypersensitive reactions
(D) no response to the antigen

15. Lymphocytes interact with foreign antigens in
(A) Bone marrow (B) Periphedral blood
(C) Thymus (D) Lymph nodes

16. Somatic cell gene transfer is used for
(P) Transgenic animal production
(Q) Transgenic diploid cell production
(R) *in-vitro* fertilization
(S) classical breeding of farm animals

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

17. Accession number is a unique identification assigned to a
(A) single database entry for DNA/Protein
(B) single database entry for DNA only
(C) single database entry for Protein only
(D) multiple database entry for DNA/Protein

18. Expressed Sequence Tag is defined as
(A) a partial sequence of a codon randomly selected from cDNA library
(B) the characteristic gene expressed in the cell
(C) the protein coding DNA sequence of a gene
(D) uncharacterized fragment of DNA presence in the cell

19. In a chemostat operating under steady state, a bacterial culture can be grown at dilution rate higher than maximum growth rate by
(A) partial cell recycling (B) using sub-optimal temperature
(C) pH cycling (D) substrate feed rate cycling

20. During lactic acid fermentation, net yield of ATP and NADH per mole of glucose is
(A) 2 ATP and 2 NADH (B) 2 ATP and 0 NADH
(C) 4 ATP and 2 NADH (D) 4 ATP and 0 NADH

21. Identify the enzyme that catalyzes the following reaction

$$\text{A-Ketoglutarate} + NADH + NH_4^+ + H^+ \longrightarrow \text{Glutamate} + NAD^+ + H_2O$$

(A) Gluamate synthetase
(B) Glutamate oxoglutarate aminotransferase
(C) Glutamate dehydrogenase
(D) α-ketogluarate deaminase

22. The degree of inhibition for an enzyme catalyzed reaction at a particular inhibitor concentration is independent of initial substrate concentration. The inhibition follows
(A) competitive inhibition (B) mixed inhibition
(C) un-competitive inhibition (D) non-competitive inhibition

23. Oxidation reduction reactions with positive standard redox potential (ΔE^0) have
(A) positive ΔG^0 (B) negative ΔG^0
(C) positive ΔE ' (D) negative ΔE '

24. Nuclease-hypersensitive sites in the chromosomes are sites that appear to be
(A) H2 and H4 histone free (B) H1 and H2 histone free
(C) H3 and H4 histone free (D) Nucleosome free

25. The formation of peptide cross-links between adjacent glycan chains in cell wall synthesis is called
(A) Transglycosylation (B) Autoglycosylation
(C) Autopeptidation (D) Transpeptidation

26-55 carry two marks each.

26. Determine the correctness or otherwise of the following **Assertion** (a) and the **Reason** (r)
Assertion: Somatic embryogenesis in plants is a two step process comprising of embryo initiation followed by embryo production.
Reason: Embryo initiation is independent of the presence of 2, 4-dichlorophenoxyacetic acid whereas embryo production requires a high concentration of 2, 4—dichlorophenoxyacetic acid.

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

27. An immobilized enzyme being used in a continuous plug flow reactor exhibits an effectiveness factor (η) of 1.2. the value of η being greater than 1.0 could be apparently due to
(A) substrate inhibited kinetics with internal pore diffusion limitation
(B) external pore diffusion limitation
(C) sigmoidal kinetics
(D) unstability of the enzyme

28. A roller bottle culture vessel perfectly cylindrical in shape having inner radius (r) = 10 cm and length (l) = 20 cm was fitted with a spiral film of length (L) = 30 cm. if the film can support 10^5 anchorage dependent cells per cm^2, the increase in the surface area after fitting the spiral film and the additional number of cells that can be grown respectively are
(A) 1200 cm^2 and 12 x 10^7 cells (B) 600 cm^2 and 6 x 10^7 cells
(C) 600 cm^2 and 8300 cells (D) 1200 cm^2 and 8300 cells

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

Assertion: MTT assay is used to determine cell viability based on the principle of colour formation by DNA fragmentation.

Reason: MTT assay is used to determine cell viability based on the colour development by converting tetrazolium soluble salt to insoluble salt.
(A) Both (a) and (r) are true and (r) is the correct reason for (a)

(B) both (a) and (r) are true and (r) is not the correct reason for (a)
(C) (a) is true but (r) is false
(D) (a) is false but (r) is true

30. Match the following antibiotics in **Group I** with their mode of action in **Group II**

Group I	**Group II**
P. Chloramphenicol	1. Binds to DNA gyrase
Q. Norfloxacin	2. Binds to RNA Polymerase
R. Puromycin	3. Inhibits peptidyl transferase
S. Rifampicin	4. Mimics aminoacyl-tRNA

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

31. Match the chemicals in **Group I** with the possible type/class in **Group II**

Group I	**Group II**
P. Picloram	1. Vitamin
Q. Zeatin	2. Auxin
R. Thiamine	3. Amino Acids
S. Glutamine	4. Cytokinin

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

32. Match **Group I** with **Group II**

Group I	**Group II**
P. Fibronectin	1. Uptake of amino acids and glucose
Q. Insulin	2. Trypsin inhibitor
R. α-Macroglobulin	3. Binds iron
S. Transferrin	4. Cell attachment to substratum

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

33. Match the promoters listed in **Group I** with the tissues listed in **Group II**

Group I	**Group II**
P. α- Amylase	1. Endosperm
Q. Glutenin	2. Tuber
R. Phaseollin	3. Aleurone
S. Patatin	4. Cotyledon

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

34. Consider the following statements,
I. T4 DNA ligase can catalyze blunt end ligation more efficiently than *E. coli* DNA ligase.
II. The ligation efficiency of T4 DNA ligase can be increased with PEG and ficoll.
(A) only I is true (B) both I and II are true
(C) only II is true (D) I is true and II is false

35. The turnover numbers for the enzymes, E1 and E2 are 150 s^{-1} and 15 s^{-1} respectively. This means
(A) E1 binds to its substrate with higher affinity than E2
(B) The velocity of reactions catalyzed by E1 and E2 at their respective saturating substrate concentrations could be equal, if concentration of E2 used is 10 times that of E1

(C) The velocity of E1 catalyzed reaction is always greater than that of E2
(D) The velocity of E1 catalyzed reaction at a particular enzyme concentration and saturating substrate concentration is lower than that of E2 catalyzed reaction under the same conditions.

36. Match the items in **Group I** with **Group II**

Group I (*Vectors*)	**Group II** (Maximum DNA packaging)
P. λ phage	1. 35-45 kb
Q. Bacterial Artificial chromosomes (BACs)	2. 100-300 kb
R. P1 derived Artificial Chromosomes (PACs)	3. ≤ 300 kb
S. λ cosmid	4. 5-25 kb

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

37. Match **Group I** with **Group II**

Group I	**Group II**
P. *Staphylococcus aureus*	1. Biofilms
Q. *Candida albicans*	2. Bacteriocins
R. *Mycobacterium tuberculosis*	3. Methicillin resistance
S. *Lactobacillus lactis*	4. Isoniazid

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

38. A mutant Gα protein with increased GTPase activity would
(A) not bind to GTP (B) not bind to GDP
(C) show increased signaling (D) show decreased signaling

39. Dizygotic twins are connected to a single placenta during their embryonic development. These twins
(A) have identical MHC haplotypes
(B) have identical T_H cells
(C) have identical T cells
(D) can accept grafts from each other (both (A) and (B)).

40. The dissociation constant K_d for ligand binding to the receptor is 10^{-7} M. the concentration of ligand require for occupying 10% of receptors is
(A) 10^{-6} M (B) 10^{-7} M
(C) 10^{-8} M (D) 10^{-9} M

41. Receptor R is over expressed in CHO cells and analysed for expression. 6×10^7 cells were incubated with is its radioactive ligand (specific activity 100 counts per picomole). If the total counts present in cell pellet was 1000 cpm, the average number of receptors R per cells is (assume complete saturation of receptors with ligand and one ligand binds to one receptor)
(A) 10^4 (B) 10^5
(C) 10^6 (D) 10^7

42. A cell has five molecules of a rare mRNA. Each cell contains 4×10^5 mRNA molecules. How many clones one will need to screen to have 99% probability of finding at least one recombinant cDNA of the rare mRNA, after making cDNA library from such cell?
(A) 4.50×10^5 (B) 3.50×10^5
(C) 4.20×10^5 (D) 4.05×10^5

43. Match the products in **Group I** with the microbial cultures in **Group II** used for their industrial production

Group I	**Group II**
P. Gluconic acid	1. *Leuconostoc mesenteroids*
Q. L – Lyjsine	2. *Aspergillus niger*
R. Dextran	3. *Brevibacterium flavum*
S. Cellulase	4. *Trichoderma reesei*

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

44. Determine the correctness or otherwise of the following **Assertion** (a) and the **Reason** (r).
Assertion: Cytoplasmic male sterility (cms) is invariably due to defect (s) in mitochondrial function.
Reason: cms can be overcome by pollinating a fertility restoring (Rf) plant with pollen from a non cms plant.
(A) both (a) and (r) are true and (r) is the correct reason for (a)
(B) both (a) and (r) are true and (r) is not the correct reason for (a)
(C) (a) is false (r) is true
(D) (a) is true but (r) is false

45. Thermal death of microorganisms in the liquid medium follows first order kinetics. If the initial cell concentration in the fermentation medium is 10^8 cells / ml and the final acceptable contamination level is 10^{-3} cells, for how long should 1 m^3 medium be treated at temperature of120^0 (thermal deactivation rate constant = 0.23 / min) to achieve acceptable load?
(A) 48 min (B) 11 min
(C) 110 min (D) 20 min

46. True breeding *Drosophila* files with curved wings and dark bodies were mated with true breeding short wings and than body *Drosophila*. The F1 progeny was observed to be with curved wings and tan body. The F 1 progeny was again allowed to breed and produced flies of the following phenotype, 45 curved wings tan body, 15 short wings tan body, 16 curved wings dark body and, 6 short wings dark body.

The mode of inheritance is
(A) Typical Mendelian with curved wings and tan body being dominant
(B) Typical non-Mendelian with curved wings and tan body not following any pattern
(C) Mendelian with suppression of phenotypes
(D) Mendelian with single crossover

47. Match **Group I** with **Group II**

Group I	**Group II**
P. Real Time-PCR	1. Biochips
Q. 2-D Electrophoresis	2. Syber Green
R. Affinity chromatography	3. Antibody linked sephrose beads
S. Microarray	4. Ampholytes

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

Common Data Questions
Common Data for Question 48 and 49

A culture of *Rhizobium* is grown in a chemostat (100 m^3 bioreactor). The feed contains 12 g / L sucrose, K_S for the organism is 0.2 g / L and μ_m = 0.3 h^{-1}.

48. The flow rate required to result in steady state concentration of sucrose as 1.5 g / L in the bioreactor will be
(A) 15 $m^3 h^{-1}$ (B) 26 $m^3 h^{-1}$
(C) 2.6 $m^3 h^{-1}$ (D) 150 $m^3 h^{-1}$

49. If $Y_{X/S}$ = 0.4 g / g for the above culture and steady state cell concentration in the bioreactor is 4 g / L the resulting substrate concentration will be
(A) 2 g / L (B) 8 g / L
(C) 4 g / L (D) 6 g / L

Common Data for Questions 50 and 51

The width of the lipid bilayer membrane is 30Å. It is permeated by a protein which is a right handed α-helix.

50. The number of α-helical turns permeating the membrane is
(A) 5.6 turns (B) 3.5 turns
(C) 6.5 turns (D) 5.0 turns

51. The number of amino acid residues present in the protein is
(A) 15 (B) 18
(C) 17 (D) 20

Linked Answer Questions
Statement for Linked Answer Questions 52 and 53

The standard redox potential values for two half-reactions are given below. The value for Faraday's constant is 96.48 kJ V^{-1} and Gas constant R is 8.31 J K^{-1} mol^{-1}.

$NAD^+ + H^+ + 2e^- \leftrightarrow NADH$ - 0.315 V
$FAD + 2H^+ + 2e^- \leftrightarrow FADH_2$ - 0.219 V

52. The ΔG^0 for the oxidation of NADH by FAD is
(A) – 9.25 kJ mol^{-1} (B) – 103.04 kJ mol^{-1}
(C) + 51.52 kJ mol^{-1} (D) – 18.5 kJ mol^{-1}

53. The value of $\Delta G'$, given K_{eq} AS 1.7, AT 23^0 C will be
(A) – 17.19 kJ mol^{-1} (B) – 19.8 kJ mol^{-1}
(C) + 52.82 kJ mol^{-1} (D) – 117 .07 kJ mol^{-1}

Statement for Linked Answer Question 54 and 55

During bioconversion of sucrose to citric acid by *Aspergillus niger* final samples of 6 batches of fermentation broth were analyzed for citric acid content. The results (in g/L) were found to be 47.3, 52.2, 49.2, 52.4, 49.1 and 46.3.

54. The mean value of acid concentration will be
(A) 49.4 (B) 51.0
(C) 48.2 (D) 50.8

55. The standard deviation for the above results is
(A) 2.49 (B) 3.0
(C) 1.84 (D) 5.91