

**M.Sc. (Biotechnology) : 2008**  
**Part A**

Directions: Choose the best answer from each of the following questions:

1. DNA containing a genetic sequence that is to be cloned is referred to as
  - a) vector DNA
  - b) donor DNA
  - c) single-stranded DNA
  - d) host DNA
2. Bacterial enzymes that cut DNA at specific sites within the DNA molecule are called
  - a) exonucleases
  - b) methylases
  - c) transferases
  - d) restriction endonucleases
3. All of the following are common methods of experimentally introducing DNA into host cells except
  - a) transformation
  - b) transduction
  - c) conjugation
  - d) electroporation
4. Which of the following eukaryotic genera contain common cloning host cells?
  - a) *Paramecium*
  - b) *Saccharomyces*
  - c) *Penicillium*
  - d) *Euglena*
5. Sphaeroplasts lack the following cellular component
  - a) endoplasmic reticulum
  - b) ribosomes
  - c) intact cell wall
  - d) cytoskeleton
6. A prophage is
  - a) an auxotrophic mutant
  - b) a gene
  - c) host DNA packed into viral heads
  - d) a phage DNA incorporated into the host genome
7. Small circular molecules capable of self-replication are called
  - a) introns
  - b) exons
  - c) plasmids
  - d) transposable elements
8. Which of the following amino acids is specified by a single codon?
  - a) glutamine
  - b) tryptophan
  - c) asparagine
  - d) isoleucine
9. When a number of genes are transcribed as one mRNA, it is said to be:
  - a) multimeric
  - b) polymeric
  - c) polycistronic
  - d) polysomal
10. A protein structure on eukaryotic chromosomes to which spindle fibers bind is a:
  - a) telomere
  - b) kinetochore
  - c) centromere
  - d) centriole
11. An enzyme that phosphorylates a protein is known as:
  - a) a protein kinase
  - b) phosphatase
  - c) kinase
  - d) phosphorylase
12. The human embryo that consists of only two layers of cells is called
  - a) a blastocyst
  - b) an embryonic disc
  - c) a placenta
  - d) a yolk sac
13. Eukaryotic RNA that specifies proteins is modified before translation by
  - a) addition of a 5' cap
  - b) splicing of exons
  - c) addition of a 3' poly-A tail
  - d) all of the three
14. What is the chemical basis of gene imprinting?
  - a) methylation of DNA
  - b) phosphorylation
  - c) oxidation of DNA
  - d) glycosylation
15. The drug chloramphenicol blocks
  - a) cell-wall formation
  - b) transcription
  - c) translation termination release factors
  - d) polypeptide chain elongation
16. A bacterium on examination is found to lack superoxide dismutase, catalase and peroxidase. Which of the following statement best describes this bacterium?
  - a) This bacterium does not possess pilus.
  - b) This bacterium does not produce endotoxins.
  - c) This bacterium is an obligate anaerobe.
  - d) This bacterium will survive in an oxygen environment.
17. Selective inhibition of the synthesis of dipicolinic acid would inhibit the formation of the following structure:
  - a) Bacterial flagella
  - b) Bacterial endospores
  - c) Sex pilus
  - d) Glycocalyx

18. Uptake by a recipient cell of soluble DNA released from a donor cell is defined as:
- Competence
  - Conjugation
  - Transduction
  - Transformation.
19. Bacterial spores are a problem in sterilization as they are:
- Resistant to antibiotics
  - Resistant to physical and chemical agents
  - Easy to kill but are protected by organic matter
  - Most pathogenic bacteria are spore formers.
20. The iron scavenging compound produced by bacteria are called:
- Siderophores
  - Toxins
  - Lipopolysaccharides
  - Lipoproteins
21. The following causes food-borne gastrointestinal illness:
- Helicobacte*
  - Campylobacter*
  - Arthrobacter*
  - Rhodobacter*
22. Which of the following function to retard the desiccation of a bacterium?
- Outer membrane
  - Murein layer
  - Capsule
  - Peptidoglycan
23. Pasteurization is designed to:
- kill all living organisms present in the material being treated
  - make the material sterile
  - reduce the number of potentially harmful microorganisms
  - all the above.
24. Which one of the following is found in the outer membrane of bacteria?
- Teichoic acids
  - Capsules
  - Lipopolysaccharides
  - Peptidoglycan
25. Biological oxygen demand helps to determine the:
- extent of pollution in wastewater.
  - filtering capacity of soil.
  - types of biota in the ecosystem.
  - number of bacteria in a 100 ml sample of water.
26. Bacterial species of *Thiobacillus* and *Beggiatoa* play important role in:
- water cycle on earth
  - phosphorus cycle
  - sulphur cycle in soil
  - breakdown of sewage.
27. Porins are located in:
- Plasma membrane
  - Outer membrane
  - Peptidoglycan
  - S layer
28. The following bacterial transport mechanism is accompanied by a chemical change in the substance that is transported:
- Active transport
  - Facilitated diffusion
  - Group translocation
  - Antiport transport
29. IL-2, TNF, IFN, TGF are names of:
- hormones
  - cytokines
  - receptors
  - viruses
30. One of the following is an autoimmune disease:
- rheumatoid arthritis
  - myeloma
  - Burkitt's lymphoma
  - marasmus
31. A tumor arising from an epithelial or endothelial cell is called a:
- sarcoma
  - myeloma
  - carcinoma
  - leukemia
32. Examples of mononuclear phagocytes are:
- monocytes, macrophages
  - T lymphocytes, natural killer cells
  - basophils, eosinophils, neutrophils
  - hepatocytes, fibroblasts
33. T lymphocytes mature in the:
- thyroid
  - testes
  - thymus
  - hypothalamus
34. The cell that cannot act as a phagocytic cell is a:
- macrophage
  - neutrophil
  - erythrocyte
  - none of the three
35. The antibody type that can be found in pentameric form is

- a) IgG  
c) IgD
- b) IgA  
d) IgM
36. Alternative forms of a gene at a particular locus found in a population are called:  
a) introns  
c) transposons
- b) exons  
d) alleles
37. Which one of the following is an “inborn error of metabolism”?  
a) Thalassemia  
c) *Beri Beri*
- b) Alkaptonuria  
d) Di George’s syndrome
38. The disease sickle cell anemia is a result of which alteration in the  $\beta$ -globin chain :  
a) 6 Glu  $\rightarrow$  Gln  
c) 6 Glu  $\rightarrow$  Leu
- b) 6 Glu  $\rightarrow$  Asp  
d) 6 Glu  $\rightarrow$  Val
39. Telomeres are found in:  
a) linear chromosomes  
c) double stranded RNA
- b) circular chromosomes  
d) all of three
40. Which of the following condition will manifest in the homozygous condition?  
a) autosomal recessive  
c) sex-linked recessive
- b) autosomal dominant  
d) all of three
41. Protein folding is a function of the:  
a) Mitochondria  
c) Endoplasmic reticulum
- b) Golgi apparatus  
d) Ribosomes
42. Histone proteins are rich in:  
a) Acidic amino acids like aspartic and glutamic acid  
b) Basic amino acids like lysine and arginine  
c) Both acidic and basic amino  
d) Hydrophobic amino acids like valine and phenylalanine
43. Colchicine can be used to arrest cells in metaphase because  
a) It inhibits synthesis of actin  
b) It inhibits depolymerization of microtubules  
c) It induces degradation of microtubules  
d) It interferes with polymerization during microtubule formation
44. The nerve cell appendage which is mainly responsible for impulse transmission is:  
a) Axon  
c) Exon
- b) Dendrite  
d) Transducer
45. Molecular chaperones are required for:  
a) correct signal transduction within a cell  
b) correct synthesis of carbohydrates  
c) correct folding of proteins  
d) correct phosphorylation of phospholipids
46. Movement of plasma membrane lipids from one side of the bilayer to another is:  
a) thermodynamically unfavorable and therefore prohibited  
b) thermodynamically favorable and yet prohibited  
c) thermodynamically unfavorable and yet permitted  
d) thermodynamically favorable and therefore permitted
47. The category of junction between animal cells that are found in all tissues are:  
a) Tight junctions, gap junctions and desmosomes  
b) Tight junctions  
c) Gap junctions  
d) Desmosomes
48. The light-harvesting complex (LHC) of a chloroplast is located in the :  
a) Stroma of the chloroplast  
c) Thylakoid membrane
- b) Chloroplast envelope  
d) Photosystem I
49. When maintaining cells in culture, the osmotic pressure of the culture medium:  
a) Should be isotonic with the intracellular fluid  
b) Should be hypotonic to the intracellular fluid  
c) Should be hypertonic to the intracellular fluid  
d) Can be isotonic, hypotonic or hypertonic in comparison to the intracellular fluid
50. The glycosylation of glycoproteins is modified and extended by the:  
a) Endoplasmic reticulum  
c) Mitochondria
- b) Nucleus  
d) Golgi apparatus
51. Fibronectins are required for:  
a) Binding of extracellular ligands to the surface of a cell

- b) Transport of small ions across the plasma membrane of a cell  
 c) Transport of large molecules across the plasma membrane of a cell  
 d) Attachment of a cell to the extracellular matrix
52. A small, membrane-limited, fluid-filled space within the cytoplasm of a cell is  
 a) glyoxysome  
 b) dictyosome  
 c) a vesicle  
 d) an inclusion body
53. Programmed cell death (PCD) is manifested as:  
 a) Aging  
 b) Apoptosis  
 c) Necrosis  
 d) De-differentiation
54. Post-mitotic cells:  
 a) do not divide  
 b) divide actively  
 c) undergo destruction  
 d) are arrested in the cell cycle
55. Pectin is a :  
 a) Plasma membrane protein  
 b) Cell wall polysaccharide  
 c) Plasma membrane polysaccharide  
 d) Cell wall glycolipid
56. Sites in a genome where mutations occur at rates higher than normal are known as:  
 a) suppressor sites  
 b) mutator sites  
 c) hotspots  
 d) cistron
57. With respect to linkage, the genes in a chromosome:  
 a) are always completely linked  
 b) are always completely unlinked  
 c) are always partially linked  
 d) may be completely linked, completely unlinked or partially linked
58. Hemophilia B or 'Christmas Disease' is caused by a reduction in the amount of  
 a) Blood clotting factor VI  
 b) Blood clotting factor VII  
 c) Blood clotting factor VIII  
 d) Blood clotting factor IX
59. The conversion of a normal cell to a cancer cell is called:  
 a) Neoplastic transformation  
 b) Cellular differentiation  
 c) Mutagenesis  
 d) Organogenesis
60. Human lymphocytes contain:  
 a) the same amount of DNA as other cells  
 b) more DNA than other cells  
 c) less DNA than other cells  
 d) no DNA
61. DNA Polymerase I isolated by Kornberg et al. from *E. coli* requires the following for *in vitro* synthesis of DNA  
 a)  $\text{CaCl}_2$   
 b)  $\text{NaCl}$   
 c)  $\text{MgCl}_2$   
 d)  $\text{KCl}$
62. Pleiotropism may be defined as:  
 a) the multiple allelic forms of a single gene  
 b) the multiple phenotypic effects of a single gene  
 c) the combined phenotypic effect of multiple genes  
 d) the partial phenotypic effect of a single gene
63. The gene responsible for xeroderma pigmentosum causes freckling in heterozygous individuals. This is because  
 a) the gene is recessive lethal  
 b) the gene is dominant lethal  
 c) the gene is semilethal  
 d) the gene is sublethal
64. In the Japanese morning glory, purple colored flower is produced by a dominant allele at either of two separate gene pairs  $A\_bb$ , or  $aaB\_$ . When dominant alleles are present at both gene pairs ( $A\_B\_$ ), the flower color is blue, and when the gene pairs are recessive homozygous ( $aabb$ ), the flower color is scarlet. If a blue F1 is produced by crossing two different purple types, what is the genotype of the parents?  
 a)  $Aabb \times aabb$   
 b)  $aaBB \times aabb$   
 c)  $aabb \times aabb$   
 d)  $AAbb \times aaBB$
65. The first multicellular organism whose genome was completely sequenced is:  
 a) *Xenopus laevis*  
 b) *Saccharomyces cerevisiae*  
 c) *Drosophila melanogaster*  
 d) *Caenorhabditis elegans*
66. Variations in genome sequence of individuals that may be the result of point mutations are called:  
 a) Minisatellites  
 b) Microsatellites  
 c) Randomly Amplified Polymorphic DNA (RAPD)  
 d) Single Nucleotide Polymorphisms (SNPs)
67. An *E. coli* cell in which the fertility factor is integrated into the bacterial chromosome is called:  
 a) Fertile cell  
 b) High frequency of recombination (Hfr) cell  
 c) Donor cell  
 d) Recipient cell

68. The enzyme involved in RNA-directed DNA synthesis is called:  
a) Endonuclease    b) Primase  
c) RNA polymerase    d) Reverse transcriptase
69. Vectors that combine the features of phages and plasmids are:  
a) Lambda replacement vector                                b) Cosmids  
c) BAC    d) PAC
70. A double trisomic can be represented as:  
a)  $2n$     b)  $2n + 1$   
c)  $2n + 1 + 1$     d)  $2n + 2$
71. In D-Glucose the anomeric carbon is sometimes called potential reducing carbon because:  
a) C-1 becomes the carbon atom of the aldehyde group that has reducing properties  
b) C-1 does not become carbon atom of the aldehyde group  
c) C-3 becomes the carbon atom of the aldehyde group having reducing properties  
d) None of the above
72. Furanoses are generally less stable because:  
a) the area of the ring is smaller                                b) the area of the ring is greater  
c) the area of the ring is unchanged                            d) None of the three
73. The two structural isomers of glucose are:  
a) Mannose & Galactose                                        b) Fructose & Mannose  
c) Galactose & Xylose    d) None of the three
74. Cellulose is the major cell material of :  
a) Plants    b) Mammals  
c) Algae     d) Fungi
75. Which of the following are reducing sugars?  
a) Methylgalactoside    b) Galactose  
c) Gluconic acid    d) None of the three
76. In Glycine solutions at pH values below 6, the amino group is present in the:  
a) Negatively charged form                                        b) Positively charged form  
c) Neutral form    d) None of the three
77. Ribonuclease contains the following that help to stabilize its conformation:  
a) Four disulphide bonds    b) Two disulphide bonds  
c) Three disulphide bonds    d) Five disulphide bonds
78. 2,3-bisphosphoglycerate (BPG) is produced within the:  
a) Red Blood Cells     b) White Blood cells  
c) Cerebral fluid    d) None of the three
79. The SOS mechanism of DNA repair is activated by which of the following?  
a) 5-Bromouracil    b) 2-Amino-purine  
c) Thymine dimers    d) Hydroxylamine
80. The bile acids are produced by the metabolism of cholesterol in the:  
a) Liver     b) Kidney  
c) Stomach    d) Heart
81. 5-Bromouracil is an analog of :  
a) Uracil     b) Cytosine  
c) Thymine    d) Adenine
82. The A and G composition (in mole percent) of one strand of a duplex DNA is A=27 and G =30. What will be the T and C contents of the complementary strand?  
a) T=27 and C=27    b) T=30 and C=27  
c) T=27 and C = 30    d) T=30 and C=30
83. For a pure enzyme,  $V_{max}$  is:  
a) the maximum volume     b) the maximum velocity  
c) the volume measurement                                        d) volume capacity
84. The enzyme trypsin is present in:  
a) the stomach    b) liver  
c) small intestine    d) kidney
85. Which of the following is an inactive enzyme:  
a) chymotrpsinogen    b)  $\alpha$ -chymotrypsin  
c) pepsin     d) elastase
86. Arginase is a hydrolase that is of urea producing organism present in  
a) kidney     b) stomach  
c) liver    d) brain

87. The part of enzyme which is responsible for its substrate specificity is:
- a) the active site
  - b) the protein
  - c) the catalytic site
  - d) the inactive site
88. Which enzyme is the main point of control of Glycolysis?
- a) Phosphofructokinase
  - b) Glucose-6-phosphate isomerase
  - c) Glyceraldehyde-3-phosphate dehydrogenase
  - d) Phosphoglycerate kinase
89. Disaccharides commonly ingested by humans are:
- a) Sucrose and Lactose
  - b) Fructose and Mannose
  - c) Fructose and Xylose
  - d) Sucrose and Fructose
90. The Citric acid cycle is part of the process of respiration. Is oxygen directly involved in the reactions of the cycle?
- a) No
  - b) Yes
  - c) Just a small part
  - d) None of the three

## Part B

### Fill in the Blanks

1. In an animal cell, DNA is found in the nucleus and in the \_\_\_\_\_.
2. Tonofilaments are components of the \_\_\_\_\_ of a cell.
3. Eukaryotic DNA replication occurs only during a part of the \_\_\_\_\_.
4. An over reactive immune system may give rise to \_\_\_\_\_.
5. A “membrane attack complex” is formed by reactions of the \_\_\_\_\_.
6. A trait in which the phenotype of an individual depends on its genotype in all the relevant loci, with each allele adding (or subtracting) a small amount is said to be \_\_\_\_\_.
7. The major sterol found in eukaryotic microorganism is \_\_\_\_\_.
8. Primase is a specific kind of RNA polymerase that is involved in the process of \_\_\_\_\_.
9. \_\_\_\_\_ is the functional and structural unit of chromosomes.
10. Glycosylation of proteins occurs in \_\_\_\_\_.
11. Phospholipid synthesis occurs in \_\_\_\_\_.
12. The basic structural unit of sphingolipid is \_\_\_\_\_.
13. \_\_\_\_\_ complexes are the main components of the cell cycle control system.
14. A chromosomal inversion which includes the centromere is called \_\_\_\_\_.
15. Manx cats are heterozygous for a dominant allele that causes \_\_\_\_\_ tail formation.
16. \_\_\_\_\_ rings are found on polytene chromosomes.
17. \_\_\_\_\_ is the primary enzyme involved in replication of the *E. coli* chromosome.
18. Random pieces of host chromosome carried along with an infecting bacteriophage and integrated into the genome of an infected bacterial cell is called \_\_\_\_\_ transduction.
19. *Agrobacterium tumefaciens* contains a plasmid for inducing tumor formation in the root of plants, this plasmid is called \_\_\_\_\_ plasmid.
20. Archaea are penicillin-resistant because they have no \_\_\_\_\_ in their cell walls.

21. The hospital superbug is \_\_\_\_\_.
22. Mutant strains of an organism with an inability to synthesize a particular organic compound required for growth are called \_\_\_\_\_.
23. *Thermus aquaticus* is the source of the thermotolerant polymerase called \_\_\_\_\_, which is used in PCR reactions.
24. Organisms which can grow at 0-15°C, e.g. microorganisms found in polar regions are called \_\_\_\_\_.
25. The phase of microbial growth where the microbial cells are preparing for cell division is called the \_\_\_\_\_ phase.
26. Pea plants form a symbiotic relationship with gram negative bacteria of the genus \_\_\_\_\_ for nitrogen fixation.
27. Adhesins are constituents of a pathogen's repertoire of \_\_\_\_\_ factors.
28. *Halobacterium* contains the photosynthetic pigment \_\_\_\_\_.
29. Plasmids carrying antibiotic-resistance genes are called \_\_\_\_\_ plasmids.
30. Rhinoviruses are in most cases responsible for \_\_\_\_\_.

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