

M. H. G.

11P/288/4

Question Booklet No. 1012

(To be filled up by the candidate by blue/black ball-point pen)

Roll No.

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Roll No.

(Write the digits in words)

Serial No. of OMR Answer Sheet

Day and Date

(Signature of Invigilator)

INSTRUCTIONS TO CANDIDATES

(Use only **blue/black ball-point pen** in the space above and on both sides of the Answer Sheet)

1. Within 10 minutes of the issue of the Question Booklet, check the Question Booklet to ensure that it contains all the pages in correct sequence and that no page/question is missing. In case of faulty Question Booklet bring it to the notice of the Superintendent/Invigilators immediately to obtain a fresh Question Booklet.
2. Do not bring any loose paper, written or blank, inside the Examination Hall *except the Admit Card without its envelope.*
3. A separate Answer Sheet is given. *It should not be folded or mutilated. A second Answer Sheet shall not be provided. Only the Answer Sheet will be evaluated.*
4. Write your *Roll Number and Serial Number of the Answer Sheet by pen* in the space provided above.
5. **On the front page of the Answer Sheet, write by pen your Roll Number in the space provided at the top, and by darkening the circles at the bottom. Also, wherever applicable, write the Question Booklet Number and the Set Number in appropriate places.**
6. No overwriting is allowed in the entries of Roll No., Question Booklet No. and Set No. (if any) on OMR sheet and also Roll No. and OMR Sheet No. on the Question Booklet.
7. Any change in the aforesaid entries is to be verified by the invigilator, otherwise it will be taken as unfair means.
8. Each question in this Booklet is followed by four alternative answers. *For each question, you are to record the correct option on the Answer Sheet by darkening the appropriate circle* in the corresponding row of the Answer Sheet, by ball-point pen as mentioned in the guidelines given on the first page of the Answer Sheet.
9. For each question, darken only one circle on the Answer Sheet. If you darken more than one circle or darken a circle partially, the answer will be treated as incorrect.
10. *Note that the answer once filled in ink cannot be changed.* If you *do not wish to attempt* a question, leave all the circles in the corresponding row blank (such question will be awarded zero mark).
11. For rough work, use the inner back page of the title cover and the blank page at the end of this Booklet.
12. Deposit *only the OMR Answer Sheet* at the end of the Test.
13. You are not permitted to leave the Examination Hall until the end of the Test.
14. If a candidate attempts to use any form of unfair means, he/she shall be liable to such punishment as the University may determine and impose on him/her.

11P/288/4

No. of Questions/प्रश्नों की संख्या : 150

Time/समय : 2 Hours/घण्टे

Full Marks/पूर्णांक : 450

Note/नोट : (1) Attempt as many questions as you can. Each question carries 3 marks. One mark will be deducted for each incorrect answer. Zero mark will be awarded for each unattempted question.

अधिकाधिक प्रश्नों को हल करने का प्रयत्न करें। प्रत्येक प्रश्न 3 अंक का है। प्रत्येक गलत उत्तर के लिए एक अंक काटा जाएगा। प्रत्येक अनुत्तरित प्रश्न का प्राप्तांक शून्य होगा।

(2) If more than one alternative answers seem to be approximate to the correct answer, choose the closest one.

यदि एकाधिक वैकल्पिक उत्तर सही उत्तर के निकट प्रतीत हों, तो निकटतम सही उत्तर दें।

1. An engineer claims to have made an engine delivering 10 kW power with fuel consumption of 1 gm/sec. The calorific value of fuel is 2 kcal/gm. This claim is

- (1) valid (2) invalid
(3) dependent on engine design (4) dependent on load

2. When 110 joules of heat are added to a gaseous system, whose internal energy increases by 40 J, then the amount of external work done is

- (1) 150 J (2) 70 J (3) 110 J (4) 40 J

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(P.T.O.)

3. The difference in the angular momentum associated with the electron in the two successive orbits of the hydrogen atom is
- (1) h/π (2) $h/2$ (3) $h/2\pi$ (4) $2h$
4. The distance traversed by light in glass (refractive index = 1.5) in a nanosecond will be
- (1) 45 cm (2) 40 cm (3) 30 cm (4) 20 cm
5. An α -particle of energy 5 MeV is scattered through 180° by a fixed uranium nucleus. The distance of closest approach is of the order
- (1) 10^{-10} m (2) 10^{-13} m (3) 10^{-14} m (4) 10^{-16} m
6. For a particle in one-dimensional box, with the increase of quantum number of the state, the number of mode will
- (1) increase (2) decrease
(3) no change (4) first increase and then decrease
7. An electron in $n = 1$ orbit of hydrogen atom is bound by 13.6 eV. If a hydrogen atom is in the $n = 3$ state, how much energy is required to ionize it?
- (1) 13.6 eV (2) 4.53 eV (3) 3.4 eV (4) 1.51 eV
8. Laser is a source of light which is
- (1) about 1000 times brighter than sunlight
(2) about 1000 times brighter than moonlight
(3) termed as 'Light Amplification by Short Emission of Radiation'
(4) termed as 'Linear Amplification of Stimulated Emission of Radiation'

9. The first Laser was produced by

- (1) T. H. Maiman (2) Charles Townes
(3) A. L. Schawlow (4) Albert Einstein

10. Among the main characteristics of Laser, which of the following is incorrect?

- (1) Directionality (2) Monochromacity
(3) Radioactive (4) Polarization

11. For medical purposes, which of the following is used?

- (1) CO₂ Laser, Nd-YAG Laser and Ar Laser
(2) Cd Laser, Co Laser and Ar Laser
(3) O₂ Laser, CO₂ Laser and Br Laser
(4) CO₂ Laser, Cd Laser and Br Laser

12. One Angstrom equals to

- (1) 10^{-1} m μ (2) 10^{-2} m μ (3) 10^{-3} m μ (4) 10^{-4} m μ

13. Chromatic aberration of a lense is

- (1) not dependent on focal length
(2) directly proportional to focal length
(3) inversely proportionally to focal length
(4) inversely proportionally to dispersive power

14. Fingerprints on paper are identified by sprinkling fluorescent powder on it and observing it under
- (1) mercury light (2) sunlight
(3) infra-red light (4) ultra-violet light
15. Two convex lenses of focal length 0.3 m and 0.05 m are used to make a telescope. The distance kept between them is equal to
- (1) 0.35 m (2) 0.75 m (3) 0.175 m (4) 0.15 m
16. The bond formation in atom is due to the fact that atoms
- (1) acquire higher energy (2) get their energy level lower
(3) change their position (4) None of these
17. Fluorine molecule is formed by overlap of
- (1) $p-p$ orbitals by side to side manner
(2) $p-p$ orbitals by end to end manner
(3) $s-p$ orbitals
(4) $s-s$ orbitals
18. If the energy of the system in the formation of molecule from atom decreases, the number of bonding electrons would be
- (1) more than the number of anti-bonding electrons
(2) less than the anti-bonding electrons
(3) equal to the anti-bonding electrons
(4) Neither of the above is true

19. Which of the following is both Bronsted acid and base?

- (1) H_2SO_4 (2) Na_2CO_3 (3) HS^- (4) H_2CO_3

20. Which of the following is not self-ionized?

- (1) H_2O (2) Liquid NH_3 (3) Liquid SO_3 (4) $\text{C}_2\text{H}_5\text{OH}$

21. Which of the following is not a Lewis acid?

- (1) Ag^+ (2) Li^+ (3) BF_3 (4) N_2H_4

22. Liquid ammonia is a/an

- (1) protogenic solvent (2) protophilic solvent
(3) aprotic solvent (4) Neither of these

23. Which of the following solvents has the highest dielectric constant?

- (1) HCN (2) H_2O (3) NH_3 (4) HF

24. Ion-exchange chromatography works on the basis of

- (1) net ionic differences of the proteins at pH 7.0
(2) differences in the sign and magnitude of the net electrical charges of protein at a given pH
(3) molecular size and binding specificities of proteins to the column matrix
(4) net negative charge on the separating proteins in the mixture as against the net positive charge on the solid matrix

25. The electrophoretic mobility (μ) of a protein in the polyacrylamide gel during electrophoresis

- (1) is a function of its molecular weight
- (2) is a function of its size and shape
- (3) can be expressed as $\mu = f/z$, where f is frictional coefficient and z is net charge of the molecule
- (4) depends on pH of the running buffer

26. Gas liquid chromatography can be used to separate mixtures of

- (1) lipids of different polarity
- (2) volatile lipid derivatives
- (3) lipids, which can bind covalently with the inert gas in the column.
- (4) neutral lipids, which can readily be extracted in volatile solvents, like chloroform or ether

27. Beer and Lambert rule may be mathematically expressed as

- (1) $A = \log_{10} I/I_0 = \epsilon cl$
- (2) $A = \log_{10} I_0/I = \epsilon cl$
- (3) $A = \log_{10} c/l = \epsilon I_0/I$
- (4) $A = \log_{10} I/I_0 = cl$

28. The unit of velocity constant for second-order reaction is

- (1) $\text{lit mole}^{-1} \text{sec}^{-1}$
- (2) $\text{mole lit}^{-1} \text{sec}$
- (3) $\text{mole lit}^{-1} \text{sec}^{-1}$
- (4) mole sec^{-1}

29. The half-life (50%) of a reaction is 5 min. The fraction of the reaction completed in 10 min would be

- (1) 20%
- (2) 25%
- (3) 30%
- (4) 40%

30. According to Baeyer's strain theory, which of the following is stable?
- (1) Cyclopropane (2) Cyclobutane (3) Cyclopentane (4) Cyclohexane
31. Coacervates are simple laboratory produced structures that seem to possess some living attributes, such as can grow, maintain its individuality and divide. Which of the following represent above coacervates?
- (1) They occur when dispersed colloidal particles separate spontaneously out of solution into droplets
- (2) They generally possess simple and long lasting form
- (3) These are small spheres formed when the thermally produced proteinoids were boiled in water and allowed to cool
- (4) These are bounded by double membranes that appear somewhat cell like and can undergo fission and budding
32. First vertebrates and first land plants appeared during
- (1) Ordovician (2) Silurian (3) Devonian (4) Cambrian
33. In the enveloped viruses, capsid is made up of
- (1) lipid bilayer derived from host and proteins encoded by viral genome
- (2) the lipid bilayer and proteins both are derived from the host
- (3) the proteins derived from the host but lipid bilayer is of viral origin
- (4) both protein and lipid bilayer which are synthesized by the viral itself
34. *Streptococci* and *Salmonella* are
- (1) Gram positive bacteria, having two membranes separated by periplasmic space
- (2) Gram negative bacteria having single membrane and a thick cell wall of peptidoglycan
- (3) Gram positive and Gram negative bacteria, respectively
- (4) Gram negative and Gram positive bacteria, respectively

- 35.** Dictyosomes are
- (1) class of ribosomes
 - (2) place of flagella fixation
 - (3) respiratory granules
 - (4) Golgi bodies
- 36.** Cellulose and hemicellulose, which are constituents of cell wall, are synthesized by
- (1) lysosomes
 - (2) microbodies
 - (3) smooth EPR
 - (4) Golgi apparatus
- 37.** In a fern
- (1) gametophyte is dependent on sporophyte
 - (2) sporophyte is dependent on gametophyte
 - (3) both gametophyte and sporophyte are independent
 - (4) both sporophyte and gametophyte are dependent on each other
- 38.** Well-developed archegonium with neck consisting of a row of 4-6 neck canal cells characterizes
- (1) gymnosperm and flowering plant
 - (2) bryophytes and pteridophytes
 - (3) gymnosperm only
 - (4) pteridophytes and gymnosperm
- 39.** In relation to carbon fixation or Calvin cycle, which of the following is incorrect?
- (1) 3 molecules of CO_2 are converted into one molecule of glyceraldehyde-3-phosphate at the net cost of 9 moles of ATP and 6 moles of NADPH
 - (2) 3 molecules of CO_2 are fixed in the presence of 3 moles of ribulose-1,5-bisphosphate to produce 6 molecules of 3-phosphoglycerate which ultimately regenerate 3 molecules of ribulose-1,5-bisphosphate in a cyclic reaction
 - (3) Conversion of 3 molecules of CO_2 into 1 molecule of glyceraldehyde-3-phosphate requires net consumption of 6 moles of ATP and 9 moles of NADPH
 - (4) In the first step of this cyclic reaction, two precursor molecules of a total of 18 carbon atoms give an end product of 3 carbon atoms and regenerate the precursor of carbon atoms to be reutilized

40. Chloroplasts in general resemble mitochondria in many features, *except*
- (1) in the process of energy inter-conversion
 - (2) in having functionally similar outer and inner membranes, and intermediate space
 - (3) in the presence of cristae which contain electron transport chains
 - (4) in having double-stranded circular DNA (genome) of their own
41. Excess of ATP is known to inhibit the rate of respiration by inhibiting which one of the following?
- | | |
|-------------------------|---------------------------|
| (1) Aldolase | (2) Hexokinase |
| (3) Phosphofructokinase | (4) Pyruvic decarboxylase |
42. Which of the following statements is correct?
- (1) Nitrate reductase is a metalloflavoprotein
 - (2) Nitrate reductase catalyses the reduction of nitrate to nitrite
 - (3) Nitrate reductase is an inducible enzyme
 - (4) All of the above
43. The source of energy for non-biological nitrogen fixation is
- (1) by reduction of proteins to ammonia
 - (2) by oxidation of ammonia to protein
 - (3) by ionizing events such as lightening and effect of cosmic rays
 - (4) ferridoxin enzyme and nitrogenase

49. Streptomycin and Cycloheximide antibiotics are produced by
- (1) *Streptomyces caespitosus*
 - (2) *S. erythreus*
 - (3) *S. griseus*
 - (4) *S. virginiae*
50. The greatest evolutionary change that enabled the land vertebrate to be completely free from water was the development of
- (1) four appendages
 - (2) lungs
 - (3) four-chambered heart
 - (4) cleidoic egg
51. Epiboly is the process of
- (1) formation of small slit-like invagination upon grey crescent
 - (2) rotation of gastrula within vitelline membrane so that animal pole becomes anterior
 - (3) mass migration of cells from animal hemisphere, so that upper micromeres migrate over the edge of dorsal lip, roll inside and are tucked beneath outer layer
 - (4) overgrowth when micromeres divide rapidly and spread downward over megameres, except at yolk plug
52. Steroid hormones transmit their information by
- (1) stimulating the receptors present on cell membrane
 - (2) entering into the cell and modifying cellular contents
 - (3) entering into the cell and modifying nuclear organization
 - (4) the help of an intracellular second messenger
53. The most recent ancestor of *Homo sapiens* who evolved in the late Pleistocene is
- (1) *Homo erectus*
 - (2) *H. Neanderthalensis*
 - (3) *H. Patilis*
 - (4) *Australopithecus afarensis*

- 54.** The 'single origin hypothesis' or 'out of Africa' model of origin of modern human from its *Homo erectus* ancestor is supported by the fact that
- (1) all the non-African nuclear genome sequences are variants of the African sequences
 - (2) all the African mitochondrial DNA sequences are variants of non-African sequences
 - (3) all the African nuclear genome sequences are variants of non-African nuclear genome sequences
 - (4) most mitochondrial DNA sequence variability were among African population, hence are the oldest and the non-African populations are derived from them
- 55.** The common myeloid progenitor cells divide further to produce differentiated cell types, like
- (1) NK cells and dendritic cell
 - (2) T-cell and B-cell
 - (3) monocytes, neutrophil and dendritic cells
 - (4) erythrocyte, B cells and NK cells
- 56.** Sickling of RBC results
- (1) from a dominant mutation in β -globin chain and hence heterozygotes show the phenotype
 - (2) when haemoglobin from sickle cells is deoxygenated, it becomes insoluble and forms polymers of tubular fibres, which gives deformed state of RBC
 - (3) from the substitution of a Val residue with Glu at 6th amino acid portion in the β -globin chain, which creates a 'sticky' hydrophobic contact point leading to the formation of fibrous aggregates, characteristics of the sickle cell trait
 - (4) people carrying sickle cell trait also deficient in resistant to lethal form of malaria

- 60.** For the protection of placenta from the attack by maternal NK cells, expression of which of the following is required?
- (1) Paternal MHC (HLA) genes in the fetus
 - (2) Maternal MHC (HLA) genes in the *maternal circulation*
 - (3) HLA-G molecules (MHC class Ib) on the placental trophoblast cells
 - (4) HLA-E (MHC class Ib) on the trophoblast cells
- 61.** One of the following is not true about cell theory
- (1) Cell theory states that all living organisms are composed of cells and cell products
 - (2) The term cell was first used by Robert Hooke (1655) and Swanson CP (1955)
 - (3) Robert Hooke coined the term 'cell' as a walled-in structure
 - (4) In 1674, Leeuwenhock discovered free cells and observed nucleus in some red blood cells
- 62.** Brown (1831) discovered that all cells have
- (1) nucleus
 - (2) mitochondria
 - (3) chromosomes in the nucleus
 - (4) nucleolus
- 63.** The modern version of the cell theory does not agree with one of the following
- (1) The properties of a given organism depend on those of its individual cells
 - (2) Cells are the morphological and physiological units of all living organisms
 - (3) All the living cells consist of membrane bound organelle and some of them have their own genetic material
 - (4) Cells originate only from other cells and its continuity is maintained through genetic material

- 64.** In most animal cells, the plasma membrane is covered by a cell coat, which is made of
- (1) starch, phospholipids and lipoproteins
 - (2) glycoproteins, glycolipids and polysaccharides
 - (3) lipid bilayer with cholesterol embedded inside
 - (4) triglycerides, cholesterol and microtubular proteins
- 65.** One of the important characteristics of eukaryotic cells is
- (1) the double membrane structures are unique to eukaryotic cells, all, perform different functions
 - (2) plasma membrane and cell wall are the only components of animal cell membrane, both perform the same function
 - (3) all cells have a fixed shape irrespective of cell type, which is maintained by the cytoskeletal system
 - (4) the volume of a cell of a given cell type varies proportionately with size of the organism
- 66.** Which of the following statements is not correct?
- (1) Cytoskeletal elements are present in eukaryotic cell, but absent in prokaryotes
 - (2) Streaming, endocytosis and exocytosis occur only in eukaryotic cells, but not in prokaryotic cells
 - (3) The circular DNA molecule in cytosol is present only in prokaryotic cells, but not in eukaryotic cells
 - (4) The first eukaryotic cell on earth evolved more than 3 billion years ago
- 67.** Membranes of the following two organelles are contiguous
- | | |
|-------------------------------|------------------------|
| (1) ER and Golgi | (2) nucleus and ER |
| (3) Golgi and plasma membrane | (4) Golgi and lysosome |

68. Of the following statements about Golgi complex :

- I. It contains a series of stacked internal cisternae
- II. It is a polar organelle with *cis*-face close to ER and *trans*-face close to plasma membrane
- III. It contains the same enzymes in all its parts
- IV. It is the site of modification of oligosaccharides

Which is/are correct?

- (1) I only (2) II and III (3) I, II and III (4) I, II and IV

69. Which one of the following enzymes does not occur in the lysosome?

- (1) Phosphatase (2) Lipase (3) Protease (4) Polymerase

70. Which one of the following is a correct statement?

- (1) Lysosomes originate from Golgi apparatus
- (2) Lysosomal enzymes are synthesized in ribosome present on ER
- (3) Lysosome are polymorphic and heterogenous organelles .
- (4) All of the above

71. Which one of the following is not the function of ER ?

- (1) Electron transport
- (2) Fatty acid desaturation
- (3) Glycosylation of proteins during translation
- (4) Glycogen breakdown

72. Which type of junctions may protect a damaged cell through chemical gating?

- (1) Tight (2) Gap (3) Adherens (4) Occluding

73. The function of mitotic spindle during cell division is

- (1) in the formation of spindle fibres
(2) to keep the chromosomes in position and distribute them between daughter cells
(3) in moving chromosomes to their respective poles from the centre
(4) All of the above

74. During DNA metabolism in meiosis, the period from zygonema to pachynema is

- (1) a phase of DNA synthesis
(2) a phase of DNA replication
(3) a phase of DNA repair type
(4) a phase of DNA replication and repair type

75. During which phase of meiosis crossing-over usually occurs?

- (1) Prophase I (2) Prophase II (3) Telophase I (4) Telophase II

76. The random assortment of genes occurs due to

- (1) crossing-over
(2) random distribution of chromosomes in the first meiotic division
(3) both (1) and (2)
(4) Neither (1) nor (2)

- 77.** Mitosis occurs in the fertilized egg during
- (1) formation of trophoblast
 - (2) cleavage
 - (3) placentation
 - (4) decidualization
- 78.** A tetraploid organism whose species normally has 40 chromosomes per cell will cause the organism's somatic cell to contain how many chromosomes?
- (1) 10
 - (2) 20
 - (3) 40
 - (4) 80
- 79.** The permeability of the lipid bilayer to specific inorganic ions can be increased by
- (1) V-type ATPases
 - (2) M-type ATPases
 - (3) Ionophores
 - (4) ABC transporters
- 80.** Among the following mechanisms of active membrane transport which one is incorrect?
- (1) Coupled carrier
 - (2) ATP-driven pump
 - (3) Light-driven pump
 - (4) Voltage gated cationic channels
- 81.** Proteins, which interact with the solute to be transported weakly and form aqueous pores, extending across the lipid bilayer, are called
- (1) channel proteins
 - (2) carrier proteins
 - (3) Ionophores
 - (4) symporters
- 82.** In a typical mammalian cell
- (1) Na^+ concentration inside is higher than K^+ concentration
 - (2) K^+ concentration inside is higher than Na^+ concentration
 - (3) Cl^- concentration inside is higher than K^+ concentration
 - (4) Cl^- concentration inside is higher than Na^+ concentration

- 83.** The flow of an ion through a membrane channel protein is accomplished by the electrochemical gradient, generated by
- (1) favourable free energy change
 - (2) voltage gradient and concentration gradient
 - (3) an unfavourable free energy change
 - (4) None of the above
- 84.** A membrane potential arises when
- (1) a slight excess of negative charge on positive charge on one side
 - (2) excess of positive charge over negative charge on both sides
 - (3) electrical charge on both sides is equal
 - (4) electric charge on both sides of membrane is different
- 85.** Which of the following is common to both *E. coli* and eukaryotic chromosomes?
- (1) DNA is circular
 - (2) DNA is negatively supercoiled
 - (3) DNA is contained in the nucleus
 - (4) DNA is packaged into nucleosomes
- 86.** Which of the following statements about histones is incorrect?
- (1) They are highly basic because they contain many positively charged amino acid side chains
 - (2) They are extensively modified after their translation
 - (3) In combination with DNA, they are the primary constituents of chromatin
 - (4) They account for approximately one-fifth of the mass of the chromosome

- 87.** Which class of DNA would be expected to have the most rapid rate of renaturation (reassociation) ?
- (1) Single-copy DNA
 - (2) Pseudogenes
 - (3) Simple sequence DNA
 - (4) Small multigene families
- 88.** A woman with normal vision but with colour-blind father marries a colour-blind man. The fourth child of the couple is a boy. The boy
- (1) may or may not be colour-blind
 - (2) must be colour-blind
 - (3) must have normal vision
 - (4) will be partially colour-blind due to being heterozygous
- 89.** Mendel did not find recombination and crossing-over as
- (1) traits he chose were either present on different chromosomes or were far apart
 - (2) traits chosen by him were not influenced by genes
 - (3) he selected only pure types
 - (4) All of the above
- 90.** A 12-year old boy develops a disorder also present in his father. No one else in the family is known to be affected. Which of the following modes of inheritance is least likely?
- (1) Autosomal recessive
 - (2) Autosomal dominant
 - (3) X-linked recessive
 - (4) Y-linked

91. In 1909, Carl Correns observed the leaves of variegated four O'clock plants showing patches of green and white tissues while same branches had only green or white leaves. He explained this to be due to
- (1) gene mutation in the gene for chloroplast pigment synthesis
 - (2) genetic polymorphism in the chloroplast gene
 - (3) cytoplasmic pattern of inheritance
 - (4) incomplete penetrance
92. In yeast, *Neurospora*, a mitochondrial mutation called 'petite' when crossed with wild type, none, none of the progenies were found petite, representing an example of
- (1) neutral petite
 - (2) quantitative inheritance
 - (3) Mendelian segregation
 - (4) suppressive petite
93. The chloroplast genome
- (1) is of the size ranging from 120–200 Kb in different plant species
 - (2) is equal in size to that of mitochondrial genome
 - (3) is a linear DNA molecule
 - (4) has its own genetic code
94. In respect to mitochondrial inheritance
- (1) sperm does not typically contribute mitochondria to offspring but the ovum does
 - (2) mitochondrial DNA chromosomes are circular and do not recombine
 - (3) no children of affected father will have it
 - (4) both sexes are affected

95. Which one of the following statements is correct?

Crossing-over within the inversion loop of

- (1) heterozygote pericentric inversion produces duplication and deficiency
- (2) heterozygote pericentric inversion produces dicentric bridge and centric fragments
- (3) heterozygote pericentric inversion produces all the normal gametes
- (4) heterozygote pericentric inversion produces dicentric bridge and acentric fragments

96. The garden pea (*Pisum sativum*) has 14 chromosomes in each of its body cells. The number of linkage groups expected in the species is

- (1) less than 7
- (2) 7
- (3) between 7 and 14
- (4) 14

97. If two loci are 10 map units apart, assuming that no multiple cross-over has taken place, what proportion of the cells undergoing meiosis will contain a single cross-over in the region between these two loci?

- (1) 10%
- (2) 20%
- (3) 30%
- (4) 40%

98. If, in *Neurospora*, the progenies of the cross between an Orange colonial strain and Albino spreading strain segregated into 1:1:1:1 ratio of Albino spreading : Orange colonial : Normal : Albino colonial, then the inference is that the traits are controlled by

- (1) single gene
- (2) two genes
- (3) three genes
- (4) four genes

99. The cross-over percentages between linked genes J and M is 20%, J and L is 35%, J and N is 70%, L and K is 15%, M and N is 50% and M and L is 15%. Thus the sequence of genes on the chromosome is

- (1) JNMLK
- (2) JMLNK
- (3) JMLKN
- (4) MJLKN

- 100.** If a chiasma forms between the loci of genes A and B in 20% of the tetrads of an individual of genotype AB/ab, the percentage of gametes expected to be Ab is
- (1) 40 (2) 20 (3) 10 (4) 5
- 101.** Two linked genes a and b show 20% recombination. The individuals of a dihybrid cross between ++/++ \times ab/ab shall show one of the following gametes
- (1) ++ 80 : ab 20 (2) ++ 50 : ab 50
 (3) ++ 40 : ab 40 : +a 10 : +b 10 (4) ++ 30 : ab 30 : +a 20 : +b 20
- 102.** The first correct counting of human chromosome number being 46 was given by
- (1) Painter in 1923 (2) Blakeslee and Eigsti in 1936
 (3) Hsu in 1952 (4) Tjio and Levan in 1956
- 103.** The discovery of QM fluorescence banding was made by
- (1) Latt SA (1973) (2) Caspersen, Zech and Johanson (1970)
 (3) Makino S (1975) (4) Ohno S (1967)
- 104.** The standard system of chromosome nomenclature was published by ISCN (1995), which stands for
- (1) International Society for Chromosome Nomenclature
 (2) International System of Chromosome Nomenclature
 (3) International System for Human Cytogenetic Nomenclature
 (4) Indian Society for Chromosome Nomenclature

- 105.** The characteristics of G-bands and R-bands are
- (1) that both are GC rich regions and stain dark with Giemsa dye
 - (2) G-bands are AT rich regions and stains dark with Giemsa while R-bands are GC rich and stains light with Geimsa
 - (3) R-bands are Q-positive while G-bands are Q-negative
 - (4) R-bands are early replicating while R-bands are late replicating
- 106.** A change in DNA that creates UAA codon at a site previously occupied by another codon would result in one of the following mutations
- (1) Amber
 - (2) Ochre
 - (3) Opal
 - (4) Polar
- 107.** Thymine dimer is formed during DNA replication by exposure to
- (1) Gamma radiation
 - (2) UV radiation
 - (3) X-rays
 - (4) Beta radiation
- 108.** Four mutant proteins have been generated suing site directed mutagenesis. Which one of the following mutants has the largest difference in terms of number of atoms between wild type and the mutant?
- (1) Ser → Cys
 - (2) Tyr → Phe
 - (3) Lys → Ala
 - (4) Arg → Lys
- 109.** Ethidium bromide acts by
- (1) substituting adenine by its structural analogue
 - (2) chemical modification of base
 - (3) production of cross-linked DNA
 - (4) intercalating between DNA bases interfering proper base stacking

- 110.** In reference to Mendelian law of independent assortment, in a test cross, the two recombinant classes always make up
- (1) 25% (1/4) of all the progeny
 - (2) 50% (1/2) of all the progeny
 - (3) 100% progeny
 - (4) No recombinant classes
- 111.** The human α -globin and β -globin gene clusters are located on
- (1) locus 16p13.3 and locus 11p15.5, respectively
 - (2) locus 9p13.3 and locus 11p15.5, respectively
 - (3) locus 16p13.3 and locus 9p13.3, respectively
 - (4) locus 11p15.5 and locus 16p13.3, respectively
- 112.** The first human genetic maps were mostly based on
- (1) RFLP
 - (2) minisatellites
 - (3) microsatellites
 - (4) SNPs
- 113.** The first high resolution maps of the human genome were
- (1) based on clone counting and STS markers
 - (2) prepared by using radiation hybrids
 - (3) prepared by using somatic cell hybrid mapping
 - (4) using SNP arrays
- 114.** Comparative Genomic Hybridization (CGH) is
- (1) simultaneous painting of chromosomes in two different colours using whole genome DNA probes from two different sources
 - (2) the use of fluorochrome labelled DNA probes to hybridize with chromosomes prepared from two different cell types to compare homology
 - (3) the use of multicoloured DNA probes to simultaneously hybridize with metaphase chromosomes from different sources
 - (4) used to karyotype human chromosome for clinical diagnosis of chromosomal aberrations

- 115.** Robertsonian translocation is a type of chromosomal abnormality found in many genetic diseases. It occurs due to
- (1) exchange of centric and acentric fragments of two chromosomes
 - (2) exchange of two acentric fragments of any two chromosomes
 - (3) exchange in proximal short arms of any two chromosomes
 - (4) balanced X-autosome translocation
- 116.** A trisomy or monosomy may result due to
- (1) anaphase lag
 - (2) non-disjunction
 - (3) metaphase block
 - (4) mosaic
- 117.** Following human chromosomes carry a small knob of chromatin called satellites
- (1) chromosome numbers 6, 7, 13, 14, 20 and 21
 - (2) chromosome numbers 13, 14, 15, 21 and 22
 - (3) chromosome numbers 13, 15, 18, 19 and X
 - (4) chromosome numbers 7, 13, 15, 20 and 22
- 118.** Cri du Chat (Cat cry) syndrome occurs as a result of
- (1) deletion of $5p^{15.2-15.3}$
 - (2) deletion of $4p^{15.2-15.3}$
 - (3) deletion of $5p^{13.2-13.3}$
 - (4) deletion of $4p^{13.2-13.3}$
- 119.** The human nuclear genome consists of 24 linear double stranded DNA molecules equivalent to the size of
- (1) 3200 Mb and about 30000 genes
 - (2) 3350 Mb and about 30000 genes
 - (3) 3000 Mb and 30000 genes
 - (4) 3000 Mb and 25000 genes
- 120.** The human mitochondrial genome is a double stranded circular DNA of
- (1) 16.1 Kb and 37 genes
 - (2) 16.6 Kb and 37 genes
 - (3) 17.2 Kb and 37 genes
 - (4) 16.4 Kb and 32 genes

- 121.** Which statement about Down's syndrome is false?
- (1) The frequency increases dramatically in mothers over the age of 40
 - (2) Affected individuals have an extra autosome
 - (3) The long time lag between onset of meiosis in ovarian tissue (during fetal development) and its completion (at ovulation) is most likely the reason for increased incidence in older mothers
 - (4) None, all statements are true
- 122.** Two individuals who both have achondroplasia (autosomal dominant) mate. What is the occurrence risk for this disorder in their offspring?
- (1) 0.5 (2) 0.25 (3) 0.75 (4) 1.0
- 123.** Which of these factors might influence the creation of translocation known to cause chronic myelogenous leukemia and Burkitt's lymphoma?
- (1) The sites of translocation show a lower frequency of breakage than other chromosomal sites
 - (2) Sites on non-homologous chromosomes may have enough similarity of sequence to stimulate 'semi-homologous recombination'
 - (3) Sister chromatid exchange can occur during mitosis
 - (4) All of these
- 124.** Which of the following observations is most conclusive that Gaucher disease is inherited in an autosomal recessive pattern?
- (1) Brothers David and Joshua are both affected with Gaucher disease
 - (2) Mom has no family history of Gaucher disease
 - (3) Mom and Dad are both unaffected with Gaucher disease
 - (4) The boys experience different severities of the disease

- 125.** Jeremy's grandfather, uncle and sister all have been diagnosed with the same genetic disorder. The most likely pattern of inheritance for this disorder is
- (1) autosomal dominant, since it is present in all 3 generations
 - (2) autosomal recessive, since Jeremy's parents are unaffected
 - (3) X-linked recessive, since it affects more males than females
 - (4) You cannot determine the pattern of inheritance from this information
- 126.** Why are males more likely to exhibit an X-linked recessive trait than females?
- (1) Most genes on the X-chromosome are not shared with the Y
 - (2) Male sex hormones affect expression of genes from the X-chromosome
 - (3) X-linked traits tend to control male secondary sexual development
 - (4) All of these
- 127.** Which of the following is a basic amino acid?
- (1) Lysine
 - (2) Glycine
 - (3) Alanine
 - (4) Tyrosine
- 128.** What is the fate of N-part of amino acids after metabolism?
- (1) Excreted through urine
 - (2) Excreted through faeces
 - (3) Both (1) and (2)
 - (4) None of the above
- 129.** Which of the following is a cofactor?
- (1) NAD
 - (2) NADP
 - (3) Mg^{++}
 - (4) All of the above
- 130.** Which of the following enzyme is a lyase?
- (1) Decarboxylases
 - (2) Peroxidases
 - (3) Transaminases
 - (4) Lipases
- 131.** Zymase are enzymes which
- (1) secreted ready for action
 - (2) needs hydrolysis to act
 - (3) needs phosphorylation to act
 - (4) None of the above

132. Alpha and Beta anomers are

- (1) —OH group at C-1 on the right and left positioned
- (2) —OH group at C-1 on the left and right positioned
- (3) levorotatory or dextrorotatory
- (4) None of the above

133. The reduction product of fructose is

- (1) Sorbitol
- (2) Mannitol
- (3) Dulcitol
- (4) Mannitol and Sorbitol

134. What are the stimulators of glycogenesis?

- (1) Insulin
- (2) Glucocorticoids
- (3) Glucose
- (4) All of the above

135. Which of the following is not a phospholipid?

- (1) Lecithin
- (2) Cephalin
- (3) Phosphatidyl serine
- (4) Cerebrosides

136. Which of the following is monounsaturated fatty acids?

- (1) Palmitoleic acid
- (2) Oleic acid
- (3) Both (1) and (2)
- (4) None of the above

137. Which of the following is true for prostaglandins?

- (1) They cause vasodilation
- (2) Decrease blood pressure
- (3) Used as contraceptives
- (4) All of the above

- 138.** The first reaction of the citric acid cycle, which generates citrate, is
- (1) a condensation reaction
 - (2) an oxidative decarboxylation reaction
 - (3) dehydrogenation reaction
 - (4) a dehydration reaction
- 139.** The F_0 complex of mitochondrial ATP synthase
- (1) contains an oligomycin-sensitive proton pore
 - (2) synthesizes ATP
 - (3) pumps protons into the mitochondrial matrix
 - (4) is a peripheral membrane protein
- 140.** Which of the following is true about the differences between the structure of B-form DNA (Watson-Crick DNA) and that of A-form and Z-form DNA ?
- (1) A-form DNA is most stable structure under physiological conditions
 - (2) Unlike B-form DNA, the structure of Z-form DNA is a left-handed helix
 - (3) Compared to B-form DNA, Z-form DNA has a wider helix and the helical rise is shorter
 - (4) The A-form is favoured in solutions that are highly hydrated
- 141.** Which of the following is true about all topoisomerases?
- (1) They relax DNA
 - (2) They underwind DNA
 - (3) They change the number of twists (Tw)
 - (4) They catalyze the breaking and resealing of phosphodiester bonds

- 142.** Which of the following is true about DNA supercoiling?
- (1) Supercoiled DNA is in its relaxed state
 - (2) Only closed-circular DNA molecules can be supercoiled
 - (3) Supercoiled circular DNA molecules, when purified and freed from cellular proteins, will lose their supercoiling
 - (4) DNA is supercoiled when the axis of DNA double helix is coiled on itself
- 143.** If the *E. coli* cells are grown in a medium containing both glucose and lactose, what is likely to happen?
- (1) Both the sugars would be utilized simultaneously
 - (2) The culture will exhibit synchronous growth
 - (3) Lactose will be utilized first followed by glucose
 - (4) Glucose will be utilized followed by lactose
- 144.** Enhancer elements are known to increase the rate of transcription when present at the upstream side of the promoter sequences. If the same enhancer element is placed in reverse orientation
- (1) the rate of transcription increases as compared to upstream side
 - (2) the rate of transcription decreases as compared to upstream side
 - (3) the rate of transcription remains same as compared to upstream side
 - (4) No transcription is observed
- 145.** In eukaryotic transcription by RNA polymerase II, formation of pre-initiation complex
- (1) begins with the binding of TBP to the TATA box of the promoter
 - (2) involves the ordered addition of several transcription factors and the RNA polymerase
 - (3) allows an ATP-dependent opening of the two strands of DNA
 - (4) All of the above are correct

- 146.** In *E. coli*, attenuation and anti-termination utilize which structure?
- (1) Stem loop structures in RNA (2) Stem loop structures in DNA
(3) RNA/DNA hybrids (4) Differential protein folding
- 147.** Which of the following is characteristic of eukaryotic transcription but not prokaryotic transcription?
- (1) Transcription and translation are coupled
(2) There is one form of RNA polymerase
(3) RNA polymerase II is responsible for synthesis of mRNA
(4) RNAs can be polycistronic
- 148.** A restriction enzyme with a four-base recognition site would cleave DNA with a statistical frequency of once every
- (1) 256 bp (2) 4 bp (3) 4096 bp (4) 65.5 Kb
- 149.** Transgenic plants are easier to produce than transgenic animals because
- (1) plants can more easily be grown from single cultured cell into which foreign DNA has been introduced
(2) plant DNA is easier to clone
(3) plant cells can be transformed by bacterial infection
(4) DNA passes more readily through the plant cell wall than through the animal cell membrane
- 150.** A DNA sample when it is diluted by a factor of 100 gives an optical density reading at 260 nm of 0.369. Assuming 50 µg/ml of DNA gives an absorbance reading of 1, the concentration of the original DNA sample is
- (1) 36.9 µg/ml (2) 1845 µg/ml (3) 36900 µg/ml (4) 184.5 µg/ml

अभ्यर्थियों के लिए निर्देश

(इस पुस्तिका के प्रथम आवरण-पृष्ठ पर तथा उत्तर-पत्र के दोनों पृष्ठों पर केवल नीली या काली बाल-प्वाइंट पेन से ही लिखें)

1. प्रश्न पुस्तिका मिलने के 10 मिनट के अन्दर ही देख लें कि प्रश्नपत्र में सभी पृष्ठ मौजूद हैं और कोई प्रश्न छूटा नहीं है। पुस्तिका दोषयुक्त पाये जाने पर इसकी सूचना तत्काल कक्ष-निरीक्षक को देकर सम्पूर्ण प्रश्नपत्र की दूसरी पुस्तिका प्राप्त कर लें।
2. परीक्षा भवन में लिफाफा रहित प्रवेश-पत्र के अतिरिक्त, लिखा या सादा कोई भी खुला कागज साथ में न लायें।
3. उत्तर-पत्र अलग से दिया गया है। इसे न तो मोड़ें और न ही विकृत करें। दूसरा उत्तर-पत्र नहीं दिया जायेगा, केवल उत्तर-पत्र का ही मूल्यांकन किया जायेगा।
4. अपना अनुक्रमांक तथा उत्तर-पत्र का क्रमांक प्रथम आवरण-पृष्ठ पर पेन से निर्धारित स्थान पर लिखें।
5. उत्तर-पत्र के प्रथम पृष्ठ पर पेन से अपना अनुक्रमांक निर्धारित स्थान पर लिखें तथा नीचे दिये वृत्तों को गाढ़ा कर दें। जहाँ-जहाँ आवश्यक हो वहाँ प्रश्न-पुस्तिका का क्रमांक तथा सेट का नम्बर उचित स्थानों पर लिखें।
6. ओ० एम० आर० पत्र पर अनुक्रमांक संख्या, प्रश्न-पुस्तिका संख्या व सेट संख्या (यदि कोई हो) तथा प्रश्न-पुस्तिका पर अनुक्रमांक सं० और ओ० एम० आर० पत्र सं० की प्रविष्टियों में उपरिलेखन की अनुमति नहीं है।
7. उपर्युक्त प्रविष्टियों में कोई भी परिवर्तन कक्ष निरीक्षक द्वारा प्रमाणित होना चाहिये अन्यथा यह एक अनुचित साधन का प्रयोग माना जायेगा।
8. प्रश्न-पुस्तिका में प्रत्येक प्रश्न के चार वैकल्पिक उत्तर दिये गये हैं। प्रत्येक प्रश्न के वैकल्पिक उत्तर के लिये आपको उत्तर-पत्र की सम्बन्धित पंक्ति के सामने दिये गये वृत्त को उत्तर-पत्र के प्रथम पृष्ठ पर दिये गये निर्देशों के अनुसार पेन से गाढ़ा करना है।
9. प्रत्येक प्रश्न के उत्तर के लिये केवल एक ही वृत्त को गाढ़ा करें। एक से अधिक वृत्तों को गाढ़ा करने पर अथवा एक वृत्त को अपूर्ण भरने पर वह उत्तर गलत माना जायेगा।
10. ध्यान दें कि एक बार स्याही द्वारा अंकित उत्तर बदला नहीं जा सकता है। यदि आप किसी प्रश्न का उत्तर नहीं देना चाहते हैं, तो सम्बन्धित पंक्ति के सामने दिये गये सभी वृत्तों को खाली छोड़ दें। ऐसे प्रश्नों पर शून्य अंक दिये जायेंगे।
11. रफ़ कार्य के लिये प्रश्न-पुस्तिका के मुखपृष्ठ के अन्दर वाले पृष्ठ तथा अंतिम पृष्ठ का प्रयोग करें।
12. परीक्षा के उपरान्त केवल ओ०एम०आर० उत्तर-पत्र परीक्षा भवन में जमा कर दें।
13. परीक्षा समाप्त होने से पहले परीक्षा भवन से बाहर जाने की अनुमति नहीं होगी।
14. यदि कोई अभ्यर्थी परीक्षा में अनुचित साधनों का प्रयोग करता है, तो वह विश्वविद्यालय द्वारा निर्धारित दंड का/की, भागी होगा/होगी।