OCT-34226
Paper-II
LIFE SCIENCES

Series

A

Question Booklet Serial No. प्रश्नपत्रिका अनुक्रमांक

Signature and Name of Invigilator

1. (Signature) .....

   (Name) .....

2. (Signature) .....

   (Name) .....

Seat No. | | | | | | | | |
(In figures as in Admit Card)

Seat No. .....
(In words)

OMR Sheet No. | | | | | | |
(To be filled by the Candidate)

Time Allowed : 2 Hours] **[Maximum Marks : 200**

Number of Pages in this Booklet : **16** Number of Questions in this Booklet : **100**

Instructions for the Candidates

1. Write your Seat No. and OMR Sheet No. in the space provided on the top of this page.
2. This paper consists of **100** objective type questions. **Each** question will carry **two** marks. **All** questions of Paper II will be **compulsory**.
3. At the commencement of examination, the question booklet will be given to the student. In the first 5 minutes, you are requested to open the booklet and compulsorily examine it as follows :
   (i) To have access to the Question Booklet, tear off the paper seal on the edge of this cover page. **Do not accept a booklet without sticker-seal or open booklet.**
   (ii) Tally the number of pages and number of questions in the booklet with the information printed on the cover page. **Faulty booklets due to missing pages/questions or questions repeated or not in serial order or any other discrepancy should not be accepted and correct booklet should be obtained from the invigilator within the period of 5 minutes.** Afterwards, neither the Question Booklet will be replaced nor any extra time will be given. The same may please be noted.
   (iii) After this verification is over, the OMR Sheet Number should be entered on this Test Booklet.
4. Each question has four alternative responses marked (A), (B), (C) and (D). You have to darken the circle as indicated below on the correct response against each item.
   Example : where (B) is the correct response.
   (A) ● (C) (D)
   Following wrong methods should not be used as they are not recognised by scanning machine in digitized assessment. Candidate using such method will be responsible for their loss.

WRONG METHODS
(A) (B) (C) (D) (A) (B) (C) (D) (A) (●) (C) (D) (A) (B) (C) (D)

5. Your responses to the items are to be indicated in the OMR Sheet given inside the Booklet only. If you mark at any place other than in the circle in the OMR Sheet, it will not be evaluated.
6. Read instructions given inside carefully.
7. Rough Work is to be done at the end of this booklet.
8. If you write your Name, Seat Number, Phone Number or put any mark on any part of the OMR Sheet, except for the space allotted for the relevant entries, which may disclose your identity, or use abusive language or employ any other unfair means, you will render yourself liable to disqualification.
9. You have to return original OMR Sheet to the invigilator at the end of the examination compulsorily and must not carry it with you outside the Examination Hall. You are, however, allowed to carry the Test Booklet and duplicate copy of OMR Sheet on conclusion of examination.
10. **Use only Blue/Black Ball point pen.**
11. Use of any calculator or log table, etc., is prohibited.
12. There is no negative marking for incorrect answers.

विद्यार्थ्यांसाठी महत्त्वाच्या सूचना

1. परीक्षार्थींनी आपला आसन क्रमांक या पृष्ठावरील वरच्या कोपऱ्यात लिहावा. तसेच आपणांस दिलेल्या OMR उत्तरपत्रिकेचा क्रमांक त्याखाली लिहावा.
2. सदर प्रश्नपत्रिकेत **100** बहुविकल्प प्रश्न आहेत. प्रत्येक प्रश्नास **दोन** गुण आहेत. या प्रश्नपत्रिकेतील **सर्व** प्रश्न सोडविणे अनिवार्य आहे.
3. परीक्षा सुरू झाल्यावर विद्यार्थ्याला प्रश्नपत्रिका दिली जाईल. सुरुवातीच्या 5 मिनिटांमध्ये आपण सदर प्रश्नपत्रिका उघडून खालील बाबी अवश्य तपासून पहाव्यात :
   (i) प्रश्नपत्रिका उघडण्यासाठी प्रश्नपत्रिकेवर लावलेले सील उघडावे. **स्टीकर सील नसलेली किंवा सील उघडलेली प्रश्नपत्रिका स्वीकारू नये.**
   (ii) पहिल्या पृष्ठावर नमूद केल्याप्रमाणे प्रश्नपत्रिकेची एकूण पृष्ठे तसेच प्रश्नपत्रिकेतील एकूण प्रश्नांची संख्या पडताळून पहावी. **पृष्ठे कमी असलेली/कमी प्रश्न असलेली/ प्रश्नांचा चुकीचा क्रम असलेली किंवा इतर त्रुटी असलेली सदोष प्रश्नपत्रिका सुरुवातीच्या 5 मिनिटातच पर्यवेक्षकाला परत देऊन दुसरी प्रश्नपत्रिका मागवून घ्यावी.** त्यानंतर प्रश्नपत्रिका बदलून मिळणार नाही तसेच वेळही वाढवून मिळणार नाही याची कृपया नोंद घ्यावी.
   (iii) वरीलप्रमाणे सर्व पडताळून पाहिल्यानंतरच प्रश्नपत्रिकेवर ओ.एम.आर. उत्तरपत्रिकेचा क्रमांक लिहावा.
4. प्रत्येक प्रश्नासाठी (A), (B), (C) आणि (D) अशी चार विकल्प उत्तरे दिली आहेत. त्यातील योग्य उत्तराचा रकाना खाली दर्शविल्याप्रमाणे ठळकपणे काळा/निळा करावा.
   उदा. : जर (B) हे योग्य उत्तर असेल तर.
   (A) ● (C) (D)
   खालील चुकीच्या पद्धती वापरू नये, कारण डिजिटाइज्ड (Digitized) मूल्यांकनात स्कॅनिंग मशीन त्यांना ओळखत नाही. त्या पद्धती वापरून नुकसान झाल्यास त्यास विद्यार्थीच जबाबदार असतील.

चुकीची पद्धती
(A) (B) (C) (D) (A) (B) (C) (D) (A) (●) (C) (D) (A) (B) (C) (D)

5. या प्रश्नपत्रिकेतील प्रश्नांची उत्तरे **ओ.एम.आर. उत्तरपत्रिकेतच दर्शवावीत**. इतर ठिकाणी लिहिलेली उत्तरे तपासली जाणार नाहीत.
6. आत दिलेल्या सूचना काळजीपूर्वक वाचाव्यात.
7. प्रश्नपत्रिकेच्या शेवटी जोडलेल्या कोऱ्या पानावरच कच्चे काम करावे.
8. जर आपण ओ.एम.आर. उत्तरपत्रिकेवर नमूद केलेल्या ठिकाणाव्यतिरिक्त इतर कोठेही नाव, आसन क्रमांक, फोन नंबर किंवा ओळख पटेल अशी कोणतीही खूण केलेली आढळून आल्यास अथवा असभ्य भाषेचा वापर किंवा इतर गैरमार्गांचा अवलंब केल्यास विद्यार्थ्याला परीक्षेस अपात्र ठरविण्यात येईल.
9. परीक्षा संपल्यानंतर विद्यार्थ्याने मूळ ओ.एम.आर. उत्तरपत्रिका पर्यवेक्षकांकडे परत करणे आवश्यक आहे. तथापि, प्रश्नपत्रिका व ओ.एम.आर. उत्तरपत्रिकेची द्वितीय प्रत आपल्याबरोबर नेण्यास विद्यार्थ्यांना परवानगी आहे.
10. **फक्त निळ्या किंवा काळ्या बॉल पेनचाच वापर करावा.**
11. कॅलक्युलेटर किंवा लॉग टेबल वापरण्यास परवानगी नाही.
12. चुकीच्या उत्तरासाठी गुण कपात केली जाणार नाही.

Life Sciences

Paper II

Time Allowed : 120 Minutes] **[Maximum Marks : 200**

Note : This Paper contains **Hundred (100)** multiple choice questions. Each question carrying **Two (2)** marks. Attempt *All* questions.

1. What kind of growth pattern is observed when E.coli is grown in medium containing both glucose and lactose ?
   (A) Diauxic growth
   (B) Synchronous growth
   (C) Arithmetic growth
   (D) Linear growth

2. Which of the following is primarily a post-transcriptional regulatory mechanism ?
   (A) DNA methylation
   (B) RNA interference
   (C) Histone acetylation
   (D) Ubiquitination

3. Which one of the following genes of lac operon if mutated will be a dominant cis-acting mutation resulting in constitutive expression of the operon ?
   (A) lac Z
   (B) lac O
   (C) lac P
   (D) lac I

4. In which of the following unicellular eukaryotes, the nuclear envelope remains intact during cell division ?
   (A) Paramecium
   (B) Diatoms
   (C) Euglena
   (D) Chlamydomonas

5. Which of the following statements about meiosis II is *not* true ?
   (A) A spindle apparatus forms during prophase II.
   (B) Chromosomes are positioned along the metaphase plate in metaphase II.
   (C) At metaphase plate the two sister chromatids of each chromosome contain identical genetic material.
   (D) The sister chromatids of each chromosome separate and start moving towards opposite poles during anaphase II.

6. Which of the following is a unique feature of G-Protein Coupled Receptors (GPCRs) ?
   (A) They have a linear chain consisting of 7 stretches of 22-28 hydrophilic sequences
   (B) They have a linear chain consisting of 9 stretches of 22-28 hydrophobic conserved sequences
   (C) They have a linear chain consisting of 7 stretches of 22-28 hydrophobic conserved sequences
   (D) They have a linear chain consisting of 7 stretches of 22-28 conserved sequences

7. Which part of the brain acts as the primary master control center for regulating appetite, hunger and energy balance ?
   (A) Amygdala
   (B) Hippocampus
   (C) Hypothalamus
   (D) Cerebellum

8. Which type of cell specifically destroys viral infected body cells ?
   (A) Plasma cells
   (B) Cytotoxic T lymphocytes
   (C) Activated B lymphocytes
   (D) Phagocytic macrophages

9. In an Electrocardiogram (ECG), the P-wave represents
   (A) Atrial depolarization
   (B) Ventricular depolarization
   (C) Atrial repolarization
   (D) Ventricular repolarization

10. Which combination of volumes makes up the vital capacity ?
   (A) Inspiratory reserve volume + Expiratory reserve volume + Tidal volume
   (B) Inspiratory reserve volume + Tidal volume + Residual volume
   (C) Expiratory reserve volume + Residual volume
   (D) Inspiratory capacity + Residual volume

11. Which enzyme from the following serves as "fuel gauge" for the living cell ?
   (A) AMP-dependent protein kinase
   (B) AMP-independent protein kinase
   (C) Protein kinase A
   (D) GTP-utilizing protein kinase

12. In antibody engineering, the following technique is used for generating and screening desired antibody molecule.
   (A) Chemical modification of amino acid residues of antibody
   (B) Yeast two hybrid system
   (C) Phage-display system
   (D) Random amplified polymorphic DNA technique

13. Which of the process is *not* involved in developing antibody diversity in a natural process inside the body ?
   (A) Somatic hypermutation at the variable region of antibody molecule
   (B) Junctional diversity generated at the at joining the gene segments of an antibody molecule
   (C) Combinatorial diversity generated by selection of different gene segments during rearrangement
   (D) Exchange of gene segments between two cells by conjugation

14. Atopic individuals are prone to have hypersensitivity because of
   (A) High IgE level leading to type I hypersensitivity reaction
   (B) High amount of auto antibodies leading to type III hypersensitivity reactions
   (C) High amount of cell reacting antibodies leading to hemolysis of RBC
   (D) High amount of circulating immune complex leading to increased activation of complements

15. Which of the following families of TGF-β super family have seven conserved cysteine residues in their mature polypeptide ?
   (A) TGF-B
   (B) Nodal
   (C) BMP
   (D) Activin

16. Which of the following does *not* affect the calibration of molecular clock ?
    (A) Generation time of organisms
    (B) Species-specific differences in genomic content
    (C) Natural selection
    (D) Population density

17. Identify the correct sequence of Geological Time Scale.
    (A) Precambrian – Paleozoic – Mesozoic – Cenozoic
    (B) Precambrian – Mesozoic – Paleozoic – Cenozoic
    (C) Paleozoic – Precambrian – Mesozoic – Cenozoic
    (D) Paleozoic – Mesozoic – Cenozoic – Precambrian

18. The source of 'B' genome in hexaploid wheat (Triticum aestivum) is
    (A) Triticum monococcum
    (B) Triticum turgidum
    (C) Aegilops speltoides
    (D) Aegilops squarrosa

19. Which biological transformation of Xenobiotics releases CO_2 and H_2O as end products ?
    (A) Biotransformation
    (B) Co-dissimilation
    (C) Preferred degradation
    (D) Biomineralization

20. Which phytoremediation approach encompasses reduced mobility of contaminants through sorption onto plant root surfaces ?
    (A) Rhizodegradation
    (B) Phytovolatilization
    (C) Phytostabilization
    (D) Rhizofilteration

21. Wasteful hydrolysis of which nucleotide triphosphate results from simultaneous glycogen synthesis and breakdown ?
    (A) ATP
    (B) GTP
    (C) UTP
    (D) CTP

22. The enzyme that does not play any role in glycogen degradation is
    (A) Glucokinase
    (B) Glycogen phosphorylase
    (C) Phosphoglucomutase
    (D) Debranching enzyme

23. Which of the following cell organelles is *not* involved in the β-oxidation of fatty acids ?
    (A) Mitochondria
    (B) Peroxisomes
    (C) Glyoxysomes
    (D) Lysosomes

24. Name the coenzyme required for amino group transfer by aminotransferase in amino acid metabolism.
    (A) Pyridoxal phosphate
    (B) NAD+
    (C) TPP
    (D) Biotin

25. Which of the following polymers on hydrolysis yields only N-acetyl glucosamine ?
    (A) Peptidoglycan
    (B) Chitin
    (C) Hyaluronic acid
    (D) Heparin

26. Which of the following molecular marker is *not* able to discriminate between homozygous and heterozygous plants ?
    (A) RFLP
    (B) AFLP
    (C) SSR
    (D) SNP

27. Which light microscopy produces images of brightly illuminated objects on a black background to view cells growing in tissue culture ?
(A) Bright-field microscopy
(B) Dark-field microscopy
(C) Phase contrast microscopy
(D) Interference microscopy

28. If you use a t-test to compare the means of five samples, what will happen ?
(A) t-test is appropriate to compare more than two samples
(B) Chances of committing type I error increases
(C) Chances of committing type II error increases
(D) Chances of committing type I error decreases

29. Which of the following statements is true about sampling ?
(A) As the sample size increases, the sampling error decreases
(B) As the sample size increases, the sampling error also increases
(C) Sample size does not affect sampling error
(D) The sample size has no relationship with the sampling error

30. In NMR spectroscopy, the chemical shift of a proton is measured relative to an internal standard. Which of the following compound is used for this purpose in proton NMR spectroscopy ?
(A) Deuterium oxide
(B) Tetramethylsilane
(C) Chloroform
(D) Sodium chloride

31. Which of the following statements is *not* true for the hypostome of *Hydra* ?
(A) It does not produce any "head inhibition signal" that suppresses the formation of new organizing centers
(B) It is the only "self-differentiating" region of the *Hydra*
(C) It produces the head activation signal
(D) When transplanted, it can induce host tissue to form a second body axis

32. Senescent cells secrete inflammatory factors and they are collectively referred to as
(A) Stem-cell niche
(B) Death-inducing signalling complex
(C) Senescence-associated secretory phenotype (SASP)
(D) Apoptosome

33. In vertebrates, regulation of cell proliferation and migration in the same spatial plane is controlled by
(A) Wnt/β-catenin pathway
(B) Wnt/PCP pathway
(C) Wnt/Ca^{2+} pathway
(D) BMP pathway

34. What would be the effect of newt limb regeneration if more than 90% of the nerve supply is severed prior to amputation ?
(A) Regeneration will take place and form a limb with no nerve supply
(B) Apical ectodermal cap stimulates the growth of blastema by secreting FGF8, but regeneration does not occur
(C) Limb regeneration with nerve supply will take place
(D) Outgrowth will occur but the identity of the limb formed will be lost with no clear anterior-posterior polarity

35. Vascular differentiation in plants is regulated by
(A) Salicylic acid
(B) Jasmonic acid
(C) Auxin
(D) Gibberellic acid

36. Which of the following correctly distinguishes taeniasis (Taenia solium) from cysticercosis in terms of how each condition is acquired ?
(A) Taeniasis results from ingesting undercooked pork containing cysticerci ; cysticercosis results from ingesting T. solium eggs
(B) Both taeniasis and cysticercosis result exclusively from ingesting undercooked pork
(C) Taeniasis results from ingesting T. solium eggs, while cysticercosis results from ingesting undercooked beef
(D) Taeniasis results from ingesting undercooked sheep, while cysticercosis results from ingesting undercooked beef

37. Which of the following statements about Tiktaalik, a fish fossil considered as a crucial evolutionary link between fish and tetrapods, is *not* true ?
(A) It had fins, gills and lungs
(B) The body was covered with scales
(C) It had wrist, neck and a full set of ribs to support air breathing
(D) Its pelvis and rear fins were similar to those found in fish

38. Which of the following phyla have hemocoel with highly reduced coelom ?
(A) Nematodes
(B) Annelids
(C) Arthropods
(D) Echinoderms

39. Which of the following pairs is correct ?
(A) Praire – Argentina
(B) Steppe – South Africa
(C) Downs – Australia
(D) Pampas – Russia

40. Which of the following atmospheric gases are taken by the producers and decomposers in an ecosystem ?
(A) O_2 and CO_2
(B) CO_2 and NO_2
(C) CO_2 and O_2
(D) NO_2 and CO_2

41. In the famous Griffith experiment, different combinations of Streptococcus pneumoniae were injected to mice. Injection of which of the following leads to death of mice ?
(A) Living S cell
(B) Heat killed S cells
(C) Living R cells
(D) Heat killed R cells

42. Initiation of protein synthesis in bacteria includes pairing of 'Shine-Dalgarno' sequence on mRNA with
(A) 3′ end of 23S rRNA
(B) 5′ end of 23S rRNA
(C) 3′ end of 16S rRNA
(D) 5′ end of 16S rRNA

43. Which of the following transcription factors involved in eukaryotic transcription initiation has ATPase, helicase and kinase activities ?
(A) $TF_{11}D$
(B) $TF_{11}H$
(C) $TF_{11}B$
(D) $TF_{11}E$

44. Which of the following is the correct order of enzymes involved in eukaryotic mRNA capping at 5′ end ?
(A) Guanyl transferase → RNA triphosphatase → Guanine-N7-methyl transferase
(B) RNA triphosphatase → Guanyl transferase → Guanine-N7-methyl transferase
(C) 2′-O-methyl transferase → Guanyl-methyl transferase → RNA triphosphatase
(D) Guanine-N7-methyl transferase → RNA triphosphatase → Guanyl transferase

45. Which one of the following sequences present on the RNA molecule is involved in termination of transcription ?
(A) rut site
(B) qut site
(C) nut site
(D) mut site

46. Which of the following hormone is associated with stomatal closure ?
(A) IAA
(B) NAA
(C) ABA
(D) GA

47. In respiration how much of the photosynthetic yield is spent by plants ?
(A) 100%
(B) 50%
(C) 25%
(D) 75%

48. One of the following cell types is involved in the final output stage of the retina whose axons form the optic nerve.
(A) Ganglion cells
(B) Rods and Cones
(C) Bipolar cells
(D) Pigment epithelial cells

49. The conversion of 11-cis-retinal to all-trans-retinal directly triggers the activation of _____ molecule in the phototransduction cascade.
(A) Acetylcholine
(B) Transducin
(C) Protein Kinase C
(D) cGMP gated sodium channel

50. Which one of the following is the part of the nephron where antidiuretic hormone (ADH) have its main effect ?
(A) The distal convoluted tubule and the collecting duct
(B) The ascending limb of the loop of Henle
(C) The proximal tubule
(D) The descending limb of the loop of Henle

51. Which one of the following mutations is most likely to affect the function of the protein ?
(A) Silent mutation
(B) Synonymous missense mutation
(C) Non-synonymous missense mutation
(D) Non-sense mutation

52. Which bacteriophage is classically associated with specialised transduction in Ecoli ?
(A) T4
(B) Lambda
(C) M13
(D) T7

53. Match the following animals with their sex determination patterns.

1. XY system	a. Drosophila
2. XO system	b. Human
3. ZW system	c. Grasshopper
4. X : A ratio	d. Birds

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

54. Which of the following technique is mainly used to generate allelic series of a gene in plants ?
(A) TILLING
(B) T-DNA mutagenesis
(C) Transposone mutagenesis
(D) CRISPR/Cas9

55. Cytoplasmic male sterility (CMS) in Maize is govern by
(A) Mitochondrial genes
(B) Chloroplast genes
(C) Nuclear genes
(D) Both mitochondrial and Chloroplast genes

56. Which of the following plants is more likely to inhabit an unpredictable environment ?
(A) A large tree producing many large seeds each year
(B) A small weed producing many tiny wind-blown seeds
(C) A low-lying plant that produces flowers in the second year after its germination
(D) A low-lying plant that produces seeds once after several years of vegetative growth

57. Which of the following is true for k-selected species ?
(A) Large adult size
(B) Fewer offspring
(C) Type-III survivorship pattern
(D) Late maturity with longer life expectancy

58. In a terrestrial ecosystem _____ shows least inter-annual variation in productivity.
(A) Reproductive community
(B) Stable community
(C) Dynamic community
(D) Unstable community

59. Which of the following primates exhibits monogamous type of mating system ?
(A) Chimpanzee
(B) Orangutan
(C) Human
(D) Gibbons

60. Which of the following statements is incorrect regarding directional selection leading to fixation of advantageous alleles in a population ?
(A) Fitness of the homozygous dominant will be maximum
(B) Fitness of the heterozygotes will be intermediate between the two homozygotes
(C) Fitness of the homozygous recessive will be less than homozygous dominant
(D) Fitness of homozygous dominant and recessive will remain constant

61. Which amino acid has the natural tendency to form an alpha-helix due to its small, uncharged and chemically simple side chain ?
(A) Proline
(B) Glycine
(C) Alanine
(D) Isoleucine

62. Which of the following compounds on hydrolysis releases maximum amount of energy ?
(A) Phosphoenol pyruvate
(B) 1,3-Bisphosphoglycerate
(C) ATP
(D) Phosphocreatine

63. Perception of blue light at the plasma membrane, mediation of phototropism, chloroplast movement and stomatal opening is managed by
(A) Phytochromes
(B) Cryptochromes
(C) Phototropins
(D) Kinase

64. The synthesis of which regulator increases during heat shock response in E.coli that compete for site on RNA polymerase
(A) pppGppp
(B) $Sigma^{H}$/$Sigma^{32}$ factor
(C) AppppA
(D) Diadeosine3′

65. Which of the following is saturated fatty acid ?
(A) stearic acid
(B) oleic acid
(C) linoleic acid
(D) erucic acid

66. How do the Transmission Electron Microscope (TEM) and the Scanning Electron Microscope (SEM) generate an image ?
(A) In TEM, electrons pass through the specimen, while in SEM, electrons are reflected back from the specimen surface
(B) TEM uses visible light, while SEM uses electrons
(C) TEM images living specimen, while SEM images only dead specimen
(D) TEM and SEM differs only in magnification

67. The fluorophore of green fluorescent protein is formed by which amino acids ?
(A) Ser-Tyr-Gly
(B) Tyr-Trp-Phe
(C) Lys-Tyr-Gly
(D) Ser-Trp-Ala

68. Which of the following radioisotope can be used to label DNA synthesis exclusively, ensuring that it is not incorporated into newly synthesized RNA molecules ?
(A) [^{14}C] uridine
(B) [methyl-^{3}H] thymidine
(C) [^{32}P] ATP
(D) [^{14}C] thymidine

69. A researcher uses SDS-PAGE to monitor the purification of a functional metabolic enzyme. The intact, fully active enzyme is known to have a total native molecular weight of 150 kDa. However, when a sample of the purified enzyme is treated with SDS and run on the gel, the researcher observes two distinct bands corresponding to 50 kDa and 100 kDa. What is the most accurate conclusion ?
(A) The purification failed because the single 150 kDa target protein has broken down into random degradation fragments.
(B) The 50 kDa and 100 kDa bands represent unrelated contaminant proteins that must be removed in a subsequent fractionation step.
(C) SDS-PAGE cannot accurately determine molecular weight because the SDS treatment alters the primary amino acid sequence of the protein.
(D) The target protein is a multimeric enzyme composed of two different subunits that were separated by the SDS treatment.

70. In the research exclusion and inclusion criteria are important because they
(A) Reduce the sampling error
(B) Help in examining a specific subset of population
(C) Help investigator to conduct research work without ethical approval
(D) Are required only in clinical research

71. Which of the following amino acids contains amide nitrogen in its R group ?
(A) Asparagine
(B) Lysine
(C) Arginine
(D) Glutamate

72. If a red blood cell is placed into a hypertonic solution, what will happen to the cell and what is the underlying physical reason for this observation ?
(A) The cell will swell and potentially undergo lysis as water enters the cell to balance the lower solute concentration outside
(B) The cell will shrink as water moves out of the cell into the surrounding solution via osmosis
(C) The cell will remain unchanged because water molecules move across the plasma membrane at equal rates in both directions
(D) The cell will actively pump salt ions inward, causing water to follow and expand the cell's volume

73. Protein kinases do not transfer phosphoryl group from ATP to which amino acid ?
(A) Serine
(B) Threonine
(C) Tryptophan
(D) Tyrosine

74. An enzyme kinetics experiment is performed in the presence of a reversible inhibitor. The resulting data shows that both the apparent Km and the Vmax decreases by the exact same ratio. What type of enzyme inhibition does this profile describe ?
(A) Noncompetitive inhibition
(B) Uncompetitive inhibition
(C) Competitive inhibition
(D) Mixed inhibition

75. The allowed area occupied by which amino acid is the largest on a Ramachandran plot ?
(A) Glycine
(B) Leucine
(C) Lysine
(D) Glutamate

76. Which autofluorescent photoprotein (238 amino acids) is isolated from the jelly fish Aequora Victoria and do *not* require addition of exogenous substrate ?
(A) UMT
(B) Luciferase
(C) Green fluorescent protein
(D) Aequorin

77. What is correct for antifoams in microbial fermentation processes ?
(A) Should be metabolized by microbial strain
(B) Should be active at low concentrations and dispersed readily
(C) Should be heat sensitive
(D) Should exert effect in latter stages of fermentation

78. Select appropriate recovery approach for the following fermentation products :

i. Ethanol	a. pH of fermented medium adjusted to 4.5 and heated for 1 hour at 121°C to solubilize
ii. Citric acid	b. Filterate passed through Podbelniak extractor and extracted with amylacetate
iii. Riboflavin	c. Fractional distillation
iv. Penicillin G	d. Precipitated by a slurry of $Ca(OH)_2$

(A) i – c, ii – d, iii – a, iv – b
(B) i – a, ii – b, iii – c, iv – d
(C) i – d, ii – a, iii – b, iv – c
(D) i – b, ii – c, iii – d, iv – a

79. Which of the following is an γ (gamma) emitting isotope ?
(A) Carbon 14
(B) Sulfur 35
(C) Phosphorus 32
(D) Iodine 131

80. Constitutive heterochromatin regions of plant chromosomes can be visualised by using following stain
(A) Acetocarmine
(B) Eosin
(C) Giemsa
(D) Saffranin

81. Read the Assertion (X) and Reason (Y) statements carefully and select the correct option.

Assertion (X) : Some viruses can contribute to cancer development.

Reason (Y) : Viral proteins can interfere with tumor suppressors and cell cycle regulatory pathways.

(A) Both X and Y are true; Y is the correct explanation for X
(B) Both X and Y are true; but Y is not the correct explanation for X
(C) X is true, but Y is false
(D) Y is true, but X is false

82. Integrins, the receptors for the extracellular matrix components, bind to a conserved amino acid sequence in their adhesion molecules. Select the correct amino acid sequence.

(A) Arginine-glycine-aspartate
(B) Arginine-leucine-isoleucine
(C) Aspartate-glycine-tyrosine
(D) Phenylalanine-tyrosine-tryptophan

83. Many viruses recognise host cells through

(A) Random interaction with membrane lipids
(B) Specific interaction between viral attachment proteins and host receptors
(C) Specific interaction between viral pili and host cells
(D) Bacterial pili

84. The pluripotency of embryonic stem cells is maintained by a core trio of transcription factors

(A) p53, Rb and Myc
(B) Oct4, Sox2 and Nanog
(C) Oct4, Sox2 and Cdx2
(D) Fas, FADD and Caspase-8

85. Which assay helps determine whether a transgenic promoter is tissue-specific in vivo ?

(A) Reporter gene assay in transgenic animal tissues using either GFP or luciferase
(B) In vitro bacterial culture
(C) Plasmid copy number measurement in bacteria
(D) Mass spectrometry of metabolites

86. In a population, the frequency of allele A is $p = 0.7$ and the frequency of its alternative allele a is $q = 0.3$, within a randomly mating large population. What is the expected frequency of heterozygous (Aa) individual in this population ?

(A) 0.09
(B) 0.21
(C) 0.42
(D) 0.49

87. Which one of the following best explains why noncrossover bivalents in Down syndrome are at increased risk of non-disjunction ?

(A) They lack chiasma leading to difficulty in proper alignment at metaphase which increases risk of improper segregation
(B) They replicate their DNA slowly leading to chromosomal loss
(C) They are larger in size hence does not fit in meiotic spindle apparatus
(D) They are eliminated by cell before meiosis-I, leading to compensatory non-disjunction in the remaining chromosomes

88. In an interrupted-mating experiment between Hfr and F^- cells, a recombinant markers (a^+, b^+, c^+, d^+, e^+) was tracked over time at different time intervals and plated on selective media. The data so obtained was then plotted and it was observed, that the maximum number of recombinants eventually reached is lower for markers with later time of entry. What is the best explanation for this observation ?
(A) Later genes are less likely to recombine with the F^- chromosome due to reduced sequence homology
(B) F^- plasmid actively degrade chromosomal DNA after 10 minutes of mating
(C) Due to interrupted mating, only fewer mating pairs succeed in transferring late genes
(D) Late transferred genes are less stable and lost by mutation before recombination can occur

89. In a Winogradsky column used to demonstrate prokaryotic metabolic diversity, which organism is most likely to grow in the bottommost layer
(A) Cyanobacteria
(B) Purple sulfur bacteria
(C) Clostridium
(D) Beggiatoa

90. After zoll, the code for botanical Nomenclature is known as
(A) International code of Nomenclature for algae, Fungi and plants
(B) International code of Botanical Nomenclature
(C) International code of Binomial Nomenclature
(D) Internation code for Botanical Nomenclature

91. What are the products of oxygenase activity of rubisco ?
(A) Two molecules of 3-phosphoglycerate
(B) Ribulose 5-phosphate
(C) 2-phosphoglycolate and 3-phosphoglycerate
(D) Fructose 1, 6-bisphosphate

92. Hypoxia stimulates the development of aerenchyma in submerged organs of plant by _____ triggered programmed cell death.
(A) Auxin
(B) Ethylene
(C) Jasmonic acid
(D) Salicylic acid

93. Which of the following pairs is *not* correct ?
(A) Anthocyanin – Attraction of animals
(B) Tannin – Pollination
(C) Rotenone – Insecticide
(D) Flavones – Protection against UV

94. The carbon to nitrogen ratio in soil organic matter is roughly
(A) 3 : 6
(B) 10 : 1
(C) 20 : 1
(D) 3 : 9

95. Glycerolipids are synthesized in which of the following cell organelles ?
(A) Plastids and ER
(B) Golgi bodies and spherosomes
(C) Mitochondria and Lysosomes
(D) Cytoskeleton

96. Read the Assertion (X) and Reason (Y) statements carefully and select the correct option.
Assertion (X) : DNA glycosylases play a central role in base excision repair.
Reason (Y) : DNA glycosylases remove the entire damaged nucleotide along with its phosphate group from the DNA backbone.
(A) Both X and Y are true, Y is the correct explanation for X
(B) Both X and Y are true, but Y is not the correct explanation for X
(C) X is true, but Y is false
(D) Y is true, but X is false

97. Match the following proteins with their respective role in regulation of phage lambda life cycle.

Column – A	**Column – B**
1. CI	i. Establishes the lytic cycle
2. Cro	ii. Controls expression of late genes
3. PN	iii. Establishes and maintains lysogeny
4. PQ	iv. Controls expression of delayed early genes

(A) 1 – i, 2 – ii, 3 – iii, 4 – iv
(B) 1 – iii, 2 – i, 3 – iv, 4 – ii
(C) 1 – i, 2 – iii, 3 – ii, 4 – iv
(D) 1 – iii, 2 – iv, 3 – i, 4 – ii

98. Among following protein synthesis inhibitors which one causes misreading during translation ?
(A) Hygromycin B
(B) Kanamycin
(C) Neomycin
(D) Streptomycin

99. Identify the enzymes involved in DNA replication for their functions.

Enzyme	**Function**
a. DNA polymerase I	i. Unzipping the DNA helix
b. Primase	ii. Supercoiling
c. Helicase	iii. Remove primer and close gaps
d. Gyrase	iv. Synthesize RNA primer

(A) a – ii, b – i, c – iv, d – iii
(B) a – iii, b – iv, c – i, d – ii
(C) a – i, b – iii, c – ii, d – iv
(D) a – iv, b – ii, c – iii, d – i

100. The mutagen nitrous acid performs an oxidative deamination of a nitrogenous base resulting in transition type of mutation. Which of the following is possible through this reaction ?
(A) Uracil to cytosine
(B) Cytosine to uracil
(C) Guanine to adenine
(D) Thymine to uracil

ROUGH WORK