

Roll No.

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(Write Roll Number from left side exactly as in the Admit Card)

Signature of Invigilators

1. _____
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1417

Question Booklet Series

X

PAPER-III

Question Booklet No.

(Identical with OMR Answer Sheet Number)

Subject Code : 14

LIFE SCIENCES

Time : 2 Hours 30 Minutes

Maximum Marks: 150

Instructions for the Candidates

1. Write your Roll Number in the space provided on the top of this page as well as on the OMR Sheet provided.
2. At the commencement of the examination, the question booklet will be given to you. In the first 5 minutes, you are requested to open the booklet and verify it:
 - (i) To have access to the Question Booklet, tear off the paper seal on the edge of this cover page.
 - (ii) Faulty booklet, if detected, should be get replaced immediately by a correct booklet from the invigilator within the period of 5 minutes. Afterwards, neither the Question Booklet will be replaced nor any extra time will be given.
 - (iii) Verify whether the Question Booklet No. is identical with OMR Answer Sheet No.; if not, the full set to be replaced.
 - (iv) After this verification is over, the Question Booklet Series and Question Booklet Number should be entered on the OMR Sheet.
3. This paper consists of seventy-five (75) multiple-choice type questions. All the questions are compulsory. Each question carries *two* marks.
4. Each Question has four alternative responses marked: (A) (B) (C) (D). You have to darken the circle as indicated below on the correct response against each question.

Example: (A) (B) (●) (D), where (C) is the correct response.
5. Your responses to the questions are to be indicated correctly in the OMR Sheet. If you mark your response at any place other than in the circle in the OMR Sheet, it will not be evaluated.
6. Rough work is to be done at the end of this booklet.
7. If you write your Name, Roll Number, Phone Number or put any mark on any part of the OMR Sheet, except the space allotted for the relevant entries, which may disclose your identity, or use abusive language or employ any other unfair means, such as change of response by scratching or using white fluid, you will render yourself liable to disqualification.
8. Do not tamper or fold the OMR Sheet in any way. If you do so, your OMR Sheet will not be evaluated.
9. You have to return the 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 question booklet and duplicate copy of OMR Sheet after completion of examination.
10. **Use only Black Ball point pen.**
11. **Use of any calculator or mobile phone etc. is strictly prohibited.**
12. **There are no negative marks for incorrect answers.**

[Please Turn Over]

LIFE SCIENCES

PAPER III

1. Which of the following compounds is a much stronger chelator of Ca^{2+} ?
 - (A) Glutamate
 - (B) γ -carboxy glutamate
 - (C) Dicoumarol
 - (D) Glutamine

2. P-loop NTPase-domain core of myosin is found in
 - (A) S1 unit
 - (B) S2 unit
 - (C) Light meromyosin unit
 - (D) S2 and light meromyosin units

3. Which of the following neurotransmitters opens a single kind of cation channel which is almost equally permeable to Na^+ and K^+ ?
 - (A) Epinephrine
 - (B) Dopamine
 - (C) Serotonin
 - (D) Acetylcholine

4. Which of the following subunits of Umami receptor does not participate in the sweet response?
 - (A) T1R3
 - (B) A3B4
 - (C) T1R1
 - (D) K1R1

5. Virus free plants can be produced through
 - (A) Protoplast culture
 - (B) Apical meristem culture
 - (C) Pollen culture
 - (D) Embryo culture

6. The word, used for the small solid supports onto which are spotted hundreds of thousands of tiny drops of DNA that can be used to screen gene expression, is
 - (A) Southern blot
 - (B) Northern blot
 - (C) DNA microarrays
 - (D) Cloning library

7. The flow cytometry technique allows detection of difference of how many mega base pairs?
 - (A) 1.2 – 2.0
 - (B) 1.5 – 4.0
 - (C) 2.5 – 5.5
 - (D) 4.5 – 10.5

8. In electron microscope, the source of electrons is
 - (A) Xenon-arc lamp
 - (B) Mercury-vapour lamp
 - (C) Tungsten-metal lamp
 - (D) Halogen lamp

9. For determining the absorption spectrum of a biomolecule in the UV-range, the sample is usually placed in a
 - (A) Glass cuvette
 - (B) Quartz cuvette
 - (C) Polystyrene cuvette
 - (D) PVC cuvette

10. In designing biochemical experiments with radioisotopes it is important to consider the half life. Which of the following isotopes has the shortest half life?
 - (A) ^{32}P
 - (B) ^{60}Co
 - (C) ^{14}C
 - (D) ^{24}Na

11. A coefficient of correlation is computed to be -0.95 means that
- The relationship between two variables is weak.
 - The relationship between two variables is strong and positive.
 - The relationship between two variables is strong but negative.
 - Correlation coefficient cannot have this value.
12. When regression line passes through the origin, then
- Intercept is zero
 - Correlation is zero
 - Regression coefficient is zero
 - Association is zero
13. If the number of trials are 8 and probability of success is 0.62, then the mean of negative probability distribution is
- 8.65
 - 12.90
 - 4.96
 - 7.30
14. The term inbreeding signifies crossing between
- Two members of a species
 - Two members of a genus
 - Two members of a family
 - Two members of an order
15. The process of detorsion is evident in
- Aplysia*
 - Pila*
 - Murex*
 - Conus*
16. Which among the following is a winged insect?
- Giant water bug
 - Louse
 - Flea
 - Female coccid
17. The situation in which juvenile characteristics of ancestors appears in the adults of decendants is known as
- Peramorphosis
 - Paedomorphosis
 - Hypermorphosis
 - Neotony
18. Floral organ is controlled by overlapping expression of 'A' class, 'B' class and 'C' class genes in different whorls. In an *Arabidopsis* mutant, the flowers had sepals, sepals, carpels and carpels in four whorls. Mutation in which one of the following is the cause of such mutant phenotype?
- A class gene alone
 - B class gene alone
 - A and B class genes
 - C class gene alone
19. Species A has $2n = 18$ chromosomes and species B has $2n = 20$ chromosomes. Give all possible chromosome number that may be found in the allotriploid.
- 36 and 40
 - 30 and 27
 - 28 and 29
 - 56 and 58
20. A diploid eukaryotic cell contains 3×10^9 base pairs of genomic DNA. How many H_1 histone molecules are present in the chromosome complement?
- $1.5 \times 10^9 H_1$ Histone molecules
 - $1.5 \times 10^7 H_1$ Histone molecules
 - $3 \times 10^7 H_1$ Histone molecules
 - $3 \times 10^9 H_1$ Histone molecules

21. The chief metallic ion involved in the assembly of ribosomal subunits is

- (A) Ca^{2+}
- (B) K^+
- (C) Mg^{2+}
- (D) Na^+

22. Important chemical steps involved in the nitrogen cycle are: (i) $\text{N}_2 \rightarrow \text{NH}_4^+$ (ii) $\text{NH}_4^+ \rightarrow \text{NO}_2^-$ (iii) $\text{NO}_2^- \rightarrow \text{NO}_3^-$ (iv) $\text{NO}_3^- \rightarrow \text{N}_2$. Which one of the following combinations of organisms is associated with the steps above?

- (A) i – *Nostoc* ii – *Nitrobacter*
iii – *Nitrosomonas* iv – *Pseudomonas*
- (B) i – *Nostoc* ii – *Nitrosomonas*
iii – *Nitrococcus* iv – *Pseudomonas*
- (C) i – *Pseudomonas* ii – *Nitrobacter*
iii – *Nostoc* iv – *Nitrosomonas*
- (D) i – *Pseudomonas* ii – *Nitrosomonas*
iii – *Nitrobacter* iv – *Nostoc*

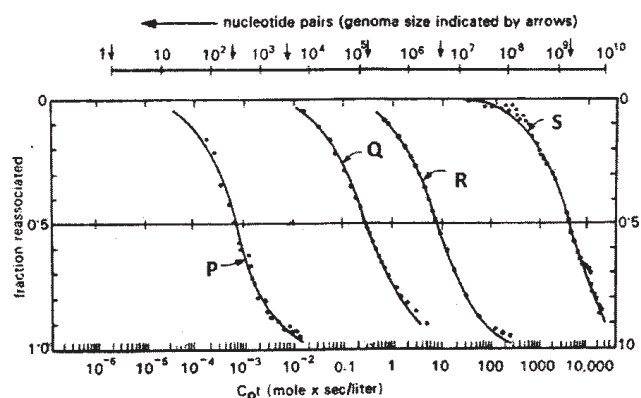
23. In a pelagic food web, the major pathway for organic matter flux is dependent on

- (A) Sinking flux
- (B) Microbial loop
- (C) Grazing food chain
- (D) Aggregation packaging

24. Species such as *Dipterocarpus grandiflorus* (Apitang) and *Porcula salvania* (Pygmy Hog) are listed under the IUCN category of

- (A) Endangered species
- (B) Critically endangered species
- (C) Vulnerable species
- (D) Lower risk species

25. The reassociation Kinetics of four samples of DNA, denoted by P, Q, R and S cot curves in the given figure are expressed as under



Which of the following statements is correct?

- (A) P — calf thymus non-repetitive DNA, Q — mouse satellite DNA, R — *E. coli* DNA, S — T_4 DNA
- (B) P — mouse satellite DNA, Q — T_4 DNA, R — *E. coli* DNA, S — calf thymus non-repetitive DNA
- (C) P — T_4 DNA, Q — mouse satellite DNA, R — calf thymus non-repetitive DNA, S — *E. coli* DNA
- (D) P — *E. coli* DNA, Q — T_4 DNA, R — calf thymus non-repetitive DNA, S — mouse satellite DNA

26. For the identification of four proteins moving together as one single band upon loading in a single lane of an SDS-PAGE gel, the best method is

- (A) One-step Western blot
- (B) Western blot followed by stripping and reproducing
- (C) NMR spectroscopy
- (D) ESR spectroscopy

27. Alterations in protein levels of two different tissue samples from a same person can be analyzed by

- (A) Edman degradation
- (B) Two-dimensional gel electrophoresis
- (C) Isoelectric focusing
- (D) Autoradiography

28. The semio-chemical (plant secondary metabolite) that gives benefit to both insect and plant is known as

- (A) Allomone
- (B) Antemone
- (C) Kairomone
- (D) Synomone

29. Which is the smallest phytogeographical kingdom of the world?

- (A) Cape Kingdom
- (B) Palaeotropical Kingdom
- (C) Holarctic Kingdom
- (D) Neotropical Kingdom

30. Which one of the following diseases is caused by fungal infection?

- (A) Typhoid
- (B) Kala-azar
- (C) Syphilis
- (D) Ringworm

31. The only positive evidence of aquatic ancestry of bryophyte is

- (A) Thread like protonema
- (B) Green colour
- (C) Some forms are still aquatic
- (D) Ciliated sperm

32. Select the oldest angiospermic fossil plant of the world.

- (A) *Amborella trichopoda*
- (B) *Archaeofructus sinensis*
- (C) *Archaeanthus linnenbergeri*
- (D) *Drimys winteri*

33. Lateral roots in dicotyledonous plants generally originate from

- (A) Cork cambium
- (B) Cortex
- (C) Pericycle cells lying against protoxylem
- (D) Endodermal cells lying against protoxylem

34. Which type of male sterility is extensively used in hybrid seed production?

- (A) Cytoplasmic male sterility
- (B) Cytoplasmic-genetic male sterility
- (C) Genetic male sterility
- (D) Temperature sensitive genetic male sterility

35. Pseudoembryo sac is found in

- (A) Onagraceae
- (B) Loranthaceae
- (C) Cyperaceae
- (D) Podostemaceae

36. In photosystem-I, the primary electron acceptor is

- (A) Ferredoxin
- (B) Cytochrome
- (C) An iron-sulphur protein
- (D) Quinone

37. Cyclin dependent kinases are

- (A) Tumour suppressor proteins
- (B) Ser/thr protein kinases controlling cell cycle progression
- (C) Negatively regulated by a set of proteins called CAKs
- (D) Regulated by single phosphorylation

38. A new population arises due to sudden appearance of reproductive isolation in two segments of the same population. This is known as
- (A) Allopatric speciation
 - (B) Sympatric speciation
 - (C) Neopatric speciation
 - (D) Divergent evolution
39. *Bacillus schlegelii* is a
- (A) Nitrite-oxidizing bacterium
 - (B) Iron-oxidizing bacterium
 - (C) Sulphur-oxidizing bacterium
 - (D) Hydrogen-oxidizing bacterium
40. Which one of the following scales is found in elasmobranchs?
- (A) Ganoid
 - (B) Placoid
 - (C) Cycloid
 - (D) Ctenoid
41. The genome of HIV is a
- (A) ss-DNA
 - (B) ss-RNA
 - (C) ds-DNA
 - (D) ds-RNA
42. Which one of the following is found in *Azolla*, used as biofertiliser?
- (A) *Rhizobium*
 - (B) Large quantity of humus
 - (C) Cyanobacteria
 - (D) Mycorrhiza
43. Terminal deoxynucleotidyl transferase (TdT) is used to
- (A) Add nucleotide to the 3' terminus of a DNA molecule.
 - (B) Add nucleotide to the 5' terminus of a DNA molecule.
 - (C) Carry out nick translation.
 - (D) Transfer phosphate group at the 3' end of the DNA.
44. A single sequence of DNA codes for two nonhomologous proteins because,
- (A) They have non-overlapping gene.
 - (B) They use alternative splicing pattern.
 - (C) They have similar reading frames.
 - (D) They are non-nested.
45. In *Escherichia coli*, which one of the following enzymes synthesizes the RNA primer for Okazaki fragments?
- (A) DnaA
 - (B) DnaC
 - (C) DnaG
 - (D) Both DnaC and DnaG
46. Following are some statements about transposons:
- (i) Most of the transposons in prokaryotes are DNA.
 - (ii) Most of the transposons in prokaryotes transpose via an RNA intermediate.
 - (iii) Transposons in eukaryotes are only retrotransposons.
 - (iv) Both RNA and DNA transposons are found in eukaryotes.
- Choose the correct combination.
- (A) (i) and (iv)
 - (B) (i) and (iii)
 - (C) (ii) and (iii)
 - (D) (ii) and (iv)

47. Hybrid dysgenesis in *Drosophila* results when
- A male fly with P elements (P^+) mates with a female fly that lacks P elements (P^-)
 - A P^+ male mates with a P^+ female
 - A P^- male mates with a P^+ female
 - A P^- male mates with a P^- female
48. A person lacking the gene for the green pigment will have trouble distinguishing
- Red and Green colour
 - Violet and Red colour
 - Blue and Green colour
 - Blue and Red colour
49. Which of the following terms is used to indicate the ability of a cancer to invade other parts of the body and produce secondary tumours?
- Carcinogenesis
 - Apoptosis
 - Metastasis
 - Mutagenesis
50. Which of the following compounds stabilizes the microtubules in polymerized form?
- Taxol
 - DDE
 - Tetrodotoxin
 - Calmodulin
51. When a virus enters a cell but does not replicate immediately, the situation is called
- Symbiosis
 - Synergism
 - Lysogeny
 - Lysis
52. *E. coli* circular DNA contains about 4.6×10^6 nucleotide pairs of DNA. If you digest a preparation of *E. coli* circular DNA with NotI that recognizes and cleaves the octameric sequence $5' - \text{GCGGCCGC} - 3'$, how many restriction fragments would you expect to produce (Assume four bases, A, T, G and C are equally present and randomly distributed in the *E. coli* genome)?
- 70
 - 71
 - 700
 - 140
53. When a lambda defective galactose (λ_{dg}) transducing particle integrates with or without a normal lambda phage into gal-DNA of another host bacterium, some of the following products are formed:
- Stable transductants which are not lysogenic.
 - Double lysogenic unstable transductants.
 - Stable lysogenic transductants.
 - Double lysogenic stable transductants.
- Which of the above statement(s) are true?
- Only (i)
 - Only (iv)
 - (i) and (ii)
 - (iii) and (iv)
54. The fluorescent dye used to detect regeneration of primary wall at a very early stage of protoplast culture is
- Fluorescein diacetate
 - Calcafluor white
 - Acridine orange
 - Quinacrine mustard
55. Main effect of gibberellins in tissue culture system is
- Releasing seeds, somatic embryos, apical buds and bulbs from dormancy
 - Induction of cell division
 - Inhibition of leaf senescence
 - Induction of somatic embryogenesis

56. In High-Performance Liquid Chromatography (HPLC) the retention volume (V_R) of an analyte is referred to as the

- (A) Volume of the sample applied in HPLC column.
- (B) Solvent volume required to elute the analyte.
- (C) Time required for the maximum elution of the analyte.
- (D) Total volume of the solvent taken by the column.

57. In gel-exclusion chromatography, molecules are separated based on their

- (A) Polarity
- (B) Molecular size
- (C) Charge
- (D) Specific affinity

58. Sedimentation coefficient which refers to the ratio of sedimentation velocity to centrifugal force is expressed in Svedberg unit S, where 1S is equal to

- (A) 10×10^5 seconds
- (B) 1×10^{-10} second
- (C) 1×10^{-13} second
- (D) 10×10^{13} seconds

59. The kind of cleavage found in an oligolecithal egg is

- (A) Meroblastic
- (B) Holoblastic
- (C) Spiral cleavage
- (D) Superficial cleavage

60. Which bacterium induces cytoplasmic incompatibility and produces sexual individuals from parthenogenetic insects?

- (A) *Bacillus*
- (B) *Wolbacchia*
- (C) *Pseudomonas*
- (D) *Streptococcus*

61. In the context of kin selection, siblings share half of each parent's contribution to their genome ($r = 0.5$) and cousins share $r = 0.125$. This law of coefficient of relatedness was stated by

- (A) Daniel Little McFadden
- (B) W.D. Hamilton
- (C) Karl Von Frisch
- (D) Niko Tinbergen

62. Match the following and select the correct answer from the code combination given below:

- | <i>List-I</i> | <i>List-II</i> |
|-------------------------|---------------------------------|
| (a) Allen's rule | (i) Pigmentation of body colour |
| (b) Gloger's rule | (ii) Number of vertebrae |
| (c) Bergman's rule | (iii) Size of animal |
| (d) Jordan's rule | (iv) Length of extremities |
| (a) (b) (c) (d) | |
| (A) (i) (ii) (iv) (iii) | |
| (B) (ii) (iii) (i) (iv) | |
| (C) (iii) (iv) (ii) (i) | |
| (D) (iv) (i) (iii) (ii) | |

63. Match the following and select the correct one from the code given below:

- | <i>Insects</i> | <i>Diseases</i> |
|-------------------------|-------------------------|
| (a) Black fly | (i) Cholera |
| (b) Tsetse fly | (ii) Onchocerciasis |
| (c) Sand fly | (iii) Sleeping sickness |
| (d) House fly | (iv) Kala azar |
| (a) (b) (c) (d) | |
| (A) (iv) (iii) (ii) (i) | |
| (B) (ii) (iii) (iv) (i) | |
| (C) (i) (ii) (iii) (iv) | |
| (D) (iii) (ii) (iv) (i) | |

64. Which of the following is the primary vector of malaria in urban India?
- (A) *Anopheles culicifacies*
 - (B) *Anopheles minimus*
 - (C) *Anopheles stephensi*
 - (D) *Anopheles dirus*
65. What is the effect of outcrossing in a population?
- (A) Genotype frequencies will equal those predicted by Hardy-Weinberg law.
 - (B) There will be more heterozygotes than predicted by Hardy-Weinberg law.
 - (C) Allelic frequencies change.
 - (D) There will be fewer heterozygotes than predicted by Hardy-Weinberg law.
66. Which of the following steps in glycolysis is reversible?
- (A) Glucose to Glucose-6-phosphate
 - (B) Fructose-1, 6-bisphosphate to Glyceraldehyde-3-phosphate
 - (C) Fructose-6-phosphate to Fructose-1, 6-bisphosphate
 - (D) Glucose-6-phosphate to Fructose-6-phosphate
67. Which one of the following compounds is the electron donor in most reductive biosynthesis?
- (A) NADPH
 - (B) NADH
 - (C) FADH₂
 - (D) FMNH₂
68. Why is *Deinococcus radiodurans* able to survive massive exposure to radiation?
- (A) Because its cell wall contains radioactive elements.
 - (B) Because it produces a thick shell which acts as a shield from the radiation.
 - (C) Because it has unique DNA repair mechanisms.
 - (D) Because it has many copies of genes encoding DNA repair.
69. An antibiotic that resembles the 3'-end of a charged tRNA molecule is
- (A) Bacitracin
 - (B) Puromycin
 - (C) Tetracycline
 - (D) Kanamycin
70. The presence of a non-competitive inhibitor leads to
- (A) A decrease in the observed V_{\max} .
 - (B) A decrease in K_m and V_{\max} .
 - (C) An increase in K_m without affecting V_{\max} .
 - (D) Both an increase in the V_{\max} of a reaction and an increase in K_m .
71. Which of the following cells is the host for HIV?
- (A) Cytotoxic T cell
 - (B) Helper T cell
 - (C) Osteoblast cell
 - (D) Red blood cell

72. What is the correct sequence of events in Southern blotting?

- (A) Hybridization of DNA fragments with a labelled probe sequence followed by separation by electrophoresis and then transfer to a membrane.
- (B) Separation of DNA fragments by electrophoresis followed by transfer to a membrane and then hybridization with a labelled probe sequence.
- (C) Transfer of DNA fragments to a membrane followed by separation by electrophoresis and then hybridization with a labelled probe sequence.
- (D) Separation of DNA fragments by electrophoresis followed by hybridization with a labelled probe sequence and then transfer to a membrane.

73. The gla domain is found in

- (A) Fibrinogen
- (B) Fibrin polymer
- (C) Prothrombin
- (D) Kininogen

74. Which of the following statements is false about somaclonal variation?

- (A) Genetic variability present among the cultured cells.
- (B) Genetic variability may arise due to change in chromosome number.
- (C) Genetic variability may arise due to change in chromosome structure and gene mutation.
- (D) Only undergoes epigenetic changes.

75. Spemann's organizer in amphibians is

- (A) Epidermal in origin
 - (B) Endodermal in origin
 - (C) Mesodermal in origin
 - (D) Ectodermal in origin
-

1417-III

X-12

ROUGH WORK