



श्री चित्रा तिरुनाल आयुर्विज्ञान और प्रौद्योगिकीसंस्थान, तिरुवनंतपुरम्-11  
SREE CHITRA TIRUNAL INSTITUTE FOR MEDICAL SCIENCES & TECHNOLOGY  
THIRUVANANTHAPURAM—695 011

PHD ENTRANCE EXAMINATION - ACADEMIC SESSION JANUARY 2019

PROGRAMME: BIOLOGICAL SCIENCES

Time: 90 Minutes

Max. Marks: 100

(Select the most appropriate answer)

(There are **no negative** marks for wrong answers)

- Ranjan Gogoi is serving as the \_\_\_\_\_ Chief Justice of India.  
a. 46<sup>th</sup>                      b. 48<sup>th</sup>                      c. 42<sup>nd</sup>                      d. 44<sup>th</sup>
- Nadia Murad won the Nobel prize for:  
a. Physics  
b. Chemistry  
c. Peace  
d. Medicine
- S-400 'Triumpf' is the name of:  
a. Missile system.  
b. Satellite system  
c. Bomber system  
d. Ecosystem
- MiG-21 is:  
a. Fighter jet  
b. War ship  
c. Submarine  
d. Rescue boat
- Find the correctly spelt word:  
a. Surveilance  
b. Surveillence  
c. Survellance  
d. Survaillence
- Which among the following is responsible for the health hazards associated with paints/varnish?  
a. Formaldehyde                      b. Lead                      c. Cadmium                      d. Chromium

7. Single disease control programs are also called
  - a. Horizontal health programs
  - b. Integrated health programs
  - c. Interventional programs
  - d. Vertical health programs
  
8. A vitamin which is soluble in water:
  - a. Vitamin C
  - b. Niacin
  - c. Riboflavin
  - d. All the above
  
9. Tides are primarily caused by:
  - a. Attraction of the moon
  - b. Farrel's law
  - c. Earth's pressure system
  - d. Ocean Currents
  
10. Primary source of nutrients for plants is:
  - a. Sun light
  - b. Soil
  - c. Chlorophyll
  - d. Pesticides
  
11. Chemical, ionizing agent or virus that can cause birth defects
  - a. Teratogenic
  - b. Mutagenic
  - c. Carcinogenic
  - d. Embryogenic
  
12. Entomology is the scientific study of:
  - a. Insects
  - b. Formation of rocks
  - c. Scientific names
  - d. Behaviour of human beings
  
13. The acronym NFHS used in the surveys for information on maternal and child health in India stand for:
  - a. National Fertility and Health Survey
  - b. National Family and Household Study
  - c. National Family Health Survey
  - d. National Farm and Household Survey

14. The Hathi commission report (1975) was on:

- a. Pharmaceutical industry in India
- b. Hospitals in India
- c. Doctors in India
- d. Nursing in India

15. A disease that spread by contact:

- a. Infectious
- b. Fatal
- c. Contagious
- d. Incurable

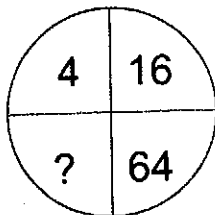
16. The ICDS scheme includes the following components, except

- a. Supplementary nutrition for mothers and children
- b. Growth monitoring
- c. Ante-natal clinics
- d. Immunization

17. Gradual changes in the frequency of a disease over a long time period is referred to as:

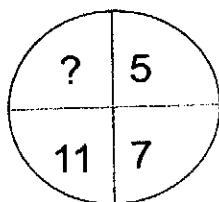
- a. Secular time trends
- b. Cyclic fluctuations
- c. Latency period
- d. Temporal clustering.

18. Find the missing number in the figure below:



- a. 16
- b. 52
- c. 112
- d. 256

19. Find out the missing number in the figure below



- a. 1
- b. 9
- c. 12
- d. 17

20. Find the odd man out:

- a. Parrot                      b. Vulture                      c. Swan                      d. Sparrow

21. Arrange the following words in the order they appear in the dictionary:

1. Scenery 2. Science 3. Scandal 4. School 5. Scatter.

- a. 3,5,1,4,2;  
b. 3,5,4,1,2;  
c. 5,3,4,2,1;  
d. 5,3,2,1,4

22. Complete the following sentences (questions 22-24) by choosing the correct passive forms of the verbs given:

The thief \_\_\_\_\_ yesterday and was prisoned

- a. is caught  
b. is being caught  
c. was caught  
d. has been caught

23. A couple of warnings \_\_\_\_\_ before the storm

- a. will have been issued  
b. have been issued  
c. had been issued  
d. has been issued

24. We know that poems \_\_\_\_\_ these days by you

- a. are being composed  
b. is being composed  
c. have been composed  
d. were being composed

25. Find the word which cannot be formed from the letters of the word, 'REPUBLICAN'.

- a. CLIP                      b. PURE                      c. ANKLE                      d. BANE

26. Find the word which cannot be formed from the letters of the word,

'RECOMMENDATION'.

- a. NATION  
b. COMMENT  
c. COMMON  
d. RECOMMENDS

27. If the first day of the year (other than the leap year) was Friday, then which was the last of that year?
- Wednesday
  - Thursday
  - Friday
  - Sunday
28. If every second Saturday and all Sundays are holidays in a 30 days month beginning on Saturday, then how many working days are there in that month?
- 15
  - 18
  - 23
  - 25
29. The programming language Java was originally developed by:
- Oracle
  - Microsoft
  - Novell
  - Sun Microsystems
30. One Terabyte (1 TB) is equal to:
- 1028GB
  - 1012GB
  - 1000GB
  - 1024 GB
31. Which operating system is developed and used by Apple Inc?
- Windows
  - Android
  - iOS
  - UNIX
32. Pick the odd one out in the following numbers: 13, 23, 33, 43, 53 ?
- 23
  - 33
  - 43
  - 53
33. It was calculated that 75 men could complete a piece of work in 20 days. When work was scheduled to commence, it was found necessary to send 25 men to another project. How much longer will it take to complete the work?
- 25 days
  - 30 days
  - 35 days
  - 40 days
34. What percentage of numbers from 1 to 70 has 1 or 9 in the unit's digit?
- 1
  - 14
  - 20
  - 21
35. REASON : SFBTPO :: THINK : ?
- SGHMJ
  - UIJOL
  - UHNKI
  - UJKPM
36. 'Captain' is related to 'Soldier' in the same way as 'Leader' is related to:
- Chair
  - Followers
  - Party
  - Minister

37. M has a son Q and a daughter R. He has no other children. E is the mother of P and daughter-in law of M. How is P related to M?
- P is the son-in-law of M
  - P is the grandchild of M
  - P is the daughter-in law of M
  - P is the grandfather of M
38. The number that least fits this set: (324, 441, 97 and 64) is \_\_\_\_\_.
- 324
  - 441
  - 97
  - 64
39. It takes 10 s and 15 s, respectively, for two trains travelling at different constant speeds to completely pass a telegraph post. The length of the first train is 120 m and that of the second train is 150 m. The magnitude of the difference in the speeds of the two trains (in m/s) is:
- 2.0
  - 10.0
  - 12.0
  - 22.0
40. The sum of two numbers is 25 and their difference is 13. Find their product.
- 104
  - 114
  - 315
  - 325
41. The inner cell mass in mammals maintains pluripotency by a core of three transcription factors known as:
- Sox2, Cdx2 and Nanog,
  - Cdx2, Oct 4 and Sox2,
  - Oct 4, Cdx2 and Nanog,
  - Nanog, Sox2 and Oct4
42. The Basal Metabolic Rate (BMR) is lowest during:
- Sleep
  - Awake and resting
  - Prolonged starvation
  - Higher environmental temperature
43. Which of the following methods is most sensitive label-free quantification of proteins?
- Infra-Red spectroscopy
  - UV spectroscopy
  - $^{13}\text{C}$  content of protein,
  - Raman spectroscopy
44. The virus that causes acute gastrointestinal illness due to contamination of drinking water:
- Norovirus,
  - Filovirus,
  - Polio virus,
  - Rotavirus
45. The energy rich fuel molecules produced in the TCA cycle are \_\_\_\_\_
- 1 GTP, 3 NADH and 1 FADH<sub>2</sub>,
  - 2 GTP, 2 NADH and 1 FADH<sub>2</sub>,
  - 1 GTP, 2 NADH and 2 FADH<sub>2</sub>,
  - 2 GTP, 3 NADH

46. The disease which is not caused by bacteria is  
 a. Tuberculosis      b. Typhoid      c. Small pox,      d. Tetanus
47. Which one of the following methods would be best suited to monitor changes in the level of a serum protein, for which an antibody is available?  
 a. Immunofluorescence microscopy  
 b. Enzyme Linked Immuno Sorbent Assay  
 c. Fluorescence in situ hybridization,  
 d. Fluorescence Activated Cell Sorting
48. Which of the following techniques CANNOT be used for determining the protein conformational dynamics?  
 a. NMR spectroscopy  
 b. Differential scanning calorimetry,  
 c. Mass spectroscopy,  
 d. Fluorescence microscopy
49. Filtration slits are formed by \_\_\_\_\_  
 a. Mesangial cells  
 b. Lacis cells  
 c. Capillary endothelial cells  
 d. Podocytes
50. The key determinant of the plane of cytokinesis in mammalian cells is the position of \_\_\_\_\_  
 a. Central spindle  
 b. Centrioles  
 c. Pre-prophase band  
 d. Chromosomes
51. Apoptotic cells can be specifically detected by \_\_\_\_\_  
 a.  $^{51}\text{Cr}$  release assay  
 b. Exclusion assay using Trypan blue,  
 c. Calorimetric assay based on Tetrazolium dye (MTT),  
 d. FITC-Annexin V based Flow Cytometry analysis
52. The most powerful buffer system of blood is  
 a. Phosphate      b. Bicarbonate      c. Proteins,      d. Haemoglobin
53. Treatment of cancer uses many approaches like surgery, radiation treatment and chemotherapy. Beyond surgery and radiation treatment, which are mostly employed in the cases of larger and discrete tumors, drug therapies are used to target residual tumor cells and to attack dispersed cancers. A list of anti-cancer drugs is given in the table. Left column (i – iv) indicates the anti-cancer drug and right column (a – d) shows its chemical nature
- |      |                |    |                     |
|------|----------------|----|---------------------|
| i.   | Methotrexate   | a) | Podophyllotoxin     |
| ii.  | Etoposide      | b) | Pyrimidine analogue |
| iii. | 5-fluorouracil | c) | Alkaloid            |
| iv.  | Paclitaxel     | d) | Folic acid analogue |

Which one of the following is most appropriate?

- a. i-a, ii-b, iii-c, iv-d
- b. i-b, ii-a, iii-d, iv-c
- c. i-c, ii-d, iii-a, iv-b
- d. i-d, ii-a, iii-b, iv-c

54. Fluorescently tagged protein was used to study protein secretion in yeast. Fluorescence was observed in: (i) the Golgi, (ii) the secretory vesicles, (iii) the rough Endoplasmic Reticulum. Which of the following describes best the sequence of these events occur?

- a. i → ii → iii
- b. ii → iii → i
- c. iii → i → ii
- d. iii → ii → i

55. Which one of the following permits the rapid diffusion of small, water-soluble molecules between the cytoplasm of adjacent cells?

- a. Tight junctions
- b. Gap junctions
- c. Adherens junctions
- d. Anchoring junctions

56. E. coli takes 40 min to duplicate its genome using a bi-directions mode of replication. If E. coli were to use uni-directional mode of replication to synthesize a full copy of DNA complementary to just one of the strands of the genome, it would take

- a. 20 min.,
- b. 40 min.
- c. 60 min.
- d. 80 min

57. Which of the following events will NOT usually lead to transformation of a normal cell to cancer cell?

- a. Gain of function of genes involved in nucleotide excision repair,
- b. Loss of function of pro-apoptosis,
- c. Loss of function of tumor suppressor,
- d. Gain of function of oncogenes

58. Some of the characteristics of MHC Class I and Class II molecules are given. Which is applicable only for MHC class I? Identify appropriate statement.

- a. They are expressed constitutively on all nucleated cells,
- b. They are glycosylated polypeptides with domain structure,
- c. They are involved in presentation of antigen fragments to cells,
- d. They are expressed on surface membrane of B cells

59. Diagnosis of influenza virus infections can be done using some of the following techniques: (i) Western blot and Southern blot, (ii) Northern blot and western blot, (iii) ELISA and RT-PCR, (iv) PCR and electron microscopy. Which combination of techniques correctly lists the detection methods?

- a. (i) and (ii) only,
- b. (iii) and (iv) only,
- c. (ii) and (iii) only
- d. (i) and (iv) only

60. In a typical gene cloning experiment, by mistake the DNA of interest was introduced within ampicillin resistant gene instead of *lac z* gene. The competent cells were allowed to take p the plasmid and then plated in the media containing ampicilin, X-gal and IPTG and subjected to



- blue-white screening. Considering all plasmids were recombinant which one of the following statements correctly describes the outcome of the experiment?
- The bacterial which took up the plasmids would grow and give blue colonies,
  - The bacteria which took up the plasmids would form white colonies,
  - The bacteria which took up the plasmids would not grow,
  - All of the bacteria would grow and give white colonies
61. Which of the following mutagens is most likely to result in a single amino acid change in a gene product?
- X-rays
  - Acridine Orange,
  - Ethidium bromide,
  - Ethylmethane sulphonate
62. Which one of the microscope would you use to visualize a protein fused to an appropriate reporter in a living cell?
- Phase contrast microscope
  - Scanning electron microscope,
  - Fluorescence microscope,
  - Differential interference contrast microscope
63. When a cell has committed to a particular fate during development, it is said to be:
- Pluripotent,
  - Totipotent,
  - Determined,
  - Differentiated
64. Which one of the following best defines an oncogene?
- An oncogene never codes for a cell cycle protein, which promotes cell proliferation,
  - An oncogene codes for a protein that prevents a cell from undergoing apoptosis,
  - Oncogenes are always involved in inherited forms of cancer,
  - An oncogene is dominantly expressed mutated gene that renders a cell advantageous towards survival
65. The tetanus vaccine given to humans in the case of a deep cut is a:
- Toxoid vaccine
  - DNA vaccine
  - Subunit vaccine,
  - Recombinant vector vaccine
66. Number of autosomes present in human sperm is:
- 21 pairs,
  - 23 pairs,
  - 22 pairs,
  - 24 pairs
67. Albinism, a total lack of melanin pigment is due to a recessive gene. A normal man and a normal woman, both of whom had one albino parent, marry. What is the probability of having an albino child for them?
- 100%,
  - 0%,
  - 50%,
  - 25%
68. Which of the following cell type is LEAST able to regenerate?
- Centro-lobular hepatocytes,

- b. Cerebral neurons,
  - c. Colonic epithelium,
  - d. Subcutaneous fibroblasts
69. The sigma subunit of prokaryotic RNA polymerase:
- a. Is part of core enzyme,
  - b. Binds the antibiotic rifampicin,
  - c. Is inhibited by  $\alpha$ -amanitin,
  - d. Specifically recognizes promoter sites.
70. Restriction enzyme was discovered by:
- a. Selman Waksman
  - b. Sir Alexander Fleming
  - c. Paul Berg,
  - d. Werner Arber, Hamilton O. Smith and Daniel Nathans
71. Select the false statement:
- a. Enzymes increase the rate of reaction without being changed by itself,
  - b. Enzymes accelerate reactions by increasing the activation energy,
  - c. Enzymes exhibit specificity,
  - d. Enzymes are sensitive to both temperature and pH
72. Which one of the following statements correctly define the term auxotrophic mutants:
- a. Mutant cell capable of synthesizing essential growth factors from the minimal medium,
  - b. Mutant cells unable to grow in the presence of auxin,
  - c. Mutant cells incapable of producing one or two growth factors essential for growth,
  - d. Mutant cells resistant to the drug
73. The function of lysosome is:
- a. Intra cellular digestion
  - b. Lipid synthesis,
  - c. Processing and packaging,
  - d. Protein synthesis
74. The blood does not clot inside the circulatory system because of:
- a. Oxygenation of blood,
  - b. Absence of  $Ca^{2+}$  in blood,
  - c. Heparin in blood,
  - d. The three dimensional bead like structure of fibrinogen
75. The characteristic that all lipids have in common is:
- a. They are all made of fatty acids and glycerol
  - b. They all contain nitrogen,
  - c. None of them is very high in energy content,
  - d. They are all acidic when mixed with water
76. With respect to the LAC operon, if both glucose and lactose are present and glucose is low, which of the following is **not** true?
- a. High CAP
  - b. Increased uptake of lactose,

- c. Low cAMP,
- d. Increased transcription of the LAC operon

77. Insulin receptor substrates IRS 1/2 are phosphorylated by the receptor tyrosine kinase domain. What would happen if the IRS 1/2 were phosphorylated on a serine/threonine residue?
- a. The insulin signal would be prematurely terminated leading to insulin resistance,
  - b. The Ras pathway would be activated prematurely and insulin signal amplified,
  - c. The PI 3- kinase pathway would be activated prematurely and insulin metabolic effects would be amplified,
  - d. GLUT 4 transporters would remain fixed on the cell membrane and would not be able to be internalized.
78. Plants and some bacteria differ from animals in that plants and some bacteria can:
- a. Form polymers from glucose,
  - b. Use carbon dioxide to increase their biomass,
  - c. Produce NADH via reductive reactions,
  - d. Synthesize glutamate and aspartate
79. In confocal microscope, the sample is illuminated using \_\_\_\_\_
- a. Electron beam,
  - b. LASER,
  - c. Visible light,
  - d. Ultra violet
80. A 30% NaOH solution has a normality of:
- a. 6N,
  - b. 3N,
  - c. 7.5N,
  - d. 0.75N
81. Lectin is an example of:
- a. Carrier,
  - b. Mitogen,
  - c. Superantigen,
  - d. None of the above
82. Select the correct statement with respect to diseases and immunization:
- a. If due to some reason B and T lymphocytes are damaged, the body will not produce antibodies against a pathogen,
  - b. Injection of snake antivenom against snake bite is an example of active immunization,
  - c. Certain protozoans have been used to mass produce hepatitis vaccine,
  - d. Injection of dead/inactivated pathogens causes passive immunity
83. The cells lining the blood vessels belong to the category of:
- a. Columnar epithelium,
  - b. Connective tissue,
  - c. Smooth muscle tissue
  - d. Squamous epithelium
84. The clonal selection theory states that:
- a. An antigen selects certain B-cells and suppresses them.
  - b. An antigen stimulates the multiplication of B-cells that produce antibodies against it,
  - c. T-cells select those B-cells that should produce antibodies regardless of antigen present,
  - d. T-cells suppress all B-cells except one that should multiply and divide.
85. Most of the members of vitamin B complex act as:
- a. Cofactor,
  - b. Coenzyme,
  - c. Prosthetic group,
  - d. Apoenzyme

86. Amongst the following, the group that is bound to the metal ion in coenzyme B12 is:  
 a. Methyl,                      b. Cyanide,                      c. Adenosyl,                      d. Hydroxyl
87. When crystals of sodium chloride are heated in the presence of sodium vapor, they turn yellow. This is due to the formation of:  
 a. Schottky defects,                      b. Frenkel defects,                      c. F-centres,                      d. H-centres
88. Hydrolysis of a peptide involves cleavage of the bond between the atoms:  
 a. N and C<sub>α</sub>                      b. C and O,                      c. C<sub>α</sub> and C,                      d. N and C
89. Cellulose serves as a structural polymer whereas starch does not. This is because cellulose contains:  
 a. β1 → 4 linked glucose monomers and inter-chain hydrogen bonds  
 b. β1 → 4 linked glucose monomers and intra-chain hydrogen bonds,  
 c. α → 4 linked glucose monomers and inter-chain hydrogen bonds,  
 d. α → 4 linked glucose monomers and intra-chain hydrogen bonds
90. The fluidity of a phospholipid membrane increases when the fatty acid:  
 a. Chain length increases and degree of unsaturation decreases,  
 b. Chain length decreases and degree of unsaturation increases,  
 c. Chain length decreases and degree of unsaturation decreases,  
 d. Chain length increases and degree of unsaturation increases
91. Polypeptides are biosynthesized on the ribosomes inside the cell. Chemical synthesis of polypeptides is also possible through Merrifield's solid-phase peptide synthesis. In both the cases the polypeptide chain is extended one amino acid at a time. The direction of polypeptide synthesis is from:  
 a. C-terminus to N-terminus in both the cases,  
 b. N-terminus to C-terminus in both the cases,  
 c. C-terminus to N-terminus on the ribosomes and N-terminus to C-terminus in solid-phase synthesis,  
 d. N-terminus to C-terminus on the ribosomes and C-terminus to N-terminus in solid-phase synthesis
92. Aspartate residues are found in the active sites of many enzymes. The pK<sub>a</sub> for the β-carboxylate of aspartate is 3.86. At physiological pH this group can function as:  
 a. A nucleophile and a conjugate acid,                      b. An electrophile and a conjugate acid,  
 c. A nucleophile and a conjugate base,                      d. An electrophile and a conjugate base
93. Which one of the following is the most appropriate technique to determine the relatedness of two bacterial species?  
 a. DNA hybridization,                      b. Doubling time measurement,  
 c. Biochemical characterization,                      d. Plasmid profiling
94. Resident macrophages of \_\_\_\_\_ are called Kupffer cells.  
 a. Brain,                      b. Liver,                      c. Lung,                      d. Kidney
95. Biofilm produced by bacteria is detected by:  
 a. Saffranin,                      b. Malachite green,                      c. Basic fuchsin,                      d. Congo red

96. Which of the following infectious agents cross the blood-brain barrier? (P) Streptococcus pneumoniae, (Q) Coxsackie virus, (R) Rotavirus, (S) Streptococcus pyogenes  
a. P & S,                      b. R & S,                      c. P & Q,                      d. Q & R
97. When cells are treated with cyanide, which ONE of the following organelles will have the highest level of cyanide inside?  
a. Mitochondria,  
b. Peroxisomes,  
c. Lysosomes,  
d. Endoplasmic reticulum
98. Which ONE of the following is often a life-threatening systemic inflammatory response?  
a. Tuberculosis  
b. Lupus erythematosus,  
c. Septic shock,  
d. Hypertension
99. Rigor mortis is caused due to:  
a. Unavailability of ATP which is necessary to break the link between actin and myosin,  
b. Rupturing of tissue due to unavailability of oxygen,  
c. Decrease in body temperature,  
d. Breakage of rigid protein molecules in sarcoplasm
100. A dividing and undifferentiated mass of cells is called:  
a. Callus,                      b. Embryo,                      c. Explant,                      d. Zygote

