

**SO BIOLOGY  
ANSWER KEY  
CODE - A**

1. Which one of the following statements is not correct ?
- A) Calmodulin is a multifunctional intermediate calcium-binding messenger protein, found universally in plants, animals and eukaryotic micro-organisms.
  - B) Calmodulin acts as a part of calcium signal transduction pathway by modifying its interactions with various target proteins such as kinases or phosphatases.
  - C) Binding of  $\text{Ca}^{2+}$  is required for the activation of calmodulin.
  - D) Each molecule of calmodulin contains two binding sites for calcium.
2. Find out the measure of central tendency which requires data arrangement in descending or ascending order for its calculation.
- A) Arithmetic mean
  - B) Mode
  - C) Median
  - D) All of the above



5. Given below are statements pertaining to ANOVA technique. Identify the incorrect statement.
- A) The essence of ANOVA is that the total amount of variation in a set of data is broken down into two types, that amount which can be attributed to chance and that amount which can be attributed to specific causes.
  - B) In ANOVA model, the different components of variance should follow multiplicative law.
  - C) The purpose of ANOVA technique is to test the homogeneity of several population means.
  - D) ANOVA test helps to determine the significance or randomness of the results of an experiment.

6. Zinc-fingers are important in eukaryotic cell metabolism because they are
- A) Structural motifs in many DNA-binding proteins
  - B) Catalytic site of many metabolic enzymes
  - C) Needed for chromosome organization
  - D) Used in RNA silencing

7. The following statements are made on transposons.
- The two most common families of moderately repeated sequences in human DNA – the *Alu* and L1 families are DNA transposons.
  - DNA transposons are segments of DNA that move from one place to another via a cut and paste mechanism.
  - Approximately 40 percent of the human genome consists of DNA transposons and more than 3% consists of retrotransposons.
  - Retrotransposons operate by means of a copy-and-paste mechanism that involves an RNA intermediate.

Which one of the following combinations of above statements is correct ?

**A) Only i and iv**

B) Only ii and iv

C) Only i and iii

D) Only ii and iii

8. Which of the following is not the part of DNA polymerase III holoenzyme ?

A) SSB proteins

B)  $\beta$ -clamps

C) Core polymerases

D)  $\gamma$ -clamp loader

9. Given below are few statements regarding the controlling of the cell cycle.

i. The cell cycle is controlled primarily at two points – START and  $G_1$ -M transition.

ii. Cdc25 normally plays a key role in the  $G_2$ /M transition by removing inhibitory phosphates from Cdk1.

iii. Sic1 acts as Cdk inhibitor during  $G_1$ .

iv. Entry of a cell into M phase is triggered by the activation of MPF.

Which one of the following combinations of above statements is incorrect ?

A) Only i

B) Only ii

C) Only i and iii

D) Only ii and iv

10. Which of the following statements is/are not correct about the term species ?
- i. It may be regarded as morphologically definable units, made up of groups of individuals which are not usually interbreeding and containing one or more gene pools.
  - ii. The biological species concept was advanced by Ernst Mayr.
  - iii. It is a community of cross-fertilizing individuals linked together by bonds of mating and isolated reproductively from other species by barriers to mating.
  - iv. Members of the same species are reproductively compatible, but are reproductively isolated from other species.
- A) Only i —  
B) Only ii —  
C) Only iii and iv —  
D) Only i and ii —



11. Enlisted below are different types of sampling methods (Column – A) and explanation (Column – B), but not in the same order.

**Column – A**

1. Stratified sampling
2. Probability sampling
3. Systematic sampling
4. Non-probability sampling

**Column – B**

- p. Researchers select members of the population at a regular interval
- q. Items for the sample are selected deliberately by the researcher
- r. The population is divided into several sub-populations that are individually more homogenous than the total population and then select item from each group to constitute a sample
- s. Every item of the universe has an equal chance of inclusion in the sample

Choose the correct combination.

A) 1 – s, 2 – r, 3 – p, 4 – q

**C) 1 – r, 2 – p, 3 – s, 4 – q**

B) 1 – q, 2 – p, 3 – s, 4 – r

D) 1 – r, 2 – s, 3 – p, 4 – q

- 12) Which of the following is not an example of transmembrane transport between different sub-cellular compartments ?
- A) Transport from mitochondrial intermembrane space into the mitochondrial matrix
  - B) Transport from cytoplasm into the lumen of endoplasmic reticulum
  - C) Transport from endoplasmic reticulum to Golgi complex
  - D) Transport from stroma into thylakoid space

13. Which of the following statements is/are an objective of PPV and FR Act, 2001 ?
- A) To establish an effective system for the protection of plant varieties, the rights of farmers and plant breeders and to encourage the development of new varieties of plants.
  - B) Facilitate the growth of seed industry in the country which will ensure the availability of high quality seeds and planting material to the farmers.
  - C) To recognize and protect the rights of farmers in respect of their contributions made at any time in conserving, improving and making available plant genetic resources for the development of new plant varieties.
  - D) All of the above
14. The design of two oligonucleotide primers is the key to the success of a PCR reaction. Choose the statement which is not correct about the primers.
- A) The primers have to be complementary to the sequences flanking the target DNA.
  - B) They must be complementary to each other.
  - C) The primers have to be matched in their G + C content.
  - D) They should have similar annealing temperature.

15. Column – A lists the types of variables and Column – B lists the explanation of these variables, but not in the same order. Match both the columns carefully and select the correct option from those listed below them.

**Column – A**

1. Dependent variable

2. Independent variable

3. Continuous variable

4. Extraneous variable

- ▶ A) 1 – q, 2 – p, 3 – s, 4 – r
- B) 1 – q, 2 – s, 3 – r, 4 – p
- C) 1 – s, 2 – r, 3 – q, 4 – p
- D) 1 – r, 2 – s, 3 – q, 4 – p

**Column – B**

- p. Variables that are not related to the purpose of the study, but may affect the outcomes of the research study
- q. Variables which can take on an unlimited number of values between the lowest and highest points of measurement
- r. The variable, value of which may change due to change in the value of other variables
- s. It is the variable that stands alone and is not changed by other factors

16. Given below are set of statistical methods (Column – A) and their applications in biological research (Column – B), but not in the same order.

**Column – A**

1. Regression analysis
2. Spearman's coefficient of correlation
3. Variance
4. Chi-square analysis

**Column – B**

- p. Calculate the deviation between observed and expected values.
- q. Measure the spread of a distribution
- r. Prediction of value of a dependent variable based on known value of an associated variable
- s. Measure the degree of association between two variables

Choose the correct combination.

- A) 1 – r, 2 – s, 3 – q, 4 – p
- C) 1 – q, 2 – r, 3 – s, 4 – p

- B) 1 – s, 2 – p, 3 – r, 4 – q
- D) 1 – p, 2 – q, 3 – s, 4 – r

... combination with incorrect

17. Following are few statements regarding sandwich ELISA. Find the option with incorrect statement.
- A) It measures the amount of antigen between two layers of antibodies (i.e., capture and detection antibody).
  - B) The advantage of this method is that the sample doesn't have to be purified before analysis.
  - C) Monoclonal or polyclonal antibodies cannot be used as the capture and detection antibodies in this method.
  - D) The antigen to be measured must contain at least two antigenic sites capable of binding to antibody.

18. Given below is a list of analytical techniques (Column – A) and their characteristics (Column – B), but not in correct order.

**Column – A**

- i. SDS-PAGE
- ii. Affinity chromatography
- iii. Mass spectrometry
- iv. X-ray crystallography

**Column – B**

- a. Used to determine the three-dimensional molecular structure of proteins and biological macromolecules
- b. Separation of proteins on the basis of their molecular mass
- c. This purification technique takes advantage of the unique structural properties of a protein
- d. An analytical technique that separates ionized particles such as atoms, molecules and clusters by using differences in the mass-to-charge ratio

Choose the correct combination.

- A) i – d, ii – a, iii – b, iv – c
- C) i – c, ii – d, iii – b, iv – a

B) i – c, ii – a, iii – b, iv – d

D) i – b, ii – c, iii – d, iv – a

- 19) Which one of the following statements about miRNAs is not true ?
- A) miRNAs carry out translational level regulation by inducing the degradation of the target mRNA.
  - B) miRNA are a class of short, non-coding RNA molecule, play a significant role in the regulation of gene expression at the transcriptional level.
  - C) miRNA can repress the synthesis of proteins at some point after the initiation of translation has occurred.
  - D) A typical miRNA is partially complementary to a region in the 3'UTR of the mRNA target.



20. Which one of the following statements about phase contrast microscope is correct ?
- ✗ A) The phase contrast microscope is not useful for examining intracellular components of living cells at relatively high resolution.
  - ✗ B) Phase contrast microscopy is a technique used for gaining contrast in translucent specimen with staining the specimen.
  - C) The phase contrast microscope converts differences in refractive index of different parts of an object into differences in intensity, which are visible to the eye.
  - ✗ D) In negative phase contrast, a light specimen will have a bright halo on a light background.
21. Which one of the following microscopy works on the principle of interferometry to gain information about the optical path length of the sample, to see otherwise invisible features ?
- A) Nomarski microscopy
  - B) Fluorescence microscopy
  - C) Scanning electron microscopy
  - D) Scanning tunneling microscopy

22. The following are the statements about  $K_m$  value.
- It is one half of maximum reaction velocity.
  - The values of  $K_m$  are measured in terms of molarity.
  - By knowing the  $K_m$  value of a particular enzyme-substrate system, one can predict whether the cell needs more enzyme or more substrate to speed up the enzymatic reaction.
  - If an enzyme can catalyze a reaction with two similar substrates in the cell, it will prefer that substrate for which the enzyme has lower  $K_m$  value.

Which of the above statements is/are true ?

- A) Only i                      B) Only ii                      C) Only iii and iv                      **D) All of the above**

23. Which of the following is correct Michaelis-Menten equation ?

A)  $V = \frac{K_m + [S]}{V_{max}[S]}$

**B)  $V = \frac{V_{max}[S]}{K_m + [S]}$**

C)  $V = \frac{V_{max} + [S]}{K_m[S]}$

D) None of the above

24. Concentration of which of the following hormones increase in plants during senescence ?

- A) Auxin and gibberellin
- C) Ethylene and ABA**

- B) Cytokinins
- D) Cytokinin and auxin

25. Given below are group of inhibitors of oxidative phosphorylation and electron transport chain (Column - A) and their roles (Column - B), in a random order.

**Column - A**

1. Oligomycins
2. Atractylic acid
3. Rotenone
4. Cyanides

**Column - B**

- a. Inhibit flow of electrons from cyt.  $a_3$  to  $O_2$  in the last place of electron transport chain
- b. Blocking the activity of enzyme ATPase in the inner mitochondrial membrane
- c. Blocking ADP-ATP antiport in the inner mitochondrial membrane
- d. Check the flow of electrons from Fe-S protein in the complex-I to Ubiquinone

Choose the correct combination.

- A) 1 - c, 2 - d, 3 - a, 4 - b
- C) 1 - c, 2 - a, 3 - b, 4 - d**

B) 1 - b, 2 - c, 3 - d, 4 - a

**D) 1 - d, 2 - a, 3 - b, 4 - c**

26. How many molecules of NADPH and ATP respectively are required for the fixation of  $6\text{CO}_2$  molecules into one hexose sugar molecule through Calvin cycle ?
- A) 12 NADPH and 12 ATP  
 B) 12 NADPH and 18 ATP  
 C) 18 NADPH and 12 ATP  
 D) 18 NADPH and 18 ATP
27. Following statements are related to the  $\beta$ -oxidation of fatty acids.
- $\beta$ -hydroxyacyl CoA is dehydrogenated and form  $\beta$ -keto fatty acyl CoA.
  - Thioclastic cleavage of  $\beta$ -keto fatty acyl-CoA into fatty acyl-CoA and acetyl CoA.
  - The activation of fatty acids in the presence of ATP and enzyme thiokinase and produce fatty acyl-CoA.
  - Two hydrogen atoms are removed between  $\alpha$  and  $\beta$ -C atoms and a trans  $\alpha, \beta$ -unsaturated fatty acyl-CoA is formed in the presence of acyl-CoA dehydrogenase.
  - The addition of a water molecule across the double bond to form corresponding  $\beta$ -hydroxyacyl-CoA in the presence of enoyl hydratase.
- Which one of the following combinations of the above statements is in the correct sequential order ?
- A) 2, 3, 1, 4, 5      B) 3, 2, 1, 4, 5      C) 3, 4, 5, 1, 2      D) 2, 3, 5, 4, 1

28. Which of the following statements is incorrect ?
- A) Vernalized plant can be devernalized by treatment with high temperature.
  - B) Vernalization shortens the vegetative period of the plants.
  - C) Vernalization increases the cold resistance of the plants.
  - D) Vernalization is an anaerobic process.

29. Which of the following mineral ions are required for the photolysis of water in photosynthesis ?
- A)  $Mn^{++}$  and  $Cl^{-}$  ions
  - B)  $K^{+}$  and  $Cl^{-}$  ions
  - C)  $Mg^{++}$  and  $K^{+}$  ions
  - D)  $Zn^{++}$  and  $Cl^{-}$  ions
30. Fluorescence In Situ Hybridization (FISH) techniques are used for the detection of
- A) mRNA
  - B) Glycoprotein
  - C) Specific DNA
  - D) Protein sequences
31. Which among the following is not a primary nucleotide database ?
- A) NCBI
  - B) EMBL
  - C) DDBJ
  - D) PIR

32. Artificial competence in cells using calcium chloride method was discovered by  
A) Mandel and Higa  
B) John Sanford  
C) Douglas Bangham  
D) Newmann and Potter
33. DOT blot is a technique used to detect  
A) DNA  
B) RNA  
C) Proteins  
D) Recombinants
34. The transfer of gene to target plant cell using a very thin needle is called  
A) Liposome transfer  
B) Microinjection  
C) Electroporation  
D) Gene gun
35. Which Committee has been constituted by the Government of India to keep a check on genetically modified research product ?  
A) ICMR  
B) GEAC  
C) NCCS  
D) IARI

36. Homozygosity and heterozygosity of an individual can be determined by  
A) Test cross      B) Back cross      C) Self-fertilization      D) Alleles
37. Which among the following is not an autosomal recessive genetic disorder ?  
A) Cystic fibrosis      B) Haemophilia  
C) Sickle cell anemia      D) Albinism
38. Which amino acid has the triplet codon GUU ?  
A) Gly      B) Val      C) Ala      D) Asp
39. Which of the following phase is involved in the conversion of chromatin to chromosome ?  
A) G1-phase      B) S-phase      C) M-phase      D) G2-phase
40. The phage transduces those bacterial genes only which are adjoining to the prophage is observed in  
A) Lambda Phage      B) P1 Phage      C) Phage P22      D) All of the above



41. Which of the following is a dietary compound having epigenetic effect ?  
A) Curcumin      B) Genistein      C) Isothiocyanates      D) All of the above
42. Who coined the term "Chromosome" ?  
A) Sutton      B) Hoffmeister      C) Waldeyer      D) Boveri
43. Which one among the following factors does not affect the Hardy Weinberg principle ?  
A) Mutation      B) Genetic drift      C) Gene migration      D) Nutrition
44. Which of the following medium is composed of chemically defined compounds ?  
A) Selective media      B) Synthetic media      C) Living media      D) Natural media
45. Which of the following component is an unorganised extracellular layer that surrounds the bacterial cell wall ?  
A) Slime layer      B) Capsule      C) Peptidoglycans      D) LPS layer

46. The primary agenda of the Kyoto Protocol is  
A) Control of Greenhouse Gases B) Save Energy  
C) Soil Conservation D) Save Water
47. Which method of sterilization is called fractional sterilization ?  
A) Autoclaving B) Boiling C) Tyndallization D) Pasteurization
48. Which among the following group of viruses causes SARS disease ?  
A) Corona viruses B) Rhino viruses C) Influenza viruses D) RSV
49. Which is an example of secondary air pollutant ?  
A) Carbon monoxide B) Acid rain  
C) Sulfur oxides D) Lead
50. Vineyard sprayer's lung disease is due to chronic poisoning of  
A) Arsenic B) Lead C) Copper D) Mercury

51. Examples of Echinoderm are  
A) Sea urchins      B) Sand dollars      C) Sea biscuits      D) All of the above
52. The maximum volume of air contained in the lung by a full forced inhalation is called  
A) Ventilation rate      B) Tidal volume  
C) Vital capacity      D) Total lung capacity
53. Only right aortic arches are present in  
A) Birds      B) Mammals      C) Reptiles      D) Fishes

54. Which of the following statements about Placozoa is/are correct ?
- A) It is a minor phylum of minute flat organisms.
  - B) These are marine invertebrates.
  - C) These are simplest metazoans.
  - D) All of the above
55. Kidneys in the human body extend from
- A) 12<sup>th</sup> thoracic vertebrae to 3<sup>rd</sup> lumbar vertebrae
  - B) 10<sup>th</sup> thoracic vertebrae to 5<sup>th</sup> lumbar vertebrae
  - C) 8<sup>th</sup> thoracic vertebrae to 12<sup>th</sup> lumbar vertebrae
  - D) 5<sup>th</sup> thoracic vertebrae to 3<sup>rd</sup> lumbar vertebrae

56. Chromophil cells in annelids are concerned with the secretion of  
A) Amylase      B) Protease      C) Lipase      D) Cocoon
57. Antioxidants fight against  
A) Viruses      B) Fungus      C) Free radicals      D) Bacteria
58. Which of the following is the uncharged derivative of an acidic amino acid?  
A) Cystine      B) Tyrosine      C) Serine      D) Glutamine
59. Black stinging catfish (*Kaaree/kadoo* in Malayalam) is a popular and delicious freshwater fish of Kerala. But it obtained its scientific name only recently, in 2021; its scientific name is  
A) *Heteropneustes fossilis* (Bloch)  
B) *Heteropneustes longipectoralis* Hemadevi and Regunathan  
C) *Heteropneustes microps* (Gunther)  
D) *Heteropneustes fuscus* Plamoottil

60. The systems that work together to regulate water balance of the body are  
A) Digestive and cardiovascular  
B) Urinary and respiratory  
C) Cardiovascular and respiratory  
D) Urinary and cardiovascular
61. Which of the following parts of the brain regulates the respiratory process ?  
A) The vagus nerve  
B) Cerebral peduncle  
C) Medulla oblongata  
D) Cerebellum
62. Isotopes of an element have a different number of  
A) Proton  
B) Neutron  
C) Electron  
D) Atom
63. Digestion of proteins occurs in  
A) Ileum  
B) Liver  
C) Pancreas  
D) Rectum
64. The strongest bond is  
A) Electrostatic  
B) Covalent bond  
C) Hydrogen bonding  
D) Van der waals

65. Name the first cell which is recruited at the place of infection.  
A) Nk cells                      B) Basophils                      **C) Neutrophils**                      D) Macrophages
66. The specificity of an antibody is due to  
A) The heavy chains  
B) Its valence  
**C) The variable portion of the heavy and light chain**  
D) The Fc portion of the molecule
67. According to Boyle's Law of Gases  
A) The pressure and volume of a gas are equal  
B) As the temperature goes up, the pressure goes up  
**C) The total gas pressure is equal to the sum of the partial pressures**  
**D) If the volume goes up, the pressure goes down**
68. If there is any damage in the hypothalamus of brain, it may affect  
**A) Regulation of body temperature**                      B) Decision making  
C) Co-ordination during locomotion                      D) Short-term memory

69. Primary immune reaction is given by  
 A) IgE                      **B) IgM**                      C) IgA                      D) IgG
70. "Blood bank" of the body is  
 A) Lungs                      B) Heart                      **C) Spleen**                      D) Liver
71. The endocrine gland setting the biological clock of the body is  
 A) Thyroid gland                      B) Pituitary gland  
 C) Thymus gland                      **D) Pineal gland**
72. These substances will not stimulate an immune response unless they are bound to a larger molecule  
 A) Antibody                      B) Miligen                      **C) Hapten**                      D) Virus
73. Which of the following is not a plasma protein ?  
 A) Fibrinogen                      B) Albumin                      C) Globulin                      **D) Fibronectin**



74. Lining of the trachea is made up of
- A) Stratified epithelium
  - B) Simple squamous epithelium
  - C) Simple cuboidal epithelium
  - D) Pseudostratified epithelium
75. How many types of antibodies are there ?
- A) Five
  - B) Three
  - C) Two
  - D) Four
76. Comprehension of spoken and written words takes place in which area of brain ?
- A) Broca's area
  - B) Wernicke's area
  - C) Association area
  - D) None of these

77. Which of the following statements is true about the IgM of humans ?

- A) It can protect the mucosal surface.
- B) It can cross the placenta.
- C) It is produced by high-affinity plasma cells.
- D) It is primarily restricted in the circulation.

78. How many lobes are present in human left lung ?

- A) 4
- B) 2
- C) 3
- D) 1

79. Which of the following compounds is not found in tears ?

- A) Lysozyme
- B) Lactoferin
- C) IgA
- D) IgE

80. B cells that produce and release large amounts of antibodies are called  
A) Neutrophils      B) Killer cells      C) Plasma cells      D) Basophils
81. \_\_\_\_\_ is used to silence the expression of specific genes.  
A) Gene silencer      B) Dot blot technique  
C) RNA interference      D) Protein interference
82. First gene responsible for human genetic disease was isolated by positional cloning was the gene of  
A) Sickle cell disease      B) Cystic fibrosis  
C) Marfan syndrome      D) None of the above
83. \_\_\_\_\_ produced by genetic engineering is used to dissolve blood clot.  
A) Interferons      B) Thymosin      C) Beta Endorphin      D) Urokinase



89. In insects moulting hormone ecdysone are produced by  
A) Prothoracic gland B) Antennules C) Mandibles D) Green glands
90. Blastulae produced by spiral cleavage is called  
A) Coeloblastula B) Discoblastula C) Stereoblastula D) Periblastula
91. Tissue that produce signal that changes the cellular behaviour of other tissue  
A) Transducer B) Inducer C) Responder D) None of the above
92. Coding regions of eukaryotes is called  
A) Introns B) Exons C) Muton D) None of the above
93. Exogenous agents that causes birth defects called  
A) Teratogens B) Royalactin C) Polyphenism D) Polymorphism

94. Expanded form of BMP is  
 A) Bone Morphogenetic Proteins  
 B) Bone marrow Morphogenetic Proteins  
 C) Bis Phenol Proteins  
 D) Bipolar Interferons
95. Capacity of undifferentiated cells to develop into any type of cell in the body of an organism is called  
 A) Pleuripotent cells  
 B) Totipotent cells  
 C) Unipotent cells  
 D) None of the above
96. The entrance of more than one sperm during fertilization resulting the aneuploidy is called  
 A) Monospermy  
 B) Polyspermy  
 C) Induction  
 D) Transduction
97. The person from which pedigree is initiated is called  
 A) Promoter  
 B) Lod score  
 C) Proband  
 D) Probe

98. Trisomy 21 is called  
A) Edward Syndrome  
B) Patau Syndrome  
C) Cri-du-chat Syndrome  
D) Down Syndrome
99. Who secured Nobel Prize in Physiology in 2022 ?  
A) Edward Philip  
B) Annie Ernaux  
C) Svante Paabo  
D) Alain Aspect
100. When the plasma of a person has both anti A and anti B antibodies, the blood group of this person would be  
A) Group A  
B) Group AB  
C) Group O  
D) Group B



**THANK YOU**