Test Centre : _____

Roll No. : _____

Name of the Candidate : _____

S A U

Entrance Test for M.Sc. (Biotechnology) 2018

[PROGRAMME CODE : 30001]

Question Paper Series Code : A

QUESTION PAPER

Time : 3 hours *Maximum Marks* : 100

INSTRUCTIONS FOR CANDIDATES

Candidates must read carefully the following instructions before attempting the Question Paper :

(i) Write your Name and Roll Number in the space provided for the purpose on the top of this Question Paper and in the OMR Sheet.

(ii) **Please darken the appropriate circle of Question Paper Series Code on the OMR Sheet in the space provided.**

(iii) This Question Paper has Two Parts : Part—A has **30** questions and Part—B has **70** questions. Each question carries **1** mark. Attempt all questions.

(iv) **A wrong answer will lead to the deduction of one-fourth (¼) of the marks assigned to that question.**

(v) Answers written on the Question Paper will **NOT** be evaluated.

(vi) Pages at the end of the Question Paper have been provided for Rough Work.

(vii) Simple calculators are allowed. Mobile Phones are **NOT** allowed.

(viii) **Return the Question Paper and the OMR Sheet** to the Invigilator at the end of the Test.

(ix) **DO NOT FOLD THE OMR SHEET.**

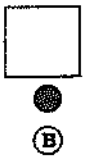
INSTRUCTIONS FOR MARKING ANSWERS ON THE 'OMR SHEET'

Use BLUE/BLACK Ballpoint Pen Only

1. **Please ensure that you have darkened the appropriate circle of 'Question Paper Series Code' and 'Programme Code' on the OMR Sheet in the space provided.**

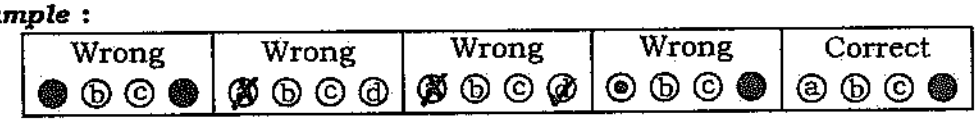
   Question Paper Series Code

   Write Question Paper Series Code **A** or **B** in the box and darken the appropriate circle.

2. Use only Blue/Black Ballpoint Pen to darken the circle. Do not use Pencil to darken the circle for Final Answer.
3. Please darken the whole circle. ●
4. Darken ONLY ONE CIRCLE for each question as shown below in the example :

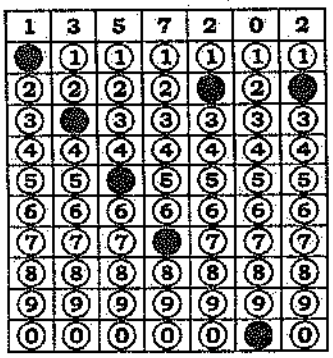
   Example :

5. Once marked, no change in the answer is possible.
6. Please do not make any stray marks on the OMR Sheet.
7. Please do not do any rough work on the OMR Sheet.
8. Mark your answer only in the appropriate circle against the number corresponding to the question.
9. **A wrong answer will lead to the deduction of one-fourth of the marks assigned to that question.**
10. Write your seven-digit Roll Number in small boxes provided for the purpose; and also darken the appropriate circle corresponding to respective digits of your Roll Number as shown in the example below.

    Example :

    ROLL NUMBER



PART—A

1. Which of the following is the most abundant protein/enzyme on earth?

   a. RuBisCO

   b. Hexokinase

   c. Triose-phosphate isomerase

   d. Catalase

2. The bacterium killed in Alexander Fleming's experiment during his discovery of penicillin was

   a. *Pseudomonas aeruginosa*

   b. *Escherichia coli*

   c. *Staphylococcus aureas*

   d. *Streptococcus pyogenes*

3. Acetic acid results from the reduction of

   a. maltose

   b. glucose

   c. carbon dioxide

   d. ethanol

4. In which step of wastewater treatment do microbes participate?

   a. Preliminary

   b. Primary

   c. Secondary

   d. Tertiary

5. If in a reaction, $A + B \rightarrow$ Product, the rate is doubled when the concentration of B is doubled, and rate increases by a factor of 8 when the concentrations of both the reactants (A and B) are doubled, then rate law for the reaction can be written as

   a. Rate = $k[A][B]$

   b. Rate = $k[A]^2[B]$

   c. Rate = $k[A][B]^2$

   d. Rate = $k[A]^2[B]^2$

6. Which one of the following amino acids is involved in the transport of excess ammonia from tissues to liver through the blood stream?

a. Glutamine

b. Glutamate

c. Alanine

d. Asparagine

7. On analysis, a certain compound was found to contain iodine and oxygen in the ratio of 254 gm of iodine to 80 gm of oxygen. The atomic mass of iodine is 127 and that of oxygen is 16. Which of the following is the formula of the compound?

a. IO

b. I_2O

c. I_5O_2

d. I_2O_5

8. In a zero-order reaction for every 10 °C rise in temperature, the rate is doubled. If the temperature is increased from 10 °C to 100 °C, then the rate of the reaction will become

a. 128 times

b. 256 times

c. 512 times

d. 1024 times

9. Which one of the following substances is formed when glycerol is treated with phosphorous pentachloride?

a. 1,2,3-trichloropropane

b. 1,2-dichloropropane

c. Isopropyl chloride

d. Phosphoglycerate

10. *A* follows first-order reaction, (*A*) → Product. Concentration of *A* changes from 0·1 M to 0·025 M in 40 minutes. Find the rate of reaction of *A*, when concentration of *A* is 0·01 M.

a. $1{\cdot}73 \times 10^{-4}$ M min^{-1}

b. $3{\cdot}47 \times 10^{-5}$ M min^{-1}

c. $3{\cdot}47 \times 10^{-4}$ M min^{-1}

d. $1{\cdot}73 \times 10^{-5}$ M min^{-1}

11. The best conductor of electricity is

a. graphite

b. coal

c. vacuum

d. air

12. Puromycin is commonly used for the inhibition of

a. DNA replication

b. transcription

c. translation

d. DNA supercoiling

13. The origins of replication are usually rich in

a. AG

b. AT

c. GC

d. CT

14. Enthalpy change occurs at

a. varied pressure

b. constant volume

c. varied volume

d. constant pressure

15. Determine the relation R in the set $A = \{1, 2, 3, 4, 5, 6\}$ as $R = \{(x, y) : y \text{ is divisible by } x\}$.

a. Reflexive, symmetric and transitive

b. Reflexive and transitive but not symmetric

c. Reflexive but not transitive and symmetric

d. Neither reflexive nor symmetric nor transitive

16. Find the principal value of $\cot^{-1}(1/\sqrt{3})$.

a. $3\pi/2$

b. $3\pi/\sqrt{2}$

c. $2\pi/3$

d. $2\pi/\sqrt{3}$

17. If A be a square matrix of order 3×3, then $|kA|$ equals to

a. $k|A|$

b. $k^2|A|$

c. $k^3|A|$

d. $3k|A|$

18. Differentiate the function with respect to x in $\cos(\sin x)$.

a. $\cos x \sin(\sin x)$

b. $-\cos x \sin(\sin x)$

c. $\sin x \cos(\sin x)$

d. $-\sin x \cos(\sin x)$

19. Find the value of $\int[(1-\sin x)/\cos^2 x]dx$.

a. $\tan x + \sec x + C$

b. $\tan x - \sec x + C$

c. $-\tan x - \sec x + C$

d. $-\tan x + \sec x + C$

20. If $2P(A) = P(B) = (5/13)$ and $P(A|B) = (2/5)$, then the value of $P(A \cup B)$ will be

a. 7/11

b. 7/13

c. 11/26

d. 11/15

21. The number of arbitrary constants in the general solution of a differential equation of fourth order is

a. 0

b. 2

c. 3

d. 4

22. How much negative charge is there in 1 L of water?

a. $5 \cdot 36 \times 10^{7}$ C

b. $3 \cdot 34 \times 10^{25}$ C

c. $5 \cdot 35 \times 10^{4}$ C

d. $9 \cdot 61 \times 10^{8}$ C

23. The electrostatic potential energy of a system consisting of two charges 7 μC and –2 μC (and with no external field) placed at (–9 cm, 0, 0) and (9 cm, 0, 0) respectively will be

a. 1·2 J

b. –1·4 J

c. –0·7 J

d. 0·9 J

24. The resistance of the platinum wire of a platinum resistance thermometer at ice point is 5 Ω and at steam point is 5·23 Ω. When the thermometer is inserted in a hot bath, the resistance of the platinum wire is 5·795 Ω. What will be the temperature of the bath?

a. 305 °C

b. 346 °C

c. 379 °C

d. 399 °C

25. A short bar magnet placed with its axis at 30° with an external field of 800 G experiences a torque of 0·016 Nm. What is the magnetic moment of the magnet?

a. $0 \cdot 4\ \text{Am}^2$

b. $0 \cdot 7\ \text{Am}^2$

c. $0 \cdot 9\ \text{Am}^2$

d. $1 \cdot 1\ \text{Am}^2$

26. A wheel with 10 metallic spokes each 0·5 m long is rotated with a speed of 120 rev/min in a plane normal to the horizontal component of earth's magnetic field H_E at a certain place. If $H_E = 0{\cdot}4$ G at that place, what is the induced e.m.f. between the axle and the rim of the wheel? Note that $1\,G = 10^{-4}$ T.

a. $2{\cdot}35 \times 10^{-5}$ V

b. $3{\cdot}18 \times 10^{-5}$ V

c. $5{\cdot}72 \times 10^{-5}$ V

d. $6{\cdot}28 \times 10^{-5}$ V

27. The amplitude of the magnetic field part of a harmonic electromagnetic wave in vacuum is $B_0 = 510$ nT. What is the amplitude of the electric field part of the wave?

a. 125 N/C

b. 153 N/C

c. 171 N/C

d. 185 N/C

28. At what speed should a galaxy move with respect to us so that the sodium line at 589 nm is observed at 589·6 nm?

a. 183 km/s

b. 257 km/s

c. 306 km/s

d. 325 km/s

29. The pressure (psi—pounds per square inch) at earth's surface is

a. 14 psi

b. 21 psi

c. 0 psi

d. 18 psi

30. The rate law for a reaction between the substances A and B is given by rate $= k[A]^n[B]^m$. On doubling the concentration of A and halving the concentration of B, the ratio of the new rate to the earlier rate of reaction will be

a. $m + n$

b. $n - m$

c. $2^{(n-m)}$

d. $\frac{1}{2}^{(m+n)}$

PART—B

31. Which one of the following column chromatography techniques can be used for the purification of poly-arginine tagged protein?

a. Affinity chromatography

b. Cation-exchange chromatography

c. Anion-exchange chromatography

d. Size-exclusion chromatography

32. How many ATPs are synthesized during the complete oxidation of a single acetyl CoA?

a. 2

b. 10

c. 20

d. 30

33. Which one of the following groups of amino acids is synthesized from pyruvate?

a. Valine, leucine and isoleucine

b. Glutamine, proline and arginine

c. Methionine, threonine and lysine

d. Tryptophan, phenylalanine and tyrosine

34. How much energy is produced by the complete oxidation of one gram of fatty acid?

a. ~0·38 kJ

b. ~3·8 kJ

c. ~38 kJ

d. ~380 kJ

35. Which one of the following glucose transporters has the highest K_M value?

a. GLUT1 of all mammalian tissues

b. GLUT2 of liver

c. GLUT3 of all mammalian tissues

d. GLUT4 of muscle and fat cells

36. Glucose-6-phosphate (6C) is converted to ribose-5-phosphate (5C) by pentose phosphate pathway. Which carbon from glucose-6-phosphate is removed in the form of CO_2 in this process?

a. C6

b. C1

c. Either C1 or C6

d. Any carbon can be removed

37. Which one of the following inheritable metabolic defects in humans was discovered first?

a. Diabetes

b. Phenylketonuria

c. Obesity

d. Lesch-Nyhan syndrome

38. Which one of the following citric acid cycle intermediates is precursor of porphyrins?

a. Oxaloacetate

b. Malate

c. Succinyl CoA

d. α-ketoglutarate

39. Which one of the following leukocytes are present in blood in the highest numbers?

a. B cells

b. NK cells

c. Eosinophils

d. Neutrophils

40. How many protein chains are there in a fully-assembled IgM antibody molecule?

a. 5

b. 20

c. 21

d. 25

41. Which one of the following statements about the antibody molecule is ***not*** true?

a. Immunoglobulin unit has two heavy and two light chains.

b. Heavy and light chains are bound by disulfide bond.

c. Each immunoglobulin unit has two different antigen binding sites.

d. Constant domains do not participate in antigen binding.

42. Virus-infected cells are generally eliminated by which kind of immune cells?

a. A class of T cells

b. A class of B cells

c. Macrophages

d. Neutrophils

43. Which one of the following properties is ***not*** associated with natural killer cells?

a. Killing of tumor cells

b. Phagocytosis of virus

c. Killing of virus-infected cells

d. Activation by interferon

44. Graft rejection reaction is mediated by

a. T cells

b. macrophages

c. B cells

d. mast cells

45. Which one of the following is ***not*** required for anti-pollen allergies?

a. IgE

b. IgA

c. Mast cell

d. Basophil

46. Which of the following is ***not*** a quantitative variable?

a. Height of a person

b. Blood pressure

c. Number of flowers

d. Weight of a newborn baby

47. Which one of the following is a central tendency?

a. Standard deviation

b. Median

c. Range

d. Median deviation

48. Interquartile range is

a. Q_1

b. Q_3

c. $Q_3 - Q_1$

d. $(Q_3 - Q_1)/2$

49. A paired *t*-test is done to identify the difference between

a. two groups

b. three groups

c. one group, before and after a treatment

d. three groups, before and after a treatment

50. Which one of the following tests is ***not*** done for categorical vs. categorical variables?

a. Chi-square test

b. Fisher's exact test

c. Student's *t*-test

d. McNemar's test

51. In a normal distribution curve

a. Mean > Median > Mode

b. Mean < Median < Mode

c. Mean = Median = Mode

d. Mean = Standard deviation

52. Which region of marine habitat refers to the microscopic interface between water and air?

a. Pelagic zone

b. Neuston

c. Euphotic zone

d. Aphotic zone

53. The term 'mycology' would best be applied to which one of the following organisms listed below?

a. Stromatolites

b. Baker's yeast

c. Cyanobacteria

d. Slime molds

54. Rhodophyta or red algae appear red due to

a. chlorophyll a

b. chlorophyll b

c. phycocyanin

d. phycoerythrin

55. Which one of the following is ***not*** a phylum among the archaea?

a. Crenarchaeota

b. Euryarchaeota

c. Methanoarchaeota

d. Nanoarchaeota

56. In wastewater, the bacteria are packed together by filamentous _____ to form sludge.

a. halophiles

b. thermophiles

c. methanogens

d. psychrophiles

57. To screen a developing embryo for genetic aberrations, or for sex determination, the fluid is collected from the

a. amnion

b. chorion

c. allantois

d. yolk sac

58. The first complete genome of a cellular organism came out in 1995 and belonged to

a. *Arabidopsis thaliana*

b. *Saccharomyces cerevisiae*

c. *Caenorhabditis elegans*

d. Hemophilus influenza

59. The characteristics that have arisen as a result of common evolutionary descent are said to be

a. homogenous

b. homologous

c. contiguous

d. parallel traits

60. The science dealing with the application of the laws of heredity and genetics towards the improvement of human race is called

a. Euthenics

b. Eugenics

c. Euphenics

d. Ethnology

61. In the B form of DNA, there are 10 bases per turn of helix. Each base pair, therefore, rotates by an angle of

a. 10°

b. 22°

c. 34°

d. 36°

62. The reverse transcription of eukaryotic mRNA can be achieved in vitro using the enzyme reverse transcriptase along with

a. oligo-dA primers

b. oligo-dT primers

c. oligo-dC primers

d. oligo-dU primers

63. Which one of the following amino acids is translationally incorporated, i.e., proteinogenic in nature?

a. Hydroxyproline

b. Acetyllysine

c. Pyrrolysine

d. Hydroxyserine

64. Post-transcriptional modification such as splicing occurs within the

a. nucleus

b. cytoplasm

c. endoplasmic reticulum

d. ribosomes

65. Catalytic activity has been observed for which one of the following species?

a. DNA

b. mRNA

c. tRNA

d. rRNA

66. Chlorophyll absorbs

a. green light

b. red and blue light

c. white light

d. UV light

67. In vascular plants, sugar is transported through

a. xylem

b. phloem

c. stomata

d. mesophyll

68. Which chemotherapeutic/anticancer drug is produced by *Catharanthus roseus*?

a. Vincristine

b. Taxol

c. Fluorouracil

d. Colchicine

69. In which one of the following acids is the natural phytohormone 'auxin' present in plants?

a. Indole acetic acid

b. 1-naphthaleneacetic acid

c. 2,4-dichlorophenoxyacetic acid

d. 2,4,5-trichlorophenoxyacetic acid

70. Monocot plants have

a. a network of veins in the leaf and vascular bundle in a ring

b. a network of veins in the leaf and scattered vascular bundle

c. parallel veins in the leaf and scattered vascular bundle

d. parallel veins in the leaf and vascular bundle in a ring

71. Which of the following plant hormones is ***not*** related to any stress?

a. Ethylene

b. Salicylic acid

c. ABA

d. Auxin

72. Which of the following hormones causes cell elongation in internodal regions of green plants?

a. ABA

b. Auxin

c. Gibberellin

d. Cytokinin

73. Which one of the following is ***not*** a micronutrient for plants?

a. K

b. Na

c. Fe

d. Zn

74. Which one of the following statements regarding transgenic technology is not a myth?

a. Transgenics have genes but normal plants don't have genes.

b. When we create transgenics, we don't exactly know the changes in the genetic level in plants.

c. Transgenic plants/products are not organic or natural and are harmful for the system.

d. Transgenes can easily spread through pollen so transgenics should be grown with strict regulation and isolation.

75. The DPT vaccine protects against

a. Diphtheria, Polio, Tetanus

b. Diphtheria, Pertussis, Tetanus

c. Diphtheria, Pertussis, Typhoid

d. Diphtheria, Polio, Typhoid

76. In India, kala-azar is caused by

a. *Leishmania donovani*

b. *Leishmania tropica*

c. *Leishmania major*

d. *Leishmania chagasi*

77. Virus-mediated transfer of cellular genetic material from one bacterial cell to another is called

a. transfection

b. transduction

c. transformation

d. transposition

78. Peptidoglycan is a polymer comprising all, *except*

a. N-acetyl glucosamine

b. N-acetyl muramic acid

c. N-acetyl neuraminic acid

d. sialic acids

79. Which one of the following is a class of RNA viruses?

a. Adenoviruses and herpesviruses

b. Poxviruses

c. Parvoviruses

d. Coronaviruses and picornaviruses

80. A messenger RNA is 336 nucleotides long, including the initiator and termination codons. The number of amino acids in the protein translated from this mRNA is

a. 999

b. 630

c. 112

d. 111

81. For ultra-high temperature (UHT) treatment of milk, to increase its shelf life up to 6 months, milk is heated to

a. 87·8 °C for 30 minutes

b. 71·6 °C for 30 seconds

c. 87·8 °C for 3 seconds

d. 71·6 °C for 15 seconds

82. The process of the formation of nitrate from ammonia is known as

a. nitrate assimilation

b. nitrification

c. ammonia assimilation

d. denitrification

83. Chloroplast contains disc-like membranous structures arranged in a stack, is called

a. cisternae

b. grana

c. stroma

d. thylakoids

84. Which one of the following viruses binds with alpha-2 macroglobulin?

a. HIV

b. Epstein-Barr virus

c. Hepatitis A

d. Rhinovirus

85. Which one of the following statements best describes why intermediate filaments cannot participate in the generation of force for cell motility?

a. They are not intrinsically polar and hence cannot utilize motor proteins.

b. The cells are unable to control the assembly.

c. They cannot disassemble.

d. They are found only in association with certain cell junctions.

86. In which form are carbohydrates present in plasmalemma?

a. Cellulose

b. Hemicellulose

c. Starch

d. Glycolipids and glycoproteins

87. What is the major function of smooth endoplasmic reticulum?

a. Lipid synthesis

b. Protein synthesis

c. Carbohydrate synthesis

d. Amino acid synthesis

88. Which one of the following organelles is called as the sorting centre of the cell?

a. Rough endoplasmic reticulum

b. Smooth endoplasmic reticulum

c. Golgi apparatus

d. Lysosome

89. Which one of the following is a cell surface carbohydrate-binding protein?

a. Cadherin

b. Integrin

c. Selectin

d. Elastin

90. Cellular totipotency means the

a. capacity of a plant cell to form complete plant

b. formation of new plant

c. formation of new cell

d. formation of new species

91. Which one of the following cyclins and cyclin-dependent kinase initiate centrosomes duplication during cell cycle?

a. E/CDK2

b. D/CDK4/6

c. A/CDK2

d. B/CDC2

92. Which one of the following drugs is a microfilament inhibitor?

a. Aspirin

b. Colchicine

c. Cyclohexamide

d. Cytochalasin-B

93. Which one of the following cell adhesion junctions is called hemidesmosome?

a. Cell-cell adhesion junction supported by microfilaments

b. Cell-cell adhesion junction supported by intermediate filaments

c. Cell-matrix junction supported by intermediate filaments

d. Cell-matrix junction supported by microfilaments

94. Which of the following cells belong to the category of professional antigen presenting cells?

a. Epithelial cells

b. Dendritic cells

c. Neutrophils

d. Endothelial cells

95. In which of the following transplantations is tissue typing not needed?

a. Kidney transplantation

b. Blood transfusion

c. Liver transplantation

d. Skin transplantation

96. Indel mutations can be brought about by the action of all of the following, *except*

a. 5-bromouracil

b. acridine

c. intercalating agents

d. gene transposition

97. Propagation of action potential across a myelinated axon is known as

a. Wallerian degeneration

b. synaptic integration

c. saltatory conduction

d. neurotransmission

98. When the contribution of two mutations to the phenotype of a double mutant exceeds the expectations from the combined effects of individual mutations, it is called

a. additive interaction

b. synergistic interaction

c. antagonistic interaction

d. complementation

99. Which one of the following groups of scientists discovered the direct link between genes and enzymatic reactions?

a. Oswald Avery, Colin McLeod and Maclyn McCarty

b. Rosalind Franklin and Maurice Wilkins

c. George Beadle and Edward Tatum

d. Maurice Wilkins, James Watson and Francis Crick

100. Plasmid DNA can be specifically isolated from bacterial cultures without genomic DNA contamination through

a. phenol-chloroform separation

b. alkaline lysis method

c. treatment with DNases

d. affinity chromatography

SPACE FOR ROUGH WORK

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★★★