ENTRANCE EXAMINATIONS – 2018

Integrated MSc/PhD Program – Biotechnology

Time: 2 hours   **Maximum Marks: 80**

HALL TICKET NUMBER [   ]

INSTRUCTIONS

1. Enter your Hall Ticket number in the OMR answer sheet given to you. Also write the Hall Ticket number in the space provided above.

2. Please read carefully the instructions before answering the questions.

3. Answers are to be marked on the OMR answer sheet with BLACK/BLUE ball point/sketch pen following the instructions provided there upon.

4. Hand over the OMR answer sheet at the end of the examination to the Invigilator. The candidate can take the question paper with him at the end of the examination.

5. The question paper contains 80 questions of multiple choice types printed in 18 pages including this page. OMR answer sheet is provided separately.

6. The question paper consists of Part A and Part B. All questions carry one mark each.

7. The marks obtained in part A will be taken into consideration in case of tie, when more than one student gets equal marks to prepare the merit list.

8. There is a negative marking; each wrong answer carries 0.33 negative mark.

9. No additional sheets will be provided. Rough works may be done in the question paper / in the space provided at the end of the booklet.

9. Use of non-programmable scientific calculator is permitted.

10. Cell/Mobile Phones are strictly prohibited in the examination hall.

PART – A

1. A college store sells T-shirts in three colors: gold, black, and purple. If the colors are in the ratio 2:3:5, respectively, and the store has 10 gold shirts, how many purple shirts are there?

    A. 15

    B. 25

    C. 20

    D. 5

2. Samantha saved $100 over 5 weeks. Each week she saved $6 more than she did during the previous week. How much money did she save in the first week?

    A. $4

    B. $8

    C. $12

    D. $16

3. The Nobel Prize in Physiology & Medicine -2017 was awarded to Jeffrey C. Hall, Michael Rosbash and Michael W. Young for their work on

    A. discoveries concerning a novel therapy against Malaria

    B. discoveries of mechanisms for autophagy

    C. discoveries of molecular mechanisms controlling the circadian rhythm

    D. cryo-electron microscopy for structural determination of biomolecules

4. If half-life of a compound is 14 days, how much will be remaining after 56 days?

    A. 3.125%

    B. 50%

    C. 12.5%

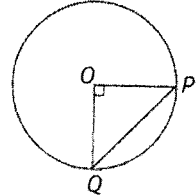   D. 6.25%

5. *r* is a straight line as shown below. Which of the following point lies on the line?

A. (6,6)

B. (7,3)

C. (10,2)

D. (9,3)
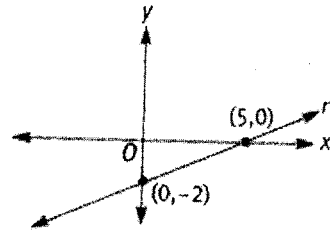
6. If the length of chord $PQ = 4\sqrt{2}$, what is the circumference of the circle with center *O*?

A. 4π

B. 8π

C. $8\pi\sqrt{2}$

D. 4

7. If quantity $A = \dfrac{1}{4} + \dfrac{1}{5} + \dfrac{1}{6} + \dfrac{1}{7}$ and quantity $B = \dfrac{1}{\frac{1}{4}+\frac{1}{5}+\frac{1}{6}+\frac{1}{7}}$, then

A. Quantity A is greater

B. Quantity B is greater

C. The two quantities are equal

D. The relationship cannot be determined from the information given

8. In a Zoological Park, the ratio of peacocks to pigeons is 4:11. If there are 84 more pigeons than peacocks, how many peacocks are there?

A. 24

B. 72

C. 36

D. 48

9. If $r = 3s$, s = *5t*, $t = 2u$, u ≠ 0, what is the value of $\dfrac{rst}{u^3}$

A. 60

B. 300

C. 600

D. 150

10. The figure below is made up of 3 squares. If the perimeter of the figure is 40 units, what is the area of the figure in square units?
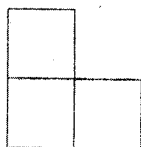
       A. 200

       B. 120

       C. 75

       D. 150

11. In which of the following medium a reaction can be conducted to determine whether water participates in the reaction?

       A. Deuterium oxide

       B. Tritium oxide

       C. Dihydrogen oxide

       D. Magnesium Oxide

12. A disease always present in a population is referred as

       A. Pandemic

       B. Endemic

       C. Epidemic

       D. Hypodermic

13. Disinfectant agents to clean surgical wounds in order to control infections in humans are introduced by

       A. Redi

       B. Semelweiss

       C. Jenner

       D. Lister

14. Ajmal drives from his house to his friend's house averaging 60 miles per hour. On the return trip, he averages 50 miles per hour. His total driving time for the round trip is 11 hours. What is the distance, in miles, between Ajmal's house and his friend's house?

    A. 300

    B. 150

    C. 110

    D. 330

15. A rectangular flower-bed is 4 times as long as it is wide. If the flower bed were 5 feet shorter and 4 feet wider, it would be a square. The length of the flower-bed is

    A. 8 feet

    B 9 feet

    C. 10 feet

    D. 12 feet

16. The grass in a city park can be mowed by 5 gardeners in 6 hours. Working at the same rate, how many hours would it take for 8 gardeners to mow that same grass?

    A. $3\frac{3}{4}$

    B. $4\frac{3}{4}$

    C. $4\frac{1}{4}$

    D. $5\frac{3}{4}$

17. The average (arithmetic mean) of $8, j, 21$, and 24 is k. The average of k, 25, and 30 is 24. What is the value of j?

    A. 17

    B. 15

    C. 19

    D. 21

18. If x, y, and z are consecutive odd integers, which of the following must be odd?

    A. $x + 2y + 3z$

    B. $x(y + z)$

5

C. $(x + 1)(z - y)$

D. xyz

19. If 2 is the remainder when m is divided by 5, what is the remainder when $3m$ is divided by 5?

    A. 0

    B. 1

    C. 2

    D. 3

20. If $5x + y = 2x + 4y$, what is x in terms of y?

    A. $(3/5)y$

    B. $2y$

    C. y

    D. $(5/7)y$

21. Earth's atmosphere layers are in the order of (by the distance from the sea level)

    A. troposphere < mesosphere < stratosphere < exosphere < thermosphere

    B. troposphere < mesosphere < stratosphere < thermosphere < exosphere

    C. troposphere < stratosphere < mesosphere < exosphere < thermosphere

    D. troposphere < stratosphere < mesosphere < thermosphere < exosphere

22. Oxidative phosphorylation involves simultaneous oxidation and phosphorylation to finally form

    A. NADP

    B. ATP

    C. Pyruvate

    D. Cytochrome

23. The total charge on the peptide RREEA is

    A. +2

    B. -2

    C. +3

    D. None of the above

24. Manushi goes to the garden center to buy 1 ornamental vine and 3 tomato plants. If the garden center is stocked with 3 types of ornamental vines and 6 types of tomato plants, how many different selections of the 4 items can Valeria make?

    A. 12

    B. 18

    C. 20

    D. 60

25. The diagonal of a square with side 4 units is a radius of a circle. What is the area of the circle?

    A. 16

    B. $16\sqrt{2}\pi$

    C. 32π

    D. $32\sqrt{2}\pi$
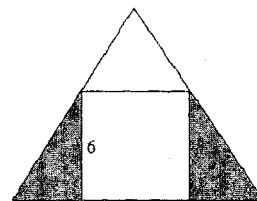
26. If $\S n = n - 4$ and $\blacklozenge n = 2n$, which of the following is the value of $\blacklozenge(\S(\blacklozenge 4))$?

    A. -4

    B. 4

    C. 8

    D. 6

27. A square with sides of length 6 is inscribed in an equilateral triangle as shown below. What is the combined area of the shaded regions?

    A. $6\sqrt{3}$

    B. $12\sqrt{3}$

    C. $24\sqrt{3}$

    D. $6+6\sqrt{3}$

28. The number of roots for the function y = 1/(1-x) is

    A. none

    B. one

    C. two

    D. three

29. Mass of a proton is nearly _____ times heavier than an electron

    A. 1837

    B. 8317

    C. 3187

    D. 7183

30. If the concentration of product formed versus time is a linear change, the order of reaction is

    A. First

    B. Fractional

    C. Zero

    D. Second

31. $Ohm^{-1} m^{-1}$ is unit of

    A. electrical resistivity

    B. electrical conductivity

    C. inductance

    D. capacitance

32. Silver stains can be removed by

    A. Nitic acid

    B. Hydrochloric acid

    C. Carbonic acid

    D. Ammonia

33. How many integers are there in the solution set of $|x-2| \leq 5$?

    A. 11

    B. 0

    C. an infinite number

    D. 9

34. If the ratio of *sin x* to *cos x* is 1 to 2, then the ratio of *tan x* to *cot x* is

    A. 1:2

    B. 1:1

    C. 2:1

    D. 1:4

35. If the following translations hold good then what does the word "Fiur" mostly mean?

    "Berum Fiur Tokens" = Where is your leader?

    "Berum Toob Cobb" = Our planet is distant.

    "Berum Fiur Cobb" = Where is our planet?

    A. Leader

    B. Where

    C. is

    D. planet

36. If $x+y = 6$, $y+z = 7$, and $x+z = 9$, then what is $x+y+z = ?$

    A. 11

    B. 12

    C. 23

    D. 13

37. The number of vibrational degrees of freedom in carbon dioxide is

    A. 3

    B. 4

    C. 5

    D. 9

38. Molecularity of the reaction: $2 NO + O_2 \rightarrow 2 NO_2$,

    A. unimolecular

    B. pseudo-unimolecular

    C. bimolecular

    D. termolecular

39. Which of the following amino acid has more than one chiral centre?

   A. serine

   B. tryptophan

   C. threonine

   D. methionine

40. A stone attached at the end of a string of 1 m in length makes 7 full rotations in a second. The angular velocity of the stone is,

   A. 3.14 radian/s

   B. 7 radian/s

   C. 22 radian/s

   D. 44 radian/s

PART B

41. Quantitative estimation of sulphate is carried out using

   A. Barium Chloride

   B. Sodium Chloride

   C. Lithium Chloride

   D. Calcium Chloride

42. Commonly used primary standard for acid-base as well as redox titrations is

   A. Potassium bromate

   B. Oxalic acid

   C. Sodium carbonate

   D. Sodium arsenite

43. The growth of a 'facultative anaerobe' will be

   A. At the surface of the culture medium

   B. At the bottom of the culture medium

   C. At the middle of the culture medium

   D. Throughout the culture medium

44. The tough, water insoluble protein present in the outer portion of the epidermis of skin is

    A. Epidermin

    B. Carotene

    C. Keratin

    D. Impenetrin

45. Which of the following is part of a virus?

    A. Capsid

    B. Core

    C. Nucleocapsid

    D. All of the above

46. If, both circular and open circular DNAs are analyzed in a single agarose gel electrophoresis,

    A. both the DNAs migrates at same speed

    B. circular DNA migrates faster

    C. open circular DNA migrates faster

    D. No relevance in migration

47. In the case of 'edible vaccines' the antigen is available as

    A. the only antigen as food material

    B. mixed along with the food material

    C. expressed in vegetable/fruit while they are growing

    D. all of the above

48. Antigen-presenting cells that activate helper T cells must express which one of the following on their surfaces?

    A. IgE

    B. gamma interferon

    C. class I MHC antigens

    D. class II MHC antigens

49. While working with a mutant DNA polymerase that is partially defective, the *In vitro* experiments show an error rate of 10^{-3} as compared to the expected error rate of 10^{-6}. Which of the following activity is the mutant polymerase likely to be missing as compared to the normal polymerase?

    A. 5' to 3' polymerase

    B. 5' to 3' exonuclease

    C. 3' to 5' exonuclease

    D. 3' to 5' recombinase

50. The association between the ribosome and the messenger RNA molecule occurs in the

    A. Nucleus

    B. Nucleolus

    C. Cytoplasm

    D. Centromere

51. What kinds of proteins are recognized by proteasome?

    A. ubiquitinylated proteins

    B. denatured proteins

    C. proteins with basic or aromatic amino acids at the N-terminus

    D. viral proteins

52. What is the role of Hsp60 (GroEL/GroES) in protein folding?

    A. To direct the three dimensional folding of a protein

    B. To hold a peptide in extended form until its synthesis is complete and correct folding can occur

    C. To provide a sequestered chamber where protein folding can occur without interference from surrounding molecules

    D. To rescue the denatured or incorrectly folded protein giving it a chance to refold

53. Which of the following protein is required for one round of *in vitro* DNA replication using a single-stranded linear DNA as the template and the appropriate DNA primer?

    A. Primase

    B. DNA polymerase

    C. Ligase

    D. Helicase

54. How many distinct transfer RNA molecules are expected to be present in a cell (not including those present in the mitochondria)?

    A. 64

    B. 61

    C. 20

    D. between 20 and 61

55. Which among the following proteins involved in peptide initiation and chain elongation is GTPase switch?

    A. Only EF-Tu

    B. Only EF-G

    C. Both EF-Tu and EF-G

    D. Initiation factor 2

56. The major differences between the prokaryotic and eukaryotic protein synthesis mechanisms are in

    A. the initiation of synthesis

    B. the chain elongation process

    C. the chain termination process

    D. none, there are no major differences

57. Which of the following best describes the 'cap' modification of eukaryotic mRNA?

    A. A modified guanine nucleotide added to the 3' end of the transcript

    B. A modified guanine nucleotide added to the 5' end of the transcript

    C. A string of adenine nucleotides added to the 3' end of the transcript

    D. A string of adenine nucleotides added to the 5' end of the transcript

58. A phosphogylceride is always

  A. only an unsaturated fatty acid esterified to a glycerol molecule to which a phosphate group is also attached

  B. a saturated or unsaturated fatty acid esterified to a glycerol molecule to which a phosphate group is also attached

  C. a saturated or unsaturated fatty acid esterified to a phosphate group, which is also attached to a glycerol molecule

  D. only a saturated fatty acid esterified to a glycerol molecule to which a phosphate group is also attached.

59. Which one of the following pairs is wrongly matched?

  A. Fruit juice – Pectinase

  B. Detergents – Lipase

  C. Alcohol – Nitrogenase

  D. Textile - Amylase

60. Which of the following is NOT required for any of the techniques of DNA fingerprinting available at present?

  A. Restriction enzymes

  B. Polymerase chain reaction

  C. Zinc finger analysis

  D. DNA – DNA hybridization

61. In glycolysis, during the oxidation, electrons are removed by

  A. Glyceraldehyde-3-phosphate

  B. ATP

  C. NAD^+

  D. Molecular oxygen

62. Link between glycolysis, Krebs' cycle and ß-oxidation of fatty acids is

  A. oxaloacetic acid

  B. succinic acid

  C. acetyl Co-A

  D. citric acid

63. Which of the following processes are sensitive to extracellular DNases?

    A. transformation

    B. conjugation

    C. transduction

    D. both transduction and conjugation

64. What would happen if in a gene coding a polypeptide of 50 amino acids, 25th codon (UAC) is mutated to UAA?

    A. a polypeptide of 49 amino acids will be formed

    B. a polypeptide of 25 amino acids will be formed

    C. a polypeptide of 24 and 25 amino acids will be formed

    D. a polypeptide of 24 amino acids will be formed

65. After mating with an *Hfr* strain, what happens to an F$^-$ cell?

    A. It becomes F$^+$ and picks up some chromosomal genes

    B. It becomes Hfr and picks up some chromosomal genes

    C. It becomes F$^+$ but does not pick up any chromosomal genes

    D. It stays F$^-$ but picks up some chromosomal

66. Which is the most common anaerobe in the normal body flora?

    A. *Salmonella enteriditis*

    B. *Campylobacter jejuni*

    C. *Yersinia pestis*

    D. *Escherichia coli*

67. The value of omega (ω) angle in a *trans* peptide unit is (in degrees)

    A. only +180

    B. only -180

    C. + or – 180

    D. none of the above

68. Signals required for T cell activation

    A. Peptide-MHC complex

    B. Co-stimulation

    C. Cytokines and other effectors molecules etc.

    D. All of the above

69. Rapid but non-antigen specific immune responses are produced by the

    A. Adaptive immune response

    B. Innate immune system

    C. Leukocytes

    D. Lymphatic system

70. Which of the following are true with regard to interferons?

    A. Activates B cells to make virus specific antibodies

    B. Are Th2 cytokines

    C. Are virus proteins that interfere with activation of cytotoxic T cells

    D. Inhibits virus replication by infected cells

71. Cells that release histamine and other vasoactive substances in response to allergens are

    A. neutrophils

    B. macrophages

    C. NK cells

    D. mast cells

72. Which of the following disease is not an autoimmune disease?

    A. rheumatoid arthritis

    B. lupus erythematosis

    C. bovine spongiform encephalitis

    D. grave's disease

73. The T cells receptors can bind to antigenic peptides

    A. only in the free form

    B. only when loaded onto MHC molecule

    C. only when bound to hapten

    D. only when bound by antibodies

74. Cytotoxic T cells are distinguished from Helper T cells by the presence of?

    A. CD2

    B. CD3

    C. CD8

    D. Class II MHC antigen

75. A white light falls on a glass. After passing through the glass, the first color emerging from the glass will be

    A. Red

    B. Yellow

    C. Green

    D. Blue

76. Which of the following types of genes are NOT known in any mitochondrial genome?

    A. tRNA genes

    B. Respiratory chain genes

    C. Glycolytic genes

    D. rRNA genes

77. --------- may contain the nitrogenous base uracil

    A. Transfer RNA only

    B. Messenger RNA only

    C. DNA only

    D. Transfer and messenger RNA only

78. The Maxam-Gilbert method of nucleotide sequencing is based on

    A. dideoxy nucleotide triphosphates

    B. chemical modifications of DNA

    C. PCR

    D. RT-PCR

79. Which of the following is not a mechanism whereby B cells or antibodies contribute to immunity?

    A. Presentation of antigen to T cells

    B. Opsonization

    C. Complement activation

    D. Direct cell killing

80. Which of the following is a prime example of a ribonucleoprotein enzyme, the catalytic activity of which (under non-physiological conditions), resides solely in its RNA component?

    A. Polynucleotide phosphorylase

    B. Reverse transcriptase

    C. RNase P

    D. Bacterial RNA polymerase