

# 105

QUESTION PAPER  
SERIES CODE

## A

Registration No. :

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Centre of Exam. : \_\_\_\_\_

Name of Candidate : \_\_\_\_\_

\_\_\_\_\_  
Signature of Invigilator

### ENTRANCE EXAMINATION, 2016

Integrated M.Sc.–Ph.D. in MOLECULAR MEDICINE

[ Field of Study Code : CMMM (233) ]

Time Allowed : 3 hours

Maximum Marks : 70

#### INSTRUCTIONS FOR CANDIDATES

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

- (i) Write your Name and Registration Number in the space provided for the purpose on the top of this Question Paper and in the Answer Sheet.
- (ii) **Please darken the appropriate Circle of Question Paper Series Code on the Answer Sheet.**
- (iii) The Question Paper is divided into two Parts : Part—A and Part—B. Both Parts have multiple-choice questions. All answers are to be entered in the Answer Sheet provided with the Question Paper for the purpose by darkening the correct choice, i.e., (a) or (b) or (c) or (d) with BLUE/BLACK BALLPOINT PEN only against each question in the corresponding Circle.
- (iv) Part—A consists of 30 questions and **all** are compulsory.
- (v) Part—B contains 60 questions. **Answer any 40 questions.**  
In case any candidate answers more than the required 40 questions, the first 40 questions attempted will be evaluated.
- (vi) Each correct answer carries 1 mark. **There will be negative marking and ½ mark will be deducted for each wrong answer.**
- (vii) Simple Calculators and Log Tables may be used.
- (viii) Pages at the end have been provided for Rough Work.
- (ix) Return the Question Paper and Answer Sheet to the Invigilator at the end of the Entrance Examination. **DO NOT FOLD THE ANSWER SHEET.**

#### INSTRUCTIONS FOR MARKING ANSWERS

1. Use only Blue/Black Ballpoint Pen (do not use pencil) to darken the appropriate Circle.
2. Please darken the whole Circle.
3. Darken **ONLY ONE CIRCLE** for each question as shown in example below :

Wrong ● (b) (c) ●	Wrong ⊗ (b) (c) (d)	Wrong ⊗ (b) (c) ⊗	Wrong ● (b) (c) ●	Correct ● (a) (b) (c) ●
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4. Once marked, no change in the answer is allowed.
5. Please do not make any stray marks on the Answer Sheet.
6. Please do not do any rough work on the Answer Sheet.
7. Mark your answer only in the appropriate space against the number corresponding to the question.
8. **Ensure that you have darkened the appropriate Circle of Question Paper Series Code on the Answer Sheet.**



**PART—A**

Answer **all** questions

1. The absorption of ink by blotting paper involves
  - (a) siphon action
  - (b) capillary action phenomenon
  - (c) diffusion of ink through the blotting
  - (d) None of the above
  
2. Minimum number of unequal vectors which can give zero resultant is
  - (a) two
  - (b) three
  - (c) four
  - (d) more than four
  
3. Natural radioactivity was first discovered by
  - (a) Marie Curie
  - (b) Ernest Rutherford
  - (c) Henri Becquerel
  - (d) Enrico Fermi
  
4. The property due to which thin sheets can be prepared from a material is called
  - (a) elasticity
  - (b) brittleness
  - (c) malleability
  - (d) ductility
  
5. Bt-brinjal, a genetically engineered form of brinjal, has been developed to
  - (a) improve its taste and nutritive qualities
  - (b) make it pest-resistant
  - (c) make it drought-resistant
  - (d) make its shelf-life longer

6. Which colour in the flame of Bunsen burner represents the highest temperature?
- (a) Red
  - (b) Blue
  - (c) Green
  - (d) White
7. Why is it difficult to see through fog?
- (a) Rays of light undergo total internal reflection from the fog droplets
  - (b) Rays of light are scattered by the fog droplets
  - (c) The refractive index of fog is extremely low
  - (d) The refractive index of fog is extremely high
8. Organisms living in a habitat are collectively called as
- (a) population
  - (b) family
  - (c) ecosystem
  - (d) community
9. Rahul gets on an elevator at the 11th floor of a building and rides up at the rate of 57 floors per minute. At the same time, Manjul gets on another elevator at the 51st floor of the same building and rides down at the rate of 63 floors per minute. If they continue travelling at these rates, then at which floor will their paths cross?
- (a) 19th
  - (b) 28th
  - (c) 30th
  - (d) 37th
10. Sandhya passed one-sixth of her life in childhood, one-twelfth in youth, and one-seventh more as a spinster. Five years after her marriage a son was born, who died four years before her father at half his final age. How old is Sandhya?
- (a) 84
  - (b) 42
  - (c) 80
  - (d) 86

11. In a survey, people were asked how they travelled to work. The results of the survey for all the people questioned are depicted below :

<i>No. of people</i>	<i>Mode of transport</i>
35	Car
42	Bus
8	Bicycle
7	Walking

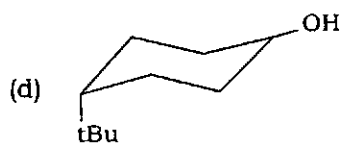
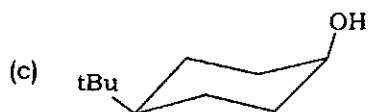
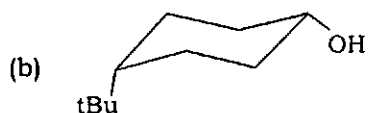
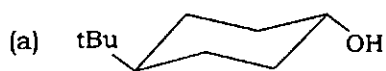
The relative frequency of people travelling by car is

- (a) 0.60  
(b) 0.46  
(c) 0.51  
(d) 0.38
12. What is the mole fraction of glycerol in a solution when 92 g glycerol is mixed with 90 g water? (Molecular weight of water = 18 and glycerol = 92)
- (a) 0.167  
(b) 0.334  
(c) 0.668  
(d) 0.833
13. An astronaut weighing 60 kg on the earth goes to the moon on a NASA mission. The size of the moon is  $\frac{1}{4}$ th that of the earth and the gravity of the moon is  $\frac{5}{6}$ th less than that of the earth. What will be the astronaut's weight (in kg) on the moon?
- (a) 2.6  
(b) 10  
(c) 3.8  
(d) 4.9

14. Salman buys an old scooter for ₹ 4,700 and spends ₹ 800 on its repairs. If he sells the scooter to Shahrukh for ₹ 5,800, his gain percent is
- (a) 5.45
  - (b) 4.57
  - (c) 3.2
  - (d) 10
15. If the area of a rectangle is  $16 \text{ cm}^2$ , the perimeter will be
- (a) 8 cm
  - (b) 32 cm
  - (c) 16 cm
  - (d) 64 cm
16. Retina has two types of photoreceptors—rods and cones. Which of the photoreceptors work relatively better in dim light?
- (a) Rods
  - (b) Cones
  - (c) Both of the above
  - (d) None of the above
17. When comparing different light-emitting sources, which of the following are the most energy-efficient?
- (a) Incandescent light bulbs
  - (b) Compact fluorescent light sources
  - (c) Light-emitting diode sources
  - (d) Both (a) and (c)
18. A hypothalamic hormone that controls reproduction is
- (a) follicle-stimulating hormone (FSH)
  - (b) luteinizing hormone (LH)
  - (c) prolactin (PRL)
  - (d) gonadotropin-releasing hormone (Gn-RH)

19. Number of ion pairs on central atom in  $I_3^-$  is
- (a) 2
  - (b) 3
  - (c) 4
  - (d) 5
20. Correct bond energy order among  $N_2$ ,  $N_2^+$  and  $N_2^-$  is
- (a)  $N_2 > N_2^+ = N_2^-$
  - (b)  $N_2 > N_2^+ > N_2^-$
  - (c)  $N_2 < N_2^+ = N_2^-$
  - (d)  $N_2^+ > N_2 > N_2^-$
21. Number of bridging CO ligands in  $Mn_2(CO)_{10}$  is
- (a) 4
  - (b) 1
  - (c) 2
  - (d) 0
22. Highest stable oxidation state for Ce is
- (a) +4
  - (b) +3
  - (c) +5
  - (d) +7
23. For second-order reaction the relation among  $t_{1/2}$ , rate constant and concentration of reactant is
- (a)  $t_{1/2} = 1/k_2$
  - (b)  $t_{1/2} = 1/k_2(C)_0$
  - (c)  $t_{1/2} = k_2(C)_0$
  - (d)  $t_{1/2} = (C)_0 / k_2$

24. Most stable conformation for *trans*-4-*t*-butyl-1-cyclohexanol is



25. A supersonic aircraft at Mach-2 is flying at

- (a) 761 mile/hour
- (b) 2000 ft above sea level
- (c) twice the speed of light
- (d) None of the above

26. The term 'climate change' refers to

- (a) global warming
- (b) rise in average surface temperatures on the earth
- (c) statistical distribution of weather patterns
- (d) All of the above

27. Magnetic resonance imaging (MRI) is based on

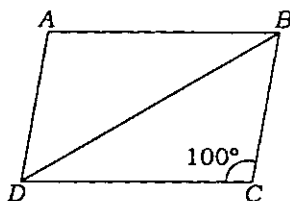
- (a) X-rays \*
- (b) computerized axial tomography (CAT) scan
- (c) properties of nuclei of certain elements
- (d) None of the above



28. The percentage increase in the area of a rectangle, if each of its sides is increased by 20%, is

- (a) 32%
- (b) 34%
- (c) 42%
- (d) 44%

29. In the following diagram of rhombus  $ABCD$ , angle  $DCB = 100^\circ$ . Find angle  $DBC$ .



- (a)  $45^\circ$
- (b)  $50^\circ$
- (c)  $30^\circ$
- (d)  $40^\circ$

30. The main buffer system of the human blood is

- (a)  $\text{H}_2\text{CO}_3 - \text{HCO}_3^-$
- (b)  $\text{H}_2\text{CO}_3 - \text{CO}_3^{2-}$
- (c)  $\text{CH}_3\text{COOH} - \text{CH}_3\text{COO}^-$
- (d)  $\text{NH}_2\text{CONH}_2 - \text{NH}_2\text{CONH}^+$

**PART—B**

Answer *any forty* questions

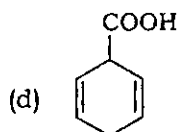
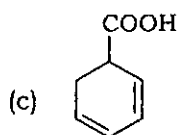
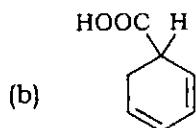
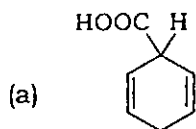
31. Which of the following components of the extracellular matrix has maximum tensile strength?
- (a) Collagen
  - (b) Fibronectin
  - (c) Laminin
  - (d) Integrin
32. A mutation that causes complete loss of gene function is called
- (a) amorphic
  - (b) hypomorphic
  - (c) hypermorphic
  - (d) neomorphic
33. The active ingredient in turmeric that offers health benefits is
- (a) catecholamine
  - (b) curcumin
  - (c) iron
  - (d) berberine yellow
34. The duration of eukaryotic 'cell cycle' phases varies considerably in different cell types. Which phases are the longest and the shortest for a typical rapidly proliferating human cell?
- (a)  $G_1$  phase and S phase respectively
  - (b)  $G_2$  phase and M phase respectively
  - (c) S phase and M phase respectively
  - (d)  $G_1$  phase and M phase respectively

35. 'Cardiolipin' is a phospholipid found in animals, plants and bacteria. Where is it located primarily in the animal cells?
- (a) In all the cellular membranes
  - (b) Almost exclusively in the inner mitochondrial membrane
  - (c) Predominantly in the plasma membranes of the cardiomyocytes
  - (d) Both (a) and (c)
36. The mechanism of RNA interference involves
- (a) single-stranded RNA interfering with DNA
  - (b) double-stranded RNA interfering with mRNA
  - (c) double-stranded DNA interfering with mRNA
  - (d) double-stranded RNA interfering with DNA
37. Transcription factors of eukaryotic origin exhibit two distinct domains that include
- (a) a DNA-binding domain and an enhancer domain
  - (b) a DNA-binding domain and an operator domain
  - (c) a DNA-binding domain and an activation domain
  - (d) a DNA-binding domain and a repressor domain
38. What is the name of the tube in placental mammals that carries both semen and urine out of the human body?
- (a) Seminal vesicles
  - (b) Urethra
  - (c) Ureter
  - (d) Vas deferens
39. Electromotive force (EMF) for the case
- $$E^{\circ} M / M^{+2} = 0.73 \text{ V}, \quad E^{\circ} M / M^{+} = 0.11 \text{ V}$$
- is
- (a) +0.84 V
  - (b) 0.62 V
  - (c) -0.84 V
  - (d) -0.62 V

40. The conjugate base of  $\text{NH}_4^+$  is

- (a)  $\text{NH}_4\text{OH}$
- (b)  $\text{NH}_3$
- (c)  $\text{KOH}$
- (d)  $\text{OH}^-$

41. Ph—COOH on treatment with the  $\text{Li}/\text{NH}_3$  and  $\text{C}_2\text{H}_5\text{OH}$  will give



42. Which of the following is a flowering hormone?

- (a) Morphactin
- (b) Florigen
- (c) ABA
- (d) Ethylene

43. Which one of the following drugs is most effective in preventing transmission of HIV virus from the mother to the fetus?

- (a) Rifamycin
- (b) Azidothymidine (AZT)
- (c) Ampicillin
- (d) Amphotericin B

44. Antiretroviral Raltegravir is unique, because of which of its following actions?
- (a) Integrase inhibition
  - (b) CCR5 coreceptor antagonism
  - (c) Fusion inhibition
  - (d) Reverse transcriptase inhibition
45. Codons representing same amino acids often differ in
- (a) first base
  - (b) second base
  - (c) third base
  - (d) None of the above
46. The oxidation of palmitic acid involves seven rounds of oxidation. The number of acetyl-CoA molecules produced will be
- (a) 6
  - (b) 7
  - (c) 8
  - (d) 9
47. Which of the following statements is true for enzymes?
- (a) They do not alter the overall change in free energy for a reaction
  - (b) They are proteins whose three-dimensional form is key to their function
  - (c) They speed up reactions by lowering activation energy
  - (d) All of the above
48. TCA cycle is often called the central metabolic pathway, because
- (a) it occurs in the centre of the cell
  - (b) its intermediates are commonly used by other metabolic reactions
  - (c) all other metabolic pathways depend upon it
  - (d) it provides energy to all the metabolic pathways

49. A phenylketonuria patient who consumes food containing high phenylalanine will accumulate
- (a) phenylalanine
  - (b) phenylpyruvate
  - (c) tyrosine
  - (d) isoleucine
50. The process of respiration in plants takes place
- (a) only at night
  - (b) when stomatas are open
  - (c) when photosynthesis stops
  - (d) all the time
51. The stalked particles on the cristae of mitochondria are called
- (a) glyoxysomes
  - (b) peroxisomes
  - (c) oxysomes
  - (d) spherosomes
52. Phagocytic phenomenon was discovered by
- (a) Louis Pasteur
  - (b) Alexander Fleming
  - (c) Elie Metchnikoff
  - (d) Robert Koch
53. A bar of soap may be manufactured by
- (a) saponification of fats and oils
  - (b) neutralization of fatty acids with an alkali
  - (c) mixing heated fat with an alkali
  - (d) All of the above

54. A facultative anaerobe
- (a) only grows anaerobically
  - (b) only grows in the presence of  $O_2$
  - (c) is ordinarily an anaerobe but can grow with  $O_2$
  - (d) is ordinarily an aerobe but can grow in absence of  $O_2$
55. During AIDS, HIV infects
- (a) CD3 lymphocytes
  - (b) CD4 lymphocytes
  - (c) CD2 lymphocytes
  - (d) B lymphocytes
56. When a bacterial cell and mitochondria are treated with cyanide and carbon monoxide, what happens initially?
- (a) Respiration is inhibited
  - (b) Protein synthesis is inhibited
  - (c) Photosynthesis is inhibited
  - (d) No effect occurs
57. The unidirectional transfer of genetic material from a donor bacterium to a recipient bacterium by cell-to-cell contact is termed as
- (a) transformation
  - (b) conjugation
  - (c) transduction
  - (d) recombination
58. MHC class I is a cell surface molecule present on
- (a) B cells
  - (b) T cells
  - (c) APCs
  - (d) all nucleated cells

59. Monoclonal antibodies are
- (a) heterogenous antibodies produced from single clone of plasma cells
  - (b) homogenous antibodies produced from single clone of plasma cells
  - (c) Both (a) and (b)
  - (d) None of the above
60. Which of the following is not a tumour suppressor gene?
- (a) BRCA1
  - (b) p38
  - (c) Rb
  - (d) K-ras
61. The DNA of a deletion mutant of a lambda bacteriophage has a length of 15 micrometre instead of 17 micrometre. How many base pairs are missing from this mutant? [Hint : 1 bp of DNA = 340 angstroms]
- (a) 20000
  - (b) 5880
  - (c) 680000
  - (d) 588
62. Reverse transcriptase, which is found in retroviruses, is a type of
- (a) DNA polymerase
  - (b) RNA polymerase
  - (c) nuclease
  - (d) protease
63. Zika virus is a type of
- (a) flavivirus
  - (b) retrovirus
  - (c) prion
  - (d) bacteriophage



64. Which of the following statements is not true?
- (a) Glycolysis is a set of reactions that converts glucose into pyruvate
  - (b) Citric acid cycle follows glycolysis
  - (c) Glycolysis occurs in the mitochondria
  - (d) One molecule of glucose generates two ATPs during glycolysis
65. DNA length associated with a protein can be determined by
- (a) SDS PAGE
  - (b) DNA printing
  - (c) DNA footprinting
  - (d) DNA fingerprinting
66. Match the following membrane channels and pumps with their open/close mechanisms :
- |                                    |                             |
|------------------------------------|-----------------------------|
| A. Acetylcholine receptor          | 1. Action potential/voltage |
| B. Sodium channel                  | 2. Ionic gradient           |
| C. $\text{Na}^+ - \text{K}^+$ pump | 3. Ligand-gated             |
| D. Na-Ca exchanger                 | 4. ATP-dependent            |
- (a) A—1, B—3, C—2, D—4
  - (b) A—2, B—4, C—1, D—3
  - (c) A—3, B—4, C—2, D—1
  - (d) A—4, B—3, C—1, D—2
67. Biochemically, starvation of body is characterized by
- (a) shifting the fuel being used from glucose to fatty acids and ketone bodies
  - (b) reduction in haemoglobin levels in the body
  - (c) decreased secretion of glucagon
  - (d) All of the above

68. The ascending order representation of the number of disulfide bonds in one's hair type is
- (a) curly > wavy > straight
  - (b) straight > wavy > curly
  - (c) wavy > curly > straight
  - (d) wavy > straight > curly
69. DNA polymerase activity does not require
- (a) a template
  - (b) ATP
  - (c)  $Mg^{2+}$
  - (d) dNTPs
70. You have chosen plasmid pBR322 as your cloning vector, and you need a large quantity of it. How many micrograms of plasmid DNA can be extracted from 1 litre of *E. coli* culture? Assume that cells are growing at a density of 10000 cells per microlitre, each *E. coli* cell contains 100 plasmids and the molecular weight of a base pair in the plasmid is 660 Da. (pBR322 is a double-stranded circular DNA molecule containing 4.4 kilobase pairs)
- (a) 4.8 micrograms
  - (b) 480 micrograms
  - (c) 4.4 micrograms
  - (d) 440 micrograms
71. Complete the sentence.  
A Ramachandran plot ...
- (a) represents sterically allowed conformations of a polypeptide backbone
  - (b) gives the frequency of occurrence of amino acids in beta-sheet structures
  - (c) shows X-ray diffraction pattern of a protein
  - (d) predicts alpha-helical structures from a given set of amino acid sequences

72. Match the following acid(s) with the most likely to occur secondary structure :

- |                |   |
|----------------|---|
| A. Alpha helix | 1. Gly  |
| B. Beta sheet  | 2. Ala  |
| C. Beta turn   | 3. All amino acids branching at the beta carbon |

(a) A—1, B—3, C—2

(b) A—2, B—3, C—1

(c) A—2, B—1, C—3

(d) A—3, B—1, C—2

73. The physiological roles of bile salts include all of the following, except

- (a) they facilitate lipid absorption
- (b) they provide a means of excreting cholesterol
- (c) they aid in digestion of sugars
- (d) they aid in lipid digestion

74. A repetitive glycan polymer contained within an LPS is referred to as O antigen. The antibody produced by human and mouse against this polymer is

- (a) IgA
- (b) glycoprotein
- (c) autoimmune antibody
- (d) interferon

75. Hybridoma technique is based on fusion between

- (a) Köhler cells and Milstein cells
- (b) primary B cells and myeloma cells
- (c) B cells and memory T cells
- (d) None of the above

76. Iodine used in Gram staining serves as
- (a) chelator
  - (b) catalyst
  - (c) mordant
  - (d) cofactor
77. One flagellum at one end of the organ is called
- (a) monotrichate
  - (b) amphitrichate
  - (c) lophotrichate
  - (d) peritrichate
78. In general, most mammalian somatic cells during interphase are diploid with total DNA contents of  $2X$ . Before the onset of mitosis, the DNA content increases to  $4X$ . What will be the DNA content of each cluster during anaphase?
- (a)  $1X$
  - (b)  $2X$
  - (c)  $3X$
  - (d)  $4X$
79. Heat change at constant pressure can be written as
- (a)  $C_p \Delta T$
  - (b)  $C_v \Delta T$
  - (c)  $\Delta E$
  - (d)  $C_p - C_v$
80. The four processes in pharmacokinetics are
- (a) stomach, liver, kidney and lungs
  - (b) receptors, ion channels, transport systems and enzymes
  - (c) administration, absorption, metabolism and elimination
  - (d) absorption, distribution, metabolism and excretion

81. Two most important sites for drug elimination are
- (a) pulmonary and liver
  - (b) liver and gastrointestinal tract
  - (c) kidney and liver
  - (d) pulmonary and kidney
82. Which one of the following glucose transporters is the new drug target for the management of type-2 diabetes mellitus?
- (a) Sodium-glucose linked transporter 2 (SGLT2)
  - (b) Glucose transporter 1 (GLUT1)
  - (c) Sodium-glucose linked transporter 1 (SGLT1)
  - (d) Glucose transporter 2 (GLUT2)
83. High-resolution localization of lysosome inside a cell may be best studied by
- (a) transmission electron microscopy
  - (b) scanning electron microscopy
  - (c) bright field microscopy
  - (d) None of the above
84. Bacterial conjugation is the transfer of genetic material between two bacterial cells by
- (a) indirect cell-to-cell contact
  - (b) horizontal gene transfer
  - (c) electroporation
  - (d) None of the above
85. The term used for solid support on which a multitude of tiny drops of DNA are spotted for screening gene expression, is
- (a) Southern blot
  - (b) cloning library
  - (c) DNA microarray
  - (d) Northern blot

86. Bases in the nucleotides and aromatic amino acids in the proteins absorb light respectively at
- (a) 280 nm and 260 nm
  - (b) 260 nm and 280 nm
  - (c) 270 nm and 280 nm
  - (d) 260 nm and 270 nm
87. Glycogen has
- (a)  $\alpha$ -1,4 linkages
  - (b)  $\alpha$ -1,6 linkages
  - (c)  $\alpha$ -1,4 linkages and  $\alpha$ -1,6 linkages
  - (d)  $\alpha$ -1,3 linkages
88. Which of the following statements is incorrect regarding HAT selection?
- (a) Myeloma cells cannot grow in HAT medium as these cells lack HGPRT
  - (b) B cells are HGPRT<sup>+</sup> and can grow in HAT medium but undergo normal cell death
  - (c) Hybrid cell survives in HAT medium as it inherits HGPRT from B cells
  - (d) Aminopterin in HAT medium blocks *de novo* pathway of nucleotide synthesis only in myeloma cells
89. T helper cell-mediated hypersensitivity is
- (a) type I
  - (b) type II
  - (c) type III
  - (d) type IV
90. A bacterial culture contained  $32 \times 10^6$  cells after 2.5 h of exponential growth. If the doubling time was 30 minutes, what was the initial population size in this culture?
- (a)  $20 \times 10^4$  cells
  - (b)  $10 \times 10^5$  cells
  - (c)  $40 \times 10^5$  cells
  - (d)  $16 \times 10^6$  cells

SPACE FOR ROUGH WORK

SPACE FOR ROUGH WORK

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