**116**

| QUESTION PAPER SERIES CODE |
|---|
| **D** |

**Registration No. :** | | | | | | |

**Centre of Exam. :** _____

**Name of Candidate :** _____

**Signature of Invigilator**

## COMBINED ENTRANCE EXAMINATION, 2016

M.Sc. BIOTECHNOLOGY

**[ Field of Study Code : BIT ]**

*Time Allowed* : 3 hours *Maximum Marks* : 240

### 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 60 questions and all are compulsory. Answer all the questions in the Answer Sheet provided for the purpose. Each correct answer carries *1* mark. **There will be negative marking and ⅓ mark will be deducted for each wrong answer.**

(v) Part—B consists of 100 questions consisting Biological and Physical Sciences. **Answer any 60 questions.** Each correct answer carries *3* marks. **There will be negative marking and 1 mark will be deducted for each wrong answer.**
In case any candidate answers more than the required 60 questions, the first 60 questions attempted will be evaluated.

(vi) Answer written by the candidates inside the Question Paper will not be evaluated.

(vii) 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 | Wrong | Wrong | Wrong | Correct |
|---|---|---|---|---|
| ● ⓑ ⓒ ● | ⊘ ⓑ ⓒ ⓓ | ⊘ ⓑ ⓒ ⊘ | ◉ ⓑ ⓒ ● | ⓐ ⓑ ⓒ ● |

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. In mosses, conducting tissue is made up of

   (a) parenchyma cells

   (b) xylem vessel elements

   (c) companion cells

   (d) collenchyma cells

2. Amensalism is a kind of interaction between two species in which

   (a) one species has beneficial effect and the other is not affected

   (b) one species has detrimental effect and the other is not affected

   (c) both species have detrimental effect

   (d) both species have beneficial effect

3. A mutation in gene X gives a mutant phenotype. A second mutation in another gene Y restores the wild-type phenotype. The mutation in gene Y is a

   (a) suppressor mutation

   (b) revertant

   (c) restorer mutation

   (d) recessive mutation

4. Invisible to the human eye, bacterial cells vary in size depending on the species. But most bacteria are usually measured in

   (a) micrometre

   (b) millimetre

   (c) angstrom

   (d) nanometre

5. Zika virus is transmitted by

   (a) housefly

   (b) sandfly

   (c) aphid

   (d) mosquito

6. Genetically engineered bacteria are being used in the commercial production of

(a) melatonin

(b) testosterone

(c) insulin

(d) thyroxine

7. Increased number of chromosomes occurs in

(a) Turner's syndrome

(b) Fragile X syndrome

(c) Down syndrome

(d) Klinefelter's syndrome

8. Normal microbiota is helpful to human beings as they produce

(a) vitamin A

(b) vitamin C

(c) vitamin E

(d) vitamin K

9. If there is a deficiency of antidiuretic hormone (ADH) its effect would be

(a) the volume of urine output will increase

(b) the volume of urine output will decrease

(c) the pH of urine will increase from 5 to 8

(d) the pH of urine will decrease from 8 to 5

10. Which ecological pyramid of the following is always upright and cannot be inverted?

(a) Pyramid of biomass

(b) Pyramid of number

(c) Pyramid of energy

(d) Pyramid of food

11. If Rh –ve person donates blood to Rh +ve person for the second time. Then

(a) Rh –ve person will have poor regeneration of blood and will die

(b) Rh +ve person will die

(c) Rh +ve person starts reacting to Rh –ve blood

(d) nothing happens to Rh +ve person

12. Which parts of the flower are collectively called perianth?

(a) When androecium and gynoecium are similar

(b) When calyx and corolla are similar

(c) When androecium and calyx are similar

(d) When gynoecium and corolla are similar

13. In humans, spotted teeth are caused by a dominant sex-linked gene. A man with spotted teeth whose mother has normal teeth marries a woman with normal teeth. Therefore,

(a) all of their daughters will have normal teeth

(b) all of their daughters will have spotted teeth

(c) none of their sons will have spotted teeth

(d) half of their sons will have spotted teeth

14. An example of innate immunity is

(a) T lymphocyte

(b) B lymphocyte

(c) neutrophil

(d) thyroid cell

15. A ball thrown vertically upward returns to its starting point in 4 seconds. Initial speed of the ball is

(a) 19·6 m/s

(b) 9·8 m/s

(c) 39·2 m/s

(d) 78·4 m/s

16. A force of 20 N gives a body of mass $m$ an acceleration of 8 $m/s^2$ and a body of mass $M$ an acceleration of 24 $m/s^2$. What is the acceleration (in $m/s^2$) that this force will cause when the two masses are joined together?

(a) 2

(b) 3

(c) 4

(d) 6

17. A sheet of copper has an area of 500 $cm^2$ at 0 °C. If the coefficient of thermal expansion is $1 \cdot 67 \times 10^{-4}$, then the area (in $cm^2$) of this sheet at 80 °C will be

(a) 501·34

(b) 500·67

(c) 502·73

(d) 503·44

18. The speed of red and yellow light are exactly same

(a) in vacuum but not in air

(b) in air but not in vacuum

(c) in vacuum as well as in air

(d) neither in vacuum nor in air

19. When light is refracted from air to water the quantity that remains unchanged is

(a) wavelength

(b) wave number

(c) wave velocity

(d) frequency

20. How far should an object be from a concave spherical mirror of radius 36 cm to form a real image that is one-ninth of its size?

(a) 60 cm

(b) 72 cm

(c) 90 cm

(d) 180 cm

**21.** A raindrop falls near the surface of the earth with almost uniform velocity, because

(a) its weight is negligible

(b) the force of surface tension balances its weight

(c) the force of viscosity balances its weight

(d) the drop is charged and the atmospheric electrical field balances its weight

**22.** A compressor pumps 70 litre of air into a 6 litre tank with the temperature remaining unchanged. If all the air is originally at 1 atmosphere pressure, then the final pressure (in atmosphere) of the air in the tank will be

(a) 11·3

(b) 12·7

(c) 64·0

(d) 420·0

**23.** Let $I_1$ and $I_2$ be the moments of inertia of two bodies of identical geometric shape, the first made of aluminium and the second made of iron. Then

(a) $I_1 < I_2$

(b) $I_1 = I_2$

(c) $I_1 > I_2$

(d) the relation between $I_1$ and $I_2$ depends on the geometrical shape

**24.** The motion of a particle is given by $x = A\sin\omega t + B\cos\omega t$. The motion is

(a) not simple harmonic

(b) simple harmonic with amplitude $A + B$

(c) simple harmonic with amplitude $\sqrt{A^2 + B^2}$

(d) simple harmonic with amplitude $(A + B)/2$

25. Two light sources are called coherent, if they produce waves

(a) of equal wavelength

(b) of equal intensity

(c) having same shape wavefront

(d) having a constant phase difference

26. X-rays cannot be diffracted by means of an ordinary grating due to its

(a) large wavelength

(b) high speed

(c) short wavelength

(d) high energy

27. If $V_0$ is the peak voltage of the AC mains, the root-mean-square voltage will be

(a) $V_0$

(b) $\frac{V_0}{\sqrt{2}}$

(c) $\sqrt{2}V_0$

(d) $2V_0$

28. Transmission lines from the powerhouse carry electricity at

(a) low voltage and low current

(b) low voltage and high current

(c) high voltage and low current

(d) high voltage and high current

29. Optical fibres used in communication systems work on the principle of

(a) refraction

(b) total internal reflection

(c) diffraction

(d) polarization

30. A die is thrown twice. The probability that the sum of points obtained is 10, is

(a) 7/36

(b) 4/36

(c) 3/36

(d) 11/36

31. Two cards are drawn from a standard pack of 52 cards. The probability that both cards are aces is

(a) 1/220

(b) 1/221

(c) 1/223

(d) 1/225

32. Equation of the parabola with focus at (2, 0) and directrix, $x + 2 = 0$ is

(a) $y^2 = 4x$

(b) $y^2 = -4x$

(c) $y^2 = 12x$

(d) $y^2 = 8x$

33. The centre of the circle $2x^2 + 2y^2 + 14x - 2y + 7 = 0$ is

(a) $(-7/2, 1/2)$

(b) $(-7/2, -1/2)$

(c) $(7/2, 1/2)$

(d) $(7/2, -1/2)$

34. The minimum value of $3\sin x + 4\cos x$ is

(a) $-5$

(b) 5·5

(c) 3

(d) 5

**35.** The point at which the tangent to the curve $y = \sqrt{4x-3} - 1$ has its slope 2/3 is

(a) (3, 2)

(b) (3, 1)

(c) (3, −2)

(d) (−3, 2)

**36.** The value of $\lim_{x \to 0} \frac{\sin 7x}{\sin 9x}$ is

(a) 1/3

(b) 3/2

(c) 7/9

(d) −2/3

**37.** The values of $x$ for which the expression $\begin{vmatrix} 3 & x \\ x & 1 \end{vmatrix} = \begin{vmatrix} 3 & 2 \\ 4 & 1 \end{vmatrix}$ is satisfied are

(a) $\pm 3\sqrt{2}$

(b) $\pm 2\sqrt{2}$

(c) $\pm 7\sqrt{2}$

(d) $\pm 5\sqrt{2}$

**38.** If $A$ and $B$ are nonsingular matrices of the same order, then $AB$ is

(a) nonsingular of same order

(b) singular of same order

(c) nonsingular of different order

(d) singular of different order

**39.** A square matrix $A$ is invertible if and only if $A$ is

(a) singular matrix

(b) nonsingular matrix

(c) zero matrix

(d) rectangular matrix

**40.** For what value of $(x, y)$, the expression $\begin{bmatrix} 1 & 3 \\ 2 & -1 \end{bmatrix}\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 4 \\ 1 \end{bmatrix}$ is satisfied?

(a) $(1, 1)$

(b) $(1, -1)$

(c) $(-1, -1)$

(d) $(-1, 1)$

**41.** The function $f$ given by $f(x) = |x-1| + |x-2|$, $x \in \mathbb{R}$ is

(a) differentiable at $x = 1, 2$

(b) not differentiable at $x = 1, 2$

(c) differentiable at $x = 1$ but not at 2

(d) nowhere differentiable

**42.** The normal at the point (1, 2) on the curve $2y + x^2 = 5$ is

(a) $x - y + 1 = 0$

(b) $x - y = 0$

(c) $x + y + 1 = 0$

(d) $xy = 1$

**43.** If $\tan\alpha = 1/2$ and $\tan\beta = 1/3$, then the value of $\alpha + \beta$ is

(a) $\pi/2$

(b) $\pi/4$

(c) $\pi/3$

(d) $\pi/12$

**44.** The value of $\int e^{3x} dx$ is

(a) $\frac{e^{3x}}{3} + c$

(b) $15e^{3x} + c$

(c) $\frac{5e^{3x}}{3} + c$

(d) $25\tan x - 15x + c$

45. Which of the following structure has delocalized $\pi$ electrons?

(a) $CO_2$

(b) HCN

(c) $O_3$

(d) CO

46. How many unpaired electrons are there in $K_3[Fe(CN)_6]$?

(a) 3

(b) 1

(c) 2

(d) 5

47. In $[Co(NH_3)_6]^{3+}$, oxidation number, coordination number and effective atomic number of cobalt are respectively

(a) +3, 6 and 36

(b) +3, 6 and 35

(c) +3, 3 and 36

(d) +6, 3 and 35

48. Which of the following element has an ionic radius that is longer than its atomic radius?

(a) Li

(b) Cl

(c) Mg

(d) Al

49. Which of the following compound has the lowest melting point?

(a) NaCl

(b) HCl

(c) LiCl

(d) KCl

50. Which of the following ligand is strong field ligand?

(a) $H_2O$

(b) $OH^-$

(c) $CN^-$

(d) $F^-$

51. Which of the following compound is diamagnetic?

(a) NO

(b) $O_2$

(c) $H_2$

(d) CO

52. Which of the following molecule contains nonpolar covalent bond?

(a) HCl

(b) HBr

(c) $F_2$

(d) $NH_3$

53. What is the colour of Zn(II) compounds?

(a) White

(b) Yellow

(c) Red

(d) Green

54. Which of the following statement about an enzyme is false?

(a) An enzyme is usually a large protein

(b) An enzyme is a catalyst for biological reactions

(c) An enzyme is a chiral molecule

(d) An enzyme changes the equilibrium constant of a reaction

55. The hybridization of the central carbon in $CH_3C{\equiv}N$ and the bond angle CCN are

(a) $sp^2$ and 180°

(b) $sp$ and 180°

(c) $sp^2$ and 120°

(d) $sp^3$ and 109°

56. In $XeF_2$ molecule

(a) the lone pairs occupy equatorial position

(b) two lone pairs occupy equatorial position and one lone pair occupies axial position

(c) one lone pair occupies equatorial position and two lone pairs occupy axial position

(d) the lone pairs occupy axial position

57. In ethylene molecule ($C_2H_4$), the H—C—H bond angle is

(a) equal to 109·5°

(b) smaller than 120°

(c) greater than 120°

(d) equal to 120°

58. Cyclopentadienyl radical is

(a) aromatic

(b) nonaromatic

(c) planar

(d) aliphatic

59. Which of the following compound has the highest boiling point?

(a) Acetone

(b) Diethyl ether

(c) Methanol

(d) Ethanol

60. Coir, a natural fibre, which is often used commercially to make doormats, brushes etc. is extracted from

(a) epicarp of coconut

(b) seed coat of coconut

(c) endocarp of coconut

(d) mesocarp of coconut

## PART—B

Answer *any* **sixty** questions

**61.** What is the atomic term symbol for helium atom with electronic configuration $1s^2$?

(a) $^2S_{1/2}$

(b) $^1P_0$

(c) $^1S_0$

(d) $^1S_1$

**62.** Diels-Alder reaction normally yields endo-adduct as a major product. This is due to

(a) lower stability of product

(b) faster rate of formation of the endo-adduct

(c) steric hindrance

(d) secondary orbital interaction between a diene and a dienophile

**63.** Match the molecules with the rotor types :

| *Molecules* | *Rotor types* |
|---|---|
| (I) $C_6H_6$ | (1) Asymmetric top |
| (II) $CCl_4$ | (2) Spherical top |
| (III) $CH_2Cl_2$ | (3) Symmetric top |

(a) (I)—(3), (II)—(2), (III)—(1)

(b) (I)—(2), (II)—(3), (III)—(1)

(c) (I)—(1), (II)—(2), (III)—(3)

(d) (I)—(3), (II)—(1), (III)—(2)

**64.** The zero-point energy of a harmonic oscillator is

(a) $\hbar\omega$

(b) zero

(c) $\frac{1}{2}\hbar\omega$

(d) $2\hbar\omega$

**65.** The complex with minimum CFSE is

(a) $[CoCl_4]^{2-}$

(b) $[Co(H_2O)_6]^{3+}$

(c) $[CoF_3(H_2O)_3]$

(d) $[CoF_6]^{3-}$

**66.** $C_{60}$ has

(a) 14 pentagons and 18 hexagons

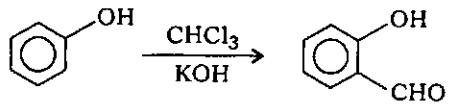
(b) 12 pentagons and 18 hexagons

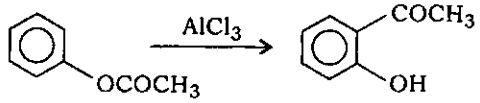
(c) 12 pentagons and 20 hexagons

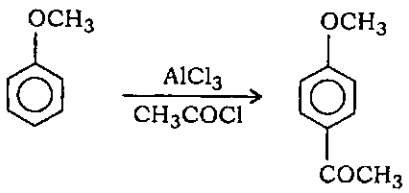
(d) 10 pentagons and 20 hexagons

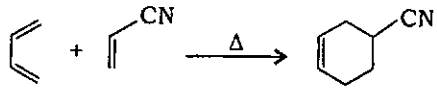
**67.** Match Column A with Column B :

*Column—A*

(I) 


(II) 


(III) 


(IV) 


*Column—B*

(1) Diels-Alder reaction

(2) Friedel-Crafts reaction

(3) Reimer-Tiemann reaction

(4) Fries rearrangement

(a) (I)—(3), (II)—(4), (III)—(1), (IV)—(2)

(b) (I)—(2), (II)—(1), (III)—(4), (IV)—(3)

(c) (I)—(3), (II)—(4), (III)—(2), (IV)—(1)

(d) (I)—(4), (II)—(3), (III)—(2), (IV)—(1)

**68.** Which of the following pair of compounds have the same number of lone pairs?

(a) $XeF_4$, $ClF_3$

(b) $XeO_4$, $ICl_4^-$

(c) $XeO_2F_2$, $ICl_4^-$

(d) $XeO_4$, $ClF_3$

**69.** Hapticity of cycloheptatriene in $Mo(C_7H_8)(CO)_3$ is

(a) 4

(b) 7

(c) 6

(d) 10

**70.** The cell voltage of Daniel cell $[Zn \mid ZnSO_4(aq) \mid\mid CuSO_4(aq) \mid Cu]$ is 1·07 V. If reduction potential of $Cu^{2+} \mid Cu$ is 0·34 V, the reduction potential of $Zn^{2+} \mid Zn$ is

(a) 1·141 V

(b) −1·41 V

(c) 0·73 V

(d) −0·73 V

**71.** A Carnot engine takes up 90 J of heat from the source at 300 K. Which of the following statement is correct?

(a) It transfers 60 J of heat to the sink at 200 K

(b) It transfers 50 J of heat to the sink at 200 K

(c) It transfers 60 J of heat to the sink at 250 K

(d) It transfers 50 J of heat to the sink at 250 K

**72.** The Ziegler-Natta catalysts are

(a) stereospecific

(b) nonmetallic complexes

(c) gaseous catalysts

(d) universal in all polymerization reactions

**73.** Which of the following biomolecule contains nontransition metal ion?

(a) Vitamin (b) Chlorophyll

(c) Hemoglobin (d) Hemocyanin

74. A PCR reaction that continues for 30 cycles will produce approximately how many PCR products from a single template DNA molecule?

(a) Approximately 1 thousand

(b) Approximately 1 lakh

(c) Approximately 1 million

(d) Approximately 1 billion

75. The basis of five classes of Ig molecules is

(a) number of amino acid residues

(b) molecular weight of heavy chains

(c) structural differences in the carboxyl terminal portion of heavy chains

(d) structural differences in the amino terminal portion of heavy chains

76. Contact dermatitis is an example of

(a) cytotoxic hypersensitivity

(b) anaphylaxis hypersensitivity

(c) cell-mediated hypersensitivity

(d) immune complex hypersensitivity

77. Plasmid of which of the following bacteria has been widely used as effective vector for specific gene transfer in plants?

(a) *Agrobacterium*

(b) *Escherichia coli*

(c) *Bacillus thuringiensis*

(d) *Thermus aquaticus*

78. Eukaryotic protein-coding genes differ from their prokaryotic counterparts in that only eukaryotic genes

(a) are present in only a single copy

(b) contain introns

(c) have a promoter

(d) transcribe mRNA

79. Which one of the following is true for disinfection?

(a) Removal of microbes from liquids

(b) Destruction of all microbes on inanimate objects

(c) Prevention of infection

(d) Inhibition of bacterial growth

80. Nucleosomes are found in

(a) *Escherichia coli*

(b) *Saccharomyces cerevisiae*

(c) Influenza virus

(d) Rickettsia spp.

81. A kind of covalent modification which occurs on both histones and DNA is

(a) phosphorylation

(b) methylation

(c) acetylation

(d) succinylation

82. In DNA replication, each daughter DNA molecule contains one parental strand and one newly-synthesized strand. This is called

(a) conservative replication

(b) repetitive replication

(c) semiconservative replication

(d) dispersive replication

83. The H1N1 strain of the influenza A virus emerged in Mexico and quickly spread worldwide over the next several months. More than 18000 people died from the pandemic. This virus had genetic components of swine influenza virus, an avian virus and a human influenza virus. The genetic process by which this pandemic strain of influenza A emerged is an example of

(a) antigenic shift

(b) antigenic drift

(c) genetic reassortment

(d) point mutation

84. Secondary structures of protein are mainly maintained by

(a) hydrogen bonds

(b) ionic bonds

(c) hydrophobic interactions

(d) van der Waals' forces

**85.** 1 map unit or centimorgan (cM) is equal to

(a) 0·1% recombination

(b) 1% recombination

(c) 10% recombination

(d) 100% recombination

**86.** The animals which are relatively large and powerful and can combat water currents are called

(a) neutans

(b) planktons

(c) nektons

(d) swimmers

**87.** Haploid human DNA has $3 \times 10^6$ kilobase pair. What is the total length (in centimetre) of human haploid DNA?

(a) 102

(b) 10·2

(c) 51

(d) 5·1

**88.** Intrinsic fluorescence of protein is due to

(a) aromatic amino acids

(b) sulphur-containing amino acids

(c) histidine

(d) proline

**89.** Enzymes which catalyze removal of groups from substrates without addition or removal of water are classified as

(a) oxidoreductases

(b) lyases

(c) transferases

(d) hydrolases

**90.** Which of the following amino acid will be the site of enzyme modification by phosphorylation?

(a) Arginine

(b) Cysteine

(c) Serine

(d) Phenylalanine

**91.** When several steps occur in a reaction, the overall rate

(a) is determined by the step with the lowest activation energy

(b) is determined by the step with the highest activation energy

(c) is independent of activation energy

(d) is determined by the fastest step

**92.** Which of the following is a prosthetic group?

(a) TPP

(b) $FAD^+$

(c) $NAD^+$

(d) Lipoic acid

**93.** In regulation of gene expression, the inducer

(a) combines with a repressor and prevents it from binding to the promoter

(b) combines with a repressor and prevents it from binding to the operator

(c) binds to promoter and prevents the repressor from binding to the operator

(d) binds to operator and prevents the repressor from binding at this site

**94.** The part of plant used for culturing is

(a) scion

(b) explant

(c) stock

(d) callus

**95.** Prokaryotic DNA gyrase is inhibited by

(a) actinomycin

(b) cephalosporin

(c) tetracycline

(d) nalidixic acid

96. Which of the following bacteria can grow in acidic pH?

(a) *Vibrio cholerae*

(b) *Lactobacilli*

(c) *Shigella* spp.

(d) *Salmonella*

97. Which of the following possesses both 5′–3′ and 3′–5′ exonuclease activities?

(a) Klenow polymerase

(b) DNA polymerase III

(c) DNA polymerase I

(d) *Taq* DNA polymerase

98. Long-chain acyl-CoA penetrates mitochondria in the presence of

(a) palmitate

(b) carnitine

(c) sorbitol

(d) DNP

99. The nature of the poliovirus given for oral vaccination (satin vaccine) as part of the eradication programme is

(a) heat-killed virus

(b) live attenuated strains of all three immunological types

(c) small dosage of wild-type live viruses

(d) formalin-inactivated viruses

100. Interferon-β is produced by

(a) bacteria-infected cells

(b) virus-infected cells

(c) both virus- and bacteria-infected cells

(d) fungi-infected cells

101. Which of the following group of microorganisms has a high level of unsaturated fatty acids in their cell membrane?

(a) Mesophilic

(b) Psychrophilic

(c) Thermophilic

(d) Hyperthermophilic

**102.** In a four-point (ABCD) cross between Hfr and F strains of *E. coli*, the pairwise frequencies of recombination fell in the following order :

$$AB > AC > AD$$

The most probable order of the genes on bacterial chromosome would be

(a) ABCD

(b) ACDB

(c) ADCB

(d) ABDC

**103.** A morphogen acts

(a) in a concentration-dependent way to elicit different cell fates

(b) as an inducer to cause a group of cells to differentiate in one particular way

(c) to promote the formation and morphology of complex organs

(d) as a regulator of morphology of an animal

**104.** The effect of auxin diffusing from the apical bud on the lateral shoots is known as

(a) promoting effect

(b) compensatory effect

(c) inhibitory effect

(d) supporting effect

**105.** Coconut milk factor is

(a) abscisic acid

(b) auxin

(c) cytokinin

(d) gibberellin

**106.** Development involves a distinctive larval stage in many members of the phylum

(a) Arthropoda

(b) Mammalia

(c) Avis

(d) Reptilia

**107.** Sodium dodecyl sulphate is used in gel electrophoresis experiments for the separation of a mixture of proteins based on their molecular size. SDS is used in this experiment to

(a) solubilize the proteins

(b) stabilize the proteins

(c) decrease the surface tension of the buffer

(d) have uniform charge density on the proteins

**108.** Cell differentiation during animal development does not normally involve

(a) differential gene expression

(b) loss of developmental potential

(c) loss of genetic information

(d) epigenetic mechanism of gene regulation

**109.** Which of the following problem makes it impossible to satisfy all of Koch's postulates?

(a) Microorganism causes serious symptoms in humans

(b) Microorganism cannot be isolated in pure culture

(c) Species of microorganism is disputed

(d) Genes from the microorganism cannot be amplified by PCR

**110.** A concentrated protein solution was diluted 100 times with a buffer at pH 7·0 and the resulting solution gave an absorbance of 0·362 in a UV spectrophotometer at 280 nm using a 1 cm path length quartz cuvette. Given the extinction coefficient of the protein 5189 $M^{-1}$ $cm^{-1}$, the concentration of the undiluted protein solution in millimolar units would be

(a) 0·69

(b) 0·0069

(c) 1·0

(d) 6·9

**111.** Cholesterol biosynthesis is regulated by enzyme

(a) thiolase

(b) HMG–CoA synthase

(c) HMG–CoA reductase

(d) cis-prenyl transferase

**112.** Which of the following test is the most sensitive measure of antibody?

(a) Precipitation

(b) Agglutination

(c) Radioimmunoassay

(d) Radial immunodiffusion

**113.** Somaclonal variations are the ones

(a) caused by mutagens

(b) produced by gamma rays

(c) produced during tissue culture

(d) caused during sexual embryogeny

**114.** If $A$ and $B$ are singular matrices of the same order, then $AB$ is

(a) nonsingular of same order

(b) singular of same order

(c) nonsingular of different order

(d) singular of different order

**115.** A square matrix $A$ is non-invertible if and only if $A$ is

(a) singular matrix

(b) Hermitian matrix

(c) identity matrix

(d) orthogonal matrix

**116.** A unit normal vector of the cone of revolution $z^2 = 4(x^2 + y^2)$ at (1, 0, 2) is

(a) $\frac{2\hat{i} - \hat{k}}{\sqrt{5}}$

(b) $\frac{\hat{i} - \hat{k}}{\sqrt{5}}$

(c) $\frac{\hat{i} - 2\hat{k}}{\sqrt{5}}$

(d) $\frac{2\hat{i} - 2\hat{k}}{\sqrt{5}}$

**117.** For any vector **A**, the correct statement is

(a) div curl **A** = 0

(b) curl div **A** = 0

(c) curl curl **A** = 0

(d) grad div **A** = 0

**118.** The value of $\lim_{n\to\infty} \int_0^{2\pi} \frac{\sin nx}{x^2+n^2} dx$ is

(a) 1

(b) 2

(c) 0

(d) $-1$

**119.** A solution of the differential equation $(x^2 + y^2)dx - 2xydy = 0$ is

(a) $x^2 - y^2 = cy$

(b) $x^2 - y^2 = cx$

(c) $x^2 - y^2 = cx^3$

(d) $x^2 - y^2 = cxy$

**120.** The functions $x^4$ and $x^3|x|$ are linearly independent on

(a) $[-1, 1]$

(b) $[-1, 0]$

(c) $[0, 1]$

(d) $[0, \frac{1}{2}]$

**121.** The function $f : [-2, 1] \to [0, 4]$ defined by $f(x) = x^2$ is

(a) surjective but not injective

(b) not surjective but injective

(c) surjective as well as injective

(d) neither surjective nor injective

**122.** Choose the incorrect statement :

(a) The set of real numbers is a group under usual addition

(b) The set of rational numbers is a group under usual addition

(c) The set of irrational numbers is a group under usual addition

(d) The set of complex numbers is a group under usual addition

**123.** Choose the incorrect statement :

(a) The set $\{0, 2, 4\}$ is a group under usual addition modulo 6

(b) The set $\{0, 1, 2, 3, 4, 5\}$ is a group under usual addition modulo 6

(c) The set $\{0, 1, 3, 5\}$ is a group under usual addition modulo 6

(d) The set $\{0, 3\}$ is a group under usual addition modulo 6

**124.** A solution of the differential equation $\frac{dy}{dx} = \frac{x+y+4}{x+y-6}$ is

(a) $y - x - 5\log(x+y-1) = c$ (b) $y - x^3 - 5\log(x+y-1) = c$

(c) $y - x - 5\log(x^2+y-1) = c$ (d) $y^2 - x - 5\log(x+y-1) = c$

**125.** A solution of the differential equation $\frac{dy}{dx} + \frac{y}{x} = \frac{y^2}{x}\log x$ is

(a) $y - x^2 - 5\log(x+y-1) = c$

(b) $\frac{1}{y} = cx + \log x + 1$

(c) $y - x - 5\log(x^2+y-1) = c$

(d) $y^2 - x^2 - 5\log(x+y-1) = c$

**126.** The eigenvalues of a skew-symmetric matrix are

(a) only purely imaginary (b) purely imaginary or zero

(c) any real number (d) any complex number

**127.** For which value of $k$, the vector $(1, -2, k)$ in $\mathbb{R}^3$ is a linear combination of the vectors $(3, 0, -2)$ and $(2, -1, -5)$?

(a) 12 (b) 8

(c) 4 (d) $-4$

**128.** The residue of the function $\frac{\sin z}{z^2}$ at $z = 0$ is

(a) 1

(b) $2\pi i$

(c) 2

(d) $4\pi i$

**129.** Let $f : \mathbb{R} \to \mathbb{R}$ be a differentiable function such that $f'(0) = 0$. Suppose, $g : \mathbb{R}^2 \to \mathbb{R}$ is a map defined by $g(x, y) = f(\sqrt{x^2 + y^2})$. Then

(a) $g$ is not continuous at $(0, 0)$

(b) $g$ is continuous at $(0, 0)$ only

(c) $g$ is everywhere continuous

(d) $g$ is nowhere continuous

**130.** Let $f(x, y) = \dfrac{xy^2}{x^2 + y^4}$, $(x, y) \neq (0, 0)$ and $f(x, y) = 0$, otherwise. Then,

(a) $f$ is continuous at $(0, 0)$

(b) $f$ is differentiable at $(0, 0)$ only

(c) $f$ is not differentiable at $(0, 0)$ only

(d) $f$ is continuous everywhere but not differentiable at $(0, 0)$

**131.** The all critical points $(x, y)$ of the function $f(x, y) = x^3 + y^3 - 3x - 12y + 20$ are

(a) $(\pm 1, \pm 2)$

(b) $(\pm 2, \pm 1)$

(c) $(\pm 1, 2)$

(d) $(1, \pm 2)$

**132.** For positive real numbers $a$ and $b$, the area of the ellipse $x = a\cos\theta$ and $y = b\sin\theta$ is

(a) $\pi ab$ sq. unit

(b) $2\pi ab$ sq. unit

(c) $2\pi a^2 b$ sq. unit

(d) $\pi^2 a^2 b^2$ sq. unit

**133.** The radius of convergence of the series $\sum_{n=1}^{\infty} \dfrac{z^n}{n!}$ is

(a) 1

(b) $\infty$

(c) 0

(d) 3·5

**134.** A loop is rolling down an inclined plane. The fraction of its kinetic energy that is associated with the rotational motion is

(a) 1 : 2 (b) 1 : 3

(c) 1 : 4 (d) 2 : 3

**135.** Two force vectors of equal magnitude act in such a way that their resultant vector has a magnitude equal to the magnitude of either of the original forces. The angle (in degrees) between the original forces is

(a) 90 (b) 30

(c) 45 (d) 120

**136.** A Carnot engine with its heat sink at 17 °C has an efficiency of 50%. If the temperature of the heat source is increased by 145 °C, its efficiency becomes

(a) 55% (b) 60%

(c) 40% (d) 75%

**137.** Two wavelengths of light $\lambda_1$ and $\lambda_2$ are sent through a Young's double-slit apparatus simultaneously. If the third order $\lambda_1$ bright fringe is to coincide with the fourth order $\lambda_2$ bright fringe, then the ratio $\lambda_2 / \lambda_1$ is

(a) 3/4

(b) 4/3

(c) 9/16

(d) 16/9

**138.** The resistance of a 20 cm wire is 5 ohm. The wire is now stretched to a uniform wire of length 40 cm. The new resistance (in ohm) will be

(a) 20

(b) 10

(c) 5

(d) 2·5

**139.** A fish looking up through water sees the entire world contained in a circular horizon. If the refractive index of water is 4/3 and the fish is 12 cm below the surface of water, the radius (in cm) of the circle is

(a) $45\sqrt{5}$

(b) $36\sqrt{7}$

(c) $\frac{36}{\sqrt{7}}$

(d) $4\sqrt{5}$

**140.** In an interference pattern, the ratio between the maximum and minimum intensities is 36 : 1. The ratio of the intensities of the two interfering waves is

(a) 6 : 1 (b) 7 : 5

(c) 36 : 1 (d) 49 : 25

**141.** An electron of mass $m$ and a positron annihilate. The minimum wavelength of one of the emitted photons is

(a) $\frac{h}{mc}$ (b) $\frac{h}{2mc}$

(c) $\frac{3h}{2mc}$ (d) $\frac{2h}{mc}$

**142.** The valence electron of $^{63}_{29}Cu$ lies in the

(a) K shell

(b) M shell

(c) N shell

(d) L shell

**143.** Momentum (in kg-ms$^{-1}$) of a photon of frequency $5 \times 10^{18}$ Hz is nearly

(a) $1 \cdot 1 \times 10^{-23}$

(b) $3 \cdot 3 \times 10^{43}$

(c) $2 \cdot 3 \times 10^{-40}$

(d) $5 \cdot 2 \times 10^{-11}$

**144.** The word 'nucleon' is used for

(a) all light nuclei

(b) neutrons only

(c) both protons and neutrons

(d) all the constituents of an atom

**145.** Nuclear magic numbers refer to

(a) the total number of protons, neutrons and electrons in the atom

(b) the total number of protons and neutrons together

(c) the total number of either protons or neutrons

(d) the difference between the number of neutrons and protons

**146.** The binding energy per nucleon for deuteron and alpha particle are 1·1 MeV and 7·0 MeV respectively. The energy (in MeV) released when two deuterons fuse to form an alpha particle is

(a) 2·2

(b) 28·0

(c) 4·8

(d) 23·6

**147.** A sample of radioactive substance has $10^6$ nuclei. Its half-life is 20 second. The number of nuclei that will be left after 10 second is approximately

(a) $1 \times 10^5$

(b) $2 \times 10^5$

(c) $7 \times 10^5$

(d) $9 \times 10^5$

**148.** Suppose that in hydrogen atom the electron is in the $n = 2$ state. The minimum energy (in eV) required to produce a $H^+$ ion will be

(a) 27·2

(b) 13·6

(c) 6·8

(d) 3·4

**149.** Nature of the dominant force responsible for interaction between two protons that are 1 Å apart is

(a) nuclear

(b) electromagnetic

(c) weak

(d) gravitational

**150.** One mole of monoatomic gas $\left(\gamma = \frac{5}{3}\right)$ is mixed with one mole of a diatomic gas $\left(\gamma = \frac{7}{5}\right)$. The value of $\gamma$ of the mixture is

(a) 1·40

(b) 1·50

(c) 1·67

(d) 0·71

**151.** Packing fraction of a body-centered cube is

(a) 0·52

(b) 0·74

(c) 0·68

(d) 1·0

**152.** In the nuclear process ${}^{11}_{6}C \rightarrow {}^{11}_{5}B + e^{+} + X$, the particle $X$ is a/an

(a) neutron

(b) neutrino

(c) antineutrino

(d) photon

**153.** In a $p$-type semiconductor

(a) the majority carriers are protons

(b) the majority carriers are electrons

(c) the minority carriers are holes

(d) the majority carriers are holes

**154.** Number of $f$ orbitals are

(a) 5

(b) 3

(c) 7

(d) 14

**155.** The relation between energy ($E$) and wavelength ($\lambda$) is

(a) $E = hc/\lambda$

(b) $E = h/\lambda$

(c) $E = hc\lambda$

(d) $E = hc/\lambda^2$

**156.** $O_3$ reacts with $CH_2{=}CH_2$ to form ozonide. On hydrolysis it forms

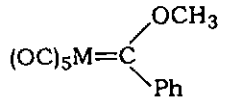
(a) ethylene oxide

(b) HCHO

(c) ethylene glycol

(d) ethyl alcohol

**157.** The molecule



obeys 18-electron rule. The two metals satisfying the condition are

(a) Cr and $Re^+$

(b) Mo and V

(c) V and $Re^+$

(d) Cr and V

**158.** The correct set of the biologically essential elements is

(a) Fe, Mo, Cu, Zn

(b) Fe, Cu, Co, Ru

(c) Cu, Mn, Zn, Ag

(d) Fe, Ru, Zn, Mg

**159.** Reduction of $>C=O$ to $CH_2$ can be carried out with

(a) catalytic reduction

(b) $Na/C_2H_5OH$

(c) Wolff-Kishner reduction

(d) $LiAlH_4$

**160.** Mulliken electronic configuration of CO molecule is

(a) $1\sigma^2\ 2\sigma^2\ 3\sigma^2\ 4\sigma^2\ 5\sigma^2\ 1\pi^4$

(b) $1\sigma^2\ 2\sigma^2\ 3\sigma^2\ 4\sigma^2\ 5\sigma^2\ 1\pi^3$

(c) $1\sigma^2\ 2\sigma^2\ 3\sigma^2\ 4\sigma^2\ 5\sigma^2\ 1\pi^2$

(d) $1\sigma^2\ 2\sigma^2\ 3\sigma^2\ 4\sigma^2\ 5\sigma^2\ 1\pi^1$

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