

# AJMAL SUPER 40

PHASE - 2



ADMISSION CUM SCHOLARSHIP TEST : 2022

**FOR 12<sup>th</sup> PASSED/APPEARING [CHALLENGERS]**



Conducted by : **AJMAL FOUNDATION, Hojai**

## INSTRUCTIONS TO THE CANDIDATES

1. Candidates are to use the Answer Sheet provided.
2. Ensure that you fill in your **Registration No.** correctly in the space provided in the OMR sheet as shown in the example there.
3. Candidates are required to mark the correct answer choice by **shading** the circle completely with blue or black ball point pen. (Pen of any other colour or pencil is not allowed). For example, if the correct answer to question no 1. is 'B' then the marking should be:



4. Write your details in the OMR sheet which are asked for.
5. Only one circle, i.e. the correct one should be shaded. Shading more than one circle will render the answer invalid.
6. A candidate having completed his/her **ANSWER SHEET** must hand it over, even if blank, to the invigilator.
7. An examinee must not bring any loose paper, book, etc. to the Examination Hall. Any examinee found in possession of even loose papers will be **EXPELLED**.
8. An examinee must not talk to, disturb or seek help from a fellow examinee during the examination.
9. Any mechanical or digital calculating device (calculator etc.) shall not be used by the examinee during the examination.
10. No candidate will be allowed to leave the Examination Hall during the first hour of the examination.
11. For each correct answer 1 marks will be awarded and no negative mark will be there for incorrect answer
12. Duration of the exam is 03 hours from 11:00 AM to 02:00 PM.
13. XII passed / appearing students will attempt the Question as follows :

For Medical			For Engineering		
Subject	Questions	Marks	Subject	Questions	Marks
Physics	40	40	Physics	40	40
Chemistry	40	40	Chemistry	40	40
Biology	70	70	Mathematics	40	40
<b>Total</b>	<b>150</b>	<b>150</b>	<b>Total</b>	<b>120</b>	<b>120</b>

14. Contravention of any of the instruction mentioned above shall render a candidate liable for disciplinary action as per rule.

**DATE OF RESULT DECLARATION - 8<sup>h</sup> JUNE - 2022 ([www.ajmalsuper40.in](http://www.ajmalsuper40.in))**

Full name of the Student:

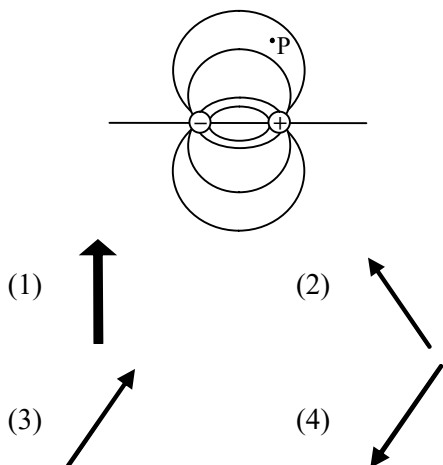
Your Application Number

Invigilator's Signature:

## ADMISSION CUM SCHOLARSHIP TEST – 2022 FOR 12<sup>TH</sup> PASSED / APPEARING [CHALLENGERS]

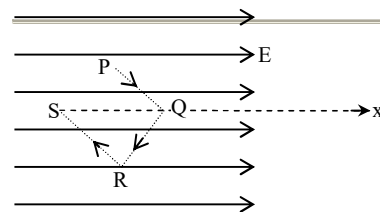
### PHYSICS

- A proton and an electron are placed in a same uniform electric field.
  - The electric forces acting on them will be equal
  - The magnitudes of the forces will be equal
  - Their accelerations will be equal
  - The magnitudes of acceleration will be Equal
- When a charge of 3 coulomb is placed in a uniform electric field it experiences a force of 3000 Newton. The potential difference between two points separated by a distance of 1 cm along field lines is -
  - 10 volt
  - 90 volt
  - 1000 volt
  - 3000 volt
- A particle of mass 2 g and charge 1  $\mu\text{C}$  is held at rest on a frictionless horizontal surface at a distance of 1 m from a fixed charge 1 mC. If the particle is released it will be repelled. The speed of the particle when it is at distance of 10 m from the fixed charge is
  - 100 m/s
  - 90 m/s
  - 60 m/s
  - 45 m/s
- Figure shows the electric field lines around and electric dipole. Which of the arrows best represents the electric field at point P?

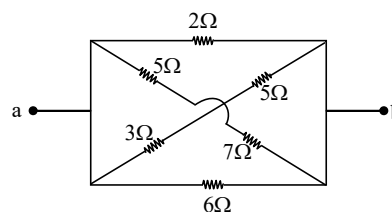


- Point charge ( $q$ ) moves from point (P) to point (S) along the path PQRS as shown in fig. in a uniform electric field  $E$ , pointing parallel to the positive direction of the  $x$ -axis. The co-ordinates of the points P, Q, R and S are  $(a, b, 0)$ ,  $(2a, 0, 0)$ ,  $(a, -b, 0)$  and  $(0, 0, 0)$  respectively. The work done

by the field in the above process is given by the expression

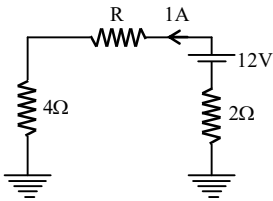


- $q E a$
  - $-q E a$
  - $q E b$
  - $q E \sqrt{[(2a)^2 + (b)^2]}$
- An isolated solid metallic sphere is charged with  $+Q$  charge. The distribution of this  $+Q$  charge on the sphere will be
    - uniform but on the surface alone
    - non uniform but on the surface alone
    - uniform inside the volume
    - non uniform inside the volume
  - If a glass rod is rubbed with silk, it acquires a positive charge because –
    - Protons are added to it.
    - Protons are removed from it.
    - Electrons are added to it.
    - Electrons are removed from it.
  - Two metal spheres of capacitances  $C_1$  and  $C_2$  carry some charges. They are put in contact and then separated. The final charges  $Q_1$  and  $Q_2$  on them will satisfy
    - $\frac{Q_1}{Q_2} < \frac{C_1}{C_2}$
    - $\frac{Q_1}{Q_2} = \frac{C_1}{C_2}$
    - $\frac{Q_1}{Q_2} > \frac{C_1}{C_2}$
    - $\frac{Q_1}{Q_2} = \frac{C_2}{C_1}$
  - In M.K.S. System,  $\frac{1}{4\pi \epsilon_0}$  equals -
    - $9 \times 10^9 \text{ N-m}^2/\text{C}^2$
    - $1 \text{ N-m}^2/\text{C}^2$
    - $1 \text{ dyne - cm}^2 / \text{stat C}^2$
    - $9 \times 10^9 \text{ dyne x cm}^2 / \text{stat C}^2$
  - Find the equivalent resistance between a & b

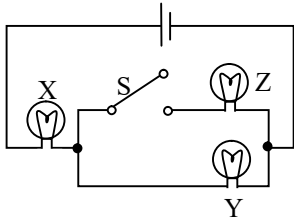


- (1)  $\frac{7}{8} \Omega$                       (2)  $\frac{8}{7} \Omega$   
 (3)  $\frac{6}{7} \Omega$                       (4)  $\frac{7}{6} \Omega$

11. For driving a current of 3 ampere for 5 minutes in an electrical circuit, 900 joule of work is to be done. Find the emf of the source in the circuit.  
 (1) 2 Volt                      (2) 3 Volt  
 (3) 1 Volt                      (4) 5 Volt
12. In the circuit shown in figure the value of R is—



- (1) 8 Ω                      (2) 6 Ω  
 (3) 10 Ω                      (4) 12 Ω
13. If X, Y, and Z in figure are identical lamps, which of the following changes to the brightnesses of the lamps occur when switch S is closed?



- (1) X stays the same, Y decreases  
 (2) X increases, Y decreases  
 (3) X increases, Y stays the same  
 (4) X decreases, Y increases
14. The value of intensity of magnetic field at a point due to a current carrying conductor is obtained from—  
 (1) Gauss's law      (2) Faraday's law  
 (3) Coulomb's law    (4) Biot Savart's law
15. The value of intensity of magnetic field at a point due to a current carrying conductor depends —  
 (1) on the value of current  
 (2) on a small part of length of conductor  
 (3) on angle between the line joining the given point to the mid point of small length and the distance between the small length of the point  
 (4) On all and the above

16. An electric current  $i$  enters and leaves a uniform circular wire of radius 'a' through diametrically opposite points. A charged particle 'q' moving along the axis of the circular wire passes through

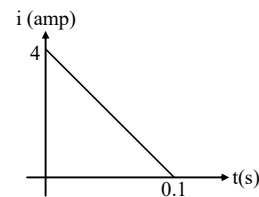
its centre at speed  $v$ . The magnetic force acting on the particle when it passes through the centre has a magnitude

- (1)  $qv \frac{\mu_0 i}{2a}$                       (2)  $qv \frac{\mu_0 i}{2\pi a}$   
 (3)  $qv \frac{\mu_0 i}{a}$                       (4) zero

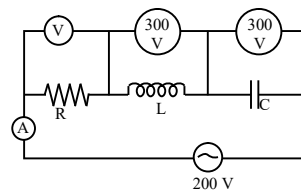
17. A rigid circular loop of radius  $r$  and mass  $m$  lies in the  $x$ - $y$  plane on a flat table and has a current  $I$  flowing in it. At this particular place. The earth's magnetic field is  $\vec{B} = B_x \hat{i} + B_y \hat{j}$ . The minimum value of  $I$  for which one end of the loop will lift from the table is

- (1)  $\frac{mg}{\pi r B_x}$                       (2)  $\frac{mg}{\pi r B_y}$   
 (3)  $\frac{mg}{2\pi r \sqrt{B_x^2 + B_y^2}}$                       (4)  $\frac{mg}{\pi r \sqrt{B_x^2 + B_y^2}}$

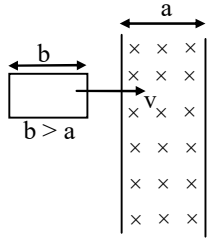
18. Some magnetic flux is changed from a coil of resistance 10 ohm. As a result an induced current is developed in it, which varies with time as shown in figure. The magnitude of change in flux through the coil in Webers is



- (1) 2                      (2) 4  
 (3) 6                      (4) 8
19. A metallic ring is held horizontal and a magnet is allowed to fall vertically through it with N-pole pointing upwards. The acceleration of magnet near the ring is  $a$ . Then  
 (1)  $a = g$   
 (2)  $a < g$  while approaching but  $a > g$  while receding  
 (3)  $a < g$  while approaching as well as receding  
 (4)  $a > g$  while approaching but  $a < g$  while Receding
20. In the series circuit shown in the figure the voltmeter reading will be



- (1) 300 V (2) 900 V  
(3) 200 V (4) 100 V
21. In the given arrangement, the loop is moved with constant velocity  $v$  in a uniform magnetic field  $B$  in a restricted region of width 'a'. The time for which the emf is induced in the circuit is -



- (1)  $\frac{2b}{v}$  (2)  $\frac{2a}{v}$   
(3)  $\frac{(a+b)}{v}$  (4)  $\frac{2(a-b)}{v}$
22. A long straight wire is placed along the axis of a circular ring of radius  $R$ . The mutual inductance of this system is

- (1)  $\frac{\mu_0 R}{2}$  (2)  $\frac{\mu_0 \pi R}{2}$   
(3)  $\frac{\mu_0}{2}$  (4) 0

23. In an ac circuit, the current is given by  $i = 4 \sin(100\pi t + 30^\circ)$  ampere. The current becomes maximum first time (after  $t = 0$ ) at  $t$  equal to -

- (1)  $(1/200)$  sec (2)  $(1/300)$  sec  
(3)  $(1/50)$  sec (4) None of these

24. In a certain circuit  $E = 200 \cos(314t)$  and  $I = \sin(314t + \pi/4)$ . Their vector representation is -

- (1) (2)   
(3) (4)

25. A plane mirror is moving with velocity  $4\hat{i} + 5\hat{j} + 8\hat{k}$ . A point object in front of the mirror moves with a velocity  $3\hat{i} + 4\hat{j} + 5\hat{k}$ . Here  $\hat{k}$  is along the normal to the plane mirror and facing towards the object. The velocity of the image is

- (1)  $-3\hat{i} - 4\hat{j} + 5\hat{k}$  (2)  $3\hat{i} + 4\hat{j} + 11\hat{k}$   
(3)  $-3\hat{i} - 4\hat{j} + 11\hat{k}$  (4)  $7\hat{i} + 9\hat{j} + 11\hat{k}$

26. A particle is moving towards a fixed spherical mirror. The image
- (1) Must move towards the mirror  
(2) May move towards the mirror  
(3) will move towards the mirror, only if the mirror is convex  
(4) All of the above

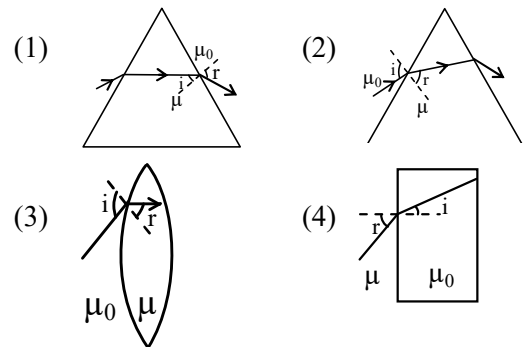
27. An air bubble in glass slab ( $\mu = 1.5$ ) when viewed from one side appears to be at 6 cm and from opposite side 4 cm. The thickness of glass slab is:
- (1) 10 cm (2) 6.67 cm  
(3) 15 cm (4) None

28. If the refracting angle of a prism or prism angle is  $60^\circ$  and minimum deviation  $30^\circ$ , the angle of incidence will be
- (1)  $30^\circ$  (2)  $45^\circ$   
(3)  $60^\circ$  (4)  $90^\circ$

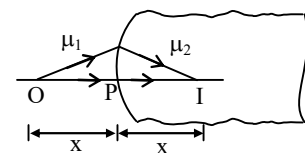
29. Calculate the dispersive power for crown glass from the given data  $\mu_v = 1.5230$ ,  $\mu_r = 1.5145$

- (1)  $2^\circ$  (2)  $3^\circ$   
(3)  $0.0163^\circ$  (4)  $2.5^\circ$

30. For which of the following cases,  $(\sin i / \sin r)$  is not equal to  $(\mu / \mu_0)$



31. A spherical surface of radius  $R$  separates two medium of refractive indices  $\mu_1$  and  $\mu_2$ , as shown in Fig. Where should an object be placed in the medium 1 so that a real image is formed in medium 2 at the same distance?

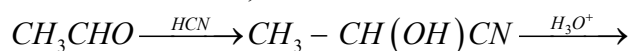


- (1)  $\left(\frac{\mu_2 - \mu_1}{\mu_2 + \mu_1}\right)R$  (2)  $\left(\frac{\mu_2 + \mu_1}{\mu_2 - \mu_1}\right)R$

- (3)  $\left(\frac{\mu_2 + \mu_1}{\mu_2}\right) \times R$       (4)  $\left(\frac{\mu_2}{\mu_2 + \mu_1}\right) R$
32. An object is placed at a distance  $m$  times the focal length of a divergent lens. The size of the image is shorter than that of the object by  
 (1)  $m$  times                      (2)  $(m + 1)$  times  
 (3)  $(m - 1)$  times              (4)  $m^2$  times
33. A thin equiconvex lens has focal length 10 cm and refractive index 1.5. One of its faces is now silvered and for an object placed at a distance  $u$  in front of it, the image coincides with the object. The value of  $u$  is  
 (1) 10 cm                          (2) 5 cm  
 (3) 20 cm                          (4) 15 cm
34. Four coherent light waves are represented by:  
 (i)  $y = a_1 \sin \omega t$   
 (ii)  $y = a_2 \sin (\omega t + \varepsilon)$   
 (iii)  $y = a_1 \sin 2\omega t$   
 (iv)  $y = a_2 \sin 2(\omega t + \varepsilon)$   
 Interference fringes may be observed due to superposition of  
 (1) (i) and (ii)                      (2) (i) and (iii)  
 (3) (ii) and (iv)                      (4) (iii) and (ii)
35. In a certain double slit experimental arrangement, interference fringes of width 1.0 mm each are observed when light of wavelength 5000 Å is used. Keeping the set-up unaltered if the source is replaced by another of wavelength 6000 Å, the fringe width will be -  
 (1) 0.5 mm                          (2) 1.00 mm  
 (3) 1.2 mm                          (4) 1.5 mm
36. Calculate the value of the first excitation potential of He<sup>+</sup> ion  
 (1) 40.8 V                          (2) 20.4 V  
 (3) 10.2 V                          (4) 81.6 V
37. If the kinetic energy of the moving particle is  $E$ , then de-Broglie wavelength is  
 (1)  $\lambda = h\sqrt{2mE}$                       (2)  $\sqrt{\frac{2mE}{h}}$   
 (3)  $\frac{h}{\sqrt{2mE}}$                           (4)  $\frac{hE}{\sqrt{2mE}}$
38. The de Broglie wavelength of a bus moving with speed  $v$  is  $\lambda$ . Some passengers left the bus at a stoppage. Now when the bus moves with twice its initial speed. Now kinetic energy is found to be twice its initial value. What will be the de Broglie wavelength, now  
 (1)  $\lambda$                                   (2)  $2\lambda$   
 (3)  $\lambda/2$                                   (4)  $\lambda/4$
39. Two protons are kept at a separation of 10 nm. Let  $F_n$  and  $F_e$  be the nuclear force and the electromagnetic force between them  
 (1)  $F_e = F_n$                           (2)  $F_e \gg F_n$   
 (3)  $F_e \ll F_n$   
 (4)  $F_e$  and  $F_n$  differ only slightly
40. In which of the following decays the element does not change?  
 (1)  $\alpha$ -decay                          (2)  $\beta^+$ -decay  
 (3)  $\beta^-$ -decay                          (4)  $\gamma$ -decay

## CHEMISTRY

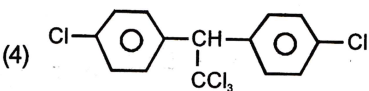
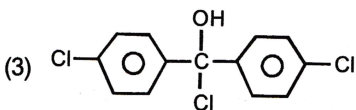
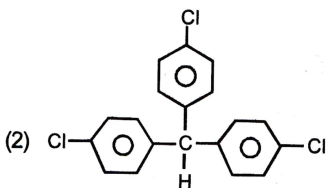
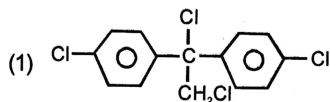
41. In the reaction,



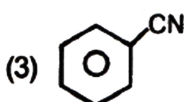
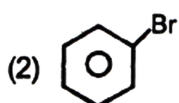
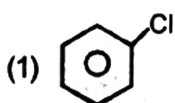
$CH_3-CH(OH)COOH$  an asymmetric centre

is generated. The acid obtains would be

- (1) 20% (d) and 80% (l) isomer
  - (2) (d) isomer
  - (3) (l) isomer
  - (4) 50% (d) and 50% (l) isomer
42. Trichloroacetaldehyde with chlorobenzene in presence of sulphuric acid produces

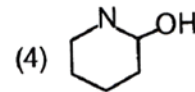
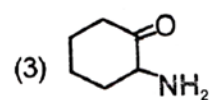
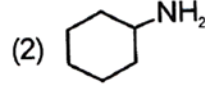
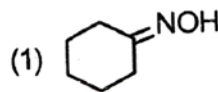
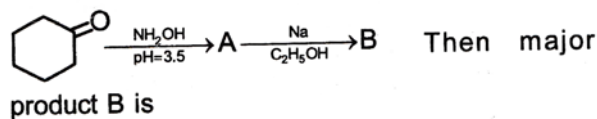


43. The term anomer of glucose refers to
- (1) A mixture of D-glucose and L-glucose
  - (2) Enantiomers of glucose
  - (3) Isomers of glucose that differ in configuration at carbon - 1
  - (4) Isomers of glucose that differ in configuration at one and four carbon
44. Sandmeyer reaction can be used to prepare



(4) All of these

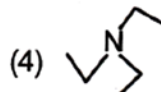
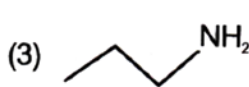
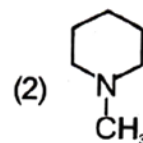
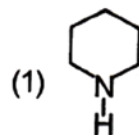
45. The slowest step in Cannizaro reaction is
- (1) Attack of NaOH on aldehyde molecule
  - (2)  $H^-$  transfer
  - (3)  $H^+$  transfer
  - (4) Dehydration



47. Connect order of acidic strength of carboxylic acid is

HCOOH I	CH <sub>3</sub> COOH II	PhCOOH III
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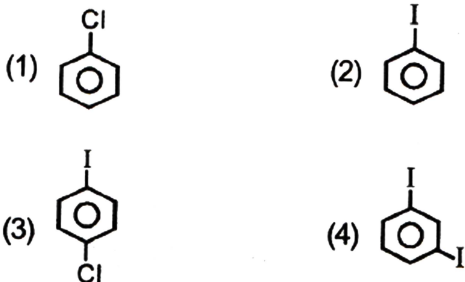
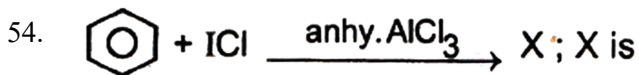
- (1) I > II > III
  - (2) I > III > II
  - (3) III > I > II
  - (4) II > I > III
48. Which of the following compound will exhibit positive Fehling's test as well as Iodoform test?
- (1) Methanal
  - (2) Ethanal
  - (3) Propanone
  - (4) Ethanol
49. Which of the following is non-reducing sugar?
- (1) Glucose
  - (2) Arbinose
  - (3) Fructose
  - (4) Sucrose
50. Which of the following gives positive isocyanide test?



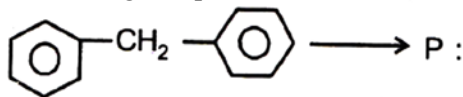
51. Fehlings solution test is given by
- (1) Benzaldehyde
  - (2) Acetone
  - (3) Acetaldehyde
  - (4) Both (1) and (3)
52. Which of the following is a polyamide?
- (1) Orlon
  - (2) Tefton
  - (3) Nylon
  - (4) Terytene



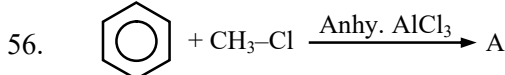
53. Sweetest artificial sugar among the following is  
 (1) Saccharin (2) Aspartame  
 (3) Sucralose (4) Alitame



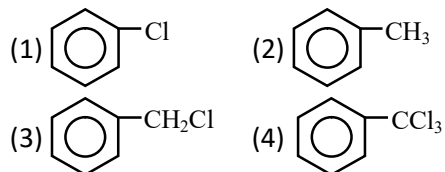
55. The number of monochloro products possible for the following compound is



- (1) 2 (2) 3  
 (3) 4 (4) 5



product A is –



57. Phenol reacts with conc. HNO<sub>3</sub> in the presence of conc. H<sub>2</sub>SO<sub>4</sub> to give –

- (1) Meta nitrophenol  
 (2) Ortho nitrophenol  
 (3) Ortho and para nitrophenol  
 (4) Picric acid

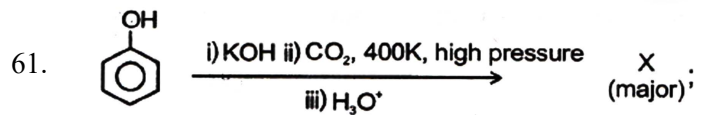
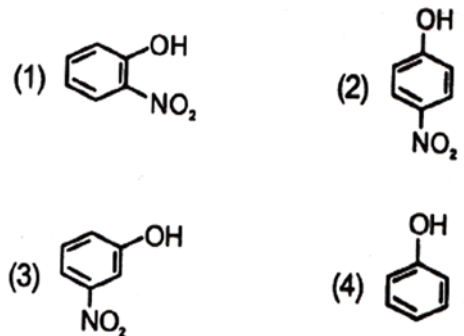
58. Which of the following are peroxyacids of sulphur?

- (1) H<sub>2</sub>SO<sub>5</sub> and H<sub>2</sub>S<sub>2</sub>O<sub>8</sub>  
 (2) H<sub>2</sub>SO<sub>5</sub> and H<sub>2</sub>S<sub>2</sub>O<sub>7</sub>  
 (3) H<sub>2</sub>S<sub>2</sub>O<sub>7</sub> and H<sub>2</sub>S<sub>2</sub>O<sub>8</sub>  
 (4) H<sub>2</sub>S<sub>2</sub>O<sub>6</sub> and H<sub>2</sub>S<sub>2</sub>O<sub>7</sub>

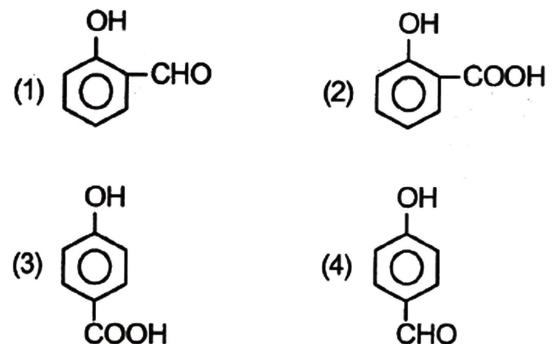
59. A first order reaction is found to have 75% completion in time period 40 minute, then what time is needed for completion of 90% of process?

- (1) 66.5 minute (2) 78.2 minute  
 (3) 62.8 minute (4) 71.6 minute

60. Which one is most acidic?



X is



62. Partial hydrolysis of one mole of peroxy disulphuric acid gives

- (1) Two moles of H<sub>2</sub>SO<sub>4</sub> only  
 (2) Two moles of Caro's Acid  
 (3) One mole of H<sub>2</sub>SO<sub>4</sub> and one mole of H<sub>2</sub>SO<sub>5</sub>  
 (4) One mole of H<sub>2</sub>SO<sub>4</sub>, one mole of H<sub>2</sub>SO<sub>5</sub> and one mole of H<sub>2</sub>O<sub>2</sub>

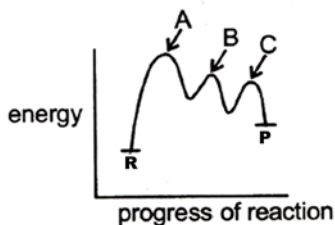
63. Which of the following has maximum number of lone pairs associated with Xe?

- (1) XeO<sub>3</sub> (2) XeF<sub>4</sub>  
 (3) XeF<sub>6</sub> (4) XeF<sub>2</sub>

64. What would be the rate equation of the reaction?  
 $A + B \rightarrow \text{Products}$

Exp	Initial conc.(A)	Initial Conc. (B)	Initial rate(r)
1	0.1 M	1.0 M	$2.1 \times 10^{-3}$
2	0.2 M	1.0 M	$8.4 \times 10^{-3}$
3	0.2 M	2.0 M	$8.4 \times 10^{-3}$

- (1)  $r = k[A]^2$                       (2)  $r = k[B]^2$   
 (3)  $r = k[A]^2[B]^1$               (4)  $r = k[A]^1[B]^1$
65. Spontaneous adsorption of a gas in solid surface produces  
 (1)  $\Delta H = +ve$                       (2)  $\Delta S = -ve$   
 (3)  $\Delta G = +ve$                       (4)  $\Delta S = +ve$
66. If oxidation potential of  $x > y > z$  then  
 (1) Y will oxidise x and not z  
 (2) Y will oxidise z and not x  
 (3) Y will oxidise both z and x  
 (4) Y will oxidise both x and z
67. The slowest step in above graph



- (1) A                                      (2) B  
 (3) C                                      (4) All
68. The correct order of equivalent conductance at infinite dilution of LiCl, NaCl and KCl is  
 (1) LiCl > NaCl > KCl  
 (2) KCl > NaCl > LiCl  
 (3) NaCl > KCl > LiCl  
 (4) LiCl > KCl > NaCl
69. What is the distance between 2 nearest face centre atoms in fcc?  
 (1)  $\sqrt{2}a$                               (2)  $\frac{a}{\sqrt{2}}$   
 (3)  $\sqrt{3}a$                               (4)  $\frac{\sqrt{3}a}{2}$
70. When NaCl is heated in Na vapour lamp, it is  
 (1) Schottky defect  
 (2) Frenkel defect  
 (3) Metal excess defect  
 (4) Metal deficiency defect

71. Which of the following solution in condition of concentration can form maximum boiling azeotrope?  
 (1) Benzene + Toluene  
 (2) n-hexane + n-heptane  
 (3) Acetone + Chloroform  
 (4) Ethanol + water
72. Which has highest freezing point?  
 (1) 1 m glucose solution    (2) 1m urea solution  
 (3) 1 m sucrose solution    (4) All have same
73. In a compound, atoms of elements y form ccp lattice and those of element x occupy  $\frac{2}{3}$ rd of tetrahedral voids, then formula of compound is  
 (1)  $X_4Y_3$                               (2)  $X_2Y_3$   
 (3)  $X_2Y$                                 (4)  $X_3Y_4$
74. The octahedral coordination compound of which one of the following compositions will produce two equivalents of AgCl on reaction with aqueous silver nitrate solution?  
 (1)  $CoCl_3 \cdot 3NH_3$                       (2)  $CoCl_3 \cdot 6NH_3$   
 (3)  $CoCl_3 \cdot 4NH_3$                       (4)  $CoCl_3 \cdot 5NH_3$
75.  $[Pt(NH_3)_4Cl_2]Br_2$  and  $[Pt(NH_3)_4Br_2]Cl_2$  are related to each other as  
 (1) Optical isomers    (2) Coordination isomers  
 (3) Ionisation isomers    (4) Linkage isomers
76. Thermit mixture is composed of  
 (1) Mg ribbon + Fe    (2) Al powder +  $Fe_2O_3$   
 (3) Fe powder                      (4) None of these
77. What is the value of CFSE for high spin  $d^4$   
 (1)  $-1.8\Delta_0$                               (2)  $-1.6\Delta_0$   
 (3)  $-0.6\Delta_0$                               (4)  $-1.2\Delta_0$
78. The orange colour of  $K_2Cr_2O_7$  is due to  
 (1) Incomplete d subshell  
 (2) Charge transfer  
 (3) d-d transition                      (4) None of these
79. NaCl is heated with  $K_2Cr_2O_7 / H^+$ , red vapour formed is because of  
 (1)  $CrO_2Cl_2$                               (2)  $CrO_5$   
 (3)  $Cr_2O_7^{--}$                               (4)  $CrO_3$
80. Magnetic moment of  $Mn^{x+}$  is 5.92 BM then value of x is  
 (1) 1                                      (2) 2  
 (3) 3                                      (4) 4



## **BIOLOGY**

81. Which of the following statements is incorrect ?
- (i) Bamboo species flower only once in their life time, generally after 50-100 years and produce large number of fruits and die.
  - (ii) In animals, the juvenile phase is followed by morphological and physiological changes prior to active reproductive behaviour.
  - (iii) The reproductive phase is of same duration in all organisms.
  - (iv) Juvenile phase is the period of growth between the birth of an individual till it reaches reproductive maturity.
- (1) Only (i)                      (2) Only (ii)  
(3) Only (iii)                    (4) Only (iv)
82. Which of the following is incorrect:
- (1) Decrease in blood pressure in general body circulation result in increase in GFR
  - (2) Aldosterone is responsible for reabsorption of electrolytes from DCT of nephron
  - (3) Fats & lipids are absorbed as micelles from intestinal lumen into the enterocytes of small intestine
  - (4) Increase in P50 value indicates lowering of binding capability between oxygen & hemoglobin
83. Which one of the following statement is incorrect?
- (1) When pollen is shed at two-celled stage, double fertilization does not take place.
  - (2) Vegetative cell is larger than generative cell.
  - (3) Pollen grains in some plants remain viable for months.
  - (4) Intine is made up of cellulose and pectin.
84. Perisperm is a
- (1) degenerate part of synergids.
  - (2) peripheral part of endosperm.
  - (3) degenerate part of secondary nucleus.
  - (4) remnant of nucellus.
85. Which one of the following statement is correct?
- (1) Geitonogamy involves the pollen and stigma of flowers of different plants.
  - (2) Cleistogamous flowers are always autogamous.
  - (3) Xenogamy occurs only by wind pollination.
  - (4) Chasmogamous flowers do not open at all.
86. Study the following statements and select the correct option.
- (i) Tapetum nourishes the developing pollen grains.
- (ii) Hilum represents the junction between ovule and funicle.
- (iii) In aquatic plants, such as water hyacinth and water lily, pollination is by water.
- (iv) The primary endosperm nucleus is triploid.
- (1) (i) and (ii) are correct but (iii) and (iv) are incorrect.  
(2) (i), (ii) and (iv) are correct but (iii) is incorrect.  
(3) (ii), (iii) and (iv) are correct but (i) is incorrect.  
(4) (i) and (iv) are correct but (ii) and (iii) are incorrect.
87. After birth, colostrum is released from mammary glands which is rich in
- (1) fat and low in proteins
  - (2) proteins and low in fat
  - (3) proteins, antibodies and low in fat
  - (4) proteins, fat and low in antibodies
88. Vasa efferentia are the ductules leading from
- (1) epididymis to urethra.
  - (2) vas deferens to epididymis.
  - (3) rete testis to vas deferens.
  - (4) testicular lobules to rete testis.
89. Select the correct statements regarding oogenesis.
- (i) It is initiated during the embryonic development stage when millions of oogonia are formed within each ovary.
  - (ii) Graafian follicle releases primary oocyte from the ovary by ovulation.
  - (iii) At puberty only 60,000 – 80,000 primary follicles are left in each ovary.
  - (iv) Secondary oocyte within tertiary follicles grows in size and completes its second meiotic division.
- (1) (i), (ii) and (iii)    (2) (i) and (iii)  
(3) (ii) and (iv)        (4) all the four statements.
90. Read the following statements (i to v) and answer the Question.
- (i) It produces several hormones like hCG, hPL, estrogens, progesterones etc.
  - (ii) It differentiates into three embryonic membrane– ectoderm, endoderm and mesoderm.
  - (3) It undergoes mitotic division.
  - (4) It is the organ, formed in the lining of the uterus by the union of the uterine mucous membrane with the membranes of the foetus.

(V) It develops at a point of implantation and providing oxygen and nutrients for the foetus and transfer of waste products from the foetal to the maternal blood circulation.

Identify the correct characteristics feature regarding placenta from the above statements.

- (1) (iii) and (v)      (2) (i), (iv) and (v)  
 (3) (i), (ii) and (iv)      (4) all the four statements.

91. Match the hormones given in column-I with their functions given in column-II and select the correct option.

Column-I (Hormones)	Column-II (Functions)
A. Luteinizing hormone	I. Develop corpus luteum
B. Progesterone	II. Essential for maintenance of uterine layer (called endometrium)
C. Estrogen	III. Develops female secondary sexual characters
D. Follicle stimulating hormone	IV. Maturation of Graafian follicle
E. Oxytocin	V. Causes uterine contraction.

- (1) A – I; B – V; C – III; D – II; E – IV  
 (2) A – III; B – I; C – II; D – IV; E – V  
 (3) A – I; B – II; C – III; D – IV; E – V  
 (4) A – I; B – II; C – III; D – V; E – IV

92. Progestasert and LNG-20 are

- (1) implants  
 (2) copper releasing IUDs  
 (3) non-medicated IUDs  
 (4) hormone releasing IUDs

93. Which of the following statement are correct?

- (i) Purpose of tubectomy is to prevent egg formation.  
 (ii) The most important component of the oral contraceptive pills is progesterone.  
 (iii) Contraceptive oral pills help in birth control by preventing ovulation.  
 (iv) Genital warts is a sexually transmitted disease caused by herpes virus.  
 (v) In India, there is rapid decline in infant mortality rate and maternal mortality rate.

- (1) (i), (ii) and (iii)      (2) (ii), (iii) and (v)  
 (3) (iii), (iv) and (v)      (4) (iv), (v) and (vi)

94. Which of the following crosses would produce a genotypic ratio of 1 : 2 : 1 in F<sub>2</sub> ?

- (1) AB × AB      (2) Ab × ab  
 (3) Ab × Ab      (4) ab × ab

95. In XO type of sex determination

- (1) females produce two different types of gametes.

(2) males produce two different types of gametes.

(3) females produce gametes with Y chromosomes.

(4) males produce single type of gametes.

96. Select the correct match of the techniques given in

	Column I		Column II
A.	ICSI	I	Artificially introduction of semen into the vagina
B.	IUI	II	Transfer of ovum collected from a donor into the fallopian tube where fertilization
C.	IUT	III	Formation of embryo by directly injecting sperm into the ovum
D.	GIFT	IV	Transfer of the zygote or early embryo (with upto 8 blastomeres) into a fallopian
E.	ZIFT	V	Transfer of embryo with more than 8 blastomeres into the uterus

- (1) A – V; B – IV; C – I; D – III; E – IV  
 (2) A – I; B – II; C – III; D – IV; E – V  
 (3) A – III; B – V; C – II; D – IV; E – I  
 (4) A – III; B – I; C – V; D – II; E – IV

97. Select the correct statement from the ones given below with respect to dihybrid cross.

- (1) Tightly linked genes on the same chromosome show higher recombinations.  
 (2) Genes far apart on the same chromosome show very few recombinations..  
 (3) Genes loosely linked on the same chromosome show similar recombinations as the tightly linked ones.  
 (4) Tightly linked genes on the same chromosome show very few recombinations.

98. Which one of the following is an incorrect statement regarding mutations?

- (1) Deletion and insertion of base pairs cause frameshift mutations.  
 (2) Cancer cells commonly show chromosomal aberrations.  
 (3) UV and gamma rays are mutagens.  
 (4) Change in a single base pair of DNA does not cause mutation.

99. Refer the given statements and select the correct option.

- (i) Percentage of homozygous dominant individuals obtained by selfing Aa individuals is 25%.  
 (ii) Types of genetically different gametes produced by genotype AABbcc are 2.  
 (iii) Phenotypic ratio of monohybrid F<sub>2</sub> progeny in case *Mirabilis jalapa* is 3 : 1.

- (1) All the statements are true.
- (2) Statements (i) and (ii) are true, but statement (iii) is false.
- (3) Statements (i) and (iii) are true, but statement (ii) is false.
- (4) Statements (ii) and (iii) are true, but statement (i) is false.

100. Match the column-I with column-II and choose the correct option.

Column -I	Column -II
A. Incomplete dominance	I. <i>Drosophila</i>
B. Mendelian disorder	II. <i>Antirrhinum</i> sp.
C. Transforming principle	III. Griffith
D. Dihybrid cross	IV. Haemophilia

- (1) A – I; B – IV; C – III; D – II
- (2) A – IV; B – II; C – III; D – I
- (3) A – II; B – III; C – IV; D – I
- (4) A – II; B – IV; C – III; D – I

101. Match column-I with column-II and select the correct option from the codes given below.

Column-I	Column-II
A. Autosomal recessive trait	I. Down's syndrome
B. Sex-linked recessive trait	II. Phenylketonuria
C. Metabolic error. linked to autosomal recessive	III. Haemophilia
D. Additional 21 <sup>st</sup> chromosome	IV. Sickle cell anaemia

- (1) A – II; B – I; C – IV; D – III
- (2) A – IV; B – I; C – II; D – III
- (3) A – IV; B – III; C – II; D – I
- (4) A – III; B – IV; C – I; D – II

102. Find out the incorrect statement.

- (1) Uracil is present in RNA at the place of thymine.
- (2) The complex of DNA and protein in chromosome is called chromatin.
- (3) Heterochromatin is the most highly condensed form of chromatin.
- (4) The process involved in the RNA formation on the DNA template is called replication.

103. Which of the following statement forms the basis of DNA fingerprinting?

- (1) The relative proportions of purines and pyrimidines in DNA.
- (2) Satellite DNA occurring as highly repeated short DNA segments.
- (3) The relative difference in the DNA occurrence in blood, skin and saliva.

- (4) The relative amount of DNA in the ridges and grooves of the fingerprints.

104. Genes that are involved in turning on or off the transcription of a set of structural genes are called

- (1) polymorphic genes
- (2) operator genes
- (3) reductant genes
- (4) regulatory genes

105. The Okazaki fragments in DNA chain

- (1) result in transcription
- (2) polymerise in the 3' to 5' direction and forms replication fork
- (3) prove semiconservative nature of DNA Replication
- (4) polymerise in the 5' to 3' direction and explain 3'to 5' DNA replication

106. Identify the correct order of organisation of genetic material from largest to smallest.

- (1) Chromosome, gene, genome, nucleotide
- (2) Genome, chromosome, nucleotide, gene
- (3) Genome, chromosome, gene, nucleotide
- (4) Chromosome, genome, nucleotide, gene

107. Protein synthesis in an animal cell takes place

- (1) only in the cytoplasm
- (2) in the nucleolus as well as in the cytoplasm
- (3) in the cytoplasm as well as in mitochondria
- (4) only on ribosomes attached to a nucleus

108. **Assertion :** Replication and transcription occur in the nucleus but translation occurs in the cytoplasm.

**Reason :** mRNA is transferred from the nucleus into the cytoplasm, where ribosomes and amino acids are available for protein synthesis.

- (1) If both Assertion and Reason are true and Reason is the correct explanation of Assertion
- (2) If both Assertion and Reason are true but Reason is not the correct explanation of Assertion
- (3) If Assertion is true but Reason is false
- (4) If both Assertion and Reason are false

109. Jurassic period of the Mesozoic era is characterised by

- (1) radiation of reptiles and origin of mammal-like Reptiles
- (2) dinosaurs became extinct and angiosperms appear
- (3) flowering plants and first dinosaurs appear
- (4) gymnosperms are dominant plants and first birds appear

110. Connecting link between annelids and molluscs is

- (1) *Limulus*
- (2) *Peripatus*
- (3) *Neopilina*
- (4) *Periplaneta*

111. In the case of peppered moth (*Biston betularia*), the black-coloured form became dominant over the light-coloured form in England during industrial revolution. This is an example of
- (1) natural selection whereby the darker forms were selected
  - (2) appearance of the darker coloured individuals due to very poor sunlight
  - (3) protective mimicry
  - (4) inheritance of darker colour character acquired due to the darker environment

112. Match the following columns.

Column I (Evolution concept)	Column II (Proposers)
A. Saltation	1. Darwin
B. Formation of life was preceded by chemical evolution	2. Louis Pasteur
C. Reproductive fitness	3. de Vries
D. Life comes from pre-existing life	4. Oparin and Haldane

Codes

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

113. In a random mating population in equilibrium, which of the following brings about a change in gene frequency in a non-directional manner?

- (1) Migration
- (2) Mutation
- (3) Random drift
- (4) Selection

114. MALT constitutes about ..... per cent of the Lymphoid tissue in human body.

- (1) 50
- (2) 20
- (3) 70
- (4) 10

115. Which is the particular type of drug that is obtained from the plant whose one flowering branch is shown below?



- (1) Hallucinogen
- (2) Depressant
- (3) Stimulant
- (4) Pain-killer

116. Common cold differs from pneumonia as

- (1) pneumonia is a communicable disease, whereas the common cold is a nutritional deficiency disease
- (2) pneumonia can be prevented by a live attenuated bacterial vaccine, whereas the common cold has no effective vaccine

- (3) pneumonia is caused by a virus, while the common cold is caused by the bacterium *Haemophilus influenza*
- (4) pneumonia pathogen infects alveoli whereas the common cold pathogen affects nose and respiratory passage but not the lungs

117. Match the following columns.

Column I (Bioactive substance)	Column II (Role)
A. Statin	1. Removal of oil stains
B. Cyclosporin-A	2. Removal of clots from blood Vessels
C. Streptokinase	3. Lowering of blood cholesterol
D. Lipase	4. Immune-suppressive agent

Codes

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

118. Match the following columns.

Column I	Column II
A. Citric acid	1. <i>Trichoderma</i>
B. Cyclosporin	2. <i>Clostridium</i>
C. Statins	3. <i>Aspergillus</i>
D. Butyric acid	4. <i>Monascus</i>

Codes

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

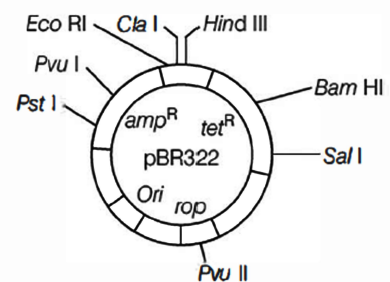
119. Which of the following is correct regarding AIDS causative agent HIV?

- (1) HIV is enveloped virus containing one molecule of single-stranded RNA and one molecule of reverse transcriptase
- (2) HIV is enveloped virus that contains two identical molecules of single-stranded RNA and two molecules of reverse transcriptase
- (3) HIV is unenveloped retrovirus
- (4) HIV does not escape but attacks the acquired immune response

120. To obtain virus-free healthy plants from a diseased plant by tissue culture technique, which part/parts of the diseased plant will be taken?

- (1) Apical meristem only
- (2) Palisade parenchyma

- (3) Both apical and axillary meristems  
(4) Epidermis only
121. Which gases are produced in anaerobic sludge digesters?  
(1) Methane and CO<sub>2</sub>  
(2) Methane, hydrogen sulphide and CO<sub>2</sub>  
(3) Methane, hydrogen sulphide and CO<sub>2</sub>  
(4) Hydrogen sulphide and CO<sub>2</sub>
122. Artificial selection to obtain cows yielding high milk output represents  
(1) stabilising selection as it stabilises this character in the population  
(2) directional selection as it pushes the mean of the character in one direction  
(3) disruptive selection as it splits the population into two, one yielding higher output and the other lower output  
(4) stabilizing selection followed by disruptive as stabilizes
123. A cell at telophase stage is observed by a student in a plant brought from the field. He tells his teacher that this cell is not like other cells at telophase stage. There is no formation of cell plate and thus the cell is containing more number of chromosomes as compared to other dividing cells. This would result in  
(1) polyploidy      (2) somaclonal variation  
(3) polyteny      (4) aneuploidy
124. The free-living fungus *Trichoderma* can be used for  
(1) killing insects  
(2) biological control of plant diseases  
(3) controlling butterfly caterpillars  
(4) producing antibiotics
125. The first restriction endonuclease reported was  
(1) *Hind* II      (2) *Eco*RI  
(3) *Hind* III      (4) *Bam*HI
126. \_\_\_\_\_ is a procedure through which a piece of DNA is introduced in a host bacterium.  
(1) Transduction      (2) Transformation  
(3) Conjugation      (4) R.D.T
127. Which of the following statement is incorrect ?  
(1) *Eco*RI cuts the DNA between bases G and A.  
(2) Each *Eco*RI restriction endonuclease recognizes a specific palindromic nucleotide sequences in DNA.  
(3) When cut by same restriction enzyme, the resultant DNA fragments do not have the same kind of sticky ends.  
(4) Making multiple identical copies of any template DNA is called cloning.
128. Stirred-tank bioreactors have been designed for  
(1) purification of product  
(2) addition of preservatives to the product  
(3) availability of oxygen throughout the Process  
(4) ensuring anaerobic condition in the culture Vessel
129. *E. coli* cloning vector pBR322 contains restriction sites in the region of *amp*<sup>R</sup>, *tet*<sup>R</sup>, genes that are responsible for the  
(1) antibiotic resistance genes  
(2) foreign DNA  
(3) selection of recombinants from non Recombinants  
(4) proteins involved in the replication of the Plasmid
130. Which of the following statement is false?  
(1) Regulators are organisms that are able to maintain homeostasis by physiological means or sometimes by behavioural means  
(2) All birds and mammals, and very few lower vertebrates and invertebrates are capable of osmoregulation and thermoregulation  
(3) Sweating and shivering are the means of thermoregulation by human  
(4) Plants are capable of thermoregulation
131. The figure below is the diagrammatic representation of the *E. coli* vector pBR322. Which one of the given options correctly identifies its certain components(s)?



- (1) *Ori*- original restriction enzyme  
(2) *rop*- reduced osmotic pressure  
(3) *Hind* III, *Eco* RI-selectable markers  
(4) *amp*<sup>R</sup>, *tet*<sup>R</sup>, - antibiotic resistance genes
132. Match column-I with column-II and identify the correct option.



Column - I	Column - II
A. Gene therapy	I. <i>Rhizobium</i>
B. Biofertilizer	II. <i>Cry</i> gene
C. <i>Bt</i> cotton	III. SCID
D. Humulin	IV. Diabetes

- (1) A – II; B – I; C – IV; D – III  
(2) A – III; B – I; C – II; D – IV  
(3) A – II; B – III; C – I; D – IV  
(4) A – IV; B – I; C – II; D – III

133. Which technique would to be completely curative in SCID ?

- (1) Gene therapy in adult stage.  
(2) Gene therapy in embryonic stage.  
(3) Bone marrow transplantation.  
(4) Enzyme replacement therapy.

134. *Bt* toxin protein crystals present in bacterium *Bacillus thuringiensis*, do not kill the bacteria themselves because

- (1) bacteria are resistant to the toxin  
(2) bacteria enclose toxins in a special sac  
(3) toxins occur as inactive protoxins in Bacteria  
(4) None of the above

135. *cry* IIAb and *cry* IAb produce toxins when introduced into plants help in control against

- (1) cotton bollworms and corn borer, Respectively  
(2) corn borer and cotton bollworms, Respectively  
(3) tobacco budworms and nematodes, Respectively  
(4) nematodes and tobacco budworms, Respectively

136. A molecular diagnostic technique which can be used to detect the presence of a pathogen in early stage of detect the presence of a pathogen in early stage of

- (1) angiography  
(2) radiography  
(3) enzyme replacement technique  
(4) polymerase chain reaction

137. The formula for logistic growth are

- (1)  $dN / dt = rN$                       (2)  $rN / dN = dt$   
(3)  $dN / dt = rN \left[ \frac{K - N}{K} \right]$   
(4)  $dN / dt = rN \left[ \frac{N - K}{N} \right]$

138. Consider the following statements (A)-(D) each with one or two blanks.

- (1) Bears go into \_\_\_(i)\_\_\_ during winter to \_\_\_(ii)\_\_\_ cold weather.  
(2) A conical age pyramid with a broad base represents \_\_\_(iii)\_\_\_ human population.  
(3) A wasp pollinating a fig flower is an example Of \_\_\_(iv)\_\_\_  
(4) An area with high levels of species richness is known as \_\_\_(v)\_\_\_

Which one of the following options, gives the correct fill ups for the respective blank numbers from (i) to (v) in the statements?

- (1) (i) - hibernation, (ii) - attract, (iii) – expanding, (iv) - commensalism, (v) – biodiversity park  
(2) (i) - hibernation, (ii) - escape, (iii) – expanding, (iv) - mutualism, (v) - hot spot  
(3) (i) - aestivation, (ii) - escape, (iii) - stable, (iv) – commensalism, (v) – marsh  
(4) (i) - aestivation, (ii) - escape, (iii) - stable, (i) – aestivation, (ii) - escape, (iii) - stable,

139. Match column-I with column-II and choose the correct answer.

	Column-I		Column-II
A	Pacific Salmon fish	I	Produces a small number of large sized offspring
B	Mammals	II	Produces a large number of small sized offspring
C	Oysters	III	Breed only once in their lifetime
D	Birds	IV	Breed many times during their lifetime

- (1) A – III, B – IV, C – II, D – I  
(2) A – I, B – IV, C – II, D – III  
(3) A – IV, B – II, C – I, D – III  
(4) A – II, B – IV, C – III, D – I

140. Which one of the following statement is correct?

- (1) Warm and moist environment favour decomposition whereas low temperature and anaerobiosis inhibit decomposition.  
(2) Warm and moist environment inhibit decomposition whereas low temperature and anaerobiosis favour decomposition.  
(3) Warm moist environment and anaerobiosis inhibit decomposition whereas low temperature favours decomposition.  
(4) Warm and low temperature inhibit decomposition whereas anaerobiosis favours decomposition.



141. The correct order of the process of decomposition is

- (1) Catabolism → Fragmentation → Leaching → Humification → Mineralization
- (2) Catabolism → Fragmentation → Humification → Leaching → Mineralization
- (3) Fragmentation → Humification → Catabolism → Leaching → Mineralization
- (4) Fragmentation → Leaching → Catabolism → Humification → Mineralization

142. Match the following and choose the correct option.

	Column-I		Column-II
A	Standing state	I	Nitrogen, Carbon
B	Gaseous cycles	II	Amount of nutrients
C	Standing crop	III	Sulphur, Phosphorus
D	Sedimentary cycles	IV	Living matter at different trophic levels

- (1) A – II; B – I; C – IV; D – III
- (2) A – I; B – II; C – III; D – IV
- (3) A – III; B – II; C – IV; D – I
- (4) A – I; B – IV; C – III; D – II

143. Consider the following statements.

- (1) An ecosystem is a functional unit of nature and comprises abiotic and biotic components.
- (2) Abiotic components are organic materials.
- (3) Biotic components are producers, consumers and decomposers.
- (4) Energy flow is bidirectional. which two statements are correct ?

144. Productivity at the second trophic level is always

- (1) greater than the productivity at the first trophic level.
- (2) less than the productivity at the first trophic level.
- (3) equal to the productivity at the first trophic level.
- (4) extremely variable compared to the productivity at the first trophic level.

145. Match the following and then choose the correct option.

	Column-I		Column-II
A	Endemism	I	Khasi and Jaintia hills Meghalaya
B	Hotspot of India	II	Advanced <i>ex-situ</i> conservation
C	Sacred groove	III	Species found in a particular area only
D	Cryopreservation	IV	Zoological park and Botanical gardens
E	<i>Ex-situ</i> conservation	V	Western Ghats

- (1) A – III, B – V, C – I, D – II, E – IV
- (2) A – I, B – II, C – III, D – IV, E – V
- (3) A – II, B – III, C – IV, D – V, E – I
- (4) A – V, B – I, C – IV, D – II, E – III

146. Biosphere reserves differ from national parks and wildlife sanctuaries because in the former

- (1) human beings are not allowed to enter.
- (2) people are an integral part of the system
- (3) plants are paid greater attention than the animals.
- (4) living organisms are brought from all over the world and preserved.

147. Which of the following is the correct statement?

- (1) Cultural eutrophication is an accelerated form of eutrophication.
- (2) In the presence of prime contaminants, such as nitrates and phosphates, the growth of algae is arrested.
- (3) The water from electricity generating units enhances the growth of indigenous fauna and flora.
- (4) All of the above

148. Match column-I with column-II and select the correct option.

	Column-I		Column-II
A	Catalytic converter	I	Particulate matter
B	Electrostatic precipitator	II	Carbon monoxide and nitrogen oxides
C	Earmuffs	III	High noise level
D	Land fills	IV	Solid wastes

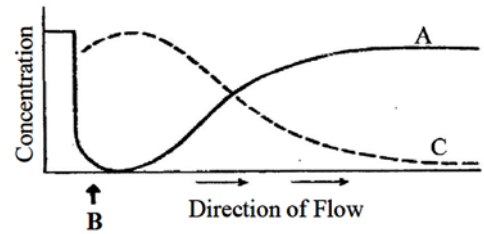
- (1) A – I, B – II, C – III, D – IV
- (2) A – II, B – I, C – III, D – IV
- (3) A – IV, B – III, C – II, D – I
- (4) A – III, B – II, C – IV, D – I

149. Match the following and choose the correct option.

	Column-I		Column-II
A	Narrowly utilitarian argument	I	Conserving biodiversity for major ecosystem services
B	Broadly utilitarian argument	II	Conserving biodiversity for philosophical or spiritual need to realize that every species has intrinsic value and moral duty to pass our biological legacy in good order to future generation.
C	Ethical argument	III	Conserving biodiversity for direct economic benefits like food, medicine, industrial products etc.

- (1) A – I, B – II, C – III  
 (2) A – III, B – I, C – II  
 (3) A – II, B – I, C – III  
 (4) A – I, B – III, C – II

150. The given graph shows the effect of sewage discharge on some important characteristics of a river. Which of the following is the correct label for A, B and C ?



- (1) (A) Dissolved oxygen, (B) Point of sewage discharge, (C) BOD  
 (2) (A) BOD, (B) Point of treated water discharge, (C) Dissolved oxygen  
 (3) (A) Dissolved oxygen, (B) Point of treated water discharge, (C) BOD  
 (4) (A) BOD, (B) Point of sewage discharge, (C) Dissolved oxygen

**MATHEMATICS**

81.  $\int \frac{(1+x)^2}{x(1+x^2)} dx$  is equal to  
 (1)  $\log x + 2 \tan^{-1} x + C$   
 (2)  $\log x - 2 \tan^{-1} x + C$   
 (3)  $-\log x + 2 \tan^{-1} x + C$   
 (4)  $2 \log x + \tan^{-1} x + C$
82.  $\int \left( \frac{\cot^2 2x - 1}{2 \cot 2x} - \cos 8x \cot 4x \right) dx$  is equal to  
 (1)  $\frac{\cos 8x}{8} + C$  (2)  $\frac{\sin 8x}{8} + C$   
 (3)  $-\frac{\cos 8x}{8} + C$  (4)  $-\frac{\sin 8x}{8} + C$
83.  $\int \tan x \cdot \tan 2x \cdot \tan 3x dx$  is equal to  
 (1)  $\log |\cos x| + \frac{1}{2}$   
 $\log |\cos 2x| + \frac{1}{3} \log |\cos 3x| + C$   
 (2)  $\log |\cos x| - \frac{1}{2}$   
 $\log |\cos 2x| - \frac{1}{3} \log |\cos 3x| + C$   
 (3)  $\log |\cos x| + \frac{1}{2} \log |\cos 2x|$   
 $-\frac{1}{3} \log |\cos 3x| + C$   
 (4) None of the above
84.  $\int \frac{\cos 2x - \cos 2\alpha}{\cos x - \cos \alpha} dx$  is equal to—  
 (1)  $(\sin x + x \cos \alpha) + C$   
 (2)  $(2 \sin x + x \cos \alpha) + C$   
 (3)  $2(\sin x + x \cos \alpha) + C$   
 (4) None of these
85.  $\int_0^\infty \frac{x \tan^{-1} x}{(1+x^2)^2} dx$  is equal to  
 (1)  $\pi / 2$  (2)  $\pi / 4$   
 (3)  $\pi / 6$  (4)  $\pi / 8$
86. The value of  $\int_0^\pi |\cos x| dx$  is—  
 (1) 2 (2) 1  
 (3) 0 (4) -1
87.  $\int_0^{100} [\tan^{-1} x] dx$  (Where  $[\cdot]$  denotes the greatest integer function) is equal to—  
 (1) 1000 (2)  $-\tan 1$   
 (3) 0 (4)  $100 - \tan 1$
88.  $\int_0^\pi x f(\sin x) dx$  is equal to  
 (1)  $\pi \int_0^\pi f(\sin x) dx$   
 (2)  $\frac{\pi}{2} \int_0^{\pi/2} f(\sin x) dx$   
 (3)  $\pi \int_0^{\pi/2} f(\cos x) dx$   
 (4)  $\pi \int_0^\pi f(\cos x) dx$
89. The value of  $\lim_{x \rightarrow 0} \int_0^{x^2} \frac{\sec^2 t dt}{x \sin x}$  is  
 (1) 0 (2) 3  
 (3) 2 (4) 1
90. The solution of  $\sin^{-1} \left( \frac{dy}{dx} \right) = (x + y)$  is  
 (1)  $y = \tan(x + y) - \sec(x + y) + C$   
 (2)  $x = \tan(x + y) - \sec(x + y) + C$   
 (3)  $y = \log[\tan(x + y)] + C$   
 (4) None of the above
91. The solution of differential equation  $y \log y + xy' = 0$ , where  $y(1) = e$ , is—  
 (1)  $x(\log y) = 1$  (2)  $xy(\log y) = 1$   
 (3)  $(\log y)^2 = 2$  (4) None of the above
92. The solution of  $\frac{dy}{dx} = \frac{2x - y + 3}{x + 2y + 4}$  is  
 (1)  $y^2 - x^2 + xy + 4y - 3x + 1 = C$   
 (2)  $y^2 - x^2 - xy - 4y + 3x - 1 = C$   
 (3)  $y^2 - x^2 + xy + 4y - 3x + 1 = C$   
 (4)  $y^2 - x^2 + xy + 4y - 3x + 1 = C$
93. The solution of differential equation  $(2x - 10y^3) \frac{dy}{dx} + y = 0$  is  
 (1)  $x + y = Ce^{2x}$  (2)  $y^2 + 2x^3 + C = 0$   
 (3)  $xy^2 - 2y^5 + C = 0$  (4)  $x(y^2 + xy) = 0$

94. The area enclosed by the curve  $y = \log_e(x + e)$  and the coordinate axes is—  
 (1) 1 sq unit (2) 2 sq units  
 (3) 3 sq units (4) 4 sq units
95. The parabolas  $y^2 = 4x$  and  $x^2 = 4y$  divide the square region bounded by  $x = 4$ ,  $y = 4$  and the coordinate axes. If  $S_1$ ,  $S_2$  and  $S_3$  are respectively the area of these parts numbered from top to bottom, then  $S_1 : S_2 : S_3$  is—  
 (1) 1 : 2 : 1 (2) 1 : 2 : 3  
 (3) 2 : 1 : 2 (4) 1 : 1 : 1
96. Angle between diagonals of a parallelogram whose sides are represented by  $\vec{a} = 2\hat{i} + \hat{j} + \hat{k}$  and  $\vec{b} = \hat{i} - \hat{j} - \hat{k}$   
 (1)  $\cos^{-1}\left(\frac{1}{3}\right)$  (2)  $\cos^{-1}\left(\frac{1}{2}\right)$   
 (3)  $\cos^{-1}\left(\frac{4}{9}\right)$  (4)  $\cos^{-1}\left(\frac{5}{9}\right)$
97. Let  $\vec{u} = \hat{i} + \hat{j}$ ,  $\vec{v} = \hat{i} - \hat{j}$  and  $\vec{w} = \hat{i} + 2\hat{j} + 3\hat{k}$  if  $\hat{n}$  is a unit vector such that  $\vec{u} \cdot \hat{n} = 0$  and  $\vec{v} \cdot \hat{n} = 0$ , then  $|\vec{w} \cdot \hat{n}|$  is  
 (1) 1 (2) 2  
 (3) 3 (4) 4
98. For any vector  $\vec{a}$ , the value of  $|\vec{a} \times \hat{i}|^2 + |\vec{a} \times \hat{j}|^2 + |\vec{a} \times \hat{k}|^2$  is  
 (1)  $4|\vec{a}|^2$  (2)  $2|\vec{a}|^2$   
 (3)  $|\vec{a}|^2$  (4)  $3|\vec{a}|^2$
99. Let  $\vec{a} = \hat{i} + \hat{j}$  and  $\vec{b} = 2\hat{i} - \hat{k}$ . The point of intersection of the lines  $\vec{r} \times \vec{a} = \vec{b} \times \vec{a}$  and  $\vec{r} \times \vec{b} = \vec{a} \times \vec{b}$  is  
 (1)  $-\hat{i} + \hat{j} + \hat{k}$  (2)  $3\hat{i} + \hat{j} - \hat{k}$   
 (3)  $3\hat{i} - \hat{j} + \hat{k}$  (4)  $\hat{i} - \hat{j} + \hat{k}$
100. If  $\vec{a}, \vec{b}, \vec{c}$  are unit coplanar vectors, then scalar triple product  $[2\vec{a} - \vec{b} \quad 2\vec{b} - \vec{c} \quad 2\vec{c} - \vec{a}]$  is—  
 (1) 0 (2) 1  
 (3)  $-\sqrt{3}$  (4)  $[a b c]$
101. The reflection of the point  $(2, -1, 3)$  in the plane  $3x - 2y - z = 9$  is—  
 (1)  $\left(\frac{17}{7}, \frac{15}{7}, \frac{26}{7}\right)$  (2)  $\left(\frac{26}{7}, \frac{15}{7}, \frac{17}{7}\right)$   
 (3)  $\left(\frac{15}{7}, \frac{26}{7}, \frac{17}{7}\right)$  (4)  $\left(\frac{26}{7}, \frac{17}{7}, \frac{15}{7}\right)$
102. The angle between lines  $\frac{x+1}{2} = \frac{y-1}{5} = \frac{z+3}{4}$  and  $\frac{x-1}{1} = \frac{y+2}{2} = \frac{z-3}{-3}$  is—  
 (1)  $45^\circ$  (2)  $30^\circ$   
 (3)  $90^\circ$  (4)  $60^\circ$
103. The equation of the line passing through  $(1, 1, 1)$  and parallel to the plane  $2x + 3y + z + 5 = 0$  is—  
 (1)  $\frac{x-1}{1} = \frac{y-1}{2} = \frac{z-1}{1}$   
 (2)  $\frac{x-1}{-1} = \frac{y-1}{1} = \frac{z-1}{1}$   
 (3)  $\frac{x-1}{3} = \frac{y-1}{2} = \frac{z-1}{1}$   
 (4)  $\frac{x-1}{2} = \frac{y-1}{3} = \frac{z-1}{1}$
104.  $\cot\left[\cos^{-1}\left(\frac{7}{25}\right)\right]$  is equal to  
 (1)  $\frac{25}{24}$  (2)  $\frac{25}{7}$   
 (3)  $\frac{24}{25}$  (4) None of the above
105. If  $\cos^{-1} x + \cos^{-1} y + \cos^{-1} z = 3\pi$ , then  $xy + yz + zx$ , is equal to  
 (1) 0 (2) 1  
 (3) 3 (4) -3
106. If  $4 \sin^{-1} x + \cos^{-1} x = \frac{\pi}{2}$ , then  $x$  is equal to—  
 (1) 0 (2)  $\frac{1}{2}$   
 (3)  $\frac{-\sqrt{3}}{2}$  (4)  $\frac{1}{\sqrt{2}}$
107. The value of  $\tan^2(\sec^{-1} 2) + \cot^2(\operatorname{cosec}^{-1} 3)$  is—  
 (1) 13 (2) 15  
 (3) 11 (4) None of these
108.  $\sin\left(\frac{1}{2} \cos^{-1} \frac{4}{5}\right)$  is equal to

- (1)  $\frac{1}{\sqrt{10}}$  (2)  $\frac{-1}{\sqrt{10}}$   
 (3)  $\frac{1}{10}$  (4)  $-\frac{1}{10}$
109. If  $A = \begin{bmatrix} 1-5 & 7 \\ 0 & 7 & 9 \\ 11 & 8 & 9 \end{bmatrix}$ , then the trace of A is  
 (1) 17 (2) 25  
 (3) 3 (4) 12
110. If every row of matrix A contains p elements and its column contains q elements, then the order of A is—  
 (1)  $p \times p$  (2)  $p \times q$   
 (3)  $p \times q$  (4)  $q \times p$
111. The number of values of k for which the system of equations  $(k+1)x + 8y = 4k$ ,  $kx + (k+3)y = (3k-1)$  has infinitely many solutions, is—  
 (1) 0 (2) 1  
 (3) 2 (4) infinite
112. A square non-singular matrix A satisfies  $A^2 - A + 2I = 0$ , then  $A^{-1}$  is equal to—  
 (1)  $I - A$  (2)  $\frac{1}{2}(I - A)$   
 (3)  $I + A$  (4)  $\frac{1}{2}(I + A)$
113. A bag contains 4 red and 3 blue balls. Two balls are drawn twice. If the drawn balls are replaced before the second draw, then the probability that first two balls are red and second two balls are blue, will be—  
 (1)  $2/49$  (2)  $5/49$   
 (3)  $1/35$  (4)  $2/35$
114. The function  $f(x) = \frac{x}{2} + \frac{2}{x}$  has a local minimum at  
 (1)  $x = -2$  (2)  $x = 0$   
 (3)  $x = 1$  (4)  $x = 2$
115. A purse contains 100 coins of unknown value, a coin drawn at random is found to be a rupee. The chance that it is the only rupee in the purse, is (assume all numbers of rupee coins in the purse to be equally likely)  
 (1)  $\frac{1}{5050}$  (2)  $\frac{2}{5151}$   
 (3)  $\frac{2}{4950}$  (4)  $\frac{2}{4950}$
116. The value of  $\lim_{x \rightarrow \infty} \left( \frac{x^2 - 1}{x + 1} - ax - b \right) = 2$ , then  
 (1)  $a = 1, b = 1$  (2)  $a = 1, b = -3$   
 (3)  $a = -1, b = -1$  (4)  $a = -1, b = 3$
117. The value of  $\lim_{x \rightarrow 0} \left[ \tan \left( \frac{\pi}{4} + x \right) \right]^{\frac{1}{x}}$  is  
 (1) e (2)  $1/e$   
 (3)  $1/e^2$  (4)  $e^2$
118. The value of  $\lim_{x \rightarrow 1} \frac{\sqrt{1 - \cos 2(x-1)}}{(x-1)}$  is  
 (1)  $\sqrt{2}$  (2)  $-\sqrt{2}$   
 (3) Does not exist (4) None of these
119. The curve  $y - e^{xy} + x = 0$  has a vertical tangent at  
 (1) (1, 1) (2) (0, 1)  
 (3) (1, 0) (4) no point
120. Let  $f(x) = \int e^x (x-1)(x-2) dx$ , then f decreases in the interval  
 (1)  $(-\infty, 2)$  (2)  $(-2, -1)$   
 (3) (1, 2) (4)  $(2, \infty)$

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**SANIA BEGUM**  
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MBBS, 1ST YEAR  
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MBBS, 1ST YEAR  
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**DIDAR H. LASKAR**  
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