

AJMAL SUPER 40



ADMISSION CUM SCHOLARSHIP TEST (PHASE - III): 2025

Challenger Batch (Complete Syllabus of Class XII)

Conducted by : **AJMAL FOUNDATION, Hojai**



TEST BOOKLET SERIES

B

INSTRUCTIONS TO CANDIDATES

1. Candidates are to use the OMR Answer Sheet provided.
2. It is the candidate's responsibility to write and fill in the **Application Number** (from Admit Card) and **Test Booklet Series** (from Question Paper) carefully and without any omission or discrepancy at the appropriate place in the **OMR Answer Sheet**.
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 on the OMR Answer 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 **OMR 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 (Smart Watch, Mobile, calculator etc.) shall not be used by the examinee during the examination.
10. No candidate will be allowed to leave the Examination Hall before completion of 3 hours.
11. For each correct answer 1 mark will be awarded and for each incorrect answer 0 mark will be deducted.
12. Duration of the exam is **03 hours from 11:00 AM to 02:00 PM**.

For Medical			For Engineering		
Subject	Questions	Marks	Subject	Questions	Marks
Physics	1 to 40	40	Physics	1 to 40	40
Chemistry	41 to 80	40	Chemistry	41 to 80	40
Biology	81 to 150	70	Mathematics	81 to 130	50
Total	150	150	Total	130	130

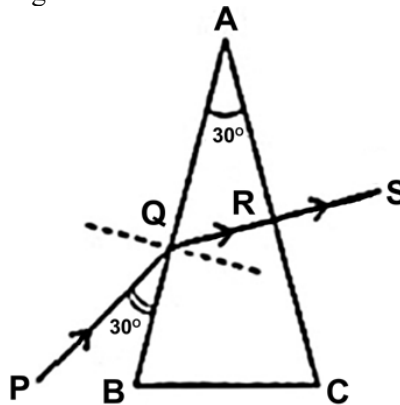
13. Contravention of any of the instruction mentioned above shall render a candidate liable for disciplinary action as per rule.
14. **Date of Result Declaration : 11 - 04 - 2025 (After 6.00 PM on www.ajmalsuper40.in)**

SPACE FOR ROUGH WORK

ADMISSION CUM SCHOLARSHIP TEST – 2025
CHALLENGER BATCH (Complete Syllabus of Class XII)

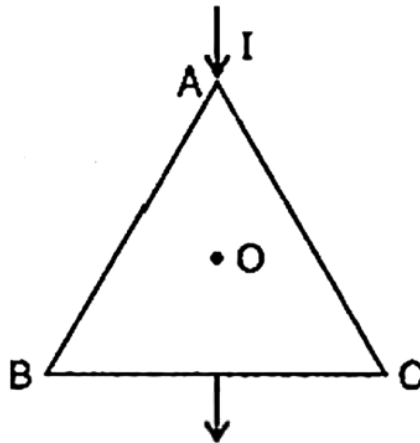
PHYSICS

01. If an electron is accelerated by $8.8 \times 10^{14} \text{ m/s}^2$, then electric field required for acceleration is (given specific charge of the electron $= 1.76 \times 10^{11} \text{ C kg}^{-1}$)
 (1) 52 V cm^{-1} (2) 50 V cm^{-1} (3) 54 V cm^{-1} (4) 56 V cm^{-1}
02. In the circuit given in the figure, an a.c. source of 200 V is connected through a diode D to a capacitor. The potential difference across the capacitor will be
-
- (1) 283 V (2) 100 V (3) 200 V (4) 310 V
03. Green light of wavelength $5,460 \text{ \AA}$ is incident on an air-glass interface. If the refractive index of glass is 1.5, the wavelength of light in glass would be (Given that the velocity of light in air, $c = \times 10^8 \text{ ms}^{-1}$)
 (1) 6731 \AA (2) 3640 \AA (3) 5460 \AA (4) 4861 \AA
04. An astronomical telescope of ten fold angular magnification has a length of 44 cm. The focal length of the objective is
 (1) 44 cm (2) 440 cm (3) 40 cm (4) 4 cm
05. A galvanometer of resistance 25Ω is shunted by a 2.5Ω wire. The part of total current I_0 that flows through the galvanometer is given by
 (1) $\frac{I}{I_0} = \frac{2}{11}$ (2) $\frac{I}{I_0} = \frac{4}{11}$ (3) $\frac{I}{I_0} = \frac{1}{11}$ (4) $\frac{I}{I_0} = \frac{3}{11}$
06. Two coils have a mutual inductance 0.005 H . The current changes in the first coil according to equation $I = I_0 \sin \omega t$, where $I_0 = 10 \text{ A}$ and $\omega = 100 \pi \text{ rad s}^{-1}$. The maximum value of emf in the second coil is
 (1) 12π (2) 2π (3) 5π (4) 6π
07. The susceptibility of a paramagnetic material is χ at 27° C . At what temperature will its susceptibility be $\frac{\chi}{2}$?
 (1) 54° C (2) 327° C (3) 237° C (4) 1600° C
08. Phenomenon of bending of waves around corners of obstacle without a change in medium is called _____.
 (1) diffraction (2) interference (3) reflection (4) refraction
09. The magnitude of the electric field due to a point charge object at a distance of 4.0 m is 9 N/C . From the same charged object the electric field of magnitude $16 \frac{\text{N}}{\text{C}}$ will be at a distance of
 (1) 3 m (2) 1 m (3) 6 m (4) 2 m
10. An electric bulb marked $40 \text{ W} - 200 \text{ V}$ is used in a circuit of supply voltage 100 V . Now its power is:
 (1) 10 W (2) 40 W (3) 20 W (4) 100 W
11. In the diagram, a prism of angle 30° is used. A ray PQ is incident as shown. An emergent ray RS emerges perpendicular to the second face. The angle of deviation is:



- (1) 60° (2) 0° (3) 30° (4) 45°

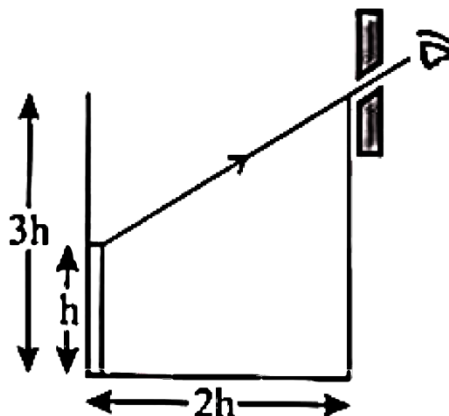
12. A bar magnet having a magnetic moment of $2 \times 10^4 \text{ JT}^{-1}$ is free to rotate in a horizontal plane. A horizontal magnetic field $B = 6 \times 10^{-4}$ exists in the space. The work done in taking the magnet slowly from a direction parallel to the field to a direction 60° from the field is
 (1) 0.6 J (2) 12 J (3) 2 J (4) 6 J
13. Phase difference between any two points on the same wavefront is
 (1) π (2) 0 (3) $\frac{\pi}{4}$ (4) $\frac{\pi}{2}$
14. When 10^{19} electrons are removed from a neutral metal plate, the electric charge on it is
 (1) -1.6 C (2) 10^{+19} C (3) $+1.6 \text{ C}$ (4) 10^{-19} C
15. Barrier potential of a p-n junction diode does not depend on
 (1) Diode design (2) Forward bias
 (3) Temperature (4) Doping density
16. An equilateral triangle is made by uniform wires AB, BC, CA. A current I enters at A and leaves from the midpoint of BC. If the lengths of each side of the triangle is L , the magnetic field B at the centroid O of the triangle is:



- (1) $\frac{\mu_0}{4\pi} \left(\frac{4I}{L} \right)$ (2) $\frac{\mu_0}{4\pi} \left(\frac{2I}{L} \right)$ (3) $\frac{\mu_0}{2\pi} \left(\frac{4I}{L} \right)$ (4) Zero
17. A coil of wire of a certain radius has 100 turns and a self-inductance of 15 mH. The self-inductance of a second similar coil of 500 turns will be:
 (1) 15 mH (2) 375 mH (3) 45 mH (4) 75 mH
18. A paramagnetic sample shows a net magnetisation of 8 Am^{-1} when placed in an external magnetic field of 0.6 T at a temperature of 4 K. When the same sample is placed in an external magnetic field of 0.2 T at a temperature of 16 K, the magnetisation will be
 (1) 6 Am^{-1} (2) $\frac{2}{3} \text{ Am}^{-1}$ (3) 2.4 Am^{-1} (4) $\frac{32}{3} \text{ Am}^{-1}$
19. **Assertion (A):** At resonance, the inductive reactance is equal and opposite to the capacitive reactance.
Reason (R): In series LCR-circuit, the inductive reactance is equal and opposite to the capacitive reactance
 (1) Both A and R are true and R is the correct explanation of A
 (2) Both A and R are true but R is not the correct explanation of A.
 (3) A is true but R is false
 (4) A is false but R is true
20. The resistance of a galvanometer is 50Ω and the current required to give full scale deflection is $100 \mu\text{A}$. In order to convert it into an ammeter for reading up to 10 A, it is necessary to put a resistance of
 (1) $5 \times 10^{-2} \Omega$ (2) $5 \times 10^{-5} \Omega$ (3) $5 \times 10^{-4} \Omega$ (4) $5 \times 10^{-3} \Omega$
21. In Young's double-slit experiment, the intensity of light at a point on the screen where the path difference is λ . Is k (λ being the wavelength of light used). The intensity at a point where the path difference is $\frac{\lambda}{4}$, will be
 (1) k (2) $\frac{k}{4}$ (3) $\frac{k}{2}$ (4) zero
22. If the frequency of the incident radiation is equal to the threshold frequency, what will be the value of the stopping potential?
 (1) 0 (2) Infinite (3) 180 V (4) 1220 V

23. What is the ratio of minimum to maximum wavelength in the Balmer series?
 (1) 5:9 (2) 5:36 (3) 1:4 (4) 3:4
24. The light of wavelength $600 \times 10^{-9} \text{ m}$ is incident normally on a slit of width $3 \times 10^{-3} \text{ m}$. The linear width of central maximum on a screen kept 3 m away from the slit is
 (1) $1.2 \times 10^3 \text{ m}$ (2) $1.2 \times 10^{-3} \text{ m}$ (3) $3.2 \times 10^{-3} \text{ m}$ (4) $2.1 \times 10^{-3} \text{ m}$
25. When a ray of light enters from one medium to another, its velocity is doubled. The critical angle for the ray for total internal reflection will be
 (1) 30° (2) 60° (3) 90° (4) 45°
26. An electric dipole of length 2 cm is placed at an angle of 30° with an electric field $2 \times 10^5 \text{ N/C}$. If the dipole experiences a torque of $8 \times 10^{-3} \text{ Nm}$, the magnitude of either charge of the dipole, is
 (1) $4 \mu\text{C}$ (2) $7 \mu\text{C}$ (3) 8 mC (4) 2 mC
27. Two long parallel wires kept 2 m apart carry 3A current each, in the same direction. The force per unit length on one wire due to the other is
 (1) $4.5 \times 10^{-7} \text{ Nm}^{-1}$, attractive (2) $4.5 \times 10^{-7} \text{ Nm}^{-1}$, repulsive
 (3) $9 \times 10^{-7} \text{ Nm}^{-1}$, repulsive (4) $9 \times 10^{-7} \text{ Nm}^{-1}$, attractive
28. The ratio of the nuclear densities of two nuclei having mass numbers 64 and 125 is
 (1) $\frac{64}{125}$ (2) $\frac{4}{5}$ (3) $\frac{5}{4}$ (4) 1
29. A hydrogen atom makes a transition from $n = 5$ to $n = 1$ orbit. The wavelength of photon emitted is λ . The wavelength of photon emitted when it makes a transition from $n = 5$ to $n = 2$ orbit is
 (1) $\frac{8}{7} \lambda$ (2) $\frac{16}{7} \lambda$ (3) $\frac{24}{7} \lambda$ (4) $\frac{32}{7} \lambda$
30. A photon of wavelengths 663 nm is incident on a metal surface. The work function of the metal is 1.50 eV. The maximum kinetic energy of the emitted photo electrons is
 (1) $3.0 \times 10^{-20} \text{ J}$ (2) $6.0 \times 10^{-20} \text{ J}$ (3) $4.5 \times 10^{-20} \text{ J}$ (4) $9.0 \times 10^{-20} \text{ J}$
31. The electric potential on the axis of an electric dipole at a distance 'r' from its centre is V . Then the potential at a point at the same distance on its equatorial line will be
 (1) 2V (2) -V (3) $\frac{V}{2}$ (4) Zero
32. The capacitance of a parallel plate capacitor is 10 μF . When a dielectric plate is introduced in between the plates, its potential becomes $1/4^{\text{th}}$ of its original value. What is the value of the dielectric constant of the plate introduced?
 (1) 4 (2) 40 (3) 2.5 (4) none of the above
33. A car battery is charged by a 12 V supply, and energy stored in it is $7.20 \times 10^5 \text{ J}$. The charge passed through the battery is
 (1) $6.0 \times 10^4 \text{ C}$ (2) $5.8 \times 10^3 \text{ J}$ (3) $8.64 \times 10^6 \text{ J}$ (4) $1.6 \times 10^5 \text{ C}$
34. If n , e , τ and m have their usual meanings, then the resistance of a wire of length l and cross-sectional area A is given by
 (1) $\frac{ne^2 A}{2m\tau l}$ (2) $\frac{ml}{ne^2 \tau A}$ (3) $\frac{m\tau A}{ne^2 l}$ (4) $\frac{ne^2 \tau A}{2ml}$
35. A ferromagnetic substance is heated above its curie temperature. Which of the following statements is correct?
 (1) Ferromagnetic domains get perfectly arranged
 (2) Ferromagnetic domains get randomly arranged
 (3) Ferromagnetic domains are not at all influenced
 (4) Ferromagnetic material transforms into diamagnetic substance
36. The voltage across a resistor, an inductor, and a capacitor connected in series to an ac source are 20 V, 15 V and 30 V respectively. The resultant voltage in the circuit is
 (1) 5 V (2) 20 V (3) 25 V (4) 65 V
37. A 15Ω resistor, an 80 mH inductor and a capacitor of capacitance C are connected in series with a 50 Hz ac source. If the source voltage and current in the circuit are in phase, then the value of capacitance is
 (1) $100 \mu\text{F}$ (2) $127 \mu\text{F}$ (3) $142 \mu\text{F}$ (4) $160 \mu\text{F}$
38. Proper arrangement of-Gamma rays, Microwave, IR wave and UV rays in ascending order of frequency is
 (1) Gamma rays > UV rays > IR rays > Microwave
 (2) Microwave > IR rays > UV rays > Gamma rays
 (3) UV rays > Gamma rays > Microwave > IR rays
 (4) IR rays > UV rays > Microwave > Gamma rays

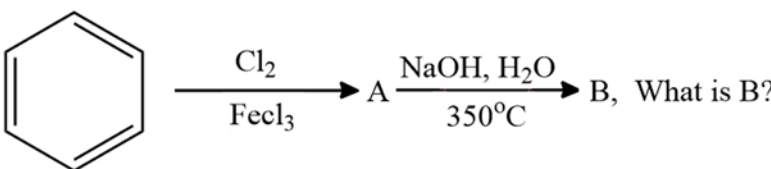
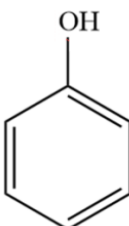
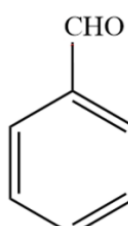
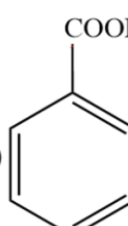
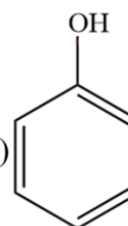
39. In Young's double slit experiment if the width of the slits are in the ratio 4 : 9 the ratio of the intensity of maxima to the intensity at minima will be
 (1) 169:25 (2) 81:16 (3) 25:1 (4) 9:4
40. An observer can see through a pin-hole the top end of a thin rod of height h , placed as shown in the figure. The beaker height is $3h$ and its radius h . When the beaker is filled with a liquid up to a height $2h$, he can see the lower end of the rod. Then the refractive index of the liquid is



- (1) $5/2$ (2) $\sqrt{5/2}$ (3) $\sqrt{3/2}$ (4) $3/2$

CHEMISTRY

41. If Hg_2Cl_2 is 100% ionised then Van't-Hoff factor will be –
 (1) 2 (2) 4 (3) 2.5 (4) 3
42. Consider 0.1M solution of two solutes X and Y. solute X dissociates into two ions whereas Y dimerises in the solution. Which of the following is false? (X and Y represents solution containing X and Y respectively, B.P → Boiling point, F.P → Freezing point π – osmotic pressure)
 (1) $(\Delta T_b)_x > (\Delta T_b)_y$ (2) $(B.P)_x > (B.P)_y$ (3) $(F.P)_x > (F.P)_y$ (4) $\pi_x > \pi_y$
43. The position of some metals in the electro-chemical series in decreasing electropositive character is given as – $Mg > Al > Zn > Cu > Ag$. What happens if a copper spoon is used to stir a solution of $Al(NO_3)_3$?
 (1) The spoon will get coated with Al (2) An alloy of Al and Cu is formed
 (3) The solution became blue (4) There is no reaction
44. Select the cell that is not rechargeable
 (1) Button cell (2) Lead storage battery (3) Leclanche cell (4) Both 1 & 3
45. According to Arrhenius equation a straight line is to be obtained by plotting the logarithm of the rate constant ($\log k$) of a chemical reaction against
 (1) T (2) $\log T$ (3) $\frac{1}{T}$ (4) $\log \frac{1}{T}$
46. A reaction involving two different reactants can never be a
 (1) Second order reaction (2) unimolecular reaction
 (3) First order reaction (4) Pseudo first order reaction
47. Which of the following lanthanides has smallest atomic radius?
 (1) Pm (2) Ce (3) Gd (4) Er
48. Find the most basic oxide from the following
 (1) CuO (2) Cr_2O_3 (3) Mn_2O_7 (4) FeO
49. Which of the following is not π -acid ligand?
 (1) $C\overset{\ominus}{N}$ (2) $S\overset{\ominus}{H}$ (3) CO (4) $N\overset{\oplus}{O}$
50. The nucleophilicities of $\overset{\ominus}{C}H_3$, $\overset{\ominus}{N}H_2$, $\overset{\ominus}{O}H$ and $\overset{\ominus}{F}$ decrease in which order?
 (1) $\overset{\ominus}{C}H_3 > \overset{\ominus}{N}H_2 > \overset{\ominus}{O}H > \overset{\ominus}{F}$ (2) $\overset{\ominus}{O}H > \overset{\ominus}{N}H_2 > \overset{\ominus}{C}H_3 > \overset{\ominus}{F}$
 (3) $\overset{\ominus}{N}H_2 > \overset{\ominus}{O}H > \overset{\ominus}{C}H_3 > \overset{\ominus}{F}$ (4) $\overset{\ominus}{C}H_3 > \overset{\ominus}{O}H > \overset{\ominus}{F} > \overset{\ominus}{N}H_2$
51. Decreasing order of boiling points of following compounds is –
 (i) CH_3CH_2OH (ii) CH_3OCH_3 (iii) H_2O
 (1) (i) > (ii) > (iii) (2) (iii) > (ii) > (i) (3) (iii) > (i) > (ii) (4) (ii) > (i) > (iii)

52. 
- (1)  (2)  (3)  (4) 
53. Phenol and cyclohexanol can be distinguished by using-
 (1) $FeCl_3$ (2) Na (3) PCl_3 (4) CH_3COCl
54. Formic acid does not react with
 (1) Tollen's reagent (2) Fehling solution (3) HCN (4) $NaHCO_3$
55. Specific rotation of freshly prepared aqueous solutions of $\alpha - D(+)$ glucose falls from $+111^\circ$ to $+52.5^\circ$ gradually with time. This is known as –
 (1) Inversion (2) Muta rotation
 (3) Epimerization (4) Racemization
56. Glucose on oxidation with Br_2 / H_2O gives gluconic acid. This suggests that the carbonyl group is present in glucose as –
 (1) Keto group (2) Aldehyde group
 (3) Carboxylic group (4) Cyanide group
57. If the various terms in the given below expressions have usual meanings, the van't Hoff factor (i) cannot be calculated by which one of the following expressions
 (1) $\pi V = \sqrt{in}RT$ (2) $\Delta T_f = iK_f \cdot m$
 (3) $\Delta T_b = iK_b \cdot m$ (4) $\frac{P^\circ_{\text{solvent}} - P_{\text{solution}}}{P^\circ_{\text{solvent}}} = i \left(\frac{n}{N+n} \right)$
58. The pressure of H_2 required to make the potential of H_2 – electrode zero in pure water at 298 K is
 (1) 10^{-14} atm (2) 10^{-12} atm (3) 10^{10} atm (4) 10^{-4} atm
59. On electrolysis of dil. sulphuric acid using Platinum (Pt) electrode, the product obtained at anode will be
 (1) Oxygen gas (2) H_2S gas (3) SO_2 gas (4) Hydrogen gas
60. For a cell involving one electron $E^\ominus_{\text{cell}} = 0.59 \text{ V}$ at 298 K, the equilibrium constant for the cell reaction is
 [Given that $\frac{2.30RT}{F} = 0.059V$ at $T = 298K$]
 (1) 1.0×10^2 (2) 1.0×10^5 (3) 1.0×10^{10} (4) 1.0×10^{30}
61. For the chemical reaction $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$ the gas is correct option is
 (1) $-\frac{1}{3} \frac{d[H_2]}{dt} = -\frac{1}{2} \frac{d[NH_3]}{dt}$ (2) $-\frac{d[N_2]}{dt} = 2 \frac{d[NH_3]}{dt}$
 (3) $-\frac{d[N_2]}{dt} = \frac{1}{2} \frac{d[NH_3]}{dt}$ (4) $3 \frac{d[H_2]}{dt} = 2 \frac{d[NH_3]}{dt}$
62. If the rate constant for a first order reaction is k, the time (t) required for the completion of 99% of the reaction is given by
 (1) $t = 0.693/k$ (2) $t = 6.909/k$
 (3) $t = 4.606/k$ (4) $t = 2.303/k$
63. Which of the following pairs of ions are isoelectronic and isostructural?
 (1) CO_3^{2-}, NO_3^- (2) ClO_3^-, CO_3^{2-}
 (3) SO_3^{2-}, NO_3^- (4) ClO_2^-, SO_3^{2-}

64. Bond dissociation enthalpy of E - H (E =element) bonds is given below. Which of the following compounds will acts as strongest reducing agent?

Compound NH_3 PH_3 AsH_3 SbH_3

$\Delta_{diss}(E-H) / kJ mol^{-1}$ 398 322 297 255

(1) NH_3

(2) PH_3

(3) AsH_3

(4) SbH_3

65. Match List-I with List-II.

List-I		List-II	
A	$[Fe(CN)_6]^{3-}$	i	5.92BM
B	$[Fe(H_2O)_6]^{3+}$	ii	0 BM
C	$[Fe(CN)_6]^{4-}$	iii	4.90 BM
D	$[Fe(H_2O)_6]^{2+}$	iv	1.73BM

Choose the correct answer from the options given below.

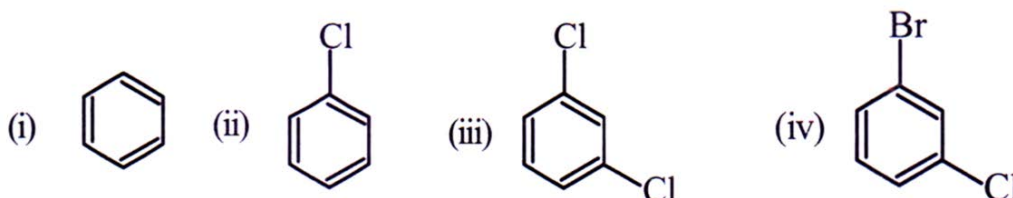
(1) A-(iv), B-(i), C-(ii), D-(iii)

(2) A-(iv), B-(ii), C-(i), D-(iii)

(3) A-(ii), B-(iv), C-(iii), D-(i)

(4) A-(i), B-(iii), C-(iv), D-(ii)

66. Arrange the following compounds in the increasing order of their densities



(1) (i) < (ii) < (iii) < (iv)

(3) (iv) < (iii) < (ii) < (i)

(2) (i) < (iii) < (iv) < (ii)

(4) (ii) < (iv) < (iii) < (i)

67. Match Column I with Column II

Column - I		Column - II	
A	$CH_2 = CH - CH_2Cl$	p	gem-Dichloride
B	$CH_2 = CHX$	q	Vinylic halide
C	CH_3CHCl_2	r	vic-Dichloride
D	CH_2ClCH_2Cl	s	Allylic halide

(1) A - (r), B - (q), C - (P), D - (s)

(2) A - (q), B - (P), C - (s), D - (r)

(3) A - (s), B - (q), C - (p), D - (r)

(4) A - (r), B - (p), C - (s), D - (q)

68. Match Column I with Column II

Column - I		Column - II	
A	$C_2H_6 \xrightarrow[C_2H_5Cl]{Cl_2/UV\ light}$	p	Finkelstein reaction
B	$C_6H_5NH_2 \xrightarrow[273-278K]{NaNO_2+HCl/Cu_2Cl_2} C_6H_5Cl$	q	Free radical Substitution
C	$CH_3Cl + NaI \rightarrow CH_3I + NaCl$	r	Swarts reaction
D	$CH_3 - Br + AgF \rightarrow CH_3F + AgBr$	s	Sandmeyer's reaction

(1) A-(q), B-(s), C-(p), D-(r)

(2) A-(q), B-(r), C-(P), D-(s)

(3) A-(r), B-(p), C-(s), D-(q)

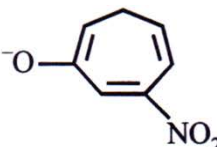
(4) A-(s), B-(r), C-(p), D-(q)

69. Which of the following species can act as the strongest base?

(1) ^-OH

(2) ^-OR

(3) $^-OC_6H_5$

(4) 

70. In Clemmensen reduction, carbonyl compounds is treated with.....

(1) zinc amalgam + HCl

(2) sodium amalgam + HCl

(3) zinc amalgam + nitric acid

(4) sodiumamalgam + HNO_3

71. Which of the following is a 3° amine?

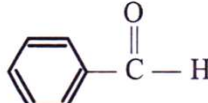
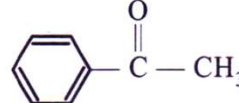
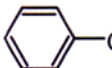
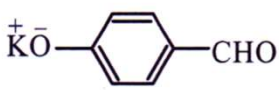
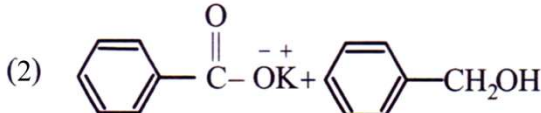
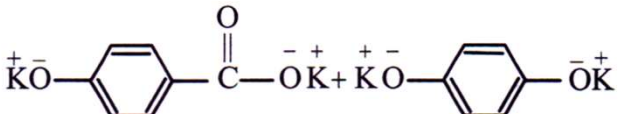
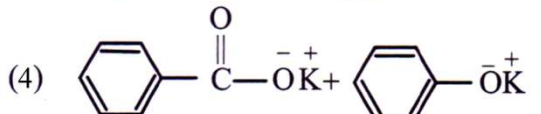
(1) 1-methylcyclohexylamine (2) Triethylamine

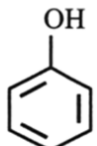
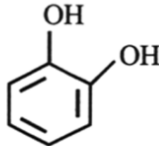
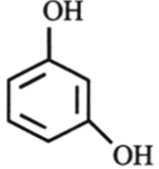
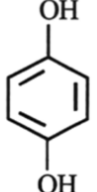
(3) tert-butylamine

(4) N-methylaniline

72. The source of nitrogen in Gabriel synthesis of amines is.....
 (1) Sodium azide, NaN_3 (2) sodium nitrite, $NaNO_2$
 (3) potassium cyanide, KCN (4) Potassium phthalimide, $C_6H_4(CO)_2 N^- K^+$
73. Which of the following B group vitamins can be stored in our body?
 (1) Vitamin B_1 (2) Vitamin B_2 (3) Vitamin B_6 (4) Vitamin B_{12}
74. Which of the following bases is not present in DNA?
 (1) Adenine (2) Thymine (3) Cytosine (4) Uracil
75. Match Column-I with Column-II.

Column-I		Column-II	
A	Methanol	p	Conversion of phenol to o-hydroxysalicylic acid
B	Kolbe's reaction	q	Wood spirit
C	Williamson's synthesis	r	Heated copper at 573 K
D	Conversion of 2° alcohol to ketone	s	Reaction of alkyl halide with sodium alkoxide

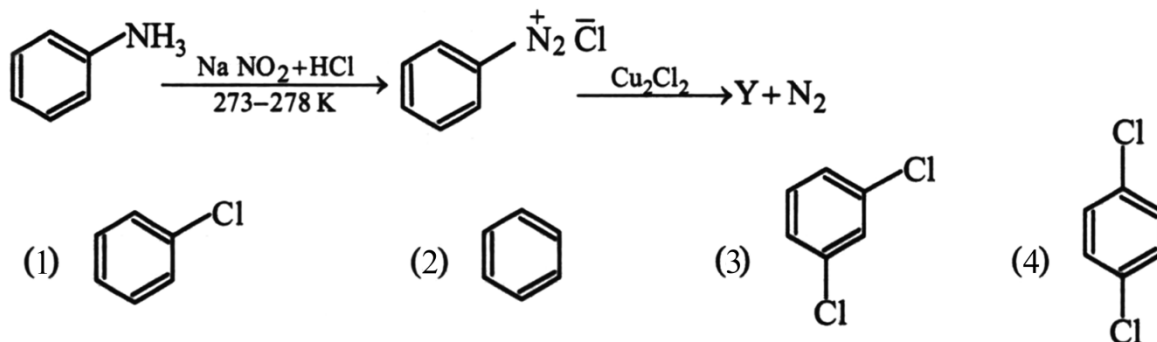
- (1) A-(s), B-(r), C-(q), D-(P) (2) A-(q), B-(s), C-(P), D-(r)
 (3) A-(q), B-(P), C-(s), D-(r) (4) A -(r), B-(q), C-(P), D -(s)
76. Which of the following compounds is most reactive towards nucleophilic addition reactions?
 (1) $CH_3 - \overset{\overset{O}{\parallel}}{C} - H$ (2) $CH_3 - \overset{\overset{O}{\parallel}}{C} - CH_3$ (3)  (4) 
77. Which product is formed when the compound  is treated with concentrated aqueous KOH solution?
 (1)  (2) 
 (3)  (4) 
78. Which of the following compounds will give butanone on oxidation with alkaline $KMnO_4$ solution?
 (1) Butan-1-ol (2) Butan-2-ol (3) Both (1) and (2) (4) None of these
79. Match Column-I with Column-II.

Column-I	Column-II
(A) 	(p) Quinol
(B) 	(q) Phenol
(C) 	(r) Catechol
(D) 	(s) Resorcinol

- (1) A-(q), B - (P), C-(s), D-(r)
 (3) A-(s), B-(q), C-(P), D-(r)

- (2) A-(r), B-(p), C-(s), D-(q)
 (4) A-(q), B-(r), C-(s), D-(P)

80. Identify the compound Y in the following reaction

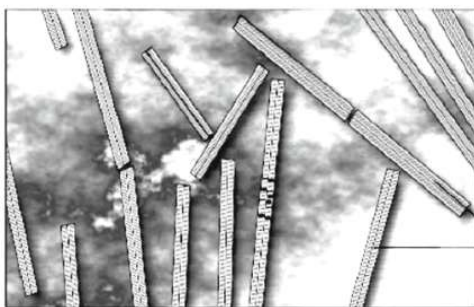


BIOLOGY

81. In the genetic code dictionary, how many codons are used to code for all the 20 amino acids
 (1) 60 (2) 20 (3) 64 (4) 61
82. After a mutation at a genetic locus the character of an organism changes due to the change in
 (1) Protein structure (2) DNA replication
 (3) protein synthesis pattern (4) RNA transcription pattern
83. Select the correct option:

	Direction of RNA synthesis	Direction of reading of the template DNA strand
(1)	5' — 3'	3' — 5'
(2)	3' — 5'	5' — 3'
(3)	5' — 3'	5' — 3'
(4)	3' — 5'	3' — 5'

84. Commonly used vectors for human genome sequencing are
 (1) T – DNA (2) BAC and YAC
 (3) Expression Vectors (4) T / A Cloning Vectors
85. Which of the following is not required for any of the techniques of DNA fingerprinting available at present
 (1) Polymerase chain reaction (2) Zinc finger analysis
 (3) Restriction enzymes (4) DNA - DNA hybridization
86. Which one of the following processes during decomposition is correctly described:
 (1) Humification – Leads to the accumulation of a dark coloured substance humus which undergoes microbial action at a very fast rate.
 (2) Catabolism – Last step in the decomposition under fully anaerobic condition
 (3) Leaching – Water soluble inorganic nutrients rise to the top layers of soil
 (4) Fragmentation – Carried out by organisms such as earthworm
87. Perisperm is
 (1) Remnant of nucellus in mature seed (2) Sporophytic tissue
 (3) Diploid tissue (4) All of these
88. How many matching are correct
 a. Mutualism – Mycorrhizae
 b. Mutualism – Lichen
 c. Mutualism – Fig tree and wasp
 d. Commensalism – *Cuscuta* and hedge plant
 (1) Four (2) Three (3) One (4) Two
89. Select the correct statement for the given diagram



- (1) It is infectious agent
 (2) It is connecting link between living and non living
 (3) It is obligate parasite
 (4) All of these

90. Which one of the following is the incorrect match
 (1) Stellers's sea cow – Over exploitation by humans
 (2) Passenger pigeon – Over exploitation by Human
 (3) Nile perch – Alien species invasions
 (4) None of these
91. How many matching are correct
 a. Paul Ehrlich – Stanford ecologist
 b. Alexander von Humboldt – German Naturalist
 c. Edward wilson – Sociobiologist
 d. African Cat fish – Alien species invasions
 (1) Three (2) Four (3) One (4) Two
92. Which one of the following is the correct match
 (1) Down syndrome – Palm crease (2) Klinefelters syndrome – Sterile individual
 (3) Turner's syndrome – Rudimentary ovaries (4) All
93. In which of the following interactions both partners are adversely affected :
 (1) Parasitism (2) Mutualism (3) Competition (4) Predation
94. The principle of competitive exclusion was stated by
 (1) Verhulst and Pearl (2) C. Darwin (3) G. F. Gause (4) MacArthur
95. Greater number of Amphibian species are present in
 (1) Eastern ghats (2) Western ghats (3) Deserts (4) Himalayan region
96. Common name of *Eicchornia* and *Parthenium* are
 (1) sea cow and carrot grass (2) water hyacinth and sea cow
 (3) water hyacinth and carrot grass (4) water hyacinth and potato plant
97. In dihybrid experiment on garden peas worked by mendel, what is the % of seed with rrYy genotype
 (1) 12.5% (2) 25% (3) 6.25% (4) 37.5%
98. Which one of the following is the correct match :
 (1) Autosomal dominant – Myotonic dystrophy
 (2) Sex - linked recessive – Myotonic dystrophy
 (3) Autosomal dominant – Thalassemia
 (4) Sex - linked dominant – Cystic fibrosis
99. Under which of the following conditions will there be no change in the reading frame of following mRNA?
5'AACAGCGGUGCUAUU3'
 (1) Insertion of G at 5th position
 (2) Deletion of G from 5th position
 (3) Insertion of A and G at 4th and 5th Positions respectively
 (4) Deletion of GGU from 7th, 8th and 9th Positions
100. If a geneticist uses the blind approach for sequencing the whole genome of an organism, followed by assignment of function to different segments, the methodology adopted by him is called as
 (1) Gene mapping (2) Expressed sequence tags
 (3) Bioinformatics (4) Sequence annotation
101. If the length of a DNA molecule is 1.1 metres, what will be the approximate number of base pairs
 (1) 6.6×10^9 bp (2) 3.3×10^6 bp
 (3) 6.6×10^6 bp (4) 3.3×10^9 bp
102. Which one of the following is the correct statement
 (1) Brood parasitism occurs in Cuckoo & Crow
 (2) *Cuscuta* has large green leaves
 (3) The blood sucking female mosquito is considered a type of parasite
 (4) Tick on dogs is the example of endoparasite
103. Examples of ectoparasite is/are
 (1) Copepods (2) *Cuscuta* (3) Lice (4) All of these
104. Which one of the following are correct in between lichen and mycorrhizae :
 (a) Both are example of mutualism (b) Both are symbiotic association
 (c) Both are non symbiotic association (d) In both fungi is one of the partner
 (1) a, b, d (2) a, c, d (3) Only a, d (4) Only a, b
105. Two strands of DNA in double helix model are held together by
 (1) Ionic bond (2) Coordinate bond
 (3) Hydrogen bond (4) Covalent bond
106. 20% of total oxygen in earth's atmosphere produced by :
 (1) Amazonian rain forest (2) Deserts
 (3) Megalaya forest (4) Sarguja forest

107. Statement I: In western countries a large number of pollen products in the form of tablets and syrups are available in the market.
Statement II: The period for which pollen grains remains viable is highly variable upto some extent it depends on the prevailing temperature and humidity.
- Both Statement I and Statement II are incorrect
 - Statement I is correct but Statement II is incorrect
 - Statement I is incorrect but Statement II is correct
 - Both Statement I and Statement II are correct
108. Select the correct statement for the microsporangium of flowering plants
- It is generally surrounded by four wall layers
 - All four wall layers perform the function of protection and help in dehiscence of anther to release the pollen
 - The outermost wall layer is the tapetum
 - Endothecium nourishes the developing pollen Grains
- (1) a, c (2) Only a (3) a, c, d (4) a, b, d
109. How many matching are incorrect for seed in angiosperm
- Seed – Basis of agriculture
 - Endospermic seed – Barley
 - Perisperm – Sugar beet
 - Endospermic seed – Maize
 - Non albuminous seed – Wheat
- (1) Four (2) Three (3) One (4) Two
110. Statement I: The rate of decomposition is controlled by chemical composition of detritus and climatic factors.
Statement II: Temperature and soil moisture are the most important climatic factors that regulate decomposition through their effects on the activities of soil microbes.
- Both Statement I and Statement II are incorrect
 - Statement I is correct but Statement II is incorrect
 - Statement I is incorrect but Statement II is correct
 - Both Statement I and Statement II are correct
111. How many matching are correct regarding contrasting traits studied by Mendel for dominant trait of pea plants?
- Flower colour Violet
 - Flower position Terminal
 - Pod colour Yellow
 - Seed colour Yellow
 - Seed shape Round
- (1) Four (2) Three (3) Two (4) One
112. In ecosystem energy is transferred from producer to consumer : A and B are the values of transferred energy. What is A and B?



- A – 10%, B – 5%
 - A – 50%, B – 50%
 - A – 10%, B – 10%
 - A – 90%, B – 90%
113. During the sewage treatment,
- BOD decreases during primary treatment.
 - BOD increases during secondary treatment.
 - BOD decreases during secondary treatment.
 - BOD decreases during secondary treatment.
114. The Ministry of Environment and Forests, government of India has initiated Ganga Action Plan and Yamuna Action Plan. What is/are goals of these plans?
- They are designed to save these major rivers of our country from pollution.
 - Under these plans, it is proposed to build a large number of sewage treatment plants so that only treated sewage may be discharged in the rivers.
 - Both 1 and 2
 - They are designed to extract biogas only.
115. Which of the following are not given any place in ecological pyramids even though they play a vital role in the ecosystem?
- Parasites
 - Plants
 - Apex predators
 - Fungi
116. GnRH, a hypothalamic hormone, needed in reproduction, acts on
- Anterior pituitary gland and stimulates secretion of LH and oxytocin
 - Anterior pituitary gland and stimulates secretion of LH and FSH
 - Posterior pituitary gland and stimulates secretion of oxytocin and FSH
 - Posterior pituitary gland and stimulates secretion of LH and relaxin

117. Choose the incorrect pair.
- (1) Antrum — Fluid-filled cavity in primary follicle
 - (2) Tertiary follicle — Primary oocyte completes its 1st meiotic division inside it
 - (3) Secondary oocyte — Haploid cell formed after 1st meiotic division
 - (4) Graafian follicle — Mature tertiary follicle which ruptures during ovulation
118. Every time copulation does not lead to fertilisation and pregnancy because of failure of sperm to reach the
- (1) Ampulla
 - (2) Cervix
 - (3) Endometrium
 - (4) Myometrium
119. The correct sequence is
- (1) Zygote → Cleavage → Morula → Blastula → Gastrula
 - (2) Cleavage → Zygote → Morula → Blastula → Gastrula
 - (3) Zygote → Morula → Blastula → Cleavage → Gastrula
 - (4) Zygote → Blastula → Morula → Cleavage → Gastrula
120. Choose the incorrect pair.
- | Organ | Time of development in foetus |
|------------------------------|---|
| (1) Heart | After one month of pregnancy |
| (2) Limbs and digits | By the end of second month |
| (3) External genital organs | By the end of 24 weeks (second trimester) |
| (4) First movement of foetus | During the fifth month |
121. Which of the following statement is not correct for oögonia?
- (1) They are a couple of million gamete mother cells
 - (2) They are formed within each foetal ovary
 - (3) They are formed throughout the life of female
 - (4) They start division and get arrested at prophase-I of meiotic division
122. Match the following columns.
- | Column I | | Column II | |
|----------|--|-----------|------------------------------|
| A. | Collected gmetes are made to form the zygote in the laboratory. | 1. | <i>In vivo</i> fertilisation |
| B. | Zygote or Early embryo with up to 8 blastomeres is transferred into the oviduct. | 2. | IUT |
| C. | Zygote with more than 8 blastomeres, is transferred into the uterus. | 3. | ZIFT |
| D. | Fusion of the gametes in the female reproductive tract. | 4. | IVF |
- (1) A-4, B-3, C-2, D-1
 - (2) A-3, B-1, C-4, D-2
 - (3) A-4, B-2, C-3, D-1
 - (4) A-2, B-1, C-3, D-4
123. Lactational amenorrhea is the
- (1) Absence of menses in adult age
 - (2) Absence of menses in elderly age
 - (3) Absence of menses during lactation
 - (4) No menses during pregnancy
124. Identify the incorrect statement(s) from those given below.
- (1) RCH programmes created awareness among people about various reproduction related aspects
 - (2) Sexually transmitted diseases can be avoided by educating people with proper information about reproduction, adolescence and related changes, etc.
 - (3) Ultrasounds have been banned as it was used for foetal sex-determination based on chromosomal studies
 - (4) All of the above
125. Evolutionary convergence is the development of
- (1) Common set of characters in closely related groups
 - (2) Common set of characters in the group of different ancestry
 - (3) Random mating
 - (4) Dissimilar characters in the closely related groups
126. In Australia, marsupials and placental mammals have evolved to share many similar characteristics. This type of evolution may be referred to as
- (1) Adaptive radiation
 - (2) Divergent evolution
 - (3) Cyclical evolution
 - (4) Convergent evolution
127. Which one of the following describes correctly the homologous structure?
- (1) Organs with anatomical similarities, but performing different functions
 - (2) Organs with anatomical dissimilarities, but performing same function
 - (3) Organs that have no function now, but had an important function in ancestor
 - (4) Organs appearing only in embryonic stage and disappearing later in the adult
128. According to the Hardy-Weinberg principle, what does 'p²' represent in the equation ($p^2 + 2pq + q^2 = 1$)?
- (1) Frequency of the recessive allele
 - (2) Frequency of heterozygous individuals
 - (3) Frequency of homozygous dominant individuals
 - (4) Frequency of dominant allele

129. Read the following statements and select the correct answer.
 I. Morphine is a very effective sedative and painkiller, and is very useful in patient who have undergone surgery.
 II. Addiction is psychological attachment to certain effects such as euphoria and temporary feeling of well-being associated with drugs and alcohol.
 III. When the drugs are taken for a purpose other than medicinal use or in amounts/frequency that impairs one's physical, physiological or psychological functions, it constitutes drug abuse.
 IV. Smoking increase carbon monoxide content in blood and reduces the concentration of oxygen. This causes oxygen deficiency in the body.
 (1) I and II (2) II and IV (3) I, II and IV (4) I, II, III and IV
130. What is the main principle of Lamarck's theory of evolution?
 (1) The survival of the fittest (2) Use and disuse of organs
 (3) Natural selection (4) Gradual change in species
131. The phenomenon where individuals with intermediate traits are favored, reducing the extremes, is called:
 (1) Disruptive selection (2) Stabilizing selection (3) Directional selection (4) Genetic drift
132. Match the following diseases with the causative organism and select the correct option.
- | Column I | | Column II | |
|----------|------------|-----------|--------------------|
| A. | Typhoid | 1. | <i>Wuchereria</i> |
| B. | Pneumonia | 2. | <i>Plasmodium</i> |
| C. | Filariasis | 3. | <i>Salmonella</i> |
| D. | Malaria | 4. | <i>Haemophilus</i> |
- (1) A-1, B-3, C-2, D-4 (2) A-3, B-4, C-1, D-2
 (3) A-2, B-1, C-3, D-4 (4) A-4, B-1, C-2, D-3
133. Transplantation of tissues/ organs fails often due to non-acceptance by the patient's body. Which type of immune response is responsible for such rejections?
 (1) Cell-mediated immune response (2) Hormonal immune response
 (3) Physiological immune response (4) Autoimmune response
134. Choose the correct statements.
 I. Innate immunity is accomplished by providing different types of barriers.
 II. Acquired immunity is present from the birth and its inherited from parents.
 III. Acquired immunity can be divided into antibody mediated and cell-mediated immunity.
 IV. Innate immunity is also called specific immunity.
 V. Acquired immunity consists of special cells (T-cell and B-cell) and antibodies that circulate in the blood.
 (1) I, II and V (2) II, III, IV and V (3) I, III and V (4) I, II, III, IV and V
135. Interferons are synthesized in response to
 (1) Mycoplasma (2) Bacteria (3) Viruses (4) Fungi
136. Which of the following are the reasons for rheumatoid arthritis?
 I. The ability to differentiate pathogens or foreign molecules from self cells increase
 II. Body attacks self cells.
 III. WBCs like neutrophil attacks the tip of the bone
 IV. The ability to differentiate pathogens or foreign molecules from self cells is lost.
 (1) I and II (2) II and IV (3) III and IV (4) I and III
137. Which one of the following is a case of wrong matching?
 (1) Somatic hybridization — Fusion of two diverse cells
 (2) Vector DNA — Site for tRNA synthesis
 (3) Micro propagation — *In vitro* production of plants in large numbers
 (4) Callus — Unorganised mass of cells produced in tissue culture
138. The specific palindromic sequence which is recognized by *EcoRI* is
 (1) 5'-GAATTC-3' (2) 5' - GGAACC -3' (3) 5'- CTTAAG - 3' (4) 5' - GGATCC - 3'
 3'-CTTAAG -5' 3'- CCTTGG -5' 3' - GAATTC -5' 3'- CCTAGG -5'
139. Following statements describe the characteristics of the enzyme restriction endonuclease. Identify the incorrect statement.
 (1) The enzyme recognises a specific palindromic nucleotide sequence in the DNA.
 (2) The enzyme cuts DNA molecule at identified position within the DNA.
 (3) The enzyme binds DNA at specific sites and cuts only one of the two strands.
 (4) The enzyme cuts the sugar-phosphate backbone at specific sites on each strand.
140. Biolistics (gene-gun) is suitable for
 (1) Disarming pathogen vectors
 (2) Transformation of plant cells
 (3) Constructing recombinant DNA by joining with vectors
 (4) DNA fingerprinting.

141. Match the following columns.

Column I		Column II	
A.	Recombinant DNA	1.	Sea weeds
B.	Gel electrophoresis	2.	DNA staining
C.	Ethidium bromide	3.	Plasmid DNA that has incorporated human DNA
D.	Agarose	4.	Process by which DNA fragments are separated based on their size

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

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

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

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

142. What is the role of cry genes in Bt crops?

(1) They increase nitrogen fixation

(2) They help in herbicide resistance

(3) They produce toxic proteins that kill insect pest

(4) They improve drought resistance

143. A novel strategy was adopted to prevent *Meloidogyne incognita* infection in tobacco plants that was based on the process of

(1) DNA interference

(2) RNA interference

(3) RNA initiation

(4) DNA initiation

144. Match the following columns.

Column I		Column II	
A.	Transgenic tobacco plant	1.	Vitamin-A
B.	Lepidopterans	2.	High yield and pest resistant
C.	<i>Bt</i> cotton	3.	<i>Meloidogyne incognita</i>
D.	Golden rice	4.	Tobacco budworm

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

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

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

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

145. The first transgenic cow, Rosie produced

(1) Human protein enriched milk (2.4 g/L)

(2) Human protein enriched milk (2.8 g/L)

(3) Human calcium enriched milk (2.4 g/L)

(4) Human calcium enriched milk (2.8 g/L)

146. Transposons are also known as

(1) Silenced genes

(2) Mobile genetic elements

(3) Pleiotropic genes

(4) Both (1) and (2)

147. Which one of the following statements gives the correct explanation for autoradiography?

(1) Clones which have unmutated genes will not appear the photographic film

(2) Clones which have mutated genes will not appear on the photographic film

(3) The probe used will have only complementary genes with unmutated protein of DNA

(4) All of the above

148. Which of the following is true for Golden rice?

(1) It has yellow grains, because of a gene introduced from a primitive variety of rice.

(2) It is vitamin A enriched, with a gene producing vitamin A.

(3) It is pest resistant, with a gene from *Bacillus thuringiensis*.

(4) It is drought tolerant, developed using *Agrobacterium* vector.

149. **Assertion (A):** Theory of chemical evolution proposed that life came from pre-existing non-living organic molecules.

Reason (R): Primitive earth conditions led to the production of organic molecules.

(1) Both A and R is correct and R is the correct explanation of A.

(2) Both A and R is correct and R is not the correct explanation of A.

(3) A is correct, but R is incorrect.

(4) A is incorrect, but R is correct.

150. **Assertion (A):** Rapid decline in death rate, MMR and IMR have lead to staggering rise in population.

Reason (R): Such an alarming growth rate has lead to an absolute scarcity of even the most basic requirements, i.e. food and shelter.

(1) Both A and R is correct and R is the correct explanation of A.

(2) Both A and R is correct and R is not the correct explanation of A.

(3) A is correct, but R is incorrect.

(4) A is incorrect, but R is correct.

MATHEMATICS

81. Let $f(x) = ax^2 + bx + c$, where a, b, c are rational, and $f: Z \rightarrow Z$ where Z is the set of integers. Then $a + b$ is
 (1) a negative integer (2) an integer
 (3) nonintegral rational number (4) none of these
82. Let $f(x) = \sin(\tan^{-1} x)$. Then $\left[f(-\sqrt{3})\right]$, where $[.]$ denotes the greatest integer function, is
 (1) $-\frac{\sqrt{3}}{2}$ (2) 0 (3) -1 (4) none of these
83. If $f(x) = \frac{x-1}{x+1}$ then $f(ax)$ in term of $f(x)$ is equal to
 (1) $\frac{f(x)+a}{1+af(x)}$ (2) $\frac{(a-1)f(x)+a+1}{(a+1)f(x)+a-1}$ (3) $\frac{(a+1)f(x)+a-1}{(a-1)f(x)+a+1}$ (4) none of these
84. The domain of the function $f(x) = \sqrt{x\sqrt{1-x^2}}$ is
 (1) $\left[-1, -\frac{1}{\sqrt{2}}\right] \cup \left[\frac{1}{\sqrt{2}}, 1\right]$ (2) $[-1, 1]$ (3) $\left(-\infty, -\frac{1}{2}\right] \cup \left[\frac{1}{\sqrt{2}}, +\infty\right)$ (4) $\left[\frac{1}{\sqrt{2}}, 1\right]$
85. If $y = \cos^{-1}(\cos x)$ then $\frac{dy}{dx}$ at $x = \frac{5\pi}{4}$ is equal to
 (1) 1 (2) -1 (3) $\frac{1}{\sqrt{2}}$ (4) none of these
86. Let $y = |x| + |x-2|$. Then $\frac{dy}{dx}$ at $x = 2$
 (1) is 2 (2) is 0 (3) does not exist (4) none of these
87. Let $f(x) = \begin{cases} \frac{1-\tan x}{4x-\pi}, & x \neq \frac{\pi}{4} \\ \lambda, & x = \frac{\pi}{4} \end{cases}$ If $f(x)$ is continuous in $\left[0, \frac{\pi}{2}\right)$ then λ is
 (1) 1 (2) $\frac{1}{2}$ (3) $-\frac{1}{2}$ (4) none of these
88. A function $f(x)$ is defined as follows :
 $f(x) = -x^2, x \leq 0$ $f(x) = 5x-4, 0 < x \leq 1$
 $f(x) = 4x^2-3x, 1 < x \leq 2$ $f(x) = 3x+4, x > 2$
 (1) $f(x)$ is not continuous at $x = 0$, but differentiable there
 (2) $f(x)$ is continuous at $x = 1$, but not differentiable there
 (3) $f(x)$ is continuous at $x = 2$, but not differentiable there
 (4) none of the above
89. Two cyclists start from the junction of two perpendicular roads, their velocities being $3v$ metres/minute and $4v$ metres/minute. The rate at which the two cyclists are separating is
 (1) $\frac{7}{2}v$ m/min (2) $5v$ m/min (3) v m/min (4) none of these
90. If there is an error of $k\%$ in measuring the edge of a cube then the per cent error in estimating its volume is
 (1) k (2) $3k$ (3) $\frac{k}{3}$ (4) none of these
91. The maximum value of $f(x) = 3\cos^2 x + 4\sin^2 x + \cos \frac{x}{2} + \sin \frac{x}{2}$ is
 (1) 4 (2) $3 + \sqrt{2}$ (3) $4 + \sqrt{2}$ (4) none of these
92. The function $f(x) = \sin^4 x + \cos^4 x$ increases if
 (1) $0 < x < \frac{\pi}{8}$ (2) $\frac{\pi}{4} < x < \frac{3\pi}{8}$ (3) $\frac{3\pi}{4} < x < \frac{5\pi}{8}$ (4) $\frac{5\pi}{8} < x < \frac{3\pi}{4}$

93. Integral of $f(x) = \sqrt{1+x^2}$ with respect to x^2 is
- (1) $\frac{2}{3} \frac{(1+x^2)^{3/2}}{x} + k$ (2) $\frac{2}{3} (1+x^2)^{3/2} + k$ (3) $\frac{2}{3} x(1+x^2)^{3/2} + k$ (4) none of these
94. $\int \frac{x dx}{1+x^4}$ is equal to
- (1) $\tan^{-1} x^2 + k$ (2) $\frac{1}{2} \tan^{-1} x^2 + k$ (3) $\log(1+x^4) + k$ (4) none of these
95. $\int \sin 2x \cdot \log \cos x dx$ is equal to
- (1) $\cos^2 x \left(\frac{1}{2} + \log \cos x \right) + k$ (2) $\cos^2 x \cdot \log \cos x + k$
- (3) $\cos^2 x \left(\frac{1}{2} - \log \cos x \right) + k$ (4) none of these
96. If $f(x) = \int_{-1}^1 \frac{\sin x}{1+t^2} dt$ then $f'\left(\frac{\pi}{3}\right)$ is –
- (1) nonexistent (2) $\frac{\pi}{4}$ (3) $\frac{\pi\sqrt{3}}{4}$ (4) none of these
97. $\int_{\pi/4}^{3\pi/4} \frac{dx}{1+\cos x}$ is equal to
- (1) 2 (2) -2 (3) 1/2 (4) -1/2
98. The area bounded by the curve $y = 2^x$, the x-axis and the y-axis is
- (1) $\log_e 2$ (2) $\log_e 4$ (3) $\log_4 e$ (4) $\log_2 e$
99. The area of the region bounded by the pairs of lines $y = |x-1|$ and $y = 3-|x|$ is –
- (1) 3 unit² (2) 4 unit² (3) 6 unit² (4) 2 unit²
100. The general solution of a differential equation is $(y+c)^2 = cx$ where c is an arbitrary constant. The order and degree of the differential equation are respectively
- (1) 1, 2 (2) 2, 2 (3) 1, 1 (4) 2, 1
101. If $y(t)$ is a solution of the equation $(1+t) \frac{dy}{dt} - ty = 1$ and $y(0) = -1$ then $y(1)$ is
- (1) $-\frac{1}{2}$ (2) $e + \frac{1}{2}$ (3) $e - \frac{1}{2}$ (4) $\frac{1}{2}$
102. The solution of primitive integral equation $(x^2 + y^2) dy = xy \cdot dx$ is $y = y(x)$. If $y(1) = 1$ and $y(x_0) = e$ then x_0 is
- (1) $\sqrt{2(e^2 - 1)}$ (2) $\sqrt{2(e^2 + 1)}$ (3) $\sqrt{3}e$ (4) $\sqrt{\frac{1}{2}(e^2 + 1)}$
103. If $\vec{a} = \vec{i} + \vec{j} + \vec{k}$, $\vec{b} = 4\vec{i} + 3\vec{j} + 4\vec{k}$ and $\vec{c} = \vec{i} + \alpha\vec{j} + \beta\vec{k}$ are linearly dependent vectors and $|\vec{c}| = \sqrt{3}$ then
- (1) $\alpha = 1, \beta = -1$ (2) $\alpha = 1, \beta = \pm 1$ (3) $\alpha = -1, \beta = \pm 1$ (4) $\alpha = \pm 1, \beta = 1$
104. A vector has components $2p$ and 1 with respect to a rectangular Cartesian system. The axes are rotated through an angle α about the origin in the anticlockwise sense. If the vector has components $p+1$ and 1 with respect to the new system then
- (1) $p = 1, -\frac{1}{3}$ (2) $p = 0$ (3) $p = -1, \frac{1}{3}$ (4) $p = 1, -1$
105. Let $|\vec{a}| = |\vec{b}| = |\vec{a} - \vec{b}| = 1$ Then the angle between \vec{a} and \vec{b} is
- (1) $\frac{\pi}{6}$ (2) $\frac{\pi}{3}$ (3) $\frac{\pi}{4}$ (4) $\frac{\pi}{2}$
106. Five boys and three girls are seated at random in a row. The probability that no boy sits between girls is
- (1) $\frac{1}{56}$ (2) $\frac{1}{8}$ (3) $\frac{3}{28}$ (4) none of these

107. Two cards are drawn at random from a pack of 52 cards. The probability of getting at least a spade and an ace is
 (1) $\frac{1}{34}$ (2) $\frac{8}{221}$ (3) $\frac{1}{26}$ (4) $\frac{2}{51}$
108. If the letters of the words ATTEMPT are written down at random, the chance that all Ts are consecutive is
 (1) $\frac{1}{42}$ (2) $\frac{6}{7}$ (3) $\frac{1}{7}$ (4) (d) none of these
109. A line makes angles α, β, γ with the positive directions of the axes of reference. The value of $\cos 2\alpha + \cos 2\beta + \cos 2\gamma$ is
 (1) 1 (2) 2 (3) -1 (4) 0
110. The equations of the line passing through the points $(-2, 1, 0)$ and $(3, 4, -1)$ are
 (1) $\frac{x+7}{5} = \frac{y+2}{3} = \frac{z-1}{-1}$ (2) $\frac{x+2}{-1} = \frac{y-1}{3} = \frac{z}{5}$ (3) $\frac{x+3}{5} = \frac{y+4}{3} = \frac{z-1}{-1}$ (4) none of these
111. The coordinates of a point on the line $\frac{x-1}{2} = \frac{y-2}{3} = \frac{z}{\sqrt{3}}$ at a distance 1 unit from the point $(-1, -1, -\sqrt{3})$ are
 (1) $\left(-\frac{3}{2}, -\frac{7}{4}, -\frac{5}{4}\sqrt{3}\right)$ (2) $\left(\frac{3}{2}, \frac{11}{4}, \frac{\sqrt{3}}{4}\right)$ (3) $\left(\frac{1}{2}, \frac{5}{4}, \frac{\sqrt{3}}{4}\right)$ (4) none of these
112. If $\begin{vmatrix} a+x & a & x \\ a-x & a & x \\ a-x & a & -x \end{vmatrix} = 0$ then x is
 (1) 0 (2) a (3) 3 (4) $2a$
113. If $\begin{vmatrix} 6i & -3i & 1 \\ 4 & 3i & -1 \\ 20 & 3 & i \end{vmatrix} = x + iy$ then
 (1) $x=3, y=1$ (2) $x=1, y=3$ (3) $x=0, y=3$ (4) $x=0, y=0$
114. The value of $\begin{vmatrix} 1 & 1 & 1 \\ (2^x + 2^{-x})^2 & (3^x + 3^{-x})^2 & (5^x + 5^{-x})^2 \\ (2^x - 2^{-x})^2 & (3^x - 3^{-x})^2 & (5^x - 5^{-x})^2 \end{vmatrix}$ is
 (1) 0 (2) 30^x (3) 30^{-x} (4) none of these
115. If $A^2 = 8A + kI$ where $A = \begin{bmatrix} 1 & 0 \\ -1 & 7 \end{bmatrix}$ then k is
 (1) 7 (2) -7 (3) 1 (4) -1
116. The matrix $\begin{bmatrix} \lambda & 7 & -2 \\ 4 & 1 & 3 \\ 2 & -1 & 2 \end{bmatrix}$ is a singular matrix if λ is
 (1) $\frac{2}{5}$ (2) $\frac{5}{2}$ (3) -5 (4) none of these
117. If $A = \begin{bmatrix} 0 & -4 & 1 \\ 2 & \lambda & -3 \\ 1 & 2 & -1 \end{bmatrix}$ then A^{-1} exists (i.e., A is invertible) if
 (1) $\lambda \neq 4$ (2) $\lambda \neq 8$ (3) $\lambda = 4$ (4) none of these
118. If $A = \begin{bmatrix} 1 & -1 & 1 \\ 1 & 2 & 0 \\ 1 & 3 & 0 \end{bmatrix}$ then the value of $|\text{adj } A|$ is equal to
 (1) 5 (2) 0 (3) 1 (4) none of these

119. The reciprocal matrix of $\begin{bmatrix} 1 & 0 & 2 \\ 0 & 1 & -1 \\ 1 & 2 & 1 \end{bmatrix}$ is
- (1) $\begin{bmatrix} -3 & -4 & 2 \\ -1 & 1 & -1 \\ 1 & 2 & -1 \end{bmatrix}$ (2) $\begin{bmatrix} 3 & 4 & -2 \\ 1 & -1 & 1 \\ -1 & -2 & 1 \end{bmatrix}$ (3) $\begin{bmatrix} -3 & -1 & 1 \\ -4 & 1 & 2 \\ 2 & -1 & -1 \end{bmatrix}$ (4) none of these
120. If one ball is drawn at random from each of the three boxes containing 3 white and 1 black, 2 white and 2 black, 1 white and 3 black balls then the probability that 2 white and 1 black balls will be drawn is
- (1) $\frac{13}{32}$ (2) $\frac{1}{4}$ (3) $\frac{1}{32}$ (4) $\frac{3}{16}$
121. Three numbers are chosen at random without replacement from 1, 2, 3, ..., 10. The probability that the minimum of the chosen numbers is 4 or their maximum is 8, is
- (1) $\frac{11}{40}$ (2) $\frac{3}{10}$ (3) $\frac{1}{40}$ (4) none of these
122. If $x \frac{dy}{dx} + y = x \cdot \frac{f(x \cdot y)}{f'(x \cdot y)}$ then $f(x \cdot y)$ is equal to (k being an arbitrary constant)
- (1) $ke^{x^2/2}$ (2) $ke^{y^3/2}$ (3) $ke^{xy/2}$ (4) none of these
123. The order and degree of the differential equation of the family of circles touching the x-axis at the origin, are respectively
- (1) 1, 1 (2) 1, 2 (3) 2, 1 (4) 2, 2
124. $\int_0^a \{f(x) + f(-x)\} dx$ is equal to
- (1) $2 \int_0^a f(x) dx$ (2) $\int_{-a}^a f(x) dx$ (3) 0 (4) $-\int_{-a}^a f(-x) dx$
125. $\int_{\pi/5}^{3\pi/10} \frac{\cos x}{\cos x + \sin x} dx$ is equal to
- (1) π (2) $\frac{\pi}{2}$ (3) $\frac{\pi}{4}$ (4) none of these
126. $\int_0^\pi \sin^6 x \cdot \cos^5 x dx$ is equal to
- (1) $2 \int_0^{\pi/2} \sin^{50} x \cdot \cos^{47} x dx$ (2) 0 (3) 1 (4) none of these
127. The function $f(x) = \frac{x}{1+x \tan x}$ has
- (1) one point of minimum in the interval $(0, \pi/2)$
 (2) one point of maximum in the interval $(0, \pi/2)$
 (3) no point of maximum, no point of minimum in the interval $(0, \pi/2)$
 (4) two points of maxima in the interval $(0, \pi/2)$
128. Let $f(x) = x^3 + 3x^2 - 9x + 2$. Then
- (1) $f(x)$ has a maximum at $x = 1$
 (2) $f(x)$ has neither a minimum nor a maximum at $x = -3$
 (3) $f(x)$ has a minimum at $x = 1$
 (4) none of these
129. If $y = (1+x)(1+x^2)(1+x^4) \dots (1+x^{2^n})$ then $\frac{dy}{dx}$ at $x = 0$ is
- (1) 1 (2) -1 (3) 0 (4) none of these
130. If $f(x) = \cos x \cdot \cos 2x \cdot \cos 4x \cdot \cos 8x \cdot \cos 16x$ then $f'\left(\frac{\pi}{4}\right)$ is
- (1) $\sqrt{2}$ (2) $\frac{1}{\sqrt{2}}$ (3) 1 (4) none of these

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