# PHYSICS

1. The physical quantity having the dimensions $\left[M^{-1}L^{-3}T^{+3}A^{2} \right]$ is
    (a) Resistance (b) Resistivity
    (c) Electrical conductivity (d) Electromotive force

2. The orbital velocity of a satellite close to the surface of the earth is v. if this satellite starts orbiting at an altitude of half the earth's radius, the orbital velocity will be
    (a) $\sqrt{\dfrac{2}{3}}\,v$ (b) $\sqrt{\dfrac{2}{5}}\,v$ (c) $\sqrt{\dfrac{2}{7}}\,v$ (d) $\sqrt{\dfrac{2}{9}}\,v$

3. A force 'F' acting on a body depends on its displacement 's' as $F \propto S^{-\frac{1}{3}}$. The power delivered by 'F' will depend on displacement as
    (a) $S^{2/3}$ (b) $S^{-3/2}$ (c) $S^{1/2}$ (d) S^{0}

4. A particle is projected from the ground with an initial speed of 'V' at an angle θ with the horizontal. Average velocity of the particle between its point of projection and highest point of the trajectory is
    (a) $\dfrac{V}{2}\sqrt{1+2\cos^{2}\theta}$ (b) $\dfrac{V}{2}\sqrt{1+\cos^{2}\theta}$ (c) $\dfrac{V}{2}\sqrt{1+3\cos^{2}\theta}$ (d) $V\cos\theta$

5. A block 'A' of mass 2 kg rests on another block B of mass 8 kg which rests on a horizontal floor. The coefficient of friction between A and B is 0.2. While that between B and floor is 0.5. When a horizontal force of 25 N is applied on the block B, the force of friction between A and B is
    (a) zero (b) 3.9 N (c) 5 N (d) 49 N

6. Temperature of the mixture of one mole of He and one mole of Hydrogen is increased from 0^{0} C to 100^{0}C at constant pressure, the amount of heat delivered will be
    (R = 2 cal/mole – K)
    (a) 600 cal (b) 1200 cal (c) 1800 cal (d) 3600 cal

7. The nucleus $_{94}Pu^{242}$ decays to $_{82}Pu^{206}$ by emitting
    (a) 9α and 12β particle (b) 9α and 6β particle
    (c) 6α and 9β particle (d) 6α and 12β particle

8. In Huygen's eyepiece, the distance between the two lenses is 'P', the effective focal length is 'Q', the focal length of field lens is 'R' and focal length of eye lens is 'S' then
    (a) R > P > Q > S (b) P > Q > R > S (c) Q > R > S > P (d) R > S > P > Q

9. A wire of length L and 3 identical cells of negligible internal resistances are connected in series. Due to the current, the temperature of the wire is raised by ΔT in a time 't'. A number 'N' of similar cells is now connected in series with a wire of the same material and cross – section but of length 2 L. The temperature of the wire is raised by the same amount in the same time. The value of N is
    (a) 4 (b) 6 (c) 8 (d) 9

Space for rough work

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10. The binding energy per nucleon for X^{200}, A^{110} and B^{90} are 7.4 MeV, 8.2 MeV and 8.2 MeV respectively. The energy released in the reaction $X^{200} \rightarrow A^{110} + B^{90} + energy$ is
    (a) 200 MeV   (b) 160 MeV   (c) 110 MeV   (d) 90 MeV

11. If the momentum of an electron is changed by ΔP, then the de Broglie wavelength associated with it changes by 0.5%. The possible initial momentum of the electrons will be
    (a) $\dfrac{\Delta P}{200}$ (b) $\dfrac{\Delta P}{199}$ (c) $199\,\Delta P$ (d) $400\,\Delta P$

12. A wire of length 1 m and radius 1 mm is subjected to a load. The extension is 'x'. The wire is melted and then drawn into a wire of square cross-section of side 1 mm. The extension under the same load is
    (a) $\pi^2 x$ (b) πx^2 (c) πx (d) π / x

13. Electric potential at any point is $V = 5x + 3y + \sqrt{15}\,z$, then the magnitude of intensity of electric field is
    (a) $3\sqrt{2}\,units$ (b) $4\sqrt{2}\,units$ (c) $5\sqrt{2}\,units$ (d) 7 units

14. For a series L-C-R circuit $R = X_L = 2X_C$. The impedence of the circuit and phase difference alternating voltage of the circuit will be
    (a) $\dfrac{\sqrt{5}}{2}R, Tan^{-1}(2)$ (b) $\sqrt{5}R, Tan^{-1}(2)$ (c) $\dfrac{\sqrt{5}}{2}R, Tan^{-1}\left(\dfrac{1}{2}\right)$ (d) $\sqrt{5}R, Tan^{-1}\left(\dfrac{1}{2}\right)$

15. When a light incident on a medium at an angle of incidence 'i' and refracted into a second medium at angle of refraction 'r', the graph of $\sin i$ and $\sin r$ is shown in the figure, then the critical angle for the two media is
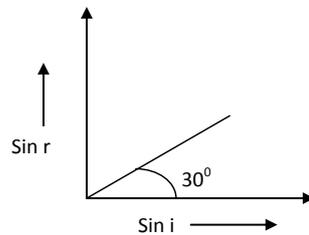
    (a) $\sin^{-1}\left(\sqrt{3}\right)$ (b) $\sin^{-1}\left(\dfrac{1}{\sqrt{3}}\right)$ (c) $\cos^{-1}\left(\dfrac{1}{\sqrt{3}}\right)$ (d) $\tan^{-1}\left(\dfrac{1}{2}\right)$

16. Three rods A, B and C of the same length and same cross-sectional area are joined in series. Their thermal conductivities are in the ratio 1 : 2 : 1.5. If the open ends of A and C are at 200^0C and 18^0C respectively, the temperature at the junction of A and B in equilibrium is
   (a) 156^0C   (b) 74^0C   (c) 116^0C   (d) 148^0C

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17. A simple pendulum has a time period T when it is at north pole. Its time period when it is at equator (R = radius of earth)

(a) $T\left[1+\dfrac{w^2 R}{2g}\right]$ (b) $T\left[2+\dfrac{w^2 R}{2g}\right]$ (c) T2wg   (d) $2\pi\sqrt{\dfrac{R}{g}}$

18. A wedge of mass 2 m and a cube of mass 'm' are shown in figure. Between cube and wedge there is no friction. The minimum coefficient of friction between wedge and ground so that wedge does not move is
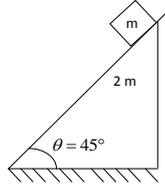
(a) 0.1   (b) 0.2   (c) 0.25   (d) 0.5

19. An object of mass 5 kg falls from rest through a vertical distance of 20 m and attains a velocity of 10 m/s. Then the work done by the resistance of the air on the object is
($g = 10$ ms^{-2})

(a) – 750 J   (b) 750 J   (c) 1000 J   (d) – 1000 J

20. Three metal spheres P, Q and R of densities d, $\dfrac{d}{2}$ and 2d are falling down in a liquid of density $\dfrac{d}{4}$ with terminal velocities. The radii of the spheres are $\dfrac{r}{2}$, r and 2r respectively. The ratio of terminal velocities of the spheres P, Q and R is

(a) 1 : 4 : 16   (b) 3 : 1 : 7   (c) 1 : 1 : 1   (d) 3 : 4 : 112

21. A source of sound is moving along a circular orbit of radius 3 m with an angular velocity of 10 rad/s. A sound detector located far away from the source is executing linear simple harmonic motion along the line BD with amplitude BC = CD = 6m. The frequency of oscillation of the detector is $\left(\dfrac{5}{\pi}\right)$ per sec. The source is at the point A when the detector is at the point B. If the source emits a continuous sound wave of frequency 340 Hz. The maximum and minimum frequencies recorded by the detector is
[Velocity of sound = 330 m/s]
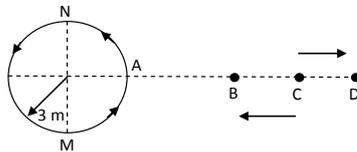
(a) 255 Hz, 442 Hz   (b) 442 Hz, 255 Hz   (c) 295 Hz, 482 Hz   (d) 482 Hz, 295 Hz

Space for rough work

22. Arrange the RMS current in ascending order for the following three sources of currents
    (I) $X_0 \sin Wt$ (II) $X_0 \sin wt \cos wt$ (III) $X_0 \sin wt + X_0 \cos wt$
    (a) II, I, III   (b) I, II, III   (c) III, II, I   (d) III, I, II

23. The sky wave propagation is suitable for radio waves of frequency
    (a) Upto 2 MHz   (b) from 2 MHz to 20 MHz
    (c) from 2 MHz to 30 MHz   (d) above 30 MHz

24. A wire of mass 'm'; and length ' ℓ ' is bent in the from of a quarter circle. The moment of inertia of this wire about an axis passing through the centre of the quarter circle and perpendicular to the plane of the quarter circle is approximately
    (a) $0.6 \, ml^2$ (b) ml^2 (c) $0.2 \, ml^2$ (d) $0.4 \, ml^2$

25. A metal cube of coefficient of linear expansion ' α ' is floating in a beaker containing a liquid of coefficient of volume expansion γ. When the temperature is raised ΔT, the depth upto which the cube is submerged in the liquid remains unchanged. The relation between α and γ is (Ignore the expansion of the beaker)

    (a) $\alpha = \gamma$ (b) $\alpha = \dfrac{\gamma}{3}$ (c) $\alpha = \dfrac{\gamma}{2}$ (d) $\alpha = 2\gamma$

26. A circular loop of radius 'r' carrying a current 'i' is held at the centre of another circular loop of radius R($\gg$ r) carrying a current I. The plane of the smaller loop makes an angle of 30^0 with that of the larger loop. If the smaller loop is held fixed in this position by applying a single force at a point on its periphery, the minimum magnitude of this force is

    (a) $\dfrac{\mu_0 \pi i I r}{4R}$ (b) $\dfrac{\mu_0 \pi i I r}{3R}$ (c) $\dfrac{\mu_0 \pi i I r}{2R}$ (d) $\dfrac{\mu_0 \pi i I r}{R}$

27. Two coils have self inductance $L_1 = 4mH$ and $L_2 = 1mH$ respectively. The currents in the two coils are increased at the same rate. At a certain instant of time both coils are given the same power. If I_1 and I_2 are the currents in the two cells at that instant of time respectively, then the value $\dfrac{I_1}{I_2}$ is

    (a) $\dfrac{1}{8}$ (b) $\dfrac{1}{4}$ (c) $\dfrac{1}{2}$ (d) 1

28. Two chambers one containing ' m_1 ' gm of a gas at a pressure P_1 and other containing ' m_2 ' gm of a gas at a pressure P_2 are put in communication with each other. If temperature remains constant, the common pressure reached will be

    (a) $\dfrac{P_1 P_2 (m_1 + m_2)}{P_2 m_1 + P_1 m_2}$ (b) $\dfrac{m_1 m_2 (P_1 + P_2)}{P_2 m_1 + P_1 m_2}$ (c) $\dfrac{P_1 P_2 m_1}{P_2 m_1 + P_1 m_2}$ (d) $\dfrac{m_1 m_2 P_1}{P_2 m_1 + P_1 m_2}$

29. A vector $\vec{a}$ makes 30^0 and $\vec{b}$ makes 120^0 angle with the x-axis. The magnitude of these vectors are 3 unit and 4 unit respectively. The magnitude of resultant vector is
    (a) 3 unit   (b) 4 unit   (c) 5 unit   (d) 1 unit

Space for rough work

30. Match the logic gates in List – I to the output for the given input A and B in List – II

List – I   List – II

(A) AND gate   (I) $\overline{A+B}$

(B) OR gate   (II) $\overline{A \cdot B}$

(C) NAND gate   (III) $A + B$

(D) NOR gate   (IV) $A \cdot B$

(a) A-III, B-I, C-IV, D-II   (b) A-I, B-III, C-II, D-IV

(c) A-II, B-I, C-IV, D-III   (d) A-IV, B-III, C-II, D-I

31. Masses each 1 kg are placed at the vertices of an isosceles triangle ABC in which AC = BC = 5 cm and AB = 8 cm. The distance of centre of mass of the system from the vertex C is

(a) 2 cm   (b) 1 cm   (c) 1.5 cm   (d) 3 cm

32. An – inelastic ball is dropped from a height of 100 m. Due to the earth, 20% of its energy is lost. To what height will the ball rise?

(a) 80 m   (b) 40 m   (c) 60 m   (d) 20 m

33. A thermocouple of resistance 'r' has cold junction at t. It is in series with a galvanometer of resistance G. If thermocouple gives an emf of E volt/^{0}C. The hot junction temperature when the galvanometer reads V volt is

(a) $t + \dfrac{VG}{E(G+r)}$ (b) $t + \dfrac{EG}{V(G+r)}$ (c) $t + \dfrac{E(G+r)}{VG}$ (d) $t + \dfrac{V(G+r)}{EG}$

34. The same mass of copper is drawn into two wires 1 mm thick and 2 mm thick. Two wires are then connected in parallel and current is passed. The heat produced in the wires is in the ratio

(a) 16 : 1   (b) 1 : 1   (c) 1 : 16   (d) 1 : 4

35. The lower end of a glass capillary tube is dipped in water. Water rises to a height of 8 cm. The tube is then broken at a height of 6 cm. The height of water column and angle of contact will be

(a) $6m, \sin^{-1}\left(\dfrac{3}{4}\right)$ (b) $6m, \cos^{-1}\left(\dfrac{3}{4}\right)$ (c) $4m, \sin^{-1}\left(\dfrac{1}{2}\right)$ (d) $4m, \cos^{-1}\left(\dfrac{3}{4}\right)$

36. A central fringe of the interference produced by light of wavelength 6000A^{0} is shifted to the position of 5th bright fringe by introducing a thin glass plate of refractive index 1.5. The thickness of the plate will be

(a) $6 \times 10^{-4} mm$ (b) $6 \times 10^{-4} m$ (c) $6 \times 10^{-4} cm$ (d) $6 \times 10^{-2} m$

37. A short magnet produces a deflection of 30^{0} when placed at a certain distance in tan A position of magnetometer. If another magnet of double the length and thrice the pole strength is placed at the same distance in tan B position the deflection produced is

(a) 30^{0} (b) 60^{0} (c) 45^{0} (d) 120^{0}

38. A variable capacitor is kept connected to a 10V battery. If the capacitance of the capacitor is changed from $7\mu F$ to $3\mu F$, the change in the energy of the capacitor is

(a) $2 \times 10^{-4} J$ (b) $4 \times 10^{-4} J$ (c) $6 \times 10^{-4} J$ (d) $8 \times 10^{-4} J$

Space for rough work

39. Assertion (A): With the increase of target voltage, the energy of x-rays can be increased.
    Reason (R): The short wavelength limit of continuous X-ray spectrum varies inversely as the target voltage.
    (a) Both A and R are true and R is the correct explanation of A
    (b) Both A and R are true and R is not the correct explanation of A
    (c) A is true, R is false
    (d) A is false, R is true

40. The fundamental frequency of a sonometer wire of length 'ℓ' is f_0. A bridge is now introduced at a distance of $\Delta\ell$ from the centre of the wire $(\Delta\ell \ll \ell)$. The number of beats heard if both sides of the bridge are set into vibration in their fundamental modes are

    (a) $\dfrac{8 f_0 \Delta\ell}{\ell}$ (b) $\dfrac{f_0 \Delta\ell}{\ell}$ (c) $\dfrac{2 f_0 \Delta\ell}{\ell}$ (d) $\dfrac{4 f_0 \Delta\ell}{\ell}$

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CHEMISTRY

41. In a nucleide one a.m.u. of mass dissipated into energy to bind its nulcueons is equivalent of this mass
    (a) 931.5 eV
    (b) 931.5×10^6 MeV
    (c) 931.5×10^6 eV
    (d) 931.5 Mv

42. Which of the following is Isotope of Ge_{32}^{76}?
    (a) $_{33}As^{77}$
    (b) Ge_{32}^{77}
    (c) Se_{34}^{77}
    (d) Br_{35}^{80}

43. How many electrons are present in the M-shell of an atom of an element with atomic number – 24?
    (a) 5
    (b) 6
    (c) 12
    (d) 13

44. The four Quantum numbers of the valency of electron potassium are
    (a) 4, 0, 1, $\frac{1}{2}$
    (b) 4, 1, 0, $\frac{1}{2}$
    (c) 4, 0, 0, $\frac{1}{2}$
    (d) 4, 1, 1, $\frac{1}{2}$

45. What is the wave length of H_β line the Balmer series of hydrogen spectrum?
    (R = Ryd bergs's constant)
    (a) $\frac{36}{5R}$
    (b) $\frac{5R}{36}$
    (c) $\frac{3R}{16}$
    (d) $\frac{16}{3R}$

46. Which of the following is the correct order of ionic radii?
    (a) $Na^+ < Mg^{+2} < A\ell^{+3} < Si^{+4}$
    (b) $A\ell^{+3} < Si^{+4} < Na^+ < Mg^{+2}$
    (c) $Si^{+4} < A\ell^{+3} > Mg^{+2} > Na^+$
    (d) $Na^+ > Mg^{+2} > A\ell^{+3} > Si^{+4}$

47. Which of the following is a correct pair?
    (a) $BeCl_2$, Linear
    (b) NH_3, Linear
    (c) CO_2, Tetra hedral
    (d) BF_3, octa hedral

48. The correct order of Vanderwaals radius of F, Cl, and Br is
    (a) $C\ell > F > Br$
    (b) $Br > C\ell > F$
    (c) $F > C\ell > Br$
    (d) $Br > F > C\ell$

49. The kinetic energy of 4 moles of nitrogen at 127^0C is _____ cals
    (a) 4400
    (b) 3200
    (c) 4800
    (d) 1524

50. What are the oxidation numbers of 'N' in NH_4NO_3?
    (a) +3, – 5
    (b) – 3, +5
    (c) +3, +6
    (d) – 2, +2

51. 50 g of calcium carbonate was completely burnt in air. What is the weight (in gms) of the residue?
    (a) 2.8
    (b) 28
    (c) 4.4
    (d) 44

52. Sodium hexa meta phosphate is known as
    (a) cal gon
    (b) permutit
    (c) Natalite
    (d) Nitrolim

53. At what temperature the density of heavy water will be maximum?
    (a) 0^0C
    (b) 11.6^0C
    (c) 4^0C
    (d) 27^0C

54. Composition of carnallite is
    (a) $Na_3A\ell F_6$
    (b) $KC\ell, MgC\ell_2 6H_2O$
    (c) $KNO_3, MgNO_3$
    (d) None

55. $BC\ell_3 + H_2O \longrightarrow$ products formed are
    (a) $H_3BO_3 + HC\ell$
    (b) $B_2O_3 + HC\ell$
    (c) $B_2H_6 + HC\ell$
    (d) No Reaction

Space for rough work

56. Percentage of lead in lead pencil is
    (a) 31 – 66   (b) 80   (c) 20   (d) 0

57. Which of the following has pyramidal shape?
    (a) XeF_4 (b) XeO_3 (c) XeF_2 (d) XeF_6

58. Which of the following is an organic compound?
    (a) CO (b) CO_2 (c) $HCOOH$ (d) H_2CO_3

59. $CaC_2 \xrightarrow{H_2O} A \xrightarrow[tube]{Hot} B \xrightarrow[CH_3C\ell]{A\ell C\ell_3} C$. C is
    (a) Toluene   (b) Benzene   (c) Acetylene   (d) Chloro Benzene

60. Alkyl halide reaction with metallic sodium in dry ether solution is called
    (a) Friedal – Craft's reaction   (b) Sand mayer's reaction
    (c) Wurtz reaction   (d) Gabriel's reaction

61. Which one of the following is mainly responsible for depletion of ozone layer?
    (a) methane   (b) carbon dioxide   (c) water   (d) chloro fluoro carbons

62. Which one of the following is diamagnetic ion?
    (a) Co^{+2} (b) Cu^{+2} (c) Mn^{+2} (d) Sc^{3+}

63. The Bond energies (in KJ mole^{-1}) of P-H, As-H and N-H are respectively
    (a) 247, 138 and 389   (b) 247, 389 and 318   (c) 318, 389 and 247   (d) 318, 247 and 389

64. What are products formed when ammonia reacts with excess of chlorine?
    (a) N_2 and $NC\ell_3$ (b) $NC\ell_3$ and $HC\ell$ (c) N_2 and NH_4Cl (d) N_2 and HCl

65. Iron sulphide is heated in air to form A, an oxide of sulphur. A is dissolved in water to give an acid. The basicity of the acid is
    (a) 2   (b) 3   (c) 1   (d) zero

66. Which one of the following is a lyophillic colloidal solution?
    (a) smoke   (b) Gold solution   (c) starch Aqueous solution   (d) cloud

67. Which of the following is not correct?
    (a) chlorophyll is responsible for the synthesis of carbohydrates in plants
    (b) the compound formed with the addition of oxygen to haemoglobin is called oxyhaemoglobin
    (c) Acetyl salicylic acid is known as asprin
    (d) The metal ion present in vitamin B_{12} is Mg^{+2}

68. The pH of aqueous KCl solution is 7.0. This solution was electrolysed for few seconds using Pt electrodes. Which of the following is correct?
    (a) The pH of solution decreases   (b) The pH of solution increases
    (c) Cl_2 is liberated at cathode   (d) The pH of solution remains same

69. The heat of formations CO(g) and CO_2(g) are $\Delta H = -110$ and $\Delta H = -393$ KJ mole^{-1} respectively. What is the heat of reaction (ΔH) (in Kj/mole) for the following reaction

    $$CO_{(g)} + \frac{1}{2}O_{2(g)} \longrightarrow CO_{2(g)}$$

    (a) – 507   (b) – 142.5   (c) -283   (d) 504

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70. What is the quantity of electricity (in coulombs) required to deposit all the silver from 250 ml of 1Mole $AgNO_3$ solution?
(a) 2412.5   (b) 24125   (c) 4825.0   (d) 48250

71. Assertion (A): Molarity of a solution decreases with an increase of temperature
Reason   (R): As temperature increases volume of solution increases
(a) Both A and R are true, R is correct explanation of A
(b) Both A and R are true, R is not correct explanation of A
(c) A is true, R is false   (d) A is false, R is true

72. Assertion (A): The aqueous solution of CH_3COONa is alkaline in nature
Reason   (R): Acerate Iron under goes Anionic hydrolysis.
(a) Both A and R are true, R is correct explanation of A
(b) Both A and R are true, R is not correct explanation of A
(c) A is true, R is false   (d) A is false, R is true

73. The rate constant of a first order reaction is 0.693 min^{-1}. What is the time (in min) required for reducing an intial concentration of 30 moles lit^{-1} to 7.5 mole lit^{-1}
(a) 4   (b) 1   (c) 2   (d) 3

74. For the following reaction $NH_{4(s)}HS \longrightarrow NH_{3(g)} + H_2S_{(g)}$ the total pressure at equilibrium is 30 atm. The value of K_p is
(a) 15 atm^2 (b) 225 atm^2 (c) 30 atm^2 (d) 45 atm^2

75. In the reaction $C_2H_5OH \xrightarrow[300°C]{Cu} X$ the molecular formula of X is:
(a) C_4H_6O (b) $C_4H_{10}O$ (c) C_2H_4O (d) C_2H_6

76. In which of the following reaction the product is Ether?
(a) $C_6H_6 + CH_3COC\ell$ / Anhydrous $A\ell C\ell_3$ (b) $C_2H_5C\ell + aq\ KOH$
(c) $C_2H_5C\ell + C_2H_5ONa$ (d) $C_6H_6 + C_6H_5COC\ell$ /Anhydrous $A\ell C\ell_3$

77. Which of the following pair is functional isomers?
(a) CH_3COCH_3, CH_3CHO (b) $C_2H_5CO_2H, CH_3CO_2CH_3$
(c) $C_2H_5CO_2H, CH_3CO_2C_2H_5$ (d) CH_3CHO, CH_3CO_2H

78. The product formed in the aldol condensation of Acetalde hyde is
(a) $CH_3CH_2CH(OH)CHO$ (b) $CH_3 - CH(OH)CH_2CHO$
(c) $CH_3CH(OH)COCH_3$ (d) $CH_3CH_2CH_2CHO$

79. In the following reactions x and y are respectively
$CH_3COOH + NH_3 \longrightarrow x \xrightarrow{\Delta} y + H_2O$
(a) CH_3CONH_2, CH_4 (b) CH_3COONH_4, CH_3CONH_2
(c) CH_3CONH_2, CH_3COOH (d) CH_3NH_2, CH_3CONH_2

80. Which of the following is the molecular formula of tertiary amine?
(a) C_2H_7N (b) C_3H_9N (c) C_2H_5N (d) CH_3N

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MATHEMATICS

81. If Q denotes the set of all rational numbers and $f\left(\dfrac{p}{q}\right)=\sqrt{p^2-q^2}$ for any $\dfrac{p}{q}\in Q$, then observe the following statements

   (A) $f\left(\dfrac{p}{q}\right)$ is real for each $\dfrac{p}{q}\in Q$ (B) $f\left(\dfrac{p}{q}\right)$ is complex number for each $\dfrac{p}{q}\in Q$

   (a) Both A and B are false   (b) A is false, B is true
   (c) A is true, B is false   (d) Both A and B are true

82. If $a^x=b^y=c^z=d^w$ then the value of $x\left(\dfrac{1}{y}+\dfrac{1}{z}+\dfrac{1}{w}\right)$ is

   (a) $\log_a bcd$ (b) $\log_a abc$ (c) $\log_b cda$ (d) $\log_c dab$

83. The number of natural numbers less than 1000, in which no two digits are repeated is
   (a) 792   (b) 837   (c) 738   (d) 720

84. The difference between two roots of the equation $x^3-13x^2+15x+189=0$ is 2, then the roots of the equation are
   (a) $-$ 3, - 7, - 9   (b) 3, -5, 7   (c) -4, -7, 9   (d) -3, 7, 9

85. The equation of the locus of z such that $\left|\dfrac{z-i}{z+i}\right|=2$, where $z=x+iy$ is a complex number of

   (a) $3x^2-3y^2-10y+3=0$ (b) $3x^2+3y^2-10y+9=0$
   (c) $3x^2-3y^2+10y-3=0$ (d) $3x^2+3y^2+10y+3=0$

86. In a triangle ABC, $\dfrac{s-a}{\Delta}=\dfrac{1}{8}$, $\dfrac{s-b}{\Delta}=\dfrac{1}{12}$, $\dfrac{s-c}{\Delta}=\dfrac{1}{24}$, then b =
   (a) 20   (b) 16   (c) 15   (d) 30

87. The function $f(x)=x\displaystyle\int_0^x \log_e\left(\dfrac{1-x}{1+x}\right)dx$

   (a) an even function   (b) a periodic function
   (c) an odd function   (d) neither even nor odd

88. If $\bar{i}-\bar{j}+\bar{k}$, $2\bar{i}+\bar{j}-2\bar{k}$, $3\bar{i}+\bar{j}+2\bar{k}$ are positive vectors of 3 points in space, then the vector area of the triangle formed by them is

   (a) $4\bar{i}+\dfrac{7}{2}\bar{j}+\bar{k}$ (b) $4\bar{i}-\dfrac{7}{2}\bar{j}+\bar{k}$ (c) $3\bar{i}+\dfrac{2}{7}\bar{k}$ (d) $4\bar{i}-\dfrac{7}{2}\bar{j}-\bar{k}$

89. If $x=\tan 15°$, $y=\cos ec75°$ and $z=4\sin 18°$ then
   (a) z > y > x   (b) x > y > z   (c) y > z > x   (d) z > x > y

Space for rough work

90. $\underset{x\to\frac{\pi}{2}}{Lt}\ \dfrac{\cos x}{x-\dfrac{\pi}{2}}$

    (a) -1   (b) 1   (c) $\dfrac{\pi}{2}$ (d) $-\dfrac{\pi}{2}$

91. The maximum value of $x^4 + x^2 + 1$ is

    (a) $\dfrac{4}{3}$ (b) not existing   (c) 0   (d) 1

92. One of the two events A and B occur. If $mP(A)=nP(B)$ then the odds in favour of B are

    (a) $(m+n):n$ (b) n : m   (c) m : n   (d) $m:(n+m)$

93. If $u = \log(x^3 + y^3 + z^3 - 3xyz)$, then $\left(\dfrac{\partial}{\partial x}+\dfrac{\partial}{\partial y}+\dfrac{\partial}{\partial z}\right)^2 u =$

    (a) $\dfrac{-8}{(x+y+z)^2}$ (b) $\dfrac{9}{(x+y+z)^2}$ (c) $\dfrac{8}{(x+y+z)^2}$ (d) $\dfrac{-9}{(x+y+z)^2}$

94. If $\displaystyle\int \dfrac{\sin x}{\sin(x-\alpha)}dx = Ax + b\log\sin(x-\alpha)+c$, then (A, B) =

    (a) $(-\cos\alpha,\sin\alpha)$ (b) $(-\sin\alpha,\cos\alpha)$ (c) $(\cos\alpha,\sin\alpha)$ (d) None

95. The image of the point (3, 4) with respect to the line $3x+4y+5=0$ is

    (a) $\left(\dfrac{21}{5},\dfrac{28}{5}\right)$ (b) $\left(\dfrac{-21}{5},\dfrac{-28}{5}\right)$ (c) $\left(\dfrac{22}{5},\dfrac{23}{5}\right)$ (d) $\left(\dfrac{21}{5},\dfrac{-28}{5}\right)$

96. The differential equation obtained by eliminating the arbitrary constants a and b from $xy = ae^x + be^{-x}$ is

    (a) $x\dfrac{d^2y}{dx^2}-2\dfrac{dy}{dx}-xy=0$ (b) $\dfrac{d^2y}{dx^2}+2\dfrac{dy}{dx}-3xy=0$

    (c) $x\dfrac{d^2y}{dx^2}+2\dfrac{dy}{dx}-xy=0$ (d) $\dfrac{d^2y}{dx^2}-2\dfrac{dy}{dx}+3xy=0$

97. The solution of $\dfrac{dy}{dx}=\dfrac{y^2}{xy-x^2}$ is

    (a) $e^{y/x}=kx$ (b) $e^{y/x}=ky$ (c) $e^{-y/x}=kx$ (d) $e^{-y/x}=ky$

98. $\sqrt{12-\sqrt{68+48\sqrt{2}}}$

    (a) $2-\sqrt{2}$ (b) $\sqrt{2}-\sqrt{3}$ (c) $2+\sqrt{2}$ (d) $\sqrt{2}+\sqrt{3}$

Space for rough work

99. If $\dfrac{3x+2}{(x+1)(2x^2+3)} = \dfrac{A}{x+1} + \dfrac{Bx+C}{2x^2+3}$, then A + C – B =

    (a) 0   (b) 1   (c) 2   (d) 3

100. $\cos ec15° + \sec 15° =$

    (a) $2\sqrt{2}$ (b) $2\sqrt{6}$ (c) $3\sqrt{6}$ (d) $4\sqrt{6}$

101. Seven balls are drawn simultaneously from a bag containing 5 white and 6 green balls. The probability of drawing 3 white and 4 green balls is

    (a) $\dfrac{7 + 6_{c_1}}{11_{c_7}}$ (b) $\dfrac{5_{c_3} + 6_{c_4}}{11_{c_7}}$ (c) $\dfrac{5_{c_2} + 6_{c_2}}{11_{c_7}}$ (d) None

102. If $f(x) = \begin{cases} \dfrac{1-\sqrt{2}\sin x}{x-4x} & if\ x \neq \dfrac{\pi}{4} \\ a & if\ x = \dfrac{\pi}{4} \end{cases}$ is continuous at $\dfrac{\pi}{4}$, then a =

    (a) $\dfrac{1}{4}$ (b) $\dfrac{2}{4}$ (c) $\dfrac{3}{4}$ (d) None

103. If $\underset{x \to 0}{Lt}\left(\dfrac{\cos 4x + a\cos 2x + b}{x^4} \right)$ is finite, then the values of a, b are respectively

    (a) 5, -4   (b) 4, 5   (c) -5, -4   (d) -4, 3

104. Dividing the interval, [0, 6] into 6 equal parts and by using trapezoidal rule the value of $\int\limits_0^6 x^3\, dx$ approximately

    (a) 333   (b) 331   (c) 332   (d) 334

105. $\int\limits_0^{\frac{\pi}{2}} \dfrac{dx}{1 + \tan^3 x} =$

    (a) π (b) $\dfrac{\pi}{2}$ (c) $\dfrac{\pi}{4}$ (d) $\dfrac{3\pi}{2}$

106. Which of the function from z to z (set of integers) is a bijection?

    (a) $f(x) = x + 2$ (b) $f(x) = 3x + 1$ (c) $f(x) = x^3$ (d) none

107. The coefficient of x^5 in the expansion of $(1+x)^{21} + (1+x)^{22} + (1+x)^{23} + ... + (1+x)^{30}$ is

    (a) 51_{c_5} (b) $31_{c_6} - 21_{c_6}$ (c) $31_{c_5} - 21_{c_5}$ (d) None

Space for rough work

108. If $a = \cos\dfrac{4\pi}{3} + i\sin\dfrac{4\pi}{3}$, then $\begin{vmatrix} 1 & 1 & 1 \\ 1 & a & a^2 \\ 1 & a^2 & a \end{vmatrix}$ is

    (a) purely real   (b) purely imaginary   (c) complex number   (d) 0

109. The period of $\cos x . \sin\left(\dfrac{\pi}{4} - x\right)$ is

    (a) $\dfrac{\pi}{2}$ (b) $\dfrac{\pi}{3}$ (c) π (d) $\dfrac{\pi}{4}$

110. If $\int (\sin 2x - \cos 2x)\,dx = \dfrac{1}{\sqrt{2}}\sin(2x - k) + c$, then k =

    (a) $\dfrac{-5\pi}{3}$ (b) $\dfrac{5\pi}{4}$ (c) $\dfrac{5\pi}{3}$ (d) $\dfrac{-5\pi}{4}$

111. If $f(x+y) = f(x)f(y) \ \forall x, y$ and $f(x) \neq 0$, then $f^1(x) =$

    (a) $f^1(x)$ (b) $f^1(y)$ (c) $f(x)f(y)$ (d) $f(x)f^1(0)$

112. $\int \dfrac{2x+3}{x^2 + x + 1}\,dx$

    (a) $\log\left|x^2 + x + 1\right| + \dfrac{2}{\sqrt{3}}\log\left(\dfrac{2x+1}{\sqrt{3}}\right) + c$ (b) $\log\left|x^2 + x + 1\right| + \dfrac{4}{\sqrt{3}}\tan^{-1}\left(\dfrac{2x+1}{\sqrt{3}}\right) + c$

    (c) $\log\left|x^2 + x + 1\right| + \dfrac{5}{\sqrt{3}}\tan^{-1}\left(\dfrac{2x+1}{\sqrt{3}}\right) + c$ (d) $\log\left|x^2 + x + 1\right| + \dfrac{1}{\sqrt{3}}\tan^{-1}\left(\dfrac{2x+1}{\sqrt{3}}\right) + c$

113. The sum of the series $1 + \dfrac{1}{4 \cdot 2!} + \dfrac{1}{16 \cdot 4!} + \dfrac{1}{64 \cdot 6!} + \ldots$ is

    (a) $\dfrac{e+1}{2\sqrt{e}}$ (b) $\dfrac{e-1}{\sqrt{e}}$ (c) $\dfrac{e+1}{\sqrt{e}}$ (d) $\dfrac{e-1}{2\sqrt{e}}$

114. If $(3, -2)$ is the mid point of the chord AB of circle $x^2 + y^2 - 4x + 6y - 5 = 0$ then AB =

    (a) 16   (b) 8   (c) 4   (d) 12

115. The area bounded by the circle $x^2 + y^2 = a^2$ and the line x + y = a in the first quadrant is

    (a) $(\pi - 2)a^2$ (b) $\dfrac{\pi a^2}{2}$ (c) $\dfrac{1}{4}(\pi - 2)a^2$ (d) $\left(\dfrac{\pi - 4}{2}\right)a^2$

116. Two sides a triangle lie along $2x^2 - 5xy + 2y^2 = 0$ and the point (2, 3) is the centroid. The equation of the third side is

    (a) 7x − 2y − 12 = 0   (b) 7x + 2y − 12 = 0   (c) 7x + 2y + 12 = 0   (d) None

Space for rough work

117. The latus rectum of a parabola whose focal chord is PSQ such that SP = 3 and SQ = 2 is given by

(a) $\dfrac{12}{5}$ (b) $\dfrac{24}{5}$ (c) $\dfrac{16}{5}$ (d) $\dfrac{48}{5}$

118. The line $r\cos(\theta-\alpha)=p$, $r\sin(\theta-\alpha)=q$ are

(a) parallel to each other   (b) inclined at an angle α to each other
(c) inclined at an angle 60^0 to each other   (d) perpendicular to each other

119. The equation of the pair of straight lines perpendicular to the pair $2x^2+5xy+2y^2+10x+5y=0$ and passing through the origin is

(a) $2x^2+5xy+2y^2=0$ (b) $2x^2-3xy+y^2=0$
(c) $2x^2+3xy+y^2=0$ (d) $2x^2-5xy+2y^2=0$

120. The product of the distinct $(2n)^{th}$ roots of $1+i\sqrt{3}$ is equal to

(a) $\dfrac{1+i\sqrt{3}}{4}$ (b) $\dfrac{-1+i\sqrt{3}}{2}$ (c) $-1-i\sqrt{3}$ (d) $1+i\sqrt{3}$

121. The angles of a triangle are in the ratio 3 : 5 : 10. Then the ratio of the smallest side to the greatest side is

(a) $1:\sin 10°$ (b) $1:2\cos 10°$ (c) $1:\sin 20°$ (d) $1:\cos 20°$

122. The elevation of an object on a hill is observed from a certain point in the horizontal plane through its base, to be 30^0. After walking 120 m towards it on level ground the elevation is found to be 60^0. Then the height of the object (in meters) is

(a) 120   (b) 140   (c) $140\sqrt{3}$ (d) $60\sqrt{3}$

123.

$$\begin{vmatrix} \log e & \log e^2 & \log e^3 \\ \log e^2 & \log e^3 & \log e^4 \\ \log e^3 & \log e^4 & \log e^5 \end{vmatrix} =$$

(a) 0   (b) $2\log e$ (c) $3\log e$ (d) $4\log e$

124. The length of the tangent around to the circles $x^2+y^2-2x+4y-11=0$ from the point (1, 3) is

(a) 3   (b) -3   (c) 4   (d) -4

125. Vector equation of the plane passing through the point $\bar{i}+\bar{j}+\bar{k}$ parallel to the vectors $2\bar{i}+3\bar{j}+4\bar{k}$, $\bar{i}-2\bar{j}+3\bar{k}$

(a) $\bar{r}=(\bar{i}+\bar{j}+\bar{k})+s(2\bar{i}+3\bar{j}+4\bar{k})+t(\bar{i}-2\bar{j}+3\bar{k})$

(b) $\bar{r}=(1-s)(\bar{i}+\bar{j}+\bar{k})+s(2\bar{i}+3\bar{j}+4\bar{k})+t(\bar{i}-2\bar{j}+3\bar{k})$

(c) $\bar{r}=(1-s-t)(\bar{i}+\bar{j}+\bar{k})+s(2\bar{i}+3\bar{j}+4\bar{k})+t(\bar{i}-2\bar{j}+3\bar{k})$ (d) none

Space for rough work

126. If $\bar{a}, \bar{b}, \bar{c}$ are 3 vectors such that $\bar{a} \cdot (\bar{b} + \bar{c}) = \bar{b} \cdot (\bar{c} + \bar{a}) = \bar{c} \cdot (\bar{a} + \bar{b}) = 0$ and $|\bar{a}| = 1, |\bar{b}| = 4, |\bar{c}| = 8$ then $|\bar{a} + \bar{b} + \bar{c}| =$

   (a) 9   (b) 18   (c) 13   (d) 26

127. $\sin \dfrac{\pi}{5} \cdot \sin \dfrac{2\pi}{5} \cdot \sin \dfrac{3\pi}{5} \cdot \sin \dfrac{4\pi}{5} =$

   (a) $\dfrac{2}{16}$ (b) $\dfrac{1}{16}$ (c) $\dfrac{3}{16}$ (d) $\dfrac{5}{16}$

128. The number of solutions of $\tan x + \sec x = 2 \cos x$ in $[0, 2\pi]$

   (a) 1   (b) 2   (c) 4   (d) 3

129. $\underset{x \to \infty}{Lt} \sqrt{x + \sqrt{x + \sqrt{x}}} - \sqrt{x}$

   (a) 0   (b) $\log 2$ (c) $\dfrac{1}{2}$ (d) $\log 4$

130. The relative error in the area of the circle is k times the relative error in the radius then k

   (a) $\dfrac{1}{3}$ (b) $\dfrac{1}{2}$ (c) 2   (d) 3

131. Area bounded between the curves $x^2 = 4y, y^2 = 4x$ is

   (a) $\dfrac{16}{3}$ sq. units   (b) $\dfrac{64}{3}$ sq. units   (c) $\dfrac{1}{3}$ sq. units   (d) $\dfrac{4}{3}$ sq. units

132. The radical centre of the circles $x^2 + y^2 = 1$, $x^2 + y^2 - 2x = 1$ and $x^2 + y^2 - 2y = 1$ is

   (a) (1, 1)   (b) (2, 2)   (c) (0, 0)   (d) (3, 3)

133. $\displaystyle\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \sin\left(\log\left(x + \sqrt{x^2 + 1}\right)\right) dx =$

   (a) 0   (b) π (c) $-\pi$ (d) 1

134. If $f : R \to R$ is defined by $f(x) = \dfrac{1}{2 \cos 3x}$ for each $x \in R$, then the range of f is

   (a) $\left(\dfrac{1}{3}, 1\right)$ (b) $\left[\dfrac{1}{3}, 1\right)$ (c) $\left[\dfrac{1}{3}, 1\right]$ (d) $\left(\dfrac{1}{3}, 1\right]$

135. The coefficient of x^k in the expansion of $\dfrac{1 - 2x - x^2}{e^{-x}}$ is

   (a) $\dfrac{1 - k - k^2}{k!}$ (b) $\dfrac{k + k^2 - 1}{k!}$ (c) $\dfrac{1 + k - k^2}{k!}$ (d) none

Space for rough work

136. The domain of the function $f(x) = \sqrt[3]{\dfrac{2x-1}{x^2-10x-11}}$

(a) $(-\infty,-1)\cup(-1,11)\cup(11,\infty)$ (b) (-1,11)

(c) $(-\infty,-1)\cup(11,\infty)$ (d) $(-\infty,\infty)$

137. A cubical die is loaded so that the probability of face k is proportional to k, k = 1, 2, 3, 4, 5, 6. it is rolled. Find the probability of getting an odd integer face

(a) $\dfrac{1}{7}$ (b) $\dfrac{3}{7}$ (c) $\dfrac{4}{7}$ (d) $\dfrac{5}{7}$

138. If $f(x) = \begin{cases} 8^x - 4^x - 2^x + 1, & for\ x > 0 \\ e^x \sin x + p\sin x + a\log 4, & for\ x \le 0 \end{cases}$ is continuous at x = 0 then a =

(a) 2   (b) $\log_e 3$ (c) $\log_e 5$ (d) $\log_e 2$

139. $\sum \bar{i} \times (\bar{a} \times \bar{i}) =$

(a) $3\bar{a}$ (b) $2\bar{a}$ (c) $4\bar{a}$ (d) $5\bar{a}$

140. If $x = 2 + 2^{1/3} + 2^{2/3}$ then $x^3 - 6x^2 + 6x + 3 =$

(a) 1   (b) 3   (c) 4   (d) 5

141. If $\sin x + \sin y = 3(\cos y - \cos x)$ then $\dfrac{\sin 3x}{\sin 3y} =$

(a) 5   (b) 4   (c) -1   (d) 1

142. The number of lines that can be drawn through the point (4, -5) at a distance of 5 units from the point (1, 3) is

(a) 2   (b) 0   (c) 3   (d) 5

143. If the polar of p(-1, 2) with respect to $(x-3)^2 + (y-4)^2 = 16$ meets the circle at Q and R then the circum centre of the triangle PQR is

(a) (1, -3)   (b) (1, 3)   (c) (-1, 3)   (d) (-1, -3)

144. The foci of the ellipse $\dfrac{x^2}{16} + \dfrac{y^2}{b^2} = 1$ and the Hyperbola $\dfrac{x^2}{144} - \dfrac{y^2}{81} = \dfrac{1}{25}$ coincide then $b^2 =$

(a) 5   (b) 9   (c) 11   (d) 7

145. The probability of a bomb hitting a bridge is $\dfrac{1}{2}$ and one hit is sufficient to destroy it. The least number of bombs required so that the probability of the bridge being destroyed is greater than 0.8 is

(a) 2   (b) 3   (c) 4   (d) 5

146. A coin is tossed 'n' terms. The probability of getting head at least once is greater than 0.8 then the least value of such 'n' is

(a) 3   (b) 4   (c) 5   (d) 6

Space for rough work

147. The period of $\dfrac{\cot(5x+3)+\sin(3x+4)}{\sec(3-4x)-\cos(4-6x)}$ is

    (a) 4π (b) 3π (c) 2π (d) $-\pi$

148. The principal value of $\cos^{-1}\left[\dfrac{1}{\sqrt{2}}\left(\cos\dfrac{9\pi}{10}-\sin\dfrac{9\pi}{10}\right)\right]$ is

    (a) $\dfrac{3\pi}{20}$ (b) $\dfrac{17\pi}{20}$ (c) $\dfrac{7\pi}{20}$ (d) $\dfrac{9\pi}{20}$

149. The equation of the circle passing through (3,-4) and concentric with $x^2+y^2+4x-2y+1=0$ is $x^2+y^2+2gx+2fy+c=0$ then $12g-22f+c=$

    (a) 0   (b) 2   (c) 3   (d) 1

150. $\displaystyle\underset{n\to\infty}{Lt}\dfrac{[x]+[2n]+----+[nx]}{n^2}$ is

    (a) n   (b) 2n   (c) $\dfrac{n}{2}$ (d) $\dfrac{n}{3}$

151. If errors of 2% each are made in the base radius and height of cone, then percentage error in its volume is

    (a) 4   (b) 5   (c) 6   (d) 8

152. The value of $(127)^{1/3}$ to 4 decimal places is

    (a) 5.4267   (b) 5.0267   (c) 5.5267   (d) 5.0001

153. $y=\tan^{-1}\left(\dfrac{\sqrt{1+x}-\sqrt{1-x}}{\sqrt{1+x}+\sqrt{1-x}}\right)$ then $\dfrac{dy}{dx}$ is

    (a) $\dfrac{1}{\sqrt{1-x^2}}$ (b) $\dfrac{1}{4\sqrt{1-x^2}}$ (c) $\dfrac{1}{2\sqrt{1-x^2}}$ (d) none

154. If $\cot\dfrac{A}{2}:\cot\dfrac{B}{2}:\cot\dfrac{C}{2}=3:5:7$ then a : b : c

    (a) 6 : 5 : 4   (b) 6 : 7 : 8   (c) 6 : 4 : 3   (d) none

155. If the rate of decrease of $\dfrac{x^2}{2}-2x+5$ is twice the decrease of x then x

    (a) 1   (b) 2   (c) 3   (d) 4

156. If $\log_{10}\left(98+\sqrt{x^2-12x+36}\right)=2$ then x =

    (a) 6   (b) 7   (c) 8   (d) 9

157. Volume of the tetrahedron with edges $\bar{i}+2\bar{j}+2\bar{k}, 2\bar{i}-\bar{j}+2\bar{k}, 2\bar{i}+2\bar{j}-\bar{k}$

    (a) $\dfrac{13}{2}$ cubic unit   (b) $\dfrac{15}{2}$ cubic unit   (c) $\dfrac{7}{2}$ cubic unit   (d) $\dfrac{9}{2}$ cubic unit

Space for rough work

158. If $\int \dfrac{2^x}{\sqrt{1-4^x}}\,dx = k\sin^{-1}\left(2^x\right)+c$ then k =

(a) $\dfrac{1}{\log 2}$ (b) $\dfrac{1}{2}\log 2$ (c) $\dfrac{1}{2\log 2}$ (d) none

159. One of the limiting point of the coaxial system of the circles determined by the two touching circles $(x-2)^2 +(y+3)^2 = 5$ and $(x-5)^2 +(y-3)^2 = 20$ is

(a) (2, -3)   (b) (3, -1)   (c) (-3, -3)   (d) (-2, -3)

160. If $\operatorname{cosec}A + \cot A = \dfrac{11}{2}$ then $\tan A$ is

(a) $\dfrac{21}{22}$ (b) $\dfrac{15}{22}$ (c) $\dfrac{44}{117}$ (d) $\dfrac{117}{43}$

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Space for rough work

BOTONY

81. The scientist who proposed several simple and practical measures for controlling wheat rusts in India is:
    (a) K.C. Mehta   (b) P.K.K Nair   (c) Micheli   (d) P.Maheswari

82. The functions of ICAR are
    (a) To promote basic and advanced research for improving crop varieties.
    (b) To control and co-ordinate agricultural research.
    (c) To provide financial assistance to young scientists working in the field of agriculture.
    (d) All the above

83. A teacher was explaining about a constant physical contact involving almost equal physiological inter dependence in two different thalloid forms. He was trying to explain one of the following:
    (a) Mycorrhizal association   (b) Establishment of heterothallism
    (c) Operation of Heterothallism   (d) Advent of lichen formation.

84. A dicot plant with only one tuberous root is seen in
    (a) Ipomoea batatus   (b) Daucus carota
    (c) Ruellia tuberosa   (d)Asparagus racemosus.

85. Leaflets are developed on the branches formed on the primary rachis only in
    (a) Tamarindus   (b) Delonix   (c) Millingtonia   (d) Coriandrum

86. Choose the correct combinations from the following

Column – A	Column – B	Column – C
(I) Hypanthodium	Fleshy cuplike peduncle	Sessile unisexual flowers
(II) Cyathium	Deep cuplike peduncle	Pedicellate unisexual flowers
(III)Head Inflorescence	Flattened disc like peduncle	Pedicellate unisexual and / or bi-sexual flowers
(IV) Spadix	Fleshy peduncle	Pedicellate unisexual flowers

    (a) I, II, III, IV   (b) I, II & III   (c) I & II   (d) I Only

87. Polysiphonous pollen grain means
    (a) Single pollentube is developed from many pollen grains
    (b) Many pollentubes are developed from many completely, fused pollen grains
    (c) More than one pollentube are formed from each pollen grain
    (d) Many pollen grains are formed from single pollentube.

88. There are 10 flowers in one individual plant of Pisum. In each microsporangium of every stamen of all the flowers, there are 30 microspore mother cells. How many pollen grains are formed from that plant?
    (a) 4,000   (b) 10,000   (c) 24,000   (d) 48,000

89. The ratio between the number of cohorts of sub classes polypetalae and gamopetalae in Bentham and Hooker classification is
    (a) 3:2   (b) 1:1   (c) 2:3   (d) 5:7

Space for rough work

90. Each carpel of Gloriosa encloses 60 ovules, out of which 27% became abortive and another 13% could not be fertilized due to various reasons. How many seeds occur in the capsule if all the remaining ovules are fertilized in the lone flower of the plant?
    (a) 36   (b) 76   (c) 108   (d) 180

91. Assertion (A): Nucleolar organizer regions are absent in prokaryotes
    Reason   (R): True nucleus is absent in prokaryotic cells
    (a) A and R are true and R is the correct explanation of A.
    (b) A and R are true and R is not the correct explanation of A.
    (c) A is true, R is false.   (d) A is false, R is true.

92. "B – DNA" molecule with $510A^0$ length contains 20% of Cytosine. Then the total number of hydrogen bonds in it are
    (a) 360   (b) 120   (c) 270   (d) 130

93. Cell organelles concern with the formation of outermost and first formed layer of cell wall during cytokinesis are
    (A) Dictyosomes   (B) Peroxysomes   (C) E.R   (D) Lysosomes
    (a) A, B   (b) B, C   (c) C, D   (d) A, C

94. Wood of a tree trunk consists of
    (I) Bast   (II) Alburnum   (III) Bark   (IV) Duramen
    (a) I, II   (b) II, III   (c) II, IV   (d) I, II, III

95. Arrange the following in the order of their location from periphery to center in the entire dicotyledonous plant body.
    (I) Fusiform cells   (II) Trichoblasts   (III) Collocytes   (IV) Tyloses
    (a) IV, I, II, III   (b) II, III, I, IV   (c) III, II, I, IV   (d) I, IV, III, II

96. Assertion (A): Libriform fibres are truefibres
    Reason   (R): Libriform fibres develop from non-functional tracheids by reduction.
    (a) A and R are true and R is the correct explanation of A.
    (b) A and R are true and R is not the correct explanation of A.
    (c) A is true, R is false.   (d) A is false, R is true.

97. Study the following lists

List - I	List – II
(A) Ephemeral	(I) Neerium
(B) Mucilage	(II) Zizipus
(C) Multiple epidermis	(III) Calotropis
(D) Spine	(IV) Tribulus
	(V) Aloe

The correct match is

	A	B	C	D			A	B	C	D
(a)	II	IV	V	I		(b)	V	II	I	IV
(c)	IV	V	I	II		(d)	IV	III	II	I

Space for rough work

98. Select the incorrect match
    (a) Salvia - Free floating rootless pteridophyte
    (b) Wolffia - Free floating rootless angiosperm
    (c) Ceratophyllum - submerged suspended rootless angiosperm
    (d) Pistia - Free floating angiosperm with root pockets.
99. According to product law the probability of yellow wrinkled seeds is represented as
    (a) $\frac{3}{4} X \frac{3}{4} = \frac{9}{16}$
    (b) $\frac{1}{4} X \frac{1}{4} = \frac{1}{16}$
    (c) $\frac{3}{4} X \frac{1}{4} = \frac{3}{16}$
    (d) $\frac{1}{2} X \frac{1}{2} = \frac{1}{4}$
100. Number of linkage groups in Pisum sativum is
    (a) 14   (b) 2   (c) 4   (d) 7
101. Assertion (A): The life cycle in Funaria is called diplohaplontic
    Reason (R): In Funaria, there is a alternation of haploid gametophytic and diploid
    sporophytic phases, one becoming parent to the other.
    (a) A and R are true and R is the correct explanation of A.
    (b) A and R are true and R is not the correct explanation of A.
    (c) A is true, R is false.   (d) A is false, R is true.
102. Two adjacent filaments of Spirogyra offinis each 10 cells participating in reproduction.
    How many new Spirogyra plants are produced during sexual reproduction?
    (a) 5   (b) 10   (c) 20   (d) 40
103. Heterothallism is a kind of
    (a) Isogamy   (b) Anisogamy
    (c) Oogamy   (d) Physiological anisogamy
104. What is the ratio of equational divisions that takes place in Cycas and Angiosperms
    respectively leading to the formation of male gametes from pollen grain?
    (a) 3:2   (b) 3:1   (c) 2:1   (d) 2:3
105. Study the following lists

List - I	List – II
(A) Apospory in Pteris takes palce in	(I) Sporophyte
(B) Endosperm in Cycas	(II) Gametophyte
(C) Calyptra	(III) Sporophyte
(D) Nucellus in Cycas	(IV) Gametophyte
	(V) Gametophyte

    The correct match is

	A	B	C	D			A	B	C	D
(a)	I	IV	V	III		(b)	IV	I	V	III
(c)	I	V	III	IV		(d)	III	II	I	IV

106. Assign the following substances to cellwall, flagella, 'S' layer and pili of bacteria in
    correct sequence.
    (I) Glycoprotein   (II) Fimbrillin   (III) Teichoic acid   (IV) Flagellin
    The correct sequence is
    (a) III, I, IV, II   (b) III, IV, I, II   (c) II, IV, III, I   (d) III, IV, II, I

Space for rough work

107. The disease caused by the virus having double stranded nucleic acid with ribose sugar as genetic material is
(a) Tobacco mosaic disease
(b) Cauliflower mosaic disease
(c) Dahlia mosaic disease
(d) Rice stunting disease

108. By which mechanism the salt resistant plants can get rid off excess Na^+ ions to the outer side through the roots?
(a) H^+ -ATP ase uniportsystem
(b) Na^+ -ATP ase uniportsystem
(c) H^+ -Cl symport system
(d) Na^+ -H^+ antiport system

109. Three plant cells A, B, C are in contact with one another as detailed below. Find the direction of water movement.

A
$\pi = -6.0\,bars$
P = 3 bars

B
$\pi = -9\,bars$
P = 5 bars

C
$\pi = -4\,bars$
P = 2 bars

(a) (b) (c) (d)
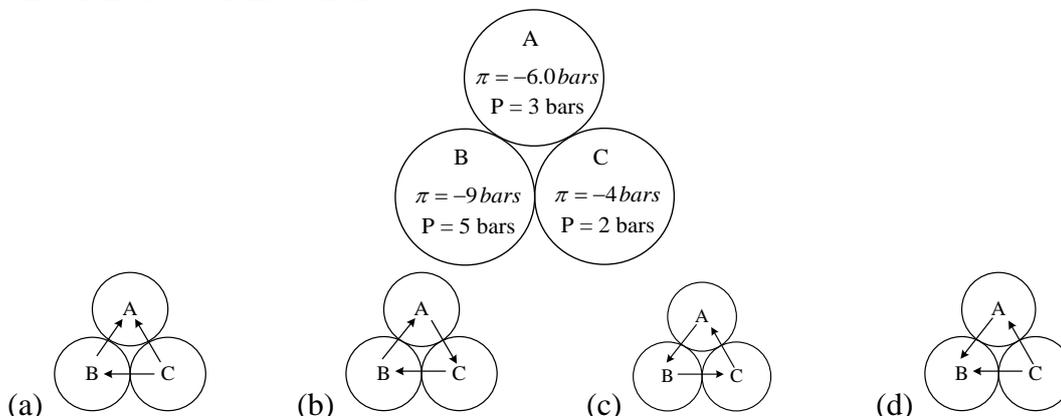
110. The water adhered to the soil particles due to surface forces but not available to the plant is
(a) Gravitational water
(b) Hygroscopic water
(c) Capillary water
(d) Runaway water

111. Study the following table and find out the correct combination.

Column – A	Column – B	Column – C
(I) Zn^{+2}	Hexokinase	IAA Synthesis
(II) Mo	Dinitroginase	NO_3^- to NO_2^-
(III) Fe^{+2}	Catalase	Breakdown of H_2O_2

(a) I alone
(b) I and II
(c) II and III
(d) III alone

112. Assertion (A) : In C_4 path way, the primary carboxylation occurs in cytosol of bundle sheath cell.
Reason (R) : PEP - Carboxylation occurs in the cytosol of mesophyll cell
(a) A and R are true and R is the correct explanation of A.
(b) A and R are true and R is not the correct explanation of A.
(c) A is true, R is false.
(d) A is false, R is true.

113. Which of the following are mobile electron carriers associated with fourth step of aerobic respiration
(I) Ubiquinone
(II) Cytochrome - 'C'
(III) Plastocyanin
(IV) Cytochrome b_6
(a) I, II and IV
(b) II, III and IV
(c) I and II
(d) IV alone

Space for rough work

114. Ratio between the number of chl a molecules of both LHC - I and LHC - II and the number of chl b molecules of both LHC - I and LHC - II is
    (a) 1:1   (b) 4:1   (c) 4:3   (d) 3:4

115. The central dogma of molecular biology was proposed by
    (a) Sachs   (b) Crick   (c) Lederberg   (d) Watson

116. This is highly efficient auxin used in horticulture to induce roots on stem cuttings
    (a) IAA   (b) PAA   (c) 2, 4, 5 - T   (d) IBA

117. Large number of desirable characters can be incorporated in to a single variety by
    (a) Mutational breeding   (b) Clonal selection
    (c) Hybridization   (d) Pureline selection

118. The common disadvantage among the algal, fungal and bacterial SCP is
    (a) Rate of growth is slow   (b) Low cell density
    (c) Risk of contamination   (d) Rich in RNA

119. The DNA with following base sequence is treated with Eco RI. At how many places the enzyme cuts the DNA.
    $$5^1 CGAATTCTGCTTAAGATAT3^1$$
    $$3^1 GCTTAAGACGAATTCTATA5^1$$
    (a) 3   (b) 4   (c) 5   (d) 2

120. Nutrition of Mushroom is
    (I) Saprophyte   (II) Symbiont   (III) Parasite   (IV) Autotroph
    The correct combination is
    (a) I and II only   (b) II and III only   (c) I, II and IV only   (d) I, II and III only

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Space for rough work

ZOOLOGY

121. In Vorticella conjugation, the number of individuals formed in the 3rd of post conjugation fission is
    (a) 8 (b) 7 (c) 4 (d) 6

122. Herbivorous insect with piercing and sucking type of mouth parts
    (a) Cimex (b) Pediculus (c) Kerrica lacca (d) Bombyx mori

123. The spermatophores received during copulation are stored in this part in Pheretima
    (a) Diverticulum of spermatheca (b) ampulla of spermatheca
    (c) Septal pouches (d) Prostate glands

124. Choose correct combination
    (A) Calcarea – Trichimella larva (B) Scyphozoa – Ephyra larva
    (C) Turbellaria – Mullers larva (D) Siphonopoda – Trochophore larva
    The correct combinations is
    (a) A & D (b) B & C (c) B & D (d) A & C

125. Haploid motile stages of plasmodium that occur in its definite host are
    (a) Male gametes, Ookinete (b) Sporozoites, Oocyst
    (c) Male gamete, Sporozoite (d) Ookinete, Gametocyte

126. The response to external stimuli is quicker and more precise in this symmetry
    (a) Radial (b) Biradial (c) Spherical (d) Bilateral

127. Match the following:
    (A) Acidophils (I) Inflammation
    (B) Basophils (II) Blood clotting
    (C) Neutrophils (III) Antibodies
    (D) Plasma cells (IV) Eosinophilia
    (E) Thromobocytes (V) Phagocytes

	A	B	C	D	E		A	B	C	D	E
(a)	IV	I	V	II	III	(b)	IV	III	II	I	V
(c)	IV	I	V	III	II	(d)	IV	V	III	II	I

128. Blood from the septal nephridia of Pheretima is collected by
    (a) Septo nephridial blood vessel (b) Commissural blood vessel
    (c) Ventro tegumentary blood vessel (d) Sub neural blood vessel

129. Scolopidia are the units of
    (a) Ommatidia (b) Chemoreceptors
    (c) Mechanoreceptors (d) Thermoreceptors

130. In the development of Taenia solium micromeres form
    (a) Embryophore (b) Shell layer
    (c) Outer embryonic membrane (d) Morula

131. One horned Rhinoceros is protected at
    (a) Kanha – National park – Madhya Pradesh
    (b) Periyar – National park – Kerala
    (c) Khaziranga – National park – Assam
    (d) Nandadevi – National park – Uttarkhand

Space for rough work

132. Sibling species are
    (a) Morphologically similar and capable of interbreeding
    (b) Geographically isolated but capable of interbreeding
    (c) Reproductively isolated and morphologically similar
    (d) Morphologically alike but not reproductively isolated

133. Assertion (A): In Pheretima, rapid conduction of impulses occur through out the whole length of the body.
    Reason   (R): Nervous system of pheretima has four giant axons along the ventral side of nerve cord.
    (a) A and R are true and R is the correct explanation of A
    (b) A and R are true and R is not the correct explanation of A
    (c) A is true, R is false   (d) A is false, R is true

134. In cockroach, flexibility of the arthrodial membrane is due to absence of
    (a) Sclerotised chitinous layer   (b) Chitinous cuticular layer
    (c) Non-Chitinous layer   (d) Cement layer

135. The bacteria responsible for the conversion of nitrites into nitrates is
    (a) Pseudomonas   (b) Closteridium   (c) Nitrobacter   (d) Nitrosomonas

136. Choose the correct combinations

Animal	Character	Group
(A) Echinocardium	Aristotle's lantern	Echinoidea
(B) Pecten	Radula	Lamellibranchiata
(C) Aphrodite	Parapodia	Polychaeta
(D) Limulus	Book gills	Xiphosura

    (a) All are correct   (b) All except B   (c) All except C   (d) C, D only

137. The site for ATpase activity in a cilium are
    (a) Myosin heads   (b) Dynein arms   (c) Microtubules   (d) Central Sheath

138. The character of annelids with fixed number of segments have
    (a) Botryoidal tissue   (b) Unisexual animals
    (c) Trochophore larva   (d) Gonoducts absent

139. Which of the following is related to secondary amoebiasis
    (a) Amoebic dysentery   (b) Amoebic hepatitis   (c) Peritonitis   (d) Appendicitis

140. Photochemical smog pollution does not contain
    (a) Nitrogen dioxide   (b) Ozone   (c) Carbon dioxide   (d) PAN

141. Assertion (A): Heart sound 'lubb' is caused during ventricular systole of cardiac cycle
    Reason   (R): Closure of Artrio ventricular valves occur, when ventricular pressure falls below the atrial pressure
    (a) A and R are true and R is the correct explanation of A
    (b) A and R are true and R is not the correct explanation of A
    (c) A is true, R is false   (d) A is false, R is true

142. The pathogen for chronic respiratory desease in poultry birds is
    (a) Paramyxo virus   (b) Oidium albicans
    (c) Pasteurella avicida   (d) Mycoplasma gallisepticum

Space for rough work

143. During propagation of nerve impulse both Na^+ activation and inactivation gates are opened in
    (a) Depolarising phase   (b) Repolarising phase
    (c) Hyperpolarising phase   (d) Resting phase

144. The substance in primary urine which is not reabsorbed in any part of nephron
    (a) Urea   (b) Creatinine   (c) Glucose   (d) Uric acid

145. Arrange the following events that occur after copulation in sequence
    (A) Delamination   (B) Amphimixis   (C) Compaction   (D) Implantation
    (E) Capacitation   (F) Involution
    (a) B, E, C, D, A, F   (b) E, B, A, D, C, F   (c) E, B, C, D, A, F   (d) E, B, C, F, A, D

146. Match the following:
    (A) Odontoid process (I) Dentary
    (B) Mastoid process   (II) Axis
    (C) Coronoid process (III) Scapula
    (D) Acromion process (IV) Periotic

	A	B	C	D			A	B	C	D
(a)	III	II	I	IV		(b)	IV	III	II	I
(c)	II	I	III	IV		(d)	II	IV	I	III

147. Autosomal recessive haemophilia is due to deficiency
    (a) Anti haemoglobin globin   (b) Thrombokinase
    (c) Plasma thromboplastin antecedent   (d) Fibrinogen

148. Read the following
    (A) Hexagonal vertebrals   (B) Dorsal scales are keeled
    (C) Arrow mark on head   (D) Cuneate plate
    (E) Single row of sub caudals
    Identify the characters of Echis
    (a) ACE   (b) BCE   (c) DCE   (d) ABC

149. The excretory organs in Assymmetron
    (a) Solenocytes   (b) Podocytes   (c) Flame cells   (d) Kidney

150. Which of the following has three – lobed diphycercal tail and is considered as living fossil
    (a) Protopterus   (b) Climatius   (c) Hippocampus   (d) Latimeria

151. A population of 100 moths show genotypic frequencies of wing color AA = 0.16, aa = 0.36 and Aa = 0.48 what is the allelic frequency of alleles A and a respectively
    (a) 0.4 and 0.6   (b) 0.6 and 0.4   (c) 0.3 and 0.7   (d) 0.7 and 0.3

152. In striated muscles T-tubules are present at A-I junctions in
    (a) Reptiles   (b) Aves   (c) Amphibians   (d) Mammals

Space for rough work

153. Following are the parts of male reproductive system in Rabbit
(A) Seminal vesicle   (B) Vas efferentia   (C) Rete Testis   (D) Epididymis
(E) Vas deferens   (F) Seminiferous tubules
Arrange them in sequence based on movement of sperms
(a) F – C – B – E – D – A   (b) F – C – B – D – E – A
(c) F – C – A – E – D – B   (d) F – C – E – D – A – B

154. Study the following

Harmone	Secreted by	Function
(A) Somatostatin	Hypothalamus	Inhibits secretion of insulin and glucagon
(B) Melatonin	Pineal gland	Regulate annual breeding cycles
(C) Cholecystokinin	Gall bladder	Secretion of pancreatic juice
(D) Calcitonin	Parathyroid	Inhibits bone resorption

In the above the correct are
(a) A and D only   (b) A and C only   (c) B, D only   (d) B only

155. If the heart valves of pig are transplanted to man, it can be classified under
(a) Autograft   (b) Isograft   (c) Xenograft   (d) Allograft

156. Sickle cell haemoglobin is formed due to replacement of
(a) Glutamic acid by valine   (b) Glutamic acid by lysine
(c) Valine by glutamic acid   (d) Lysine by glutamic acid

157. Oxygen – haemoglobin dissociation curve shifts to the right under the condition
(a) Low PH   (b) Low temperature   (c) High PH   (d) High PO_2

158. Malignant tumours of epithelial cells
(a) Sarcoma   (b) Leukamia   (c) Carcinoma   (d) Lymphoma

159. The natural selective force that brings phenotypic stability for long period is
(a) Stabilising selection   (b) Directional selection
(c) Disruptive selection   (d) Natural selection

160. Read the following
(A) skin   (B) Phagocytes   (C) T cells
(D) Fever   (E) NK cell   (F) Saliva
Which of the above are second line defence
(a) B, D, E   (b) A, B, F   (c) B, C, F   (d) A, C, F

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Space for rough work