MHT CET 2022 PCM Aug 8 Shift 1 Question Paper

Conducted by the State Common Entrance Test Cell, Maharashtra

Time Allowed: 180 Minutes **Total Questions: 150** **Maximum Marks: 200**

General Instructions

(i) This **PCM** paper is from **MHT CET 2022**, conducted by the **State Common Entrance Test Cell, Maharashtra**.

(ii) Answer all **150 multiple choice questions**: **50 Physics**, **50 Chemistry** and **50 Mathematics**.

(iii) Each question offers **four choices**, with **one correct answer**.

(iv) Allow **90 minutes for Physics and Chemistry together**, followed by **90 minutes for Mathematics**. The first group closes before the second opens.

(v) Correct answers earn **1 mark in Physics and Chemistry** and **2 marks in Mathematics**.

(vi) There is **no negative marking**. Unanswered questions score zero.

1. A particle is moving in U.C.M. with speed V and radius R. The angular acceleration of the particle is

(A) $\frac{V^2}{R}$ Perpendicular to the plane of the circle.
(B) $\frac{V^2}{R}$ along the tangent to the circle.
(C) $\frac{V^2}{R}$ along the radius towards the centre of the circle.
(D) zero.

2. A car is driven on the banked road of radius of curvature 20 m with maximum safe speed. In order to increase its safety speed by 10%, the increase in the radius of curvature will be [Angle of banking and friction is unchanged in both the cases.]

(A) 4.2 m
(B) 6.1 m
(C) 24.2 m
(D) 12.1 m

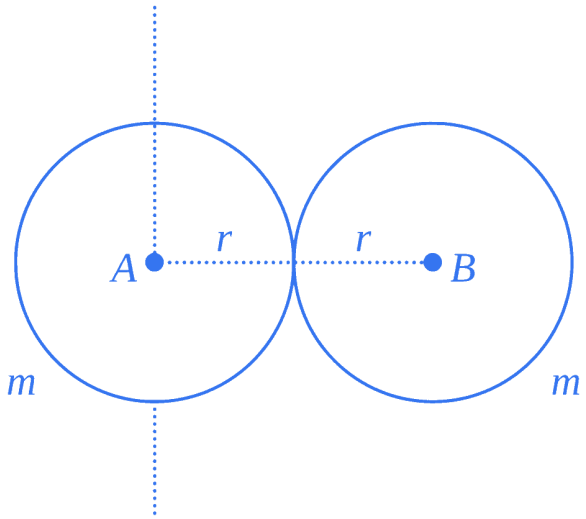
3. A sphere of mass' m ' moving with velocity ' v 'collides head-on another sphere of same mass which is at rest. The ratio of final velocity of second sphere to the initial velocity of the first sphere is (e is coefficient of restitution and collision is inelastic)

(A) $\frac{e-1}{2}$
(B) $\frac{e}{2}$
(C) $\frac{e+1}{2}$
(D) e

4. The ratio of radius of gyration of a ring to that of a disc (both circular) of same radius and mass, about a tangential axis perpendicular to the plane is

(A) $\frac{2}{\sqrt{3}}$
(B) $\frac{\sqrt{2}}{1}$
(C) $\frac{\sqrt{3}}{2}$
(D) $\frac{2}{\sqrt{5}}$

5. Two discs A and B each of radius r and mass m are attached as shown to form a system. The moment of inertia of this system about an axis perpendicular to the plane of the discs and passing through the center of disc A is



(A) $\frac{9}{2}mr^2$
(B) mr^2
(C) $2mr^2$
(D) $5mr^2$

6. The mass and radius of the earth and moon are M, R and m, r respectively. The distance between their centers is d. The minimum velocity with which a particle of mass m_0 should be projected from the midpoint between them so that it could reach infinity is

(A) $2\sqrt{\frac{G}{d}(M+m)}$
(B) $2\sqrt{\frac{Gm}{d}(M+m)}$
(C) $2\sqrt{\frac{2G}{d}(M+m)}$
(D) $2\sqrt{\frac{Gm(M+m)}{d(R+r)}}$

7. A satellite S_1 of mass m is moving in an orbit of radius r. Another satellite S_2 of mass 2 m is moving in an orbit of radius $2r$. The ratio of time period of satellite S_2 to that of S_1 is

(A) 2:1
(B) 1:8
(C) 1:4
(D) $2\sqrt{2}:1$

8. Two rain drops of same radius r falling with terminal velocity V merge and form bigger drop with radius R, terminal velocity is

(A) $\frac{VR^2}{r^2}$
(B) $\frac{VR}{r}$
(C) $\frac{Vr^2}{R^2}$
(D) $\frac{2VR}{r}$

9. A certain number of spherical liquid drops of radius r coalesce to form a single drop of radius R and volume V. If T is the surface tension of the liquid, which one of the following statements is true for the energy (E) in the process?

(A) $E = 3VT\left[\frac{1}{r} - \frac{1}{R}\right]$ is absorbed.
(B) $E = 4VT\left[\frac{1}{r} - \frac{1}{R}\right]$ is released.
(C) $E = 3VT\left[\frac{1}{r} - \frac{1}{R}\right]$ is released.
(D) $E = 4VT\left[\frac{1}{r} - \frac{1}{R}\right]$ is absorbed.

10. In a streamlined flow, the velocity of a fluid at a given point

(A) is always constant
(B) does not remain constant
(C) changes from low value to high value
(D) changes from high value to low value

11. Three black discs x, y, z have radii 1 m, 2 m and 3 m respectively. The wavelength corresponding to maximum intensity are 200 nm, 300 nm and 400 nm respectively. The relation between emissive power E_x, E_y and E_z is

(A) E_x is maximum
(B) E_y is maximum
(C) E_z is maximum
(D) $E_x = E_y = E_z$

12. At 273°C, the emissive power of a perfectly black body is R. It emissive power at 0°Cis

(A) $\frac{R}{4}$
(B) $\frac{R}{8}$
(C) $\frac{R}{16}$
(D) $\frac{R}{2}$

13. The coefficient of thermal conductivity of a rod depends on its

(A) area of cross-section.
(B) material of the rod.
(C) length.
(D) mass.

14. Which one of the following equations specifies an isochoric process?

[$Q =$ heat supplied, $\Delta p =$ change in pressure, $\Delta V =$ change in volume, $\Delta T =$ change in temperature]

(A) $\Delta V = 0$
(B) $Q = 0$
(C) $\Delta P = 0$
(D) $\Delta T = 0$

15. A polyatomic gas $\left(Y = \frac{4}{3}\right)$ is compressed to $\left(\frac{1}{8}\right)^{\text{th}}$ of its volume adiabatically. If its initial pressure is p, its new pressure will be

(A) 8p
(B) 16p
(C) 2p
(D) 6p

16. The average translational kinetic energy of N molecules in a gas is E_1. The kinetic energy of the electron (e) accelerated from rest through potential difference V volt is E_2. The temperature at which $E_1 = E_2$ possible is ($R =$ gas constant, $N =$ number of molecules)

(A) $\frac{3VNe}{2R}$
(B) $\frac{VNe}{2R}$
(C) $\frac{VNe}{3R}$
(D) $\frac{2VNe}{3R}$

17. A pendulum clock is running slow. To correct its time, we should

(A) reduce the amplitude of oscillation.
(B) increase the length of the pendulum.
(C) reduce the length of the pendulum.
(D) reduce the mass of the bob.

18. The total energy of the body executing simple harmonic motion is E. When the displacement is half of the amplitude then the kinetic energy is

(A) $\frac{E}{4}$
(B) $\frac{3E}{4}$
(C) $\frac{\sqrt{3}E}{4}$
(D) $\frac{E}{2}$

19. Two simple harmonic motions are represented as $y_1 = 10\sin\omega t$ and $y_2 = 10\sin\omega t + 5\cos\omega t$. The ratio of the amplitudes of y_1 and y_2 is

(A) $1:\sqrt{2}$
(B) 1:4
(C) 1:1
(D) $2:\sqrt{5}$

20. An organ pipe P_1 closed at one end has vibrating air column in its first overtone and another pipe P_2 open at both ends has vibrating air column in the third overtone, which are in resonance with a given tuning fork. The ratio of the length of pipe P_1 to that of P_2 is

(A) 3:8
(B) 1:2
(C) 1:8
(D) 5:8

21. The velocity of sound is 340 m/s. A source of sound having frequency of 90 Hz is moving towards a stationary observer with a speed of one-tenth that of sound. The apparent frequency of sound as heard by the observer is

(A) 45 Hz (B) 100 Hz

(C) 80 Hz (D) 50 Hz

22. On closing an open organ pipe from one end, it is noticed that the frequency of third harmonic is 50 Hz more than the fundamental frequency of vibration in open organ pipe. The fundamental frequency of open organ pipe is

(A) 100 Hz (B) 50 Hz

(C) 250 Hz (D) 200 Hz

23. The first overtone of the vibrating air column of a closed pipe has the same frequency as the second overtone of an open pipe 1.5 m Jung. The length of the closed pipe is

(A) 1.0 m (B) 0.75 m

(C) 0.5 m (D) 1.25 m

24. Two identical parallel plate air capacitors are connected in series to a battery of emf ' V '. If one of the capacitor is inserted in liquid of dielectric constant ' K ' then, potential difference of the other capacitor will become

(A) $\frac{K-1}{KV}$ (B) $\frac{K+1}{KV}$

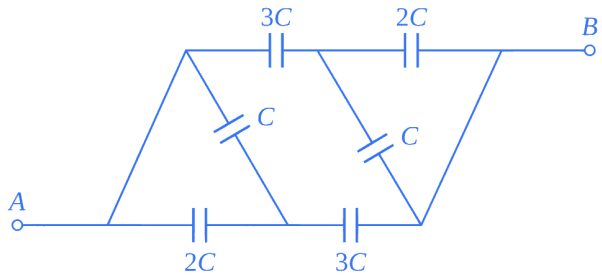
(C) $\left(\frac{KV}{K+1}\right)$ (D) $\frac{KV}{K-1}$

25. A parallel plate capacitor having plate area A and separation d is charged to a potential difference V. The charging battery is disconnected and the plates are pulled apart to four times the initial separation. The work required to increase the distance between plates is:

(A) $\frac{\varepsilon_0 AV^2}{4d}$ (B) $\frac{2\varepsilon_0 AV^2}{4d}$

(C) $\frac{\varepsilon_0 AV^2}{3d}$ (D) $\frac{3\varepsilon_0 AV^2}{2d}$

26. The network of six capacitors is as shown in figure. The equivalent capacitance between A and B is



(A) $\frac{2C}{3}$ (B) $\frac{4C}{3}$

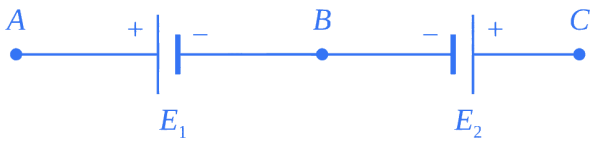
(C) 2C (D) 3C

27. Potentiometer wire is 4 m long and potential difference of 3 V is maintained between the ends. The e.m.f. of the cell which balances against a length of 100 cm of the potentiometer wire is

(A) 0.60 V (B) 0.20 V

(C) 0.45 V (D) 0.75 V

28. Two cells of e.m.f.'s E_1 and $E_2 (E_1 > E_2)$ are connected as shown in figure:



When a potentiometer is connected between A and B the balancing length of the potentiometer wire is 300 cm. By connecting the same potentiometer between A and C, the balancing length is 100 cm. The ratio of $\frac{E_1}{E_2}$ is

(A) 2:3 (B) 1:3

(C) 3:1 (D) 3:2

29. An electric charge moving with uniform velocity has

(A) only magnetic field around it. (B) neither electric field nor magnetic field around it.

(C) only electric field around it. (D) both electric and magnetic field around it.

30. A wire of certain length carries a steady current. It is first bent to form a circular coil of one turn. The same wire is then bent to form a circular coil of three turns. The ratio of magnetic inductions at the centre of the coil in the two cases is

(A) 1:9 (B) 1:3
(C) 3:1 (D) 9:1

31. An average induced emf of 0.5 V appears in a coil when the current in it is changed from 10 A in one direction to 10 A in opposite direction in 0.8 second. The self-inductance of the coil is

(A) 50 mH (B) 20 mH
(C) 25 mH (D) 40 mH

32. When a current I flows through a coil, it stores the energy E_1 in it. Now the current is reduced to $\frac{I}{2}$, the energy stored in the coil becomes E_2. The change in the energy is

(A) $\frac{E_1}{4}$ (B) $\frac{3E_1}{4}$
(C) $\frac{4E_1}{3}$ (D) $\frac{E_1}{2}$

33. A current of 5 A is flowing at 220 V in the primary coil of transformer. If the voltage produced in the secondary coil is 2200 V and 50% of power is lost, then the current in secondary will be

(A) 2.5 A (B) 0.5 A
(C) 0.25 A (D) 5 A

34. An alternating voltage of 22 V is applied across an inductance coil of reactance 11Ω. If the inductance of the coil is 0.07H, the frequency of alternating voltage is

(A) 25 Hz (B) 40 Hz
(C) 50 Hz (D) 20 Hz

35. In series $L-C-R$ circuit, the capacitance is changed from C to $2C$. To obtain the same resonance frequency the inductance should be changed from L to

(A) $2L$ (B) $4L$
(C) $\frac{L}{2}$ (D) L

36. Resistor of 2Ω, inductor of 100μH and capacitor of 400pF are connected in series across an a.c. source of $e_{rms} = 0.1$ volt. At resonance, voltage drop across inductor is

(A) 20V (B) 25 V
(C) 2.5 V (D) 250 V

37. If ε_0 and ε represent the permittivity of free space and absolute permittivity of a medium then the relative permittivity of the medium is

(A) $\frac{\varepsilon^2}{\varepsilon_0}$ (B) $\frac{\varepsilon_0}{\varepsilon}$
(C) $\varepsilon\varepsilon_0$ (D) $\frac{\varepsilon}{\varepsilon_0}$

38. A convex lens is dipped in a liquid whose refractive index is equal to refractive index of lens material. Then its focal length will

(A) become infinite (B) remain same
(C) decrease (D) become zero

39. A convex lens A of focal length 20 cm and a concave lens B of focal length 56 cm are kept along the same axis with the distance d between them. If a parallel beam of light falling on A leaves B as a parallel beam, then the magnitude of distance d (in cm) is

(A) 25 (B) 36
(C) 30 (D) 50

40. The thickness of a plate having refractive index μ which will produce a change in optical path equal to half the wavelength λ of the light passing through it is

(A) $\frac{\lambda}{4(\mu-1)}$ (B) $\frac{\lambda}{(\mu-1)}$
(C) $\frac{3\lambda}{4(\mu-1)}$ (D) $\frac{\lambda}{2(\mu-1)}$

41. In Young's double slit experiment the intensity at a point on the screen is K, where path difference is λ. What will be the intensity at the point where path difference is $\frac{\lambda}{4}$?

(A) $\frac{K}{4}$ (B) $\frac{K}{2}$
(C) K (D) 0

42. In Young's double slit experiment with monochromatic light, fringes are obtained on a screen placed at some distance from the slits. If the screen is moved by 5×10^{-2} m towards the slits, the change in fringe width is 3×10^{-5} m. If the separation between the slits is 10^{-3} m, the wavelength of light used is

(A) 6000Å (B) 5000Å
(C) 45000Å (D) 3000Å

43. In a photoelectric emission experiment, the stopping potential for a given metal is V volt, when radiation of wavelength λ is used. If radiation of wavelength 2λ is used with the same metal, then the stopping potential (in volt) will be

[c = velocity of light, e = charge on electron, h = Planck's constant]

(A) $V - \frac{hc}{2e\lambda}$ (B) $V + \frac{hc}{2e\lambda}$

(C) $\frac{V}{2}$ (D) $2V$

44. Electrons of mass m with de-Broglie wavelength λ fall on the target. The cut-off wavelength λ_0 is equal to [h = Planck's constant, C = velocity of light]

(A) $\frac{2mc\lambda^2}{h}$ (B) $\frac{mc\lambda}{h}$

(C) $\frac{2h}{mc\lambda^2}$ (D) $\frac{2mc\lambda}{h}$

45. If the potential difference used to accelerate electrons is doubled, by what factor does the de-Broglie wavelength associated with the electrons change?

(A) Wavelength is increased to $\sqrt{2}$ times.

(B) Wavelength is decreased to $\sqrt{2}$ times.

(C) Wavelength is decreased to $\frac{1}{\sqrt{2}}$ times.

(D) Wavelength is increased to $\frac{1}{\sqrt{2}}$ times.

46. An electron is moving in an orbit around the nucleus in an atom. Let m, b orbital magnetic moment and L be angular momentum of the electron, then

(A) m and L are in opposite direction perpendicular to the plane of orbit.

(B) m and L are in opposite direction parallel to the plane of orbit.

(C) m and L are in the same direction perpendicular to the plane of the orbit.

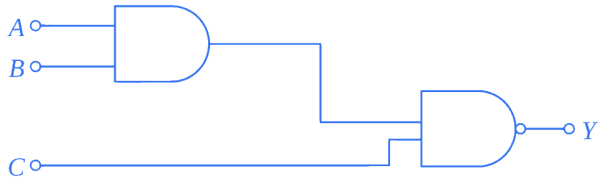
(D) m and L are in the same direction parallel to plane of the orbit.

47. If E and L denote the magnitudes of total energy and of angular momentum of electron in Bohr orbit then the true relation between them is

(A) $L \propto \frac{1}{\sqrt{E}}$ (B) $E \propto \frac{1}{L}$

(C) $E \propto L$ (D) $L \propto \sqrt{E}$

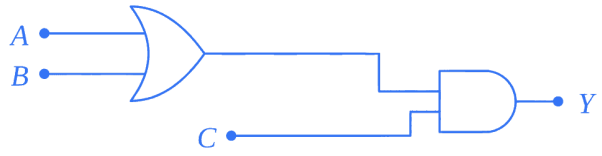
48. For the following combination of logic gates, when all the three inputs A, B and C are first 'high' and then 'low', the output Y will be respectively.



(A) 0,0 (B) 0,1

(C) 1,0 (D) 1,1

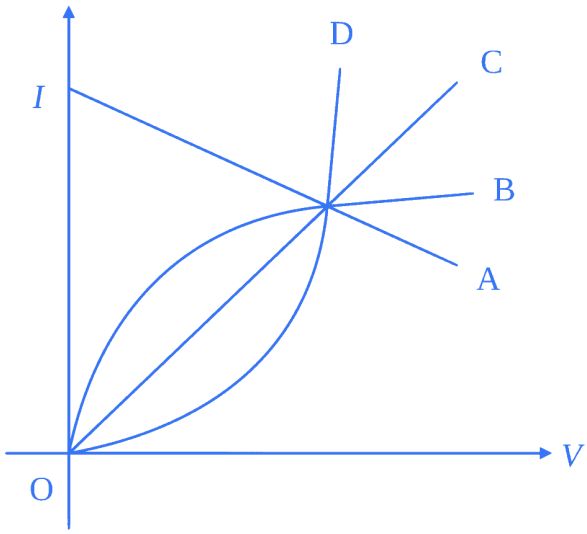
49. To get an output 1 from the logic circuit shown in the figure, the input can be



(A) A=1, B=0, C=0 (B) A=1, B=0, C=1

(C) A=1, B=1, C=0 (D) A=0, B=0, C=1

50. Which one of the following graph represents forward bias characteristic of a diode?



(A) C (B) B

(C) D (D) A

51. What is the volume occupied by 32 g methane gas at STP?

(A) $56.0dm^3$ (B) $33.6dm^3$

(C) $22.4dm^3$ (D) $44.8dm^3$

52. Which of the following compounds is octahedral?

(A) TeF_4 (B) $SeCl_2$

(C) SF_6 (D) SeF_4

53. Identify a molecule having bent shape from following.

(A) SO_2 (B) $BeBr_2$

(C) CO_2 (D) BF_3

54. Which of the following gases is difficult to liquefy?

(A) O_2 (B) SO_2

(C) Cl_2 (D) NH_3

55. If the mixture of $7g$ of N_2 and $8g$ of Ar in a cylinder has the total pressure 27bar. What is the partial pressure of N_2 ? (Atomic mass of $N = 14\ g\ mol^{-1}$, $Ar = 40\ g\ mol^{-1}$)

(A) 18 bar (B) 12 bar

(C) 15 bar (D) 9 bar

56. A gas is allowed to expand against a constant external pressure of 2.5 bar from an initial volume of 2.5 L to a final volume of 4.5 L. What is amount of work done?

(A) -375 J (B) -650 J

(C) -250 J (D) -500 J

57. What is internal energy change when 2 moles of an ideal gas at 25°C is compressed isothermally and reversibly from 1.0 bar to 10.0 bar?

(A) zero kJ (B) 34.23 kJ

(C) 22.82 kJ (D) 11.41 kJ

58. What is the internal energy change when XJ of work is done on the system and YJ of heat is transferred to surrounding?

(A) $X + YJ$ (B) XYJ

(C) $Y - XJ$ (D) $X - YJ$

59. The percent dissociation of weak monobasic acid is 3% in its 0.02M solution. What is the dissociation constant of acid?

(A) 9×10^{-4} (B) 3×10^{-2}

(C) 2×10^{-2} (D) 1.8×10^{-5}

60. The $[H^+]$in lemon juice is found to be 0.0063M. What is pH value of lemon juice $(\log 6.3 = 0.7993)$?

(A) 2.8 (B) 3.8

(C) 5.2 (D) 2.2

61. Which among the following is an example of salt of weak acid and strong base?

(A) Na_2So_4 (B) NH_4CN

(C) KCN (D) KCl

62. Which of following salt's solubility increases appreciably with increase in temperature?

(A) NaBr (B) NaCl

(C) KCl (D) KNO_3

63. What is oxidation number of oxygen in super oxide?

(A) MO_2 (B) +1

(C) $-\frac{1}{2}$ (D) $\frac{1}{2}$

64. Which among the following is used in the breathing equipment for mountaineers?

(A) Na_2O_2 (B) KO_2

(C) CaO (D) Li_2O

65. IUPAC name of anisole is

(A) 1-propoxybenzene (B) 2-propoxybenzene

(C) methoxybenzene (D) ethoxybenzene

66. Which among the following is dicarboxylic acid?

(A) Valeric acid (B) Caproic acid

(C) Glutaric acid (D) Butyric acid

67. Which free radical from following is least stable?

(A) $\dot{C}H_3$ (B) $CH_3 - C\dot{H}_2$

(C) $(CH_3)_3C$ (D) $(CH_3)_{22}\dot{C}H$

68. Which of the following alkanes is used for road surfacing?

(A) $C_{20}H_{42}$ to $C_{24}H_{50}$ (B) $C_{36}H_{74}$ and above

(C) $C_{10}H_{22}$ to $C_{12}H_{26}$ (D) $C_{15}H_{32}$ to $C_{19}H_{40}$

69. The reaction of aryl halide with sodium metal in dry ether to give biphenyl is known as

(A) Fittig reaction (B) Wurtz reaction

(C) Swartz reaction (D) Wurtz-Fittig reaction

70. Which among the following compounds is obtained as a major product X in reaction given below? Anisole $\xrightarrow[\text{AlCl}_3\text{ (anhydrous)}]{\text{acetylchloride}} X$

(A) 2-Methoxy acetophenone (B) 4-Methoxy acetophenone

(C) 4-Methoxy toluene (D) 2-Methoxy toluene

71. Which among the following is an example of 2-dimensional nanostructure?

(A) Microcapsules (B) Nanowires

(C) Thin films (D) Nanorings

72. Edge length of unit cell of a crystal is 288pm. If its density is $7.2\ \text{g cm}^{-3}$ determine the type of unit cell (cat mass $= 52$).

(A) Hexagonal cubic (B) Simple cubic close

(C) Face centered cubic (D) Body centered cubic

73. Lithium forms BCC structure having edge length of unit cell 351pm then atomic radius of lithium is

(A) 75 pm (B) 152 pm

(C) 180 pm (D) 210 pm

74. If M is atomic mass of element and a is edge length of unit cell then the formula to calculate density is

(A) $\rho = \frac{nM}{a^3N_A}$ (B) $\rho = \frac{a^3N_A}{n\times M}$

(C) $\rho = \frac{a^3M}{nN_A}$ (D) $\rho = \frac{MN_A}{a^3n}$

75. Which among the following is NOT ferromagnetic in nature?

(A) Fe (B) Zn

(C) Ni (D) Co

76. Calculate freezing point of a 0.05 molal aqueous solution of a nonelectrolyte?

(A) 186 K (B) 272.9 K

(C) 93 K (D) 278 K

77. What is vapour pressure of a solution containing $1.8g$ glucose in 16. 2 g of water if vapour pressure of water is 32 mmHg ?

(A) 22. 2 mmHg (B) 26. 6 mmHg

(C) 24. 6 mmHg (D) 31. 7 mmHg

78. What is the value of conductivity of 0.01M solution of an electrolyte having molar conductivity $141\Omega^{-1}\ \text{cm}^2\ \text{mol}^{-1}$?

(A) $5.64\times10^{-3}\Omega^{-1}\ \text{cm}^{-1}$

(B) $1.41\times10^{-3}\Omega^{-1}\ \text{cm}^{-1}$

(C) $4.23\times10^{-3}\Omega^{-1}\ \text{cm}^{-1}$

(D) $7.09\times10^{-3}\Omega^{-1}\ \text{cm}^{-1}$

79. What is the SI unit of conductivity?

(A) Ωmol^{-1} (B) $\Omega^{-1}\ \text{cm}^2\ \text{mol}^{-1}$

(C) $\Omega^{-1}\ \text{cm}^{-1}$ (D) $\Omega^{-1}\ \text{mol}^{-1}$

80. What will be the weight of Al deposited at cathode, when 0.5 faraday of electricity is passed through aqueous solution of $AlCl_3$? (at mass of Al $= 27$)

(A) 4.5 g (B) 13.5 g

(C) 40.5 g (D) 3.0 g

81. The rate law for a reaction between reactants A, B and C is $r = K[A][B][C]^2$, if concentration of A is halved, then rate of reaction

(A) increase $\frac{1}{2}$ times (B) remains the same

(C) decreases $\frac{1}{2}$ times (D) increase 2 times

82. Which of the following is an example of first order reaction?

(A) $2NH_3(\text{ g}) \rightarrow N_2(\text{ g}) + 3H_2(\text{ g})$

(B) $2H_2O(\text{l}) \rightarrow 2H_2O(\text{l}) + O_2(\text{ g})$

(C) $4PH_3 \xrightarrow{\text{W}} P_4 + 6H_2(\text{ g})$

(D) $2\ N_2O(\text{g}) \xrightarrow{\text{Pt}} 2\ N_2(\text{ g}) + O_2(\text{ g})$

83. Time required for 90% completion of a first order reaction is t. What is the time required for 99.9% completion of reaction?

(A) t (B) $\frac{t}{2}$

(C) $2t$ (D) $3t$

84. Identify the gases used to fill in electric bulbs?

(A) Ar and N_2 (B) He and O_2

(C) He and N_2 (D) Ne and He

85. Which among the following elements in their respective oxidation states develops lowest spin only magnetic moment? (Atomic number $Cu = 29$, $Fe = 26$, $Ni = 28$, $Co = 27$)

(A) Co^{2+} (B) Cu^{2+}

(C) Fe^{2+} (D) Ni^{2+}

86. What is total number of unpaired electrons present in observed electronic configuration of $Cr(Z = 24)$?

(A) 4 (B) 5

(C) 6 (D) 3

87. Identify the number of unpaired electrons present and the geometry respectively of a complex $[CoF_6]^{3-}$(given atomic number $Co = 27$)

(A) 4, Octahedral (B) 2 , trigonal bipyramidal

(C) 0 , Octahedral (D) 0 , trigonal bipyramidal

88. Identify a formula of coordinates complex Bis(ethylenediamine) dithiocyanatoplatinum (IV).

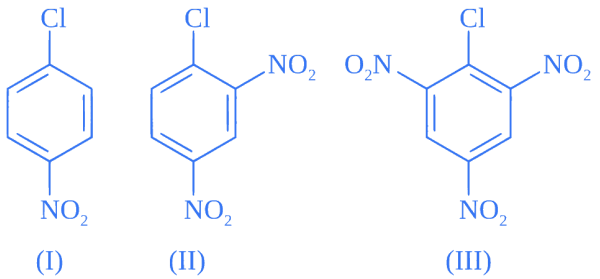
(A) $[Pt(en)_2(NCS)_2]^{4+}$

(B) $[Pt(en)_2(SCN)_2]^{2+}$

(C) $[Pt_4(NH_3)_2(NCS)_2]$

(D) $[Pt(NH_3)_4(\ S_2CN)]^{2+}$

89. The correct order of reactivity for reactions involving cleavage of $C-X$ bond in following compounds is



(I) (II) (III)

(A) I>III>II (B) III>II>I

(C) I>II>III (D) II>III>I

90. Which among the following has highest melting point?

(A) P - Cresol (B) P - Nitrophenol

(C) O-Nitrophenol (D) Phenol

91. Which of the following compounds has difficulty in breaking $C-X$ bond?

(A) O-nitrochlorobenzene

(B) P - nitrochlorobenzene

(C) m-nitrochlorobenzene

(D) 2, 4, 6-trinitrochlorobenzene

92. Identify the product ' B ' in following sequence of reaction.

Methyl magnesium bromide $\xrightarrow{CdCl_2}$ A $\xrightarrow{CH_3COCl}$ B

(A) Dimethyl Cadmium (B) Butanone

(C) Propanone (D) Propanol

93. Which of the following reagents is used in Gatterman-Koch formylation of arene?

(A) CO, $HCl/AlCl_3$ (anhydrous) (B) CrO_2Cl_2, CS_2

(C) CrO_3 (D) $Cl_2/hv, H_3O^+$

94. Which among the following is a correct order of p^{kb} values of amines?

(A) $R-NH_2 > NH_3 > R_2NH < R_3\ N$

(B) $R_3\ N > R_2-NH > R-NH_2 > NH_3$

(C) $R_2NH > R_3\ N > R-NH_2 > NH_3$

(D) $NH_3 > R-NH_2 > R_2NH < R_3\ N$

95. How many moles of ethyl bromide is required for formation of 1 mole N, N - Di ethyl ethanamine from ethyl amine?

(A) 1 (B) 2

(C) 3 (D) 4

96. How many secondary hydroxyl groups are present in glucose?

(A) 3 (B) 5

(C) 2 (D) 4

97. Which among the following compounds contains both, amino and carboxyl groups in it?

(A) Lactic acid (B) Acetamide

(C) Glycerol (D) Glycine

98. Which of the following sugar is present in nucleotide of RNA?

(A) L-GlucoseD-Ribose (B) D-Ribose

(C) L-Threose (D) D-Fructose

99. Urea formaldehyde resin is an example of

(A) Elastomer (B) Fibers

(C) Thermoplastic polymer (D) Thermosetting polymer

100. Which of following monomers is used in preparation of PAN?

(A) $HO(CH_2)_2OH$ (B) $CH_2 = CH - CN$

(C) $F_2C = CF_2$ (D) $CH_2 = CH - Cl$

101. The domain and range for the function $f(x) = e^{|x| \sin x}$ are domain = IR

(A) range $= [0, \infty)$ domain = IR
(B) range $= [1, \infty)$ domain = IR
(C) range = IR domain $= IR$
(D) range $= (0, \infty)$

102. The value of $(\cos\alpha + \cos\beta)^2 + (\sin\alpha + \sin\beta)^2$ is

(A) $2\sin^2\left(\frac{\alpha-\beta}{2}\right)$
(B) $2\cos^2\left(\frac{\alpha-\beta}{2}\right)$
(C) $4\cos^2\left(\frac{\alpha-\beta}{2}\right)$
(D) $4\sin^2\left(\frac{\alpha-\beta}{2}\right)$

103. With usual notations in $\triangle ABC$ if $a^2 + b^2 - c^2 = ab$, then measure of angle C is

(A) $\frac{\pi}{4}$
(B) $\frac{\pi}{6}$
(C) $\frac{\pi}{2}$
(D) $\frac{\pi}{3}$

104. The Cartesian form of complex number $z = 4(\cos 300^\circ)$, where $i = \sqrt{1}$ is

(A) $2 - 2\sqrt{3}i$
(B) $1 + \sqrt{3}i$
(C) $1 - \sqrt{3}i$
(D) $2 + 2\sqrt{3}i$

105. If the Cartesian co-ordinates of a point are $\left(\frac{-5\sqrt{3}}{2}, \frac{5}{2}\right)$, then its polar co-ordinates are

(A) $\left(5, \frac{2\pi}{3}\right)$
(B) $\left(5, \frac{13\pi}{18}\right)$
(C) $\left(5, \frac{5\pi}{6}\right)$
(D) $\left(5, \frac{11\pi}{18}\right)$

106. $N(3, -4)$ is the foot of the perpendicular drawn from the orgin to a line L. Then the equation of the line L is

(A) $4x - 3y - 24 = 0$
(B) $x - y - 7 = 0$
(C) $3x - 4y - 25 = 0$
(D) $4x + 3y = 0$

107. If sum of the slopes of lines represented by $x^2 - 2xy\tan\theta - y^2 = 0$ is 4 , then $\theta =$

(A) $\tan^{-1}(-1)$
(B) $\tan^{-1}(1)$
(C) $\tan^{1}(2)$
(D) $\tan^{-1}(-2)$

108. The joint equation of the lines passing through the origin and trisecting the first quadrant is

(A) $\sqrt{3}\ x^2 - 4xy + \sqrt{3}\ y^2 = 0$
(B) $x^2 - \sqrt{3}xy - y^2 = 0$
(C) $3x^2 - y^2 = 0$
(D) $x^2 + \sqrt{3}xy - y^2 = 0$

109. The parametric equations of the circle $x^2 + y^2 - 6x - 2y + 9 = 0$ are

(A) $x = 1 + \cos\theta, y = 3 + \sin\theta$
(B) $x = 3 + \cos\theta, y = 1 + \sin\theta$
(C) $x = 3 + \sin\theta, y = 1 + \cos\theta$
(D) $x = 3 + \sin\theta, y = 1 + \cos\theta$

110. $\lim_{x\to 1} \frac{2^{2x-2} - 2^x + 1}{\sin^2(x-1)} =$

(A) $\frac{1}{2}(\log 2)^2$
(B) $(\log 2)^2$
(C) $2\ \log 2$
(D) $2(\log 2)^2$

111. If $(p \wedge \sim r) \to (\sim p \vee q)$ has truth value ' F ', then truth values of p, q and r are respectively

(A) F,F,T
(B) T,T,T
(C) T,F,F
(D) F,F,F

112. If p : A man is happy, q : A man is rich, then the symbolic form of ' A man is neither happy nor rich' is

(A) $\sim p \wedge q$
(B) $\sim p \vee \sim q$
(C) $p \vee q$
(D) $\sim (p \vee q)$

113. The value of $\tan^{-1}\left(\frac{1}{3}\right) + \tan^{-1}\left(\frac{1}{5}\right) + \tan^{-1}\left(\frac{1}{7}\right) + \tan^{-1}\left(\frac{1}{8}\right)$ is

(A) $\frac{4\pi}{3}$
(B) $\frac{\pi}{4}$
(C) $\frac{2\pi}{4}$
(D) $\frac{3\pi}{4}$

114. If $A = \begin{bmatrix} 1 & -1 & 1 \\ 0 & 2 & -3 \\ 2 & 1 & 3 \end{bmatrix}$ and $B = \text{adj}A, C = 54$, then $\frac{|\text{adj}B|}{|C|} =$

(A) 5
(B) 25
(C) -1
(D) 1

115. If $A = \begin{bmatrix} 2 & -3 \\ 5 & -7 \end{bmatrix}$, then $A - A^{-1} =$

(A) $\begin{bmatrix} -5 & 0 \\ 0 & -5 \end{bmatrix}$ (B) $\begin{bmatrix} 3 & 2 \\ 10 & 3 \end{bmatrix}$

(C) $3\begin{bmatrix} 3 & -2 \\ \frac{10}{3} & -3 \end{bmatrix}$ (D) $5\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$

116. If $A = \begin{bmatrix} 2 & -1 \\ -1 & 2 \end{bmatrix}$ such that $A^2 - 4A + 3I = 0$, where I is a unit matrix of order 2 , then A^{-1} is

(A) $\frac{1}{3}\begin{bmatrix} -2 & 1 \\ 1 & -2 \end{bmatrix}$ (B) $\frac{1}{3}\begin{bmatrix} 2 & -1 \\ -1 & 2 \end{bmatrix}$

(C) $\frac{1}{3}\begin{bmatrix} 2 & 1 \\ 1 & 2 \end{bmatrix}$ (D) $\frac{1}{3}\begin{bmatrix} -1 & 2 \\ 2 & -1 \end{bmatrix}$

117. $f(x) = \begin{cases} \frac{x-4}{\lvert x-4\rvert} + a, & \text{for } x < 4 \\ a + b, & \text{for } x = 4 \\ \frac{x-4}{\lvert x-4\rvert} + b, & \text{for } x > 4 \end{cases}$ Is continuous at $x = 4$, then

(A) a=0,b=0 (B) a=1,b=1

(C) a=-1,b=1 (D) a=1,b=-1

118. If $xy = \tan^{-1}(xy) + \cot^{-1}(xy)$, then $\left(\frac{dy}{dx}\right)_{(4,2)} =$ (where $x, y \in IR$)

(A) $\frac{-1}{2}$ (B) -2

(C) 2 (D) $\frac{1}{2}$

119. If $x = \sqrt{a^{\sin^{-1}t}}$ and $y = \sqrt{a^{\cos^{-1}t}}$, then $\frac{dy}{dx} =$

(A) $\frac{y}{x}$ (B) $\frac{-x}{y}$

(C) $\frac{x}{y}$ (D) $-\frac{y}{x}$

120. If $\log(x + y) = \log xy + 3$, then $\frac{dy}{dx} =$

(A) $\left(\frac{y}{x}\right)^2$ (B) $-\left(\frac{x}{y}\right)^2$

(C) $-\left(\frac{y}{x}\right)^2$ (D) $\left(\frac{x}{y}\right)^2$

121. If $x = t^2$ and $y = 2t$ are parametric equations of a curve, then equation of the normal to the curve at $t = 2$ is

(A) $2x + y - 12 = 0$ (B) $x + y - 8 = 0$

(C) $x + 2y - 12 = 0$ (D) $2x + 3y - 20 = 0$

122. The function, $f(x) = x\sqrt{1-x}$, where $x \in (0, 1)$, has local maximum at $x =$

(A) $\frac{1}{3}$ (B) $\frac{1}{4}$

(C) $\frac{2}{3}$ (D) $\frac{3}{4}$

123. If the water is being poured at the rate 36 $m^3/$ sec in cylindrical vessel of base radius 3 m, then the rate at which water level is rising, is

(A) $\frac{4}{\pi}$m/ sec (B) 4πm/ sec

(C) $\frac{\pi}{4}$ m/ sec (D) $\frac{3}{\pi}$m/ sec

124. $\int \frac{dx}{2+\cos x} =$ (Where C is a constant of integration.)

(A) $\frac{2}{\sqrt{3}}\tan^{-1}\left(\frac{\tan\left(\frac{x}{2}\right)}{2\sqrt{3}}\right) + C$

(B) $\frac{1}{2\sqrt{3}}\tan^{-1}\left(\frac{\tan\left(\frac{x}{2}\right)}{2\sqrt{3}}\right) + C$

(C) $\frac{1}{\sqrt{3}}\tan^{-1}\left(\frac{\tan\left(\frac{x}{2}\right)}{\sqrt{3}}\right) + C$

(D) $\frac{2}{\sqrt{3}}\tan^{-1}\left(\frac{\tan\left(\frac{x}{2}\right)}{\sqrt{3}}\right) + C$

125. $\int \frac{x}{\sqrt{1-2x^4}}\,dx =$ (Where C is a constant of integration)

(A) $\frac{1}{2\sqrt{2}}\sin^{-1}\left(\sqrt{2}x^2\right) + C$

(B) $\frac{1}{2\sqrt{2}}\sin^{-1}\left(2\sqrt{2}x^2\right) + C$

(C) $\frac{1}{2}\sin^{-1}(2x) + C$

(D) $\frac{1}{\sqrt{2}}\sin^{-1}(\sqrt{2}x) + C$

126. $\int \frac{\sin 4x}{\sin x}\,dx =$ (where C is a constant of integration.)

(A) $\frac{\sin 3x}{3} + 4\sin x + C$

(B) $\frac{1}{3}\sin 3x - \frac{2}{3}\sin x + C$

(C) $\frac{2\sin 3x}{3} + 2\sin x + C$

(D) $\frac{2}{3}\sin 3x - 2\sin x + C$

127. $\int_{-1}^{1} \log\left(\frac{2-x}{2+x}\right) dx =$

(A) 1 (B) -1

(C) 0 (D) 2

128. $\int_0^{\frac{\pi}{4}} \sec^4 x dx =$

(A) $\frac{2}{3}$ (B) $\frac{1}{3}$

(C) $\frac{4}{3}$ (D) 1

129. The area bounded by the curve, $y = -x^2$, x-axis, $x = 1$ and $x = 4$, is

(A) 21 sq. units (B) 10 sq. units

(C) 20 sq. units (D) $\frac{21}{2}$ sq. units

130. Water at 100°C cools in 10 minutes to 80°C in a room temperature of 25°C, then the temperature of water after 20 minutes will be

(A) 65.33°C (B) 69.33°C
(C) 60.33°C (D) 63.33°C

131. The differential equation whose solution is $y = c^2 + \frac{c}{x}$, where c is constant, is

(A) $x^4\left(\frac{dy}{dx}\right)^2 - x\frac{dy}{dx} - y = 0$

(B) $x^2\left(\frac{dy}{dx}\right)^2 + \frac{dy}{dx} - y = 0$

(C) $x\left(\frac{dy}{dx}\right)^2 - x^2\frac{dy}{dx} + y = 0$

(D) $x^4\left(\frac{dy}{dx}\right)^2 - \frac{dy}{dx} + y = 0$

132. The particular solution of the differential equation $(2x - 2y + 3)dx - (x - y + 1)dy = 0$ when $x = 0, y = 1$ is

(A) $x - 2y - \log(x - y + 2) + 2 = 0$

(B) $x - y - \log(x - y + 2) + 1 = 0$

(C) $2x + y - \log(x - y + 2) - 1 = 0$

(D) $2x - y - \log(x - y + 2) + 1 = 0$

133. The differential equation $y' = \frac{y}{x+\sqrt{xy}}$ has general solution given by (Where C is a constant of integration.)

(A) $y = Ce^{2\sqrt{xy}}$ (B) $y = Ce^{2\left(\sqrt{\frac{y}{x}}\right)}$
(C) $y = Ce^{2\left(\sqrt{\frac{x}{y}}\right)}$ (D) $y = Ce^{-2\sqrt{xy}}$

134. The general solution of the differential equation $\frac{dy}{dx} = 1 - x + y - xy$ is (where C is a constant of integration)

(A) $\log(1 + y) = x + \frac{x^2}{2} + C$

(B) $\log(1 - x) = \log(1 + y) + y + C$

(C) $\log(1 + y) = y - \frac{x^2}{2} + C$

(D) $\log(1 + y) = x - \frac{x^2}{2} + C$

135. If $\bar{a} = \hat{i} + \hat{j} + \hat{k}, \bar{b} = \hat{i} - \hat{j} + 2\hat{k}, \bar{c} = x\hat{i} + (x - 2)\hat{j} - \hat{k}$ and $\bar{c}$ is linear combination of $\bar{a}$ and $\bar{b}$, then x has the value

(A) 1 (B) -2
(C) 0 (D) -4

136. The position vectors of vertices of $\triangle ABC$ are $4\hat{i} - 2\hat{j}$; $\hat{i} + 4\hat{j} - 3\hat{k}$ and $-\hat{i} + 5\hat{j} + \hat{k}$ respectively, then $m\angle ABC =$

(A) $\frac{\pi}{3}$ (B) $\frac{\pi}{4}$
(C) $\frac{\pi}{6}$ (D) $\frac{\pi}{2}$

137. If $\bar{a} + 2\bar{b} + 3\bar{c} = \bar{0}$ and $(\bar{b} \times \bar{b}) + (\bar{b} \times \bar{c}) + (\bar{c} \times \bar{a}) = \lambda(\bar{b} \times \bar{c})$, then λ has the value

(A) 4 (B) 5
(C) 3 (D) 6

138. If the area of the triangle with vertices $\hat{i} + y\hat{j}, \hat{i} + 2\hat{k}$ and $3\hat{j} + \hat{k}$ is $\sqrt{6}$ sq. units, then the values of y are

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

139. If $\overline{AB} = (2\hat{i} + 3\hat{j} - \hat{k})$ and $A(1, 2, -1)$ is the given point, then the coordinates of B are

(A) (2,4,1) (B) (3,5,2)
(C) (3,5,-2) (D) (2,4,-1)

140. The Cartesian equation of a line is $\frac{x+2}{3} = \frac{y-4}{2} = \frac{z-5}{5}$, then the vector equation of the line is

(A) $\bar{r} = (-2\hat{i} + 4\hat{j} + 5\hat{k}) + \lambda(3\hat{i} + 2\hat{j} + 5\hat{k})$

(B) $\bar{r} = (2\hat{i} - 4\hat{j} - 5\hat{k}) + \lambda(-3\hat{i} + 2\hat{j} - 5\hat{k})$

(C) $\bar{r} = (-2\hat{i} + 4\hat{j} + 5\hat{k}) + \lambda(10\hat{i} + 25\hat{j} - 16\hat{k})$

(D) $\bar{r} = (3\hat{i} + 2\hat{j} + 5\hat{k}) + \lambda(10\hat{i} + 25\hat{j} - 16\hat{k})$

141. The equation of the plane passing through the points $(1, 2, 3)$, $(-1, 4, 2)$ and $(3, 1, 1)$ is

(A) $5x + 6y + 2z - 23 = 0$

(B) $5x + y + 2z - 13 = 0$

(C) $5x + y + 12z - 43 = 0$

(D) $5x + y + 12z - 43 = 0$

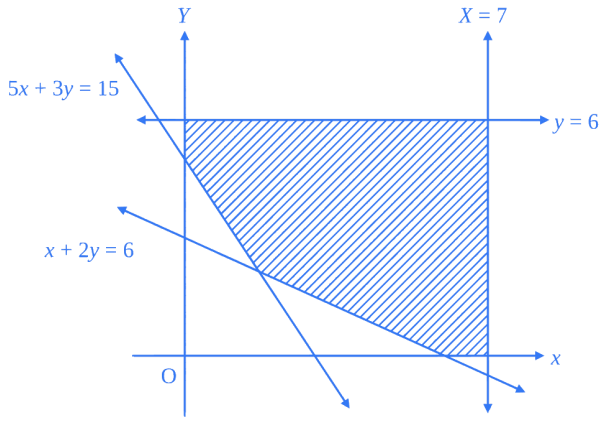
142. The distance between the lines $\frac{x}{2} = \frac{y}{-1} = \frac{z}{2}$ and $\frac{x-1}{2} = \frac{y-1}{-1} = \frac{z-2}{2}$ is

(A) $\sqrt{3}$ units (B) $\sqrt{2}$ units
(C) 1 unit (D) 2 units

143. If the planes $\bar{r} \cdot (2\hat{i} - \lambda\hat{j} + \hat{k}) = 3$ and $\bar{r} \cdot (4\hat{i} - \hat{j} + \mu\hat{k}) = 5$ are paralle, then values of λ and μ are respectively

(A) $\frac{1}{2}, 2$ (B) $\frac{-1}{2}, 2$
(C) $\frac{1}{2}, -2$ (D) $\frac{-1}{2}, -2$

144. For the following shaded region, the linear constraints are



(A) $x + 2y \leq 6, 5x + 3y \leq 15, x \leq 7, y \leq 6, x, y \geq 0$

(B) $x + 2y \leq 6, 5x + 3y \geq 15, x \leq 7, y \leq 6, x, y \geq 0$

(C) $x + 2y \geq 6, 5x + 3y \leq 15, x \leq 7, y \leq 6, x, y \geq 0$

(D) $x + 2y \geq 6, 5x + 3y \geq 15, x \leq 7, y \leq 6, x, y \geq 0$

145. For the following frequency distribution

X	5	6	7	8	10
Frequency	3	7	4	2	4

The variance is

(A) 2.85 (B) 2.18

(C) 2.37 (D) 2.49

146. A player tosses 2 fair coins. He with Rs. 5 if 2 heads appear, Rs. 2 if 1 head appears and Rs. 1 if no head appear, then the variance of his winning amount is

(A) $\frac{9}{4}$ (B) 6

(C) $\frac{5}{2}$ (D) $\frac{17}{2}$

147. In a certain examination, a candidate has to pass in each of the 5 subjects. Hence, the number of ways he can fail is

(A) 5! (B) 5

(C) $2^5 - 1$ (D) 2^5

148. In a Binomial distribution, $n = 4$ and $2P(X = 3) = 3P(X = 2)$, then $q =$

(A) $\frac{2}{13}$ (B) $\frac{11}{13}$

(C) $\frac{9}{13}$ (D) $\frac{4}{13}$

149. There are 2 shelves. One shelf has 5 Physics and 3 Bilogy books and other has 4 Physics and 2 Biology books. Then probability of drawing a Physics book is

(A) $\frac{1}{2}$ (B) $\frac{31}{48}$

(C) $\frac{9}{14}$ (D) $\frac{9}{38}$

150. If the function $P[X = x] = \begin{cases} \frac{K \cdot 2^x}{x!}, & x = 0, 1, 2, 3 \\ 0, & \text{otherwise} \end{cases}$ Forms p.m.f., then value of K is

(A) $\frac{5}{19}$ (B) $\frac{2}{19}$

(C) $\frac{3}{19}$ (D) $\frac{1}{19}$

- End of Question Paper -