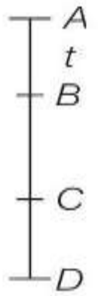
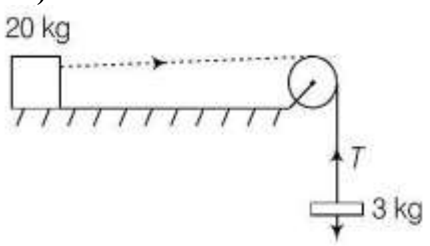
Physics

1. **Electron microscope is based on the principle of**
   (a) photoelectric effect
   (b) wave nature of electron
   (c) superconductivity
   (d) laws of electromagnetic induction
2. **Force is given by the expression, $F = A\cos(Bx) + C\cos(Dt)$, where x is displacement and t is time. The dimension of $\left(\frac{D}{B}\right)$ is same as that of**
   (a) velocity
   (b) velocity gradient
   (c) angular velocity
   (d) angular momentum
3. **A car accelerates from rest with $2\ m/s^2$ on a straight -line path and then comes to rest after applying brakes. Total distance travelled by the car is 100 m in 20 seconds. Then, the maximum velocity attained by the car is**
   (a) $10\ m/s$ (b) $20\ m/s$
   (c) $15\ m/s$ (d) $5\ m/s$
4. **A body is falling freely from a point A at a certain height from the ground and passes through points B, C and D (vertically as shown below) so that BC = CD. The time taken by the particle to move from B to C is 2 s and from C to D is 1 s . Time taken to move from A to B**



in seconds is
(a) 0.6 (b) 0.5
(c) 0.2 (d) 0.4

5. **A particle moves from $(1,0,3)$ to the point $(-3,4,5)$, when a force $F = \hat{i} + 5\hat{k}$ acts on it. Amount of work done in joules is**
   (a) 14 (b) 10 (c) 6 (d) 15
6. **A particle is projected with velocity $2\sqrt{gh}$ and at an angle 60° to the horizontal so that it just clears two walls of equal height h which are at a distance 2h from each other. The time taken by the particle to travel between these two walls is**
   (a) $2\sqrt{\frac{2h}{g}}$ (b) $\sqrt{\frac{h}{2g}}$
   (c) $2\sqrt{\frac{h}{g}}$ (d) $\sqrt{\frac{h}{g}}$
7. **A body of mass 20 kg is moving on a rough horizontal plane. A block of mass 3 kg is connected to the 20 kg mass by a string of negligible mass through a smooth pulley as shown in the below figure. The tension in the string is 27 N . The coefficient of kinetic friction between the heavier mass and the surface is ($g = 10\ m/s^2$)**



(a) 0.025 (b) 0.035
(c) 0.35 (d) 0.25

8. Two masses m_1 and m_2 are placed on a smooth horizontal surface and are connected by a string of negligible mass. A horizontal force F is applied on the mass m_2 as shown in the figure. The tension in the string is

(a) $\left(\frac{m_1}{m_1+m_2}\right) F$ (b) $\frac{m_2 F}{m_1+m_2}$

(c) $\left(\frac{m_1}{m_2}\right) F$ (d) $\frac{m_2 F}{m_1}$

9. A body of mass 3 kg moving with a velocity $(2\hat{i}+3\hat{j}+3\hat{k}) m/s$ collides with another body of mass 4 kg moving with a velocity $(3\hat{i}+2\hat{j}-3\hat{k}) m/s$. The two bodies stick together after collision. The velocity of the composite body is

(a) $\frac{1}{7}(4\hat{i}+6\hat{j}-3\hat{k})$ (b) $\frac{1}{7}(18\hat{i}+17\hat{j}-3\hat{k})$

(c) $\frac{1}{7}(6\hat{i}+4\hat{j}-6\hat{k})$ (d) $\frac{1}{7}(9\hat{i}+8\hat{j}-6\hat{k})$

10. A simple pendulum of length L carries a bob of mass m. When the bob is at its lowest position, it is given that the minimum horizontal speed necessary for it to move in a vertical circle about the point of suspension. When the string is horizontal, the net force on the bob is

(a) $\sqrt{10}$mg (b) $\sqrt{5}$mg

(c) 4 mg (d) 1 mg

11. A system of two particles is having masses m_1 and m_2. If the particle of mass m_1 is pushed towards the centre of mass of particles through a distance d, by what distance the particle of mass m_2 should be moved, so as to keep the centre of mass of particles at the original position?

(a) $\left(\frac{m_1}{m_1+m_2}\right) d$ (b) d

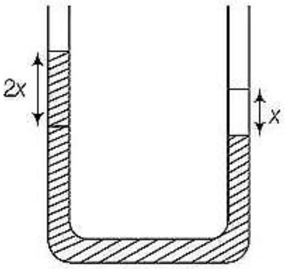
(c) $\left(\frac{m_1}{m_2}\right) d$ (d) $\left(\frac{m_2}{m_1}\right) d$

12. A thin uniform circular disc of mass M and radius R is rotating in a horizontal plane about an axis passing through its centre and perpendicular to its plane with an angular velocity ω. Another disc of same thickness and radius but of mass $\frac{1}{8}$M is placed gently on the first disc coaxially. The angular velocity of the system is now

(a) $\frac{8}{9}\omega$ (b) $\frac{5}{9}\omega$

(c) $\frac{1}{3}\omega$ (d) $\frac{2}{9}\omega$

13. 9 kg solution is poured into a glass U-tube as shown in the figure below. The tube's inner diameter is $2\sqrt{\frac{\pi}{5}}$ m and the solution oscillates freely up and down about its position of equilibrium $(x=0)$. The period of oscillation in seconds is $\left(1 \text{ m}^3\right.$ of solution has a mass $\mu = 900$ kg, $g = 10 \text{ m/s}^2$, ignore frictional and surface tension effects)



(a) 0.1 (b) 10 (c) $\sqrt{\pi}$ (d) 1

14. The bodies of masses 100 kg and 8100 kg are held at a distance of 1 m . The gravitational field at a point on the line joining them is zero. The gravitational potential at that point in J/kg is $\left(G = 6.67 \times 10^{-11} Nm^2/kg^2\right)$

(a) -6.67×10^{-7} (b) -6.67×10^{-10}

(c) -13.34×10^{-7} (d) -6.67×10^{-9}

15. An elastic spring of unstretched length L and force constant k is stretched by a small length x. It is further stretched by another small length y. Work done during the second stretching is

(a) $\frac{ky}{2}(x+2y)$ (b) $\frac{k}{2}(2x+y)$

(c) $ky(x+2y)$ (d) $\frac{ky}{2}(2x+y)$

16. A soap bubble of radius 1.0 cm is formed inside another soap bubble of radius 2.0 cm . The radius of an another soap bubble which has the same pressure difference as that between the inside of the smaller and outside of large soap bubble, in metres is

(a) 6.67×10^{-3} (b) 3.34×10^{-3}

(c) 2.23×10^{-3} (d) 4.5×10^{-3}

17. A slab of stone of area $3600\ cm^2$ and thickness 10 cm is exposed on the lower surface to steam at $100^\circ C$. A block of ice at $0^\circ C$ rests on upper surface of the slab. In one hour 4.8 kg of ice is melted. The thermal conductivity of the stone in $Js^{-1}\ m^{-1}k^{-1}$ is (Latent heat of ice $= 3.36 \times 10^5\ J/kg$)

(a) 12.0 (b) 10.5

(c) 1.02 (d) 1.24

18. The surface of a black body is at a temperature $727^\circ C$ and its cross-section is $1\ m^2$. Heat radiated from this surface in one minute in joules is (Stefan's constant $= 5.7 \times 10^{-8}\ W/m^2/k^4$)

(a) 34.2×10^5 (b) 2.5×10^5

(c) 3.42×10^5 (d) 2.5×10^6

19. Two moles of a gas is expanded to double its volume by two different processes. One is isobaric and the other is isothermal. If W_1 and W_2 are the works done, respectively then

(a) $W_2 = \frac{W_1}{\log e^2}$ (b) $W_2 = W_1$

(c) $W_2^2 = W_1$ loge ^{2} (d) $W_2 = W_1 \log_e(2)$

20. Uranium has two isotopes of masses 235 and 238 units. If both of them are present in uranium hexafluoride gas, find the percentage ratio of difference in rms velocities of two isotopes to the rms velocity of heavier isotope.

(a) 1.64 (b) 0.064

(c) 0.64 (d) 6.4

21. A source of frequency 340 Hz is kept above a vertical cylindrical tube closed at lower end. The length of the tube is 120 cm . Water is slowly poured in just enough to produce resonance. Then, the minimum height (velocity of sound $= 340\ m/s$) of the water level in the tube for that resonance is

(a) 0.75 m (b) 0.25 m

(c) 0.95 m (d) 0.45 m

22. A thin convex lens of focal length f made of crown glass is immersed in a liquid of refractive index $\mu_l(\mu_l > \mu_c)$, where μ_c is the refractive index of the crown glass. The convex lens now is

(a) a convex lens of longer focal length

(b) a convex lens of shorter focal length

(c) a divergent lens

(d) a convex lens of focal length $(\mu_c - \mu_l)f$

23. Two convex lenses of focal lengths f_1 and f_2 form images with magnification m_1 and m_2, when used individually for an object kept at the same distance from the lenses. Then, f_1/f_2 is

(a) $\frac{m_1(1-m_1)}{m_2(1-m_2)}$ (b) $\frac{m_1(1-m_2)}{m_2(1-m_1)}$

(c) $\frac{m_2(1-m_1)}{m_1(1-m_2)}$ (d) $\frac{m_2(1-m_2)}{m_1(1-m_1)}$

24. With the help of a telescope that has an objective of diameter 200 cm , it is proved that light of wavelengths of the order of 6400Å coming from a star can be easily resolved. Then, the limit of resolution is

(a) 39×10^{-8}deg (b) 39×10^{-8}rad

(c) 19.5×10^{-8}rad (d) 19.5×10^{-8}deg

25. Two charged identical metal spheres A and B repel each other with a force of 3×10^{-5} N. Another identical uncharged sphere C is touched with sphere A and then it is placed mid-way between A and B. Then, the magnitude of net force on C is

(a) 1×10^{-5} N (b) 3×10^{-5} N

(c) 2×10^{-5} N (d) 5×10^{-5} N

26. The electrostatic potential inside a charged sphere is given as $V = Ar^2 + B$, where r is the distance from the centre of the sphere, A and B are constants. Then, the charge density in the sphere is

(a) $16A\varepsilon_0$ (b) $-6A\varepsilon_0$
(c) $20A\varepsilon_0$ (d) $-15A\varepsilon_0$

27. Three unequal resistances are connected in parallel. Two of these resistances are in the ratio 1:2. The equivalent resistance of these three resistors connected in parallel is 1Ω. What is the highest resistance value among these three resistances if no resistance is fractional?

(a) 10Ω (b) 8Ω
(c) 15Ω (d) 6Ω

28. Two electric resistors have equal values of resistance R. Each can be operated with a power of 320 watts (W) at 220 volts. If the two resistors are connected in series to a 110 volts electric supply, then the power generated in each resistor is

(a) 90 watts (b) 80 watts
(c) 60 watts (d) 20 watts

29. A current of 1 A is flowing along the sides of an equilateral triangle of side 4.5×10^{-2} m. The magnetic field at the centroid of the triangle is ($\mu_0 = 4\pi \times 10^{-7}$ H/m)

(a) 4×10^{-5} T (b) 2×10^{-5} T
(c) 4×10^{-4} T (d) 2×10^{-4} T

30. A charged particle (charge = q; mass = m) is rotating in a circle of radius R with uniform speed V. Ratio of its magnetic moment (μ) to the angular momentum (L) is

(a) $\frac{q}{2m}$ (b) $\frac{q}{m}$ (c) $\frac{9}{4m}$ (d) $\frac{2q}{m}$

31. Two small magnets have their masses and lengths in the ratio 1:2. The maximum torques experienced by them in a uniform magnetic field are the same. For small oscillations, the ratio of their time periods is

(a) $\frac{1}{2\sqrt{2}}$ (b) $\frac{1}{\sqrt{2}}$
(c) $\frac{1}{2}$ (d) $2\sqrt{2}$

32. Two coils have mutual inductance 0.005 H . The current changes in the first coil according to equation $I = I_0 \sin \omega t$, where $I_0 = 10$ A and $\omega = 100\pi\,\text{rads}^{-1}$. The maximum value of induced emf in the second coil is

(a) 5 (b) 5π
(c) 0.5π (d) π

33. A capacitance of $\left(\frac{10^{-3}}{2\pi}\right)$ F and an inductance of $\left(\frac{100}{\pi}\right)$ mH and a resistance of 10Ω are connected in series with an AC voltage source of 220 V, 50 Hz. The phase angle of the circuit is

(a) 60° (b) 30°
(c) 45° (d) 90°

34. Two equations are given below:

(A) $\oint \mathbf{E} \cdot d\mathbf{A} = \frac{Q}{\varepsilon_0}$

(B) $\oint \mathbf{B} \cdot d\mathbf{A} = 0$

They are

(a) (A) Ampere's law
(B) Gauss law for electricity
(b) (A) Gauss law for electric fields
(B) Gauss law for magnetic fields
(c) (A) Faraday's law
(B) Gauss law for electric fields
(d) Both (A) and (B) represents Faraday's law

35. A charged particle is accelerated from rest through a certain potential difference. The de-Broglie wavelength is λ_1 when it is accelerated through V_1 and is λ_2 when accelerated through V_2. The ratio λ_1/λ_2 is

(a) $V_1^{3/2} : V_2^{3/2}$ (b) $v_2^{1/2} : v_1^{1/2}$
(c) $V_1^{1/2} : V_2^{1/2}$ (d) $V_1^2 : V_2^2$

36. If the first line of Lyman series has a wavelength 1215.4Å, the first line of Balmer series is approximately

(a) 4864Å (b) 1025.5Å
(c) 6563Å (d) 6400Å

37. **A certain radioactive element disintegrates with a decay constant of 7.9×10^{-10}/s. At a given instant of time, if the activity of the sample is equal to 55.3×10^{11} disintegration/second, then number of nuclei at that instant of time is**
(a) 7.0×10^{21} (b) 4.27×10^{13}
(c) 4.27×10^{3} (d) 6×10^{23}

38. **The change in current through a junction diode is 1.2 mA when the forward bias voltage is changed by 0.6 V . The dynamic resistance is**
(a) 500Ω (b) 300Ω
(c) 150Ω (d) 250Ω

39. **A semiconductor has equal electron and hole concentration of $2 \times 10^{8}\ m^{-3}$. On doping with a certain impurity, the electron concentration increases to $4 \times 10^{10}\ m^{-3}$, then the new hole concentration of the semiconductor is**
(a) $10^{6}\ m^{-3}$ (b) $10^{8}\ m^{-3}$
(c) $10^{10}\ m^{-3}$ (d) $10^{12}\ m^{-3}$

40. **A message signal of 12 kHz and peak voltage 20 V is used to modulate a carrier wave frequency 12 MHz and peak voltage 30 V . Then, the modulation index is**
(a) 0.32 (b) 6.7
(c) 0.67 (d) 67

Chemistry

41. **Assertion (A) Atoms with completely filled and half-filled subshells are stable.**
Reason (R) Completely filled and half-filled subshells have symmetrical distribution of electrons and have maximum exchange energy.
The correct answer is
(a) (A) and (R) are correct, (R) is the correct explanation of (A)
(b) (A) and (R) are correct, (R) is not the correct explanation of (A)
(c) (A) is correct, but (R) is not correct
(d) (A) is not correct, but (R) is correct

42. **The element with the electronic configuration $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^1$ is**
(a) Cu (b) Ca (c) Cr (d) Co

43. **Among the following, the isoelectronic specie (s) is/are**
(i) $O^{2-}, F^{-}, Na^{+}, Mg^{2+}$
(ii) $Na^{+}, Mg^{+}, Al^{3+}, F^{-}$
(iii) $N^{3-}, O^{2-}, F^{-}, Ne$
(a) (i) and (ii) (b) (i), (ii) and (iii)
(c) (ii) and (iii) (d) (i) and (iii)

44. **What is the atomic number of the element with symbol Uus?**
(a) 117 (b) 116
(c) 115 (d) 114

45. **Match the following.**

List I	List II
(A) PCl_3	(I) Square planar
(B) BF_3	(II) T-shape
(C) ClF_3	(III) Trigonal pyramidal
(D) XeF_4	(IV) See-saw
	(V) Trigonal planar

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

(d) (II) (IV) (III) (v)

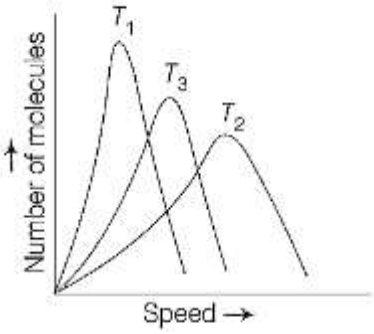
46. The order of covalent character of KF, KI, KCl is

(a) KCl < KF < KI
(b) KI < KCl < KF
(c) KF < KI < KCl
(d) KF < KCl < KI

47. If the kinetic energy in J, of CH_4 (molar mass $= 16 \text{ g mol}^{-1}$) at T(K) is X, the kinetic energy in J, of O_2 (molar mass $= 32 \text{ g mol}^{-1}$) at the same temperature is

(a) X (b) 2X (c) x^2 (d) $\frac{x}{2}$

48. The given figure shows the Maxwell distribution of molecular speeds of a gas at three different temperatures T_1, T_2 and T_3. The correct order of temperature is



(a) $T_1 > T_2 > T_3$ (b) $T_1 > T_3 > T_2$
(c) $T_3 > T_2 > T_1$ (d) $T_2 > T_3 > T_1$

49. In Haber's process, 50.0 g of $N_2(g)$ and 10.0 g of $H_2(g)$ are mixed to produce $NH_3(g)$. What is the number of moles of $NH_3(g)$ formed?

(a) 3.33 (b) 2.36
(c) 2.01 (d) 5.36

50. The following reaction occurs in acidic medium

$$KMnO_4 + 8H^+ + 5e^- \longrightarrow K^+ + Mn^{2+} + 4H_2O$$

What is the equivalent weight of $KMnO_4$?

(Molecular weight of $KMnO_4 = 158$)

(a) 79.0 (b) 31.6
(c) 158.0 (d) 39.5

51. Given that $N_2(g) + 3H_2(g) \longrightarrow 2NH_3(g)$;

$\Delta_r H^\circ = -92$ kJ, the standard molar enthalpy of formation in kJmol^{-1} of $NH_3(g)$ is

(a) -92 (b) +46 (c) +92 (d) -46

52. Which one of the following is correct?

(a) The equilibrium constant (K_c) is independent of temperature
(b) The value of K_c is independent of initial concentrations of reactants and products
(c) At equilibrium, the rate of the forward reaction is twice the rate of the backward reaction
(d) The equilibrium constant (K_c) for the reaction

$Ni(s) + 4CO(g) \rightleftharpoons Ni(CO)_4(g)$ is, $\frac{[Ni(CO)_4]}{[CO]}$

53. pH of an aqueous solution of NH_4Cl is

(a) 7 (b) > 7
(c) < 7 (d) 1

54. What is the change in the oxidation state of Mn in the reaction of MnO_4^- with H_2O_2 in acidic medium?

(a) $7 \rightarrow 4$ (b) $6 \rightarrow 4$
(c) $7 \rightarrow 2$ (d) $6 \rightarrow 2$

55. Which one of the following will not give flame test?

(a) Ca (b) Ba (c) Sr (d) Be

56. Which one of the following forms a basic oxide?

(a) B (b) TI (c) Al (d) Ga

57. The gas produced by the passage of air over hot coke is

(a) carbon monoxide (b) carbon dioxide
(c) producer gas (d) water gas

58. In environmental chemistry, the medium which is affected by a pollutant is called as the .
(a) sink (b) slag
(c) solvent (d) receptor

59. The hybridisation of each carbon in the following compound respectively is

$$CH_3-\overset{\overset{\displaystyle O}{||}}{C}-CH_2-CN$$

(a) sp^3, sp^2, sp^3, sp
(b) sp^3, sp^3, sp^2, sp
(c) sp^3, sp, sp^3, sp^2
(d) sp^3, sp^2, sp, sp^3

60. The product Z of the following reaction is

$H_3CC \equiv CH \xrightarrow{2HBr} Z$

(a) $H_3CCH_2CHBr_2$ (b) $H_3CCBr_2CH_3$
(c) $H_3CCHBrCH_2Br$ (d) $BrCH_2CH_2CH_2Br$

61. Identify X and Y in the following reaction sequence

$X \xrightarrow{Zn} Y \underset{Zn-H_2O}{\xrightarrow{O_3}} (CH_3)_2CO + CH_2O$

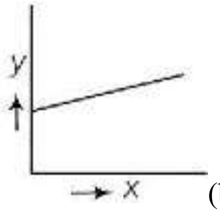
	X	Y
(a)	$(CH_3)_2\underset{\displaystyle Br}{\underset{\vert}{C}}HCH_3$	$CH_3CH = CHCH_3$
(b)	$(CH_3)_2CHCH_2Br$	$CH_3CH = CHCH_3$
(c)	$(CH_3)_2CBrCH_2Br$	$(CH_3)_2C = CH_2$
(d)	$(CH_3)_2CHCHBrr_2$	$(CH_3)_2C = CH_2$

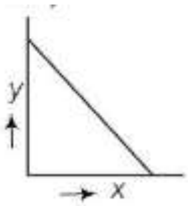
62. The packing efficiency of simple cubic (sc), body centred cubic (bcc) and cubic close packing (ccp) lattices follow the order
(a) bcc < ccp < sc (b) ccp < bcc < sc
(c) sc < ccp < bcc (d) sc < bcc < ccp

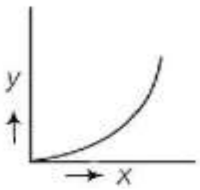
63. The experimental depression in freezing point of a dilute solution is 0.025 K . If the van't Hoff factor (i) is 2.0 , the calculated depression in freezing point (in K) is
(a) 0.00125 (b) 0.025
(c) 0.0125 (d) 0.05

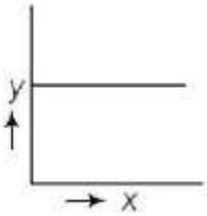
64. The molality of an aqueous dilute solution containing non-volatile solute is 0.1 m . What is the boiling temperature (in °C) of solution? (Boiling point elevation constant, $K_b 0.52$ kg mol^{-1} K; boiling temperature of water = 100°C).
(a) 100.0052 (b) 100.052
(c) 100.0 (d) 100.52

65. Which one of the following is correct plot of $\Lambda_m($ in cm^2 $mol^{-1})$ and $\sqrt{C}(in mol/L^{1/2})$ for KCl solution? $(y = \Lambda_m; x = \sqrt{C})$

(a) 

(b) 

(c) 

(d) 

66. For the reaction

$$\mathbf{5Br^-(aq) + 6H^+(aq) + BrO_3^-(aq) \longrightarrow 3Br_2(aq) + 3H_2O(l)}$$

if, $-\frac{\Delta[BrO_3^-]}{\Delta t} = 0.01\ \text{mol L}^{-1}\ \text{min}^{-1}$,

$\frac{\Delta[Br_2]}{\Delta t}$ **in** $\text{molL}^{-1}\ \text{min}^{-1}$ **is**

(a) 0.01 (b) 0.3
(c) 0.03 (d) 0.005

67. Which one of the following is an emulsion?

(a) Milk (b) Soap lather
(c) Butter (d) Vanishing cream

68. Copper matte contains ……...

(a) Cu_2O, Cu_2S (b) Cu_2O, FeO
(c) Cu_2S, FeS (d) Cu_2S, FeO

69. X reacts with dilute nitric acid to form 'laughing gas'. What is X ?

(a) Cu (b) P_4 (c) S_8 (d) Zn

70. Xenon reacts with fluorine at 873 K and 7 bar to form XeF_4. In this reaction, the ratio of xenon and fluorine required is

(a) 1: 5 (b) 10: 1
(c) 1: 3 (d) 5: 1

71. Which of the following metal ions has a calculated magnetic moment value of $\sqrt{24}$ BM ?

(a) Mn^{2+} (b) Fe^{2+}
(c) Fe^{3+} (d) Co^{2+}

72. Which one of the following does not exhibit geometrical isomerism?

(a) Octahedral complex with formula $[MX_2L_4]$
(b) Square planar complex with formula $[MX_2L_2]$
(c) Tetrahedral complex with formula $[MAB \times L]$
(d) Octahedral complex with formula $[MX_2(L-L)_2]$

73. The poly dispersity index (PDI) of a polymer is ($\bar{M}_w$ = weight average molecular mass and $\bar{M}_n$ = number average molecular mass)

(a) the product of $\bar{M}_n$ and $\bar{M}_w$
(b) the sum of $\bar{M}_n$ and $\bar{M}_w$
(c) the difference between $\bar{M}_w$ and $\bar{M}_n$
(d) the ratio between $\bar{M}_w$ and $\bar{M}_n$

74. Hormone that maintains the blood glucose level within the limit is

(a) thyroxine (b) insulin
(c) testosterone (d) epinephrine

75. Chloroxylenol is an example of …….

(a) antiseptic (b) antipyretic

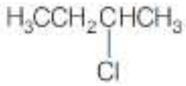
(c) analgesic (d) tranquiliser

76. Which one of the following has highest boiling point?

(a) $H_3CCH_2CH_2CH_2Cl$

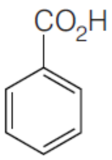
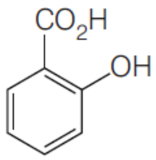
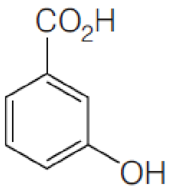
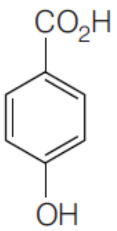
(b) $(H_3C)_2CHCH_2Cl$

(c) $(H_3C)_3CCl$

(d) 

77. $X + Y \xrightarrow{H^+}$ **Aspirin** $+ H_3CCOOH$

Identify X and Y from the following

	X	Y
(a)		H_3CCOCl
(b)		$(H_3CCO)_2O$
(c)		H_3CCO_2H
(d)		H_3CCOCH_3

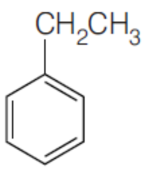
78. $R - CN \xrightarrow[\text{(ii) } H_3O^+]{\text{(i) } SnCl_2 + HCl} R - CHO$

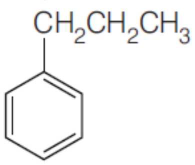
What is the name of the above reaction?

(a) Rosenmund (b) Williamson

(c) Stephen (d) Kolbe

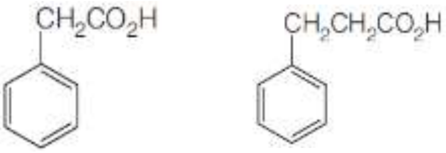
79. Consider the following reactions,

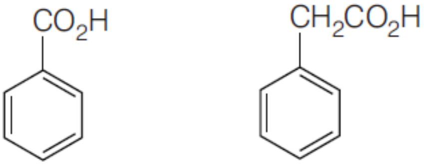
 $\xrightarrow[\text{(ii) } H_3O^+]{\text{(i) } KMnO_4 - KOH/\Delta} Y$

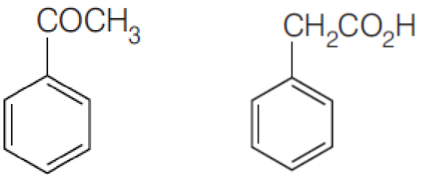
 $\xrightarrow[\text{(ii) } H_3O^+]{\text{(i) } KMnO_4 - KOH/\Delta} Z$

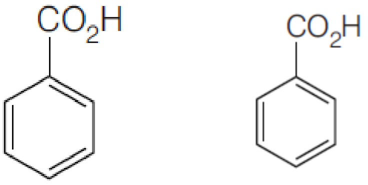
What are the structures of Y and Z ?

X **Z**

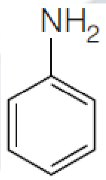
(a) 

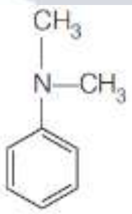
(b) 

(c) 

(d) 

80. Which is the strongest base among the following?

(a) $H_3\,CNH_2$ (b) 

(c)  (d) 

Mathematics

81. If $f(x)=x^2-2x+4$, then the set of values of x satisfying $f(x-1)=f(x+1)$ is

(a) $\{-1\}$ (b) $\{-1,1\}$

(c) $\{1\}$ (d) $\{1,2\}$

82. The number of real linear functions $f(x)$ satisfying $f(f(x))=x+f(x)$ is

(a) 0 (b) 4 (c) 5 (d) 2

83. The remainder when $7^n-6n-50 (n\in N)$ is divided by 36 , is

(a) 22 (b) 23 (c) 1 (d) 21

84. Consider the system of equations

$$ax+by+cz=2$$
$$bx+cy+az=2$$
$$cx+ay+bz=2$$

where a,b,c are real numbers such that $a+b+c=0$. Then, the system

(a) has two solutions

(b) is inconsistent

(c) has unique solution

(d) has infinitely many solutions

85. Suppose A and B are two square matrices of same order. If A and B are symmetric matrix, then $AB-BA$ is

(a) a symmetric matrix

(b) a skew-symmetric

(c) a scalar matrix

(d) a triangular matrix

86. If $A(x) = \begin{vmatrix} x+1 & 2x+1 & 3x+1 \\ 2x+1 & 3x+1 & x+1 \\ 3x+1 & x+1 & 2x+1 \end{vmatrix}$, then $\int_0^1 A(x)dx$ is equal to

(a) -15 (b) $-\frac{15}{2}$

(c) -30 (d) -5

87. If $z = x + iy$ is a complex number such that $\bar{z}^{\frac{1}{3}} = a + ib$, then the value of $\frac{1}{a^2+b^2}\left(\frac{x}{a}+\frac{y}{b}\right)$ is equal to

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

88. The locus of z satisfying $|z| + |z - 1| = 3$ is

(a) a circle (b) a pair of straight lines

(c) an ellipse (d) a parabola

89. If the point $z = (1 + i)(1 + 2i)(1 + 3i) \dots (1 + 10i)$ lies on a circle with centre at origin and radius r, then r^2 is equal to

(a) 10 !

(b) $2 \times 3 \times 4 \times \dots \times 10$

(c) $2 \times 5 \times 10 \times . \times 101$

(d) 11 !

90. The minimum value of $|z - 1| + |z - 5|$ is

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

91. The number of real roots of $|x|^2 - 5|x| + 6 = 0$ is

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

92. If α, β are the roots of $x^2 - x + 1 = 0$, then the quadratic equation whose roots are $\alpha^{2015}, \beta^{2015}$ is

(a) $x^2 - x + 1 = 0$ (b) $x^2 + x + 1 = 0$

(c) $x^2 + x - 1 = 0$ (d) $x^2 - x - 1 = 0$

93. If α, β, γ are roots of $x^3 - 5x + 4 = 0$, then $(\alpha^3 + \beta^3 + \gamma^3)^2$ is equal to

(a) 12 (b) 13

(c) 169 (d) 144

94. Suppose α, β, γ are roots of $x^3 + x^2 + 2x + 3 = 0$. If $f(x) = 0$ is a cubic polynomial equation whose roots are $\alpha + \beta, \beta + \gamma, \gamma + \alpha$, then $f(x)$ is equal to

(a) $x^3 + 2x^2 - 3x - 1$

(b) $x^3 + 2x^2 - 3x + 1$

(c) $x^3 + 2x^2 + 3x - 1$

(d) $x^3 + 2x^2 + 3x + 1$

95. The number of 4 letter words that can be formed with the letters in the word EQUATION with at-least one letter repeated is

(a) 2400 (b) 2408

(c) 2416 (d) 2432

96. The number of divisors of 7 ! is

(a) 24 (b) 72 (c) 64 (d) 60

97. The sum of the series $1 + \frac{2}{3}\left(\frac{1}{8}\right) + \frac{2\times5}{3\times6}\left(\frac{1}{8}\right)^2 + \frac{2\times5\times8}{3\times6\times9}\left(\frac{1}{8}\right)^3 + \cdots$ is

(a) $\frac{4}{\sqrt[3]{49}}$ (b) $\frac{\sqrt[3]{49}}{4}$

(c) $\frac{4}{\sqrt[3]{81}}$ (d) $\frac{\sqrt[3]{81}}{4}$

98. If C_r denotes the binomial coefficient ${}^nC_r$, then $(-1)C_0^2 + 2C_1^2 + 5C_2^2 + \cdots + (3n - 1)C_n^2$ is equal to

(a) $(3n - 2)\ {}^{2n}C_n$ (b) $\left(\frac{3n-2}{2}\right)\ {}^{2n}C_n$

(c) $(5 + 3n)\ {}^{2n}C_n$ (d) $\left(\frac{3n-5}{2}\right)\ {}^{2n}C_{n+1}$

99. If $\frac{x+1}{x^4(x+2)}=\frac{A}{x}+\frac{B}{x^2}+\frac{C}{x^3}+\frac{D}{x^4}+\frac{E}{x+2}$, then $B+D+E$ is equal to
(a) $A+C$ (b) $A-C$
(c) $2A+C$ (d) $2A+2C$

100. If $\cos^3\theta+\cos^3\left(\frac{2\pi}{3}+\theta\right)+\cos^3\left(\frac{4\pi}{3}+\theta\right)=a\cos 3\theta$, then a is equal to
(a) $\frac{1}{4}$ (b) $\frac{3}{4}$ (c) $\frac{5}{4}$ (d) $\frac{7}{4}$

101. $\frac{\cos 13^\circ-\sin 13^\circ}{\cos 13^\circ+\sin 13^\circ}+\frac{1}{\cot 148^\circ}$ is equal to
(a) 1 (b) -1 (c) 0 (d) $\frac{1}{2}$

102. If $\cos x+\cos y+\cos\alpha=0$ and $\sin x+\sin y+\sin\alpha=0$, then $\cot\left(\frac{x+y}{2}\right)$ is equal to
(a) $\sin\alpha$ (b) $\cos\alpha$
(c) $\tan\alpha$ (d) $\cot\alpha$

103. If $f(x)=\cos^2 x+\cos^2 2x+\cos^2 3x$, then the number of values of $x\in[0,2\pi]$ for which $f(x)=1$ is
(a) 4 (b) 6 (c) 8 (d) 10

104. The value of x which satisfies $\sin(\cot^{-1}x)=\cos(\tan^{-1}(1+x))$ is
(a) $-\frac{1}{2}$ (b) $\frac{1}{2}$ (c) -1 (d) 1

105. For $\theta\in\left(0,\frac{\pi}{2}\right)$, $\operatorname{sech}^{-1}(\cos\theta)$ is equal to
(a) $\log\left|\tan\left(\frac{\pi}{6}+\frac{\theta}{2}\right)\right|$
(b) $\log\left|\tan\left(\frac{\pi}{3}+\frac{\theta}{2}\right)\right|$
(c) $\log\left|\tan\left(\frac{\pi}{4}+\frac{\theta}{2}\right)\right|$
(d) $\log\left|\tan\left(\frac{\pi}{4}-\frac{\theta}{2}\right)\right|$

106. If $\triangle ABC$ is such that $\angle A=90^\circ, \angle B\neq\angle C$, then $\frac{b^2+c^2}{b^2-c^2}\sin(B-C)$ is equal to
(a) $\frac{1}{3}$ (b) $\frac{1}{2}$ (c) 1 (d) $\frac{3}{2}$

107. In $\triangle ABC$, if $8R^2=a^2+b^2+c^2$, then the triangle is a/an
(a) right angled triangle
(b) equilateral triangle
(c) scalene triangle
(d) obtuse angled triangle

108. In $\triangle ABC$, if $2R+r=r_2$, then $\angle B$ is equal to
(a) $\frac{\pi}{3}$ (b) $\frac{\pi}{4}$ (c) $\frac{\pi}{6}$ (d) $\frac{\pi}{2}$

109. ABCDEF is a regular hexagon whose centre is O. Then, AB + AC + AD + AE + AF is equal to
(a) 2 AO (b) 3 AO
(c) 5 AO (d) 6 AO

110. ABCD is a parallelogram and P is the mid-point of the side AD. The line BP meets the diagonal AC in Q. Then, the ratio of AQ: QC is equal to
(a) 1: 2 (b) 2: 1
(c) 1: 3 (d) 3: 1

111. The vectors $2\hat{i}-3\hat{j}+\hat{k}, \hat{i}-2\hat{j}+3\hat{k}$ and $3\hat{i}+\hat{j}-2\hat{k}$
(a) are linearly dependent
(b) are linearly independent
(c) form sides of a triangle
(d) are coplanar

112. a, b and c are three vectors such that $|a|=1, |b|=2, |c|=3$ and b, c are perpendicular. If projection of b on a is the same as the projection of c on a, then $|a-b+c|$ is equal to
(a) $\sqrt{2}$ (b) $\sqrt{7}$ (c) $\sqrt{14}$ (d) $\sqrt{21}$

113. If a, b, c are unit vectors satisfying the relation $a+b+\sqrt{3}c=0$, then the angle between a and b is
(a) $\frac{\pi}{6}$ (b) $\frac{\pi}{4}$ (c) $\frac{\pi}{3}$ (d) $\frac{\pi}{2}$

114. a is perpendicular to both b and c. The angle between b and c is $\frac{2\pi}{3}$. If $|a| = 2$, $|b| = 3$, $|c| = 4$, then $c \cdot (a \times b)$ is equal to

(a) $18\sqrt{3}$ (b) $12\sqrt{3}$
(c) $8\sqrt{3}$ (d) $6\sqrt{3}$

115. If the average of the first n numbers in the sequence 148, 146, 144, ..., is 125 , then n is equal to

(a) 18 (b) 24 (c) 30 (d) 36

116. The standard deviation of $a, a + d, a + 2d, \ldots, a + 2nd$ is

(a) nd (b) $n^2 d$
(c) $\sqrt{\frac{n(n+1)}{3}}d$ (d) $\sqrt{\frac{n(n+3)}{3}}d$

117. Two events A and B are such that $P(A) = \frac{1}{4}$, $P(A/B) = \frac{1}{4}$ and $P(B/A) = \frac{1}{2}$.

Consider the following statements :

(I) $P(\bar{A}/\bar{B}) = \frac{3}{4}$

(II) A and B are mutually exclusive

(III) $P(A/B) + P(A/\bar{B}) = 1$

Then,

(a) only (I) is correct
(b) only (I) and (II) are correct
(c) only (I) and (III) are correct
(d) only (II) and (III) are correct

118. A five- digit number is formed by the digits 1 , 2, 3, 4, 5 with no digit being repeated. The probability that the number is divisible by 4 , is

(a) $\frac{1}{5}$ (b) $\frac{2}{5}$ (c) $\frac{3}{5}$ (d) $\frac{4}{5}$

119. When a pair of six faced fair dice are thrown, the probability that the sum of the numbers on the two dice is greater than 7 , is

(a) $\frac{1}{3}$ (b) $\frac{5}{12}$ (c) $\frac{1}{2}$ (d) $\frac{1}{4}$

120. In a family with 4 children, the probability that there are at least two girls, is

(a) $\frac{1}{2}$ (b) $\frac{9}{16}$ (c) $\frac{3}{4}$ (d) $\frac{11}{16}$

121. On an average nine out of 10 ships that have departed at A reach B safely. The probability that out of five ships that have departed at A atleast four will reach B safely is

(a) $14(0.9)^5$ (b) $1.4(0.9)^5$
(c) $0.14(0.9)^4$ (d) $1.4(0.9)^4$

122. If $A(5, -4)$ and $B(7, 6)$ are points in a plane, then the set of all points $P(x, y)$ in the plane such that $AP : PB = 2 : 3$ is

(a) a circle (b) a hyperbola
(c) an ellipse (d) a parabola

123. If the axes are rotated anticlockwise through an angle 90°, then the equation $x^2 = 4ay$ is changed to the equation

(a) $y^2 = 4ax$ (b) $x^2 = -4ay$
(c) $y^2 = -4ax$ (d) $x^2 = 4ay$

124. The combined equation of the straight lines of the form $y = kx + 1$ (where k is an integer) such that the point of intersection of each with the line $3x + 4y = 9$ has an integer as its x-coordinate is

(a) $(y + x + 1)(y + 2x - 1) = 0$
(b) $(y + x - 1)(y + 2x + 1) = 0$
(c) $(y + x + 1)(y + 2x + 1) = 0$
(d) $(y + x - 1)(y + 2x - 1) = 0$

125. A value of k such that the straight lines $y - 3kx + 4 = 0$ and $(2k-1)x - (8k-1)y - 6 = 0$ are perpendicular is

(a) $\frac{1}{6}$ (b) $-\frac{1}{6}$ (c) 1 (d) 0

126. The length of the segment of the straight line passing through $(3,3)$ and $(7,6)$ cut off by the coordinate axes is

(a) $\frac{4}{5}$ (b) $\frac{5}{4}$ (c) $\frac{7}{4}$ (d) $\frac{4}{7}$

127. The equation of the pair of straight lines through the point $(1,1)$ and perpendicular to the pair of straight lines $3x^2 - 8xy + 5y^2 = 0$ is

(a) $5x^2 + 8xy + 3y^2 - 14x - 18y + 16 = 0$

(b) $5x^2 + 8xy + 3y^2 - 18x - 14y + 16 = 0$

(c) $5x^2 - 8xy + 3y^2 - 18x - 14y + 32 = 0$

(d) $5x^2 - 8xy + 3y^2 - 14x - 18y + 32 = 0$

128. The combined equation of the three sides of a triangle is $(x^2 - y^2)(2x + 3y - 6) = 0$. If the point $(0, \alpha)$ lies in the interior of this triangle, then

(a) $-2 < \alpha < 0$ (b) $-2 < \alpha < 2$

(c) $0 < \alpha < 2$ (d) $\alpha \geq 2$

129. The point where the line $4x - 3y + 7 = 0$ touches the circle $x^2 + y^2 - 6x + 4y - 12 = 0$ is

(a) $(1,1)$ (b) $(1,-1)$

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

130. The normal to the circle given by $x^2 + y^2 - 6x + 8y - 144 = 0$ at $(8,8)$ meets the circle again at the point

(a) $(2,-16)$ (b) $(2,16)$

(c) $(-2,16)$ (d) $(-2,-16)$

131. For all real values of k, the polar of the point $(2k, k-4)$ with respect to $x^2 + y^2 - 4x - 6y + 1 = 0$ passes through the point

(a) $(1,1)$ (b) $(1,-1)$

(c) $(-3,1)$ (d) $(3,1)$

132. If the circles $x^2 + y^2 - 2\lambda x - 2y - 7 = 0$ and $3(x^2 + y^2) - 8x + 29y = 0$ are orthogonal, then λ is equal to

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

133. The radical centre of the circles $x^2 + y^2 = 1, x^2 + y^2 - 2x - 3 = 0$ and $x^2 + y^2 - 2y - 3 = 0$ is

(a) $(1,1)$ (b) $(1,-1)$

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

134. From a point $(C, 0)$ three normals are drawn to the parabola $y^2 = x$. Then,

(a) $C < \frac{1}{2}$ (b) $C = \frac{1}{2}$

(c) $C > \frac{1}{2}$ (d) $\frac{1}{2} > C > \frac{1}{4}$

135. The points of intersection of the parabolas $y^2 = 5x$ and $x^2 = 5y$ lie on the line

(a) $x + y = 10$ (b) $x - 2y = 0$

(c) $x - y = 0$ (d) $2x - y = 0$

136. For the ellipse given by $\frac{(x-3)^2}{25} + \frac{(y-2)^2}{16} = 1$, match the equations of the lines given in List I with those on the List II.

List I	List II
(i) The equation of the major axis	(p) $3x = 34$
(ii) The equation of a directrix	(q) $y = 2$
(iii) The equation of a latusrectum	(r) $x + y = 9$

	(s) $x = 6$
	(t) $x = 3$
	(u) $3y = 34$

	(i)	(ii)	(iii)
(a)	(t)	(p)	(s)
(b)	(q)	(u)	(t)
(c)	(q)	(p)	(t)
(d)	(q)	(p)	(s)

137. If S and S' are the foci of the ellipse $\frac{x^2}{25}+\frac{y^2}{16}=1$ and if PSP' is a focal chord with $SP = 8$, then SS' is equal to

(a) $4 + S'P$ (b) $S'P - 1$

(c) $4 + SP$ (d) $SP - 1$

138. Let $A(2\sec\theta, 3\tan\theta)$ and $B(2\sec\phi, 3\tan\phi)$ where $\theta+\phi=\frac{\pi}{2}$, be two points on the hyperbola $\frac{x^2}{4}-\frac{y^2}{9}=1$. If (α,β) is the point of intersection of normals to the hyperbola at A and B, then β is equal to

(a) $-\frac{13}{3}$ (b) $\frac{13}{3}$

(c) $\frac{3}{13}$ (d) $-\frac{3}{13}$

139. Points $A(3,2,4)$, $B\left(\frac{33}{5},\frac{28}{5},\frac{38}{5}\right)$ and $C(9,8,10)$ are given. The ratio in which B divides $\overline{AC}$ is

(a) $5:3$ (b) $2:1$

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

140. If the angle between the lines whose direction cosines are $\left(-\frac{2}{\sqrt{21}},\frac{C}{\sqrt{21}},\frac{1}{\sqrt{21}}\right)$ and $\left(\frac{3}{\sqrt{54}},\frac{3}{\sqrt{54}},-\frac{6}{\sqrt{54}}\right)$ is $\frac{\pi}{2}$, then the value of C is

(a) 6 (b) 4 (c) -4 (d) 2

141. The image of the point $(5,2,6)$ with respect to the plane $x+y+z=9$ is

(a) $(3,-5,2)$ (b) $\left(\frac{7}{2},-1,5\right)$

(c) $\left(\frac{7}{3},-\frac{2}{3},\frac{10}{3}\right)$ (d) $\left(\frac{7}{3},\frac{2}{3},-\frac{5}{3}\right)$

142. $\lim_{x\to\infty}\left[\frac{x^2+x+3}{x^2-x+2}\right]^x$ is equal to

(a) ∞ (b) e (c) e^4 (d) e^2

143. The values of p and q so that the function

$$f(x)=\begin{cases}(1+|\sin x|)^{\frac{p}{\sin x}} & ,\frac{-\pi}{6}<x<0\\ q & ,x=0\\ e^{\frac{\sin 2x}{\sin 3x}} & ,0<x<\frac{\pi}{6}\end{cases}$$

is continuous at $x = 0$, are

(a) $p=\frac{1}{3}, q=e^{2/3}$ (b) $p=0, q=e^{2/3}$

(c) $p=\frac{2}{3}, q=e^{-2/3}$ (d) $p=-\frac{2}{3}, q=e^{2/3}$

144. If $y=\tan^{-1}\left[\frac{5\cos x-12\sin x}{12\cos x+5\sin x}\right]$, then $\frac{dy}{dx}$ is equal to

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

145. $\frac{d}{dx}\tan^{-1}\left[\frac{\sqrt{1+\sin x}-\sqrt{1-\sin x}}{\sqrt{1+\sin x}+\sqrt{1-\sin x}}\right]$ is equal to

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

146. If $y = a\cos(\sin 2x) + b\sin(\sin 2x)$, then $y'' + (2\tan 2x)y'$ is equal to

(a) 0 (b) $4(\cos^2 2x)y$

(c) $-4(\cos^2 2x)y$ (d) $-(\cos^2 2x)y$

147. **The length of the segment of the tangent line to the curve $x = a\cos^3 t, y = a\sin^3 t$, at any point on the curve cut off by the coordinate axes is**

(a) $4a$ (b) a (c) a^2 (d) $2a$

148. **The area of the triangle formed by the positive X-axis, the tangent and normal to the curve $x^2 + y^2 = 16a^2$ at the point $(2\sqrt{2}a, 2\sqrt{2}a)$ is**

(a) a^2 (b) $16a^2$

(c) $4a^2$ (d) $8a^2$

149. **Define $f(x) = \frac{1}{2}[|\sin x| + \sin x], 0 < x \leq 2\pi$. Then, f is**

(a) increasing in $\left(\frac{\pi}{2}, \frac{3\pi}{2}\right)$

(b) decreasing in $\left(0, \frac{\pi}{2}\right)$ and increasing in $\left(\frac{\pi}{2}, \pi\right)$

(c) increasing in $\left(0, \frac{\pi}{2}\right)$ and decreasing in $\left(\frac{\pi}{2}, \pi\right)$

(d) increasing in $\left(0, \frac{\pi}{4}\right)$ and decreasing in $\left(\frac{\pi}{4}, \pi\right)$

150. **The smallest value of the constant $m > 0$ for which $f(x) = 9mx - 1 + \frac{1}{x} \geq 0$ for all $x > 0$, is**

(a) $\frac{1}{9}$ (b) $\frac{1}{16}$ (c) $\frac{1}{36}$ (d) $\frac{1}{81}$

151. $\int \frac{x^2+1}{x^4+7x^2+1}dx$ **is equal to**

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

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

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

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

152. $\int \frac{x^3}{\sqrt{1+x^2}}dx$ **is equal to**

(a) $\sqrt{1+x^2} - \frac{x}{3}(1+x^2)^{3/2} + C$

(b) $x\sqrt{1+x^2} + \frac{2}{3}(1+x^2)^{3/2} + C$

(c) $x^2\sqrt{1+x^2} - \frac{2}{3}(1+x^2)^{3/2} + C$

(d) $x^2\sqrt{1+x^2} - \frac{1}{3}(1+x^2)^{1/2} + C$

153. $\int \frac{dx}{\cos(x+4)\cos(x+2)}$ **is equal to**

(a) $\frac{1}{\sin 2}\log|\cos(x+4)^2| + C$

(b) $\frac{1}{2}\log\left|\frac{\sec(x+2)}{\sec(x+4)}\right| + C$

(c) $\frac{1}{\sin 2}\log\left|\frac{\sec(x+4)}{\sec(x+2)}\right| + C$

(d) $\log\left|\frac{\sec(x+4)}{\sec(x+2)}\right| + C$

154. $\int \frac{2x+2}{\sqrt{x^2-4x-5}}dx$ **is equal to**

(a) $\sqrt{x^2-4x-5} + \log\left|x + \sqrt{x^2-4x-5}\right| + C$

(b) $\log\left|\sqrt{x^2-4x-5}\right| - \sqrt{x^2-4x-5} + C$

(c) $\sqrt{x^2-4x-5} + 6\log\left|(x-2) + \sqrt{x^2-4x-5}\right| + C$

(d) $2\sqrt{x^2-4x-5} + 6\log\left|(x-2) + \sqrt{x^2-4x-5}\right| + C$

155. $\int_0^{\pi/4} \frac{\sin x+\cos x}{7+9\sin 2x}dx$ **is equal to**

(a) $\frac{\log 3}{4}$ (b) $\frac{\log 3}{36}$

(c) $\frac{\log 7}{12}$ (d) $\frac{\log 7}{24}$

156. $\int_0^{\pi/4}[\sqrt{\tan x} + \sqrt{\cot x}]dx$ **is equal to**

(a) $\frac{\pi}{\sqrt{2}}$ (b) $\frac{\pi}{2}$ (c) $\frac{3\pi}{\sqrt{2}}$ (d) π

157. If the area bounded by the curves $y = ax^2$ and $x = ay^2, (a > 0)$ is 3 sq units, then the value of a is

(a) $\frac{2}{3}$ (b) $\frac{1}{3}$ (c) 1 (d) 4

158. Let $p \in IR$, then the differential equation of the family of curves $y = (\alpha + \beta x)e^{px}$, where α, β are arbitrary constants, is

(a) $y'' + 4py' + p^2y = 0$
(b) $y'' - 2py' + p^2y = 0$
(c) $y'' + 2py' - p^2y = 0$
(d) $y'' + 2py' + p^2y = 0$

159. The solution of the differential equation $3xy' - 3y + (x^2 - y^2)^{1/2} = 0$, satisfying the condition $y(1) = 1$ is

(a) $3\cos^{-1}\left(\frac{y}{x}\right) = \ln|x|$
(b) $3\cos\left(\frac{y}{x}\right) = \ln|x|$
(c) $3\cos^{-1}\left(\frac{y}{x}\right) = 2\ln|x|$
(d) $3\sin^{-1}\left(\frac{y}{x}\right) = \ln|x|$

160. The solution of the differential equation $y' = \frac{1}{e^{-y} - x}$ is

(a) $x = e^{-y}(y + C)$
(b) $y + e^{-y} = x + C$
(c) $x = e^{y}(y + C)$
(d) $x + y = e^{-y} + C$