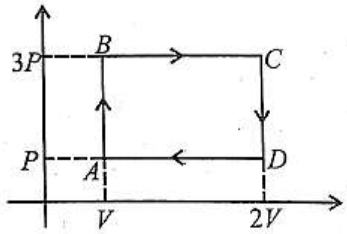
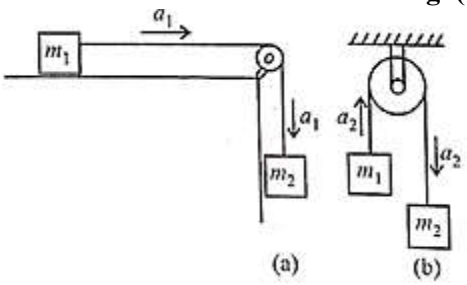
Physics

1. A monoatomic ideal gas goes through a cyclic process as shown in the figure. The efficiency of this process is



(a) 78% (b) 42%
(c) 19.04% (d) 21%

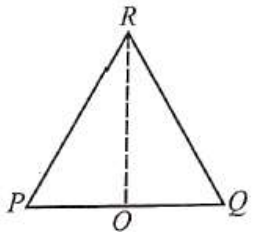
2. Two situations are shown in fig. (a) and (b).



In each case, $m_1 = 3$ kg and $m_2 = 4$ kg. If a_1, a_2 are the respective accelerations of the blocks in these situations, then the values of a_1 and a_2 are respectively $[g = 10\ ms^{-2}]$

(a) $\frac{20}{7}\ ms^{-2}, \frac{10}{7}\ ms^{-2}$
(b) $\frac{10}{7}\ ms^{-2}, \frac{25}{7}\ ms^{-2}$
(c) $\frac{40}{7}\ ms^{-2}, \frac{10}{7}\ ms^{-2}$
(d) $\frac{30}{7}\ ms^{-2}, \frac{5}{7}\ ms^{-2}$

3. Three uniform thin aluminium rods each of length 2 m form an equilateral triangle PQR as shown in the figure. The mid point of the rod PQ is at the origin of the coordinate system. If the temperature of the system of rods increases by 50°C, the increase in y-coordinate of the centre of mass of the system of the rods is . mm. (Coefficient of volume expansion of aluminium $= 12\sqrt{3} \times 10^{-6}\ K^{-1}$)



(a) 0.05 (b) 0.8
(c) 0.1 (d) 0.2

4. An infinitely long thin straight wire has uniform linear charge density of $\frac{1}{3} Cm^{-1}$. Then the magnitude of the force acting on a charge 3μC situated at a point of 18 cm away from the wire is $\left(\frac{1}{4\pi\varepsilon_0} = 9 \times 10^9 Nm^2C^{-2}\right)$

(a) 2×10^5 N (b) 10^5 N
(c) $\frac{1}{3} \times 10^6$ N (d) 3×10^{11} N

5. An electrostatic paint sprayer has a metal sphere of diameter 18 cm and at a potential of 25 kV . The charge on the metal sphere is

(a) 0.25μC (b) 2.5μC
(c) 0.5μC (d) 25μC

6. **A body- is projected from the top of a tower with a velocity $\vec{u} = 3\hat{i} + 4\hat{j} + 5\hat{k}\ ms^{-1}$, where $\hat{i}, \hat{j}$ and $\hat{k}$ are unit vectors along east, north and vertically upwards respectively. If the height of the tower is 30 m , horizontal range of the body on the ground is $(g = 10\ ms^{-2})$**
   (a) 15 m (b) 25 m
   (c) 9 m (d) 12 m
7. **Two long parallel conducting wires carrying currents are separated by a distance ' x '. Work done per unit length in changing the distance between the wires is proportional to**
   (a) $\frac{1}{\log_e x}$ (b) $\frac{1}{x}$
   (c) $\log_e x$ (d) x
8. **A Zener diode voltage regulator operated in the range $120\ V - 180\ V$ produces a constant supply of 110 V and 250 mA to the load. If the maximum current is equally shared between the load and the Zener diode, then the values of load resistance (R_L) and series resistance (R_S) are respectively**
   (a) $R_L = 280\Omega, R_S = 70\Omega$
   (c) $R_L = 70\Omega, R_S = 280\Omega$
   (b) $R_L = 440\Omega, R_S = 140\Omega$
   (d) $R_L = 440\Omega, R_S = 1400\Omega$
9. **Equation of a projectile is given by $y = Px - Qx^2$, where P and Q are constants. The ratio of maximum height to the range of the projectile is**
   (a) $\frac{Q^2}{2P}$ (b) $\frac{P^2}{Q}$ (c) 4P (d) $\frac{P}{4}$
10. **The transverse displacement of a string of a linear density $0.01\ kg\ m^{-1}$, clamped at its ends is given by $Y_{(x,t)} = 0.03\sin\left(\frac{2\pi x}{3}\right)\cos(60\pi t)$, where x and y are in metres and time t is in seconds. Tension in the string is**
    (a) 9 N (b) 36 N
    (c) 162 N (d) 81 N
11. **A girl of mass 50 kg swinging on a cradle. If she moves with a velocity of $2\ ms^{-1}$ upwards in a direction making an angle 60° with the vertical, then the power generated is $(g = 9.8\ ms^{-2})$**
    (a) 245 W (b) $490\sqrt{2}$ W
    (c) $490\sqrt{3}$ W (d) 980 W
12. **Two- point sources S_1 and S_2 are 24 cm apart. Where should a convex lens of focal length 9 cm be placed in between them, so that the images of both sources are formed at the same place?**
    (a) 8 cm (b) 12 cm
    (c) 6 cm (d) 10 cm
13. **Assertion (A) : It is more difficult to push a magnet into a coil with more number of turns.**
    Reason (R) : The emf induced in a coil opposes the motion of a magnet when it is moved towards the coil.
    (a) A is false, R is true
    (b) Both A and R are true. R is correct explanation of A
    (c) A is true, R is false
    (d) Both A and R are true. R is not correct explanation of A
14. **A wall is made of equally thick layers P and Q of different materials. Thermal conductivity of Q is half of that of the P. In the steady state, if the temperature difference across the wall is $24^\circ C$, then the temperature difference across the layer ' P ' is**
    (a) $12\ ^\circ C$ (b) $16^\circ C$
    (c) $4^\circ C$ (d) $8^\circ C$
15. **In the determination of the internal resistance of a cell with a potentiometer, the error in the measurement of the balancing length is ± 1 mm. When the cell alone is connected in the circuit, the balancing length is obtained at 60 cm and when the cell is shunted with a resistance of $10\Omega \pm 2\%$, the balancing length is**

obtained at 50 cm . The error in the determination of the internal resistance of the cell is

(a) 2.4% (b) 4.2%

(c) 1.8% (d) 5.6%

16. The half -life of a stream of radioactive particles moving along a straight path with a constant kinetic energy of 4 eV is 1 minute. The percentage of particles which decay before travelling a distance of 3.6 km is (Mass of the radioactive particles $= 3.2 \times 10^{-21}$ kg and charge of the electron $= 1.6 \times 10^{-19}$C).

(a) 87.5 (b) 175

(c) 37.5 (d) 75

17. The process of recovering the modulating signal from the modulated carrier wave is called

(a) amplification (b) detection

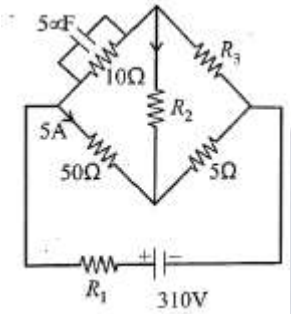
(c) rectification (d) noise

18. Two bodies of masses 4 m and 9 m are separated by a distance ' r '. The gravitational potential at a point on this line joining them where the gravitational field becomes zero is

(a) $\frac{-25Gm}{r}$ (b) $\frac{-4Gm}{r}$

(c) $\frac{-9Gm}{r}$ (d) $\frac{-13Gm}{r}$

19. If the charge on the capacitor is 1 mC in the given circuit,



then $\frac{R_1R_2}{R_3} = \cdots \ldots \Omega$.

(a) 6 (b) 0.4

(c) 0.6 (d) 10

20. The amplitude of electric field in an electromagnetic wave is $60 Vm^{-1}$. Then the amplitude of magnetic field is

(a) 2×10^{-7} T (b) 2×10^{7} T

(c) 6×10^{7} T (d) 6×10^{-7} T

21. A bird is tossing (flying to and fro) between two cars moving towards each other on a straight road. One car has speed of $54 kmh^{-1}$ while the other has the speed of $36 kmh^{-1}$. The bird starts moving from first car towards the other and is moving with the speed of $36 kmh^{-1}$ where the two cars were separated by 36 km . The total distance covered by the bird before the cars meet each other is

(a) 14400 m (b) 1440 m

(c) 244 m (d) 24400 m

22. If the average translational kinetic energy of a molecule in a gas is equal to the kinetic energy of an electron accelerating from rest through 10 V , then the temperature of the gas molecule is (Boltzmann constant $= 1.38 \times 10^{-23} JK^{-1}$)

(a) 7.73×10^{3} K (b) 730 K

(c) 73.7 K (d) 77.3×10^{3} K

23. A closed organ pipe of length ' L ' and an open organ pipe contain gases of densities ρ_1 and ρ_2 respectively. The compressibility of gases are equal in both the pipes. If. the frequencies of their first overtones are same, then the length of the open organ pipe is

(a) $\frac{4L}{3}\sqrt{\frac{\rho_2}{\rho_1}}$ (b) $\frac{4L}{3}\sqrt{\frac{\rho_1}{\rho_2}}$
(c) $\frac{4L}{3}$ (d) $\frac{L}{3}$

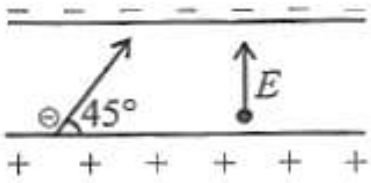
24. One mole of a gas expands such that its volume ' V ' changes with absolute temperature ' T ' in accordance with the relation $V = KT^2$ where ' K ' is a constant. If the temperature of the gas changes by $60^\circ C$, then work done by the gas is (R is universal gas constant).

(a) KRln 60 (b) Rln 60
(c) 40 KR (d) 120R

25. When a coil is connected to AC supply of frequency 50 Hz , a current of 4 A flows in it and it consumes 240 W power. If the potential difference across the coil is 100 V , then the inductance value of the coil is

(a) $L = (5\pi)H$ (b) $L = \frac{\pi}{5}H$
(c) $L = \frac{1}{5\pi}H$ (d) $L = \frac{1}{25\pi}H$

26. The uniform electric field intensity between the two plates of a parallel plate capacitor is $1 \times 103 Vm^{-1}$ acting vertically upwards as shown in the figure.



The plates are sufficiently long and have separation 2 cm . A particle of negative charge 1μC and mass 2 g is projected at an angle 45° with the electric field from the lower plate with a velocity ' u '. The maximum velocity acquired by the particle, if it is not hit the upper plate is

(a) 2 ms^{-1} (b) 1 ms^{-1}
(c) 0.1 ms^{-1} (d) 0.2 ms^{-1}

27. Both an electron and a photon have same de-Broglie wavelength of 1.2Å. The ratio of their energies is nearly

(a) 1:100 (b) 1:10
(c) 1:1000 (d) 1:1

28. When the terminals of a cell are connected by a wire of resistance 4Ω, the potential difference across the cell is 1.6 V. If a wire of the same resistance is connected in parallel with the first, the potential difference becomes 1.33 V . The emf and internal resistance of the cell are respectively

(a) 1 V, 1Ω (b) 2 V, 1Ω
(c) 1 V, 2Ω (d) 2 V, 2Ω

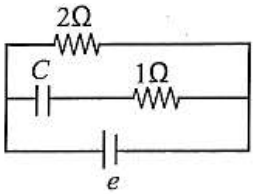
29. Two concentric coils of 20 turns each are placed in same plane. Their radii are 30 cm and 60 cm and carry 0.4 A and 0.6 A currents respectively in opposite directions. The magnetic induction at the centre in tesla is……..

(a) $\frac{8}{3}\mu_0$ (b) $\frac{2}{3}\mu_0$
(c) $\frac{5}{3}\mu_0$ (d) $\frac{10}{3}\mu_0$

30. Time period of a simple pendulum of length ' L ' is T_1. Time period of a uniform rod of same length ' L ' suspended from one end and oscillating in a vertical plane is T_2. Amplitude of oscillation is small in both the cases. Then $\frac{T_1}{T_2}$ is

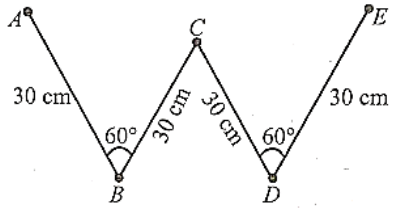
(a) $\sqrt{\frac{2}{3}}$ (b) $\sqrt{\frac{3}{2}}$ (c) $\sqrt{\frac{4}{3}}$ (d) 1

31. In steady state, a capacitor of capacitance 2μ F is charged to 4μC, as shown in figure. If the internal resistance of the cell is 0.5Ω, then the emf of the cell is



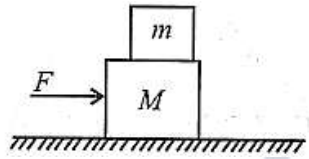
(a) 4 V (b) 5 V
(c) 2.5 V (d) 2 V

32. A uniform thin rod of 120 cm length and 1600 g mass is bent as shown in the figure. The moment of inertia of the bent rod about an axis passing through the point ' O ' and perpendicular to the plane of the paper is…..$kg - m^2$.



(a) 0.084 (b) 0.360
(c) 0.018 (d) 0.120

33. Two blocks of masses ' M ' and ' m ' are placed on one another on a smooth horizontal surface as shown in the figure.



The force ' F ' is acting on the mass ' M ' horizontally during time interval ' t '. Assuming no relative sliding between the blocks, the work done by friction on the blocks is ……..

(a) $\frac{Ft}{2(M+m)}$ (b) $\frac{M+m}{mt^2}$
(c) $\frac{mF^2t^2}{2(M+m)^2}$ (d) $\frac{F^2t^2}{(M+m)}$

34. A solid sphere is projected up along an inclined plane of inclination 30° with the horizontal with a speed of $4\ ms^{-1}$. If it rolls without slipping, the maximum distance traversed by it is…….$(g = 10\ ms^{-2})$.

(a) 2.24 m (b) 112 m
(c) 1.12 m (d) 22.4 m

35. Fully filled open water tank has two holes on either sides of its walls. One is a square hole of side x cm at a depth of 2 m from the top, and the other hole is equilateral triangle of side 4 cm at a depth of 6 m from the top. If the rate of flow of water is same from both the holes, then ' x ' is

(a) 1.73 cm (b) 12 cm
(c) 6.92 cm (d) 3.46 cm

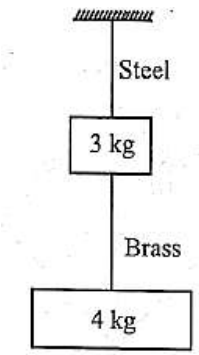
36. The radius of orbit of an electron and the speed of electron in the ground state of hydrogen atom are 5.5×10^{-11} m and $4 \times 10^6\ ms^{-1}$ respectively. Then, the orbital period of this electron in the first excited state will be……

(a) $6.908\ 10^{-16}$ s (b) 9.608×10^{-16} s
(c) 7.806×10^{-16} s (d) 8.9068×10^{-16} s

37. Two slits separated by 0.5 mm are illuminated by light of wavelength 500 nm . The screen is at a distance of 120 cm from the slits. The phase difference between the interfering waves at a point 3 mm on the screen from the central bright fringe is

(a) 5π (b) π (c) 3π (d) 7π

38. The ratios of lengths, areas of cross-section and Young's modulii of steel to that of brass wires shown in the figure are a, b and c respectively. The ratio of increase in the lengths of brass to that of steel wires is [Assume that the masses of steel and brass wires are negligible]



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

39. A person of 60 kg mass is in a lift which is coming down such that the man exerts a force of 150 N on the floor of the lift. Then the acceleration of the lift is $(g = 10\ ms^{-2})$

(a) 7.5 ms^{-2} (b) 40.0 ms^{-2}
(c) 22.5 ms^{-2} (d) 15.0 ms^{-2}

40. Match the following

List-I	List-II
(A) High retentivity	(i) Telephone diaphram
(B) High resistivity	(ii) Diamagnet
(C) Low coercivity	(iii) To decrease eddy current losses
(D) Negative	(iv) Permanent magnet susceptibility

The correct answer is
(a) A-(i), B-(iv), C-(iii), D-(ii)
(b) A-(iv), B-(iii), C-(i), D-(ii)
(c) A-(i), B-(ii), C-(iii), D-(iv)
(d) A-(iv), B-(ii), C-(i), D-(iii),

Chemistry

41.
(i) $H_3PO_4(aq) \rightleftharpoons H^+(aq) + H_2PO_4^-(aq)$
(ii) $H_2PO_4^-(aq) \rightleftharpoons H^+(aq) + HPO_4^{2-}(aq)$
(iii) $HPO_4^{2-}(aq) \rightleftharpoons H^+(aq) + PO_4^{3-}(aq)$
The equilibrium constants for the above reactions at a certain temperature are K_1, K_2 and K_3 respectively. The equilibrium constant for the reaction $H_3PO_4(aq) \rightleftharpoons 3H^+(aq) + PO_4^{3-}(aq)$ in terms of K_1, K_2 and K_3 is

(a) $K_1 + K_2 + K_3$ (b) $\frac{K_1}{K_2 + K_3}$
(c) $\frac{K_3}{K_1 K_2}$ (d) $K_1 K_2 K_3$

42. Which among the following are having diamagnetic property?
(i) B_2 (ii) N_2 (iii) O_2 (iv) C_2
(a) ii, iii (b) i, iv
(c) ii, iv (d) i , ii

43. Which one of the following statements is not correct?
(a) The hydration enthalpies of alkali metal ions decrease down the group.
(b) Lithium halides are some- what covalent in nature.
(c) Alkali metals react with water liberating oxygen gas.
(d) KO_2 is paramagnetic.

44. Which one of the following is more reactive towards S_N2 reaction?

(a) $(CH_3)_3CX$ (b) $(CH_3)_2CHX$

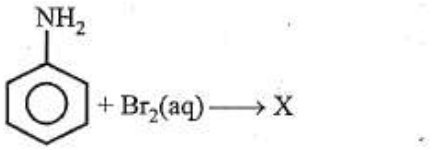
(c) CH_3CH_2X (d) CH_3X

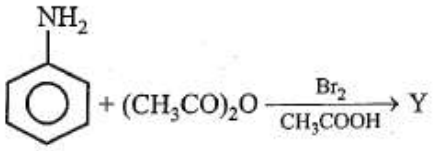
45. Identify, from the following, the diamagnetic, tetrahedral complex

(a) $[Ni(Cl)_4]^{2-}$ (b) $[Co(C_2O_4)_3]^{3-}$

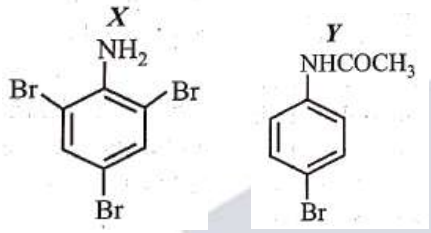
(c) $[Ni(CN)_4]^{2-}$ (d) $[Ni(CO)_4]$

46. What are X and Y in the following reactions?

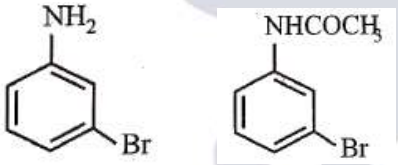




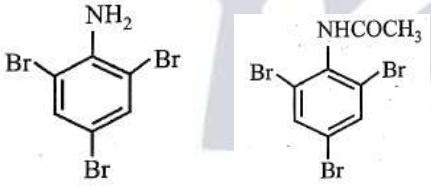
(a)



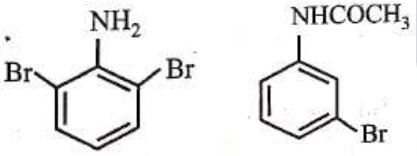
(b)



(c)



(d)



47. Which of the following forms holes in the ozone layer?

(a) CO (b) SO_2

(c) CO_2 (d) CF_2Cl_2

48. Which one of the following is not used as an initiator in ionic polymerisation?

(a) $NaNH_2$ (b) $SnCl_2$

(c) $AlCl_3$ (d) $(C_6H_5CO)_2O_2$

49. Identify the statement which is not correct?

(a) Dehydrobromination of 2-bromopentane gives pent-1-ene as the major product.

(b) Freon 12 is manufactured by Swarts reaction.

(c) $CHCl_3$ is stored in closed, dark coloured bottles.

(d) Chronic exposure to $CHCl_3$ causes liver damage.

50. To prepare $XeF_6 \cdot Xe$ and F_2 are mixed at 573 K and 60-70 bar in the ratio of

(a) 20:1 (b) 1:5

(c) 5:1 (d) 1:20

51. Which one of the following solutions of compounds show highest osmotic pressure? (AB, AB_2 and A_2B_3 are ionic compounds)

(a) 5.0 M urea i = 1.0 and temperature is 67°C

(b) $1.5MA_2B_3$ type i = 4.1 and temperature is 27°C

(c) 3.0 M AB type i = 1.6 and temperature is 27°C

(d) 2.5 M AB type i = 2.5 and temperature is 57°C

52. In which of the following reactions, hydrogen is liberated?

(i) $Al(s) + HCl(aq) \longrightarrow$ (ii) $Al(s) + NaOH(aq) \longrightarrow$

(iii) $NaBH_4 + I_2 \longrightarrow$

(a) i, ii (b) ii, iii

(c) i, iii (d) i, ii, iii

53. 31 g of ethylene glycol ($C_2H_6O_2$) is dissolved in 600 g of water. The freezing point depression of the solution is (K_f for water is 1.86 K kg mol^{-1})

(a) 0.77 K (b) 1.55 K

(c) 4.65 K (d) 3.10 K

54. The equilibrium constant (K_C) for the following equilibrium

$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$

at 563 K is 100 . At equilibrium, the number of moles of SO_3 in the 10 litre flask is twice the number of moles of SO_2, then the number of moles of oxygen is

(a) 0.4 (b) 0.3

(c) 0.2 (d) 0.1

55. The energy and radius of electron present in second orbit of He^+ respectively are

(a) -1.09×10^{-18} J, 105.8pm

(b) -8.72×10^{-18} J, 211.6pm

(c) -4.36×10^{-18} J, 52.9pm

(d) -2.18×10^{-18} J, 105.8pm

56. What are X and Y in the following reactions?

(i) $MnO_4^- + I^- \xrightarrow{H^+} X$

(ii) $MnO_4^- + I^- \xrightarrow{H_2O} Y$

(a) I_2, IO_4^- (b) I_2, IO_3^-

(c) IO_3^-, IO_3^- (d) IO_3^-, I_2

57. Assertion (A) : Na^+ and Mg^{2+} ions are isoelectronic but the ionic radius of Na^+ is greater than that of Mg^{2+}.

Reason (R): The effective nuclear charge of Na^+ ion is less than that of Mg^{2+} ion.

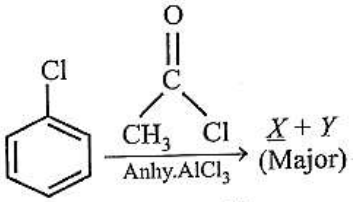
(a) Both (A) and (R) are correct but (R) is not the correct explanation of (A).

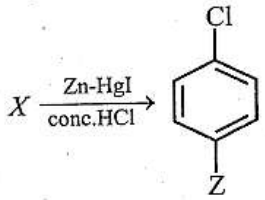
(b) Both (A) and (R) are correct and (R) is correct explanation of (A).

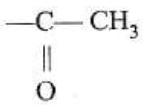
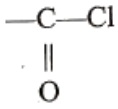
(c) (A) is not correct but (R) is correct.

(d) (A) is correct but (R) is not correct.

58. What is Z in the following sequence of reactions?





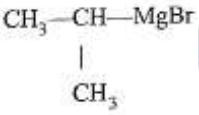
(a)  (b) 

(c) $-CH_3$ (d) $-CH_2-CH_3$

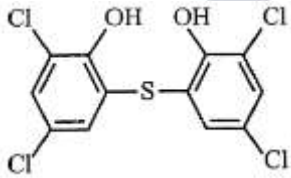
59. What are X and Y in the following reactions?

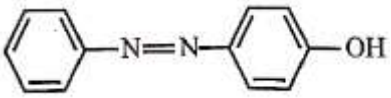
$CH_2O \xrightarrow[(ii)H_3O^+]{(i)X} CH_3(CH_2)_2CH_2OH$

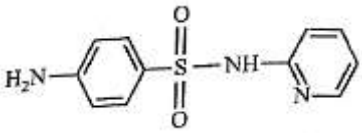
$Y \xrightarrow[(ii)H_3O^+]{(i)C_2H_5MgBr} CH_3CH_2C(CH_3)_2OH$

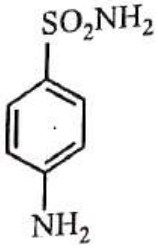
	X	Y
(a)		$C_2H_5COCH_3$
(b)	$CH_3CH_2CH_2MgBr$	CH_3-CO-CH_3
(c)	CH_3-CH_2-MgBr	CH_3CH_2CHO
(d)	$(CH_3)_3CMgBr$	CH_3-CO-CH_3

60. Which of the following structure represents the compound, generally added to soaps to impart antiseptic properties?

(a) 

(b) 

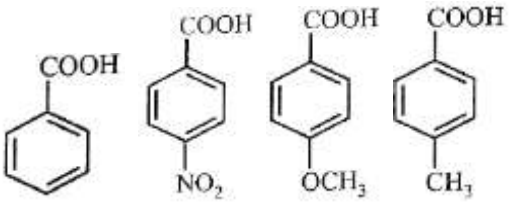
(c) 

(d) 

61. The work functions of Ag, Mg, K and Na respectively in eV are 4.3, 3.7, 2.25, 2.30. When an electromagnetic radiation of wavelength of 300 nm is allowed to fall on these metal surface, the number of metals from which the electrons are ejected is $(1eV = 1.6022 \times 10^{-19}\ J)$

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

62. The increasing order of acidity of the following carboxylic acids is



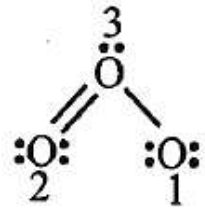
I II III IV

(a) III < IV < II < I (b) II < III < IV < I
(c) I < II < IV < III (d) III < IV < I < II

63. Colloidal solution of gold is in different colours like red, purple, blue and golden because of

(a) variable oxidation states of gold.
(b) size difference in the particles of gold.
(c) presence of impurities.
(d) difference in the concentration of gold particles.

64. The Lewis structure for O_3 molecule is given below. The correct formal charges on oxygen atoms labelled 1, 2,3 are respectively.



(a) $-1,0,+1$ (b) $+1,0,-1$
(c) $+1,-1,0$ (d) $0,+1,-1$

65. Identify the statement which is not correct from the following.

(i) Carbohydrates are stored as glycogen in animals.

(ii) In glycylalanine,  of peptide bond belongs to alanine.

(iii) Base - sugar- phosphate unit is known as nucleoside

(iv) Obesity is due to hypothyroidism.

The correct answer is

(a) i, iv (b) ii, iii, iv
(c) i, iii, iv (d) ii, iii

66. The enthalpy of formation (ΔH_f) of methanol, formaldehyde and water are $-239, -116$ and -286 kJ mol^{-1} respectively. The enthalpy change for the oxidation of methanol to formaldehyde and water in kJ is

(a) -136 (b) -173
(c) 163 (d) -163

67. Copper matte contains

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

68. At 27°C in a 10 L flask 4.0 g of an ideal gaseous mixture containing. He (molar mass 4.0 g mol^{-1}) and Ne (molar mass 20 g mol^{-1}) has a pressure of 1.23 atm . What is the mass % of neon ? (R = 0.082 L atm K^{-1} mol^{-1})

(a) 25.2 (b) 62.5
(c) 84.2 (d) 74.2

69. $S + \text{Conc. } H_2SO_4 \rightarrow X + Y$

Here X is a gas and Y is a liquid and both are triatomic molecules. The number of electron lone pairs present on the central atoms of X and Y are respectively.

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

70. Identify the correct statements from the following
(i) Electromeric effect is a permanent effect.
(ii) Hyper conjugation is a temporary effect.
(iii) Fractional distillation is used to separate two liquids from a mixture if the difference in their boiling points is less.
(iv) Different compounds are adsorbed on an adsorbent different extents.
(a) ii, iii, iv (b) i, ii, iii
(c) ii, iv (d) iii, iv

71. Which of the following is used in the estimation of carbon monoxide?
(a) I_2O_4 (b) BrO_3
(c) Cl_2O_7 (d) I_2O_5

72. Which one of the following statements is not correct?
(a) In CO_2 molecule, carbon hybridisation is sp.
(b) Fullerenes are made by heating graphite in an electric arc in the presence of argon gas.
(c) Both $[SiF_6]^{2-}$ and $[SiCl_6]^{2-}$ ions are known.
(d) In CO molecule, there are one 'sigma' (σ) and two "pi" (π) bonds.

73. The drug, which was designed to prevent the interaction of histamine with the receptors present in the stomach wall is
(a) prontosil (b) cimetidine
(c) aspartame (b) cimetidine

74. Identify the correct statements for a ring system to exhibit aromaticity
(i) It must not be planar.
(ii) It must possess $(4n + 2)\pi$-electrons.
(iii) It must be planar.
(iv) It must possess $4n\pi$-electrons.
The correct answer is
(a) ii, iv (b) i , ii
(c) i, iv (d) ii, iii

75. Two oxides of a X contain 50% and 40% of non-metal respectively. If the formula of the first oxide is XO_2. Then the formula of second oxide is
(a) X_2O_3 (b) X_2O_5
(c) XO_3 (d) X_2O

76. An element has a body centered cubic structure with a unit cell edge length of 400 pm . Atomic mass of an element is 24 g mol^{-1}. What is the density of the element?
$(N_A = 6 \times 10^{23}\ mol^{-1})$
(a) 2.50 g cm^{-3} (b) 1.80 g cm^{-3}
(c) 3.60 g cm^{-3} (d) 1.25 g cm^{-3}

77. 20% of a first order reaction was found to be completed at 10:00 a.m at 11.30 a.m. on the same day, 20% of the reaction was found to be remaining. The half life period in minutes of the reaction is
(a) 90 (b) 45 (c) 60 (d) 30

78. The gaseous products formed at cathode (X) and anode (Y), when an aqueous solution of sodium acetate is electrolysed are

X	Y
(a) CO_2	C_2H_6, H_2
(b) H_2, CO_2	C_2H_6
(c) H_2	C_2H_6, CO_2
(d) C_2H_6, H_2	CO_2

79. How many millilitres of 20 volume H_2O_2 solution is needed to react completely with 500 mL of acidified 1 N$KMnO_4$ solution?

(a) 224 (b) 280
(c) 140 (d) 56

80. Same amount of electricity is passed through aqueous solutions of $AgNO_3$ and $CuSO_4$. The number of Ag and Cu atoms deposited are x and y respectively. The correct relationship between x and y is

(a) $x < y$ (b) $x = 2y$
(c) $x = y$ (d) $y = 2x$

Mathematics

81. In $\triangle ABC$, if $b\cos\theta = c - a$, (where θ is an acute angle), then $(c - a)\tan\theta =$

(a) $2\sqrt{ca}\cos\frac{B}{2}$ (b) $2\sqrt{ca}\sin\frac{B}{2}$
(c) $2ca\cos\frac{B}{2}$ (d) $2ca\sin\frac{B}{2}$.

82. Given below is the distribution of a random variable X

X=x	1	2	3	4
P(X=x)	λ	2λ	3λ	4λ

If $\alpha = P(X < 3)$ and $\beta = P(X > 2)$, then $\alpha : \beta =$

(a) 2:5 (b) 3:4
(c) 4:5 (d) 3:7

83. If $f: R \to R$ is defined by

$$f(x) = \begin{cases} x - 1, & \text{for } x \le 1 \\ 2 - x^2, & \text{for } 1 < x \le 3 \\ x - 10, & \text{for } 3 < x < 5 \\ 2x, & \text{for } x \ge 5 \end{cases}$$

then the set of points of discontinuity of f is

(a) $R - \{1,5\}$ (b) $\{1,3,5\}$
(c) $\{1,5\}$ (d) $R - \{1,3,5\}$

84. If the pair of lines $x^2 - 16pxy - y^2 = 0$ and $x^2 - 16qxy - y^2 = 0$ are such that each pair bisects the angle between the other pair, then $pq =$

(a) $\frac{-1}{64}$ (b) $\frac{1}{64}$ (c) $\frac{-1}{8}$ (d) $\frac{1}{8}$

85. If a non-zero vector a is parallel to the line of intersection of the plane determined by the vectors $\hat{j} - \hat{k}, 3\hat{j} - 2\hat{k}$ and the plane determined by the vectors $2\hat{i} + 3\hat{j}, \hat{i} - 3\hat{j}$, then the angle between the vectors a and $\hat{i} + \hat{j} + \hat{k}$ is

(a) $\sin^{-1}\left(\frac{2}{\sqrt{3}}\right)$ (b) $\cos^{-1}\left(\pm\frac{2}{\sqrt{3}}\right)$
(c) $\tan^{-1}\sqrt{3}$ (d) $\cos^{-1}\left(\pm\frac{1}{\sqrt{3}}\right)$

86. If three numbers are drawn at random successively without replacement from a set $S = \{1, 2, \ldots 10\}$, then the probability that the minimum of the chosen numbers is 3 or their maximum is 7 .

(a) $\frac{11}{40}$ (b) $\frac{5}{40}$ (c) $\frac{3}{40}$ (d) $\frac{1}{40}$

87. For $x^2 - 4 \neq 0$, the value of $\frac{d}{dx}\left[\log\left\{e^x\left(\frac{x-2}{x+2}\right)^{\frac{3}{4}}\right\}\right]$ at $x = 3$ is

(a) $\frac{8}{5}$ (b) 2 (c) 1 (d) $\frac{8e^3}{5}$

88. If $y = \frac{\sinh^{-1}x}{\sqrt{1+x^2}}$, then $(1 + x^2)y_2 + 3xy_1 + y =$

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

89. The area (in sq. units) enclosed between the curves $y = x^2$ and $y = |x|$ is

(a) $\frac{2}{3}$ (b) $\frac{1}{6}$ (c) $\frac{1}{3}$ (d) 1

90. $\int \frac{5x^2+3}{x^2(x^2-2)}dx =$

(a) $\frac{13}{2\sqrt{2}}\log\left|\frac{\sqrt{2}-x}{\sqrt{2}+x}\right|+\frac{3}{2x}+C$

(b) $\frac{13}{4\sqrt{2}}\log\left|\frac{x+\sqrt{2}}{x-\sqrt{2}}\right|+\frac{3}{2x}+C$

(c) $\frac{13}{4\sqrt{2}}\log\left|\frac{x-\sqrt{2}}{x+\sqrt{2}}\right|+\frac{3}{2x}+C$

(d) $\frac{5}{3\sqrt{2}}\log\left|\frac{x+\sqrt{2}}{x-\sqrt{2}}\right|+\frac{3}{5}x+C$

91. If $y=\tan^{-1}\left\{\frac{x}{1+\sqrt{1-x^2}}\right\}+\sin\left\{2\tan^{-1}\sqrt{\frac{1-x}{1+x}}\right\}$, then $\frac{dy}{dx}=$

(a) $\frac{1-2x}{2\sqrt{1-x^2}}$ (b) $\frac{1-2x}{x\sqrt{1-x^2}}$

(c) $\frac{2x+1}{x\sqrt{1-x}}$ (d) $\frac{2-x}{2\sqrt{1-x^2}}$

92. The equation of the plane through $(4,4,0)$ and perpendicular to the planes $2x+y+2z+3=0$ and $3x+3y+2z-8=0$ is

(a) $4x+3y+3z=28$

(b) $4x-2y-3z=8$

(c) $4x+2y+3z=24$

(d) $4x+2y-3z=24$

93. $\lim_{n\to\infty}\left[\frac{1^k+2^k+3^k+\cdots+n^k}{n^{k+1}}\right]=$

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

94. The coefficient of x^5 in the expansio of $(1+x)^{21}+(1+x)^{22}+\cdots+(1+x)^{30}$ is

(a) ${}^{31}C_6-{}^{21}C_6$ (b) ${}^{51}C_5$

(c) ${}^{9}C_5$ (d) ${}^{30}C_5+{}^{20}C_5$

95. Let $A=\{-4,-2,-1,0,3,5\}$ and $f: A\to R$ be defined by

$$f(x)=\begin{cases}3x-1 & \text{for } x>3\\ x^2+1 & \text{for } -3\le x\le 3\\ 2x-3 & \text{for } x<-3\end{cases}$$

Then the range of f is

(a) $\{-11,5,2,1,10,14\}$

(b) $\{-11,-7,2,1,8,14\}$

(c) $\{-11,5,2,1,8,14\}$

(d) $\{-11,-7,-5,1,10,14\}$

96. The incentre of the triangle formed by the straight lines $y=\sqrt{3}x, y=-\sqrt{3}x$ and $y=3$ is

(a) $(0,2)$ (b) $(1,2)$

(c) $(2,0)$ (d) $(2,1)$

97. The solution of the equation $(x-4y^3)\frac{dy}{dx}-y=0,(y>0)$ is

(a) $x=y^3+cy$ (b) $x+2y^3=cy$

(c) $y=x^3+cx$ (d) $y+2x^3=cx$

98. If a circle with radius 2.5 units passes through the points $(2,3)$ and $(5,7)$, then its centre is

(a) $(1.5,2)$ (b) $(7,10)$

(c) $(3,4)$ (d) $(3.5,5)$

99. The circum centre of the triangle formed by the points $(1,2,3),(3,-1,5),(4,0,-3)$ is

(a) $(1,1,1)$ (b) $(2,2,2)$

(c) $(3,3,3)$ (d) $\left(\frac{7}{2},\frac{-1}{2},1\right)$

100. A bag P contains 5 white marbles and 3 black marbles. Four marbles are drawn at random from P and are put in an empty bag Q. If a marble drawn at random from Q is found to be black then the probability that all the three black marbles in P are transfered to the bag Q is.

(a) $\frac{1}{7}$ (b) $\frac{6}{7}$ (c) $\frac{1}{8}$ (d) $\frac{7}{8}$

101. $\mathbf{sech^{-1}\left(\frac{1}{\sqrt{2}}\right) + cosech^{-1}(-1) =}$

(a) 0 (b) $\sqrt{2}+1$
(c) $\sqrt{2}$ (d) $\sqrt{2}-1$

102. **If the points having the position vectors $3\hat{i}-2\hat{j}-\hat{k}, 2\hat{i}+3\hat{j}-4\hat{k}, -\hat{i}+\hat{j}+2\hat{k}$ and $4\hat{i}+5\hat{j}+\lambda\hat{k}$ are coplanar, then λ =.**

(a) $-\frac{146}{17}$ (b) 8 (c) -8 (d) $\frac{146}{17}$

103. **The lines $y = 2x+\sqrt{76}$ and $2y+x=8$ touch the ellipse $\frac{x^2}{16}+\frac{y^2}{12}=1$. If the point of intersection of these two lines lie on a circle. whose centre coincides with the centre of that ellipse, then the equation of that circle is**

(a) $x^2+y^2=28$
(b) $x^2+y^2=16$
(b) $x^2+y^2=12$
(d) $x^2+y^2=(4+\sqrt{8})^2$

104. **The equation of the pair of lines through the point $(2,1)$ and perpendicular to the pair of lines $4xy+2x+6y+3=0$ is**

(a) $xy-x-2y+2=0$
(b) $xy+x-2y-2=0$
(c) $xy+x+2y-6=0$
(d) $xy-x+2y-2=0$

105. **The harmonic mean of two numbers is $-\frac{8}{5}$ and their geometric mean is 2 . The quadratic equation whose roots are twice those numbers is**

(a) $x^2+5x+4=0$
(b) $x^2+10x+16=0$
(c) $x^2-10x+16=0$
(d) $x^2-5x+4=0$

106. **If z is a complex number with $|z|\geq 5$. Then the least value of $\left|z+\frac{2}{z}\right|$ is**

(a) $\frac{24}{5}$ (b) $\frac{26}{5}$ (c) $\frac{23}{5}$ (d) $\frac{29}{5}$

107. **$\triangle$ ABC is formed by $A(1,8,4), B(0,-11,4)$ and $C(2,-3,1)$. If D is the foot of the perpendicular from A to BC. Then the coordinates of D are**

(a) $(-4,5,2)$ (b) $(4,5,-2)$
(c) $(4,-5,2)$ (d) $(4,-5,-2)$

108. **For the function $f(x)=(x-1)(x-2)$ defined on $\left[0,\frac{1}{2}\right]$, the value of c satisfying Lagrange's mean value theorem is**

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

109. **A container is the shape of an inverted cone. Its height is 6 m and radius is 4 m at the top. If it is filled with water at the rate of 3 m^3/min. then the rate of change of height of water (in mt/min) when the water level is 3 m , is**

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

110. **If the roots of the equation $x^3-7x^2+14x-8=0$ are in geometric progression, then the difference between the largest and the smallest roots is**

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

111. If the mean and variance of a binomial variate X are $\frac{4}{3}, \frac{8}{9}$ respectively, then $P(X = 2) =$

(a) $\frac{4}{27}$ (b) $\frac{16}{81}$ (c) $\frac{8}{27}$ (d) $\frac{8}{81}$

112. If α is a non-real root of $x^7 = 1$, then $\alpha(1+\alpha)(1+\alpha^2+\alpha^4) =$

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

113. If $\cot(\cos^{-1} x) = \sec\left\{\tan^{-1}\left(\frac{a}{\sqrt{b^2-a^2}}\right)\right\}$: $b > a$, then $x =$

(a) $\frac{b}{\sqrt{2b^2-a^2}}$ (b) $\frac{\sqrt{b^2-a^2}}{ab}$

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

114. In $\triangle ABC$, L, M, N are points on BC, CA, AB respectively, dividing them in the ratio $1:2, 2:3, 3:5$. If the point K divides AB in the ratio $5:3$, then $\frac{|\overline{AL}+\overline{BM}+\overline{CN}|}{|\overline{CK}|} =$

(a) $\frac{5}{8}$ (b) $\frac{2}{5}$ (c) $\frac{3}{5}$ (d) $\frac{1}{15}$

115. The point to which the origin is to be shifted to remove the first degree terms from the equation $2x^2 + 4xy - 6y^2 + 2x + 8y + 1 = 0$ is

(a) $\left(\frac{7}{8}, \frac{3}{8}\right)$ (b) $\left(\frac{-7}{8}, \frac{-3}{8}\right)$

(c) $\left(\frac{-7}{8}, \frac{3}{8}\right)$ (d) $\left(\frac{7}{8}, \frac{-3}{8}\right)$

116. If α, β, γ are the lengths of the tangents from the vertices of a triangle to its incircle. Then

(a) $\alpha + \beta + \gamma = \frac{1}{r^2}(\alpha\beta\gamma)$

(b) $\frac{1}{\alpha} + \frac{1}{\beta} + \frac{1}{\gamma} = r(\alpha\beta\gamma)$

(c) $\alpha + \beta + \gamma = \frac{1}{r}(\alpha\beta\gamma)$

(d) $\alpha^2 + \beta^2 + \gamma^2 = \frac{2}{r}(\alpha\beta\gamma)$

117. If $\int_0^{10} f(x)dx = 5$, then $\sum_{k=1}^{10} \int_0^1 f(k-1+x)dx =$

(a) 50 (b) 10 (c) 5 (d) 20

118. The angle between the tangents drawn from the point $(1, 2)$ to the ellipse $3x^2 + 2y^2 = 5$ is

(a) $\tan^{-1}\left(\frac{12\sqrt{5}}{5}\right)$ (b) $\tan^{-1}\left(\frac{12\sqrt{5}}{13}\right)$

(c) $\frac{\pi}{4}$ (d) $-\frac{\pi}{4}$

119. If $lx + my = 1$ is a normal to the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$, then $a^2m^2 - b^2l^2 =$

(a) $\frac{m^2}{l^2}(a^2+b^2)^2$ (b) $(l^2+m^2)(a^2+b^2)^2$

(c) $\frac{l^2}{m^2}(a^2+b^2)^2$ (d) $l^2m^2(a^2+b^2)^2$

120. $\int \frac{x^{e-1}+e^{x-1}}{x^e+e^x}dx =$

(a) $\frac{-1}{e}\log|x^e + e^x| + C$

(b) $-e\log|x^e + e^x| + C$

(c) $\frac{1}{e}\log|x^e + e^x| + C$

(d) $e\log|x^e + e^x| + C$

121. If $\Delta = \begin{vmatrix} 1 & \cos\theta & 1 \\ -\cos\theta & 1 & \cos\theta \\ -1 & -\cos\theta & 1 \end{vmatrix}$, then

Δ lies in the interval

(a) [2,4] (b) (2,4)
(c) [1,4] (d) $[-1,1]$

122. **The equation of the circle whose diameter is the common chord of the circles $x^2+y^2+2x+2y+1=0$ and $x^2+y^2+4x+6y+4=0$ is**
(a) $10x^2+10y^2+14x+8y+1=0$
(b) $3x^2+3y^2-3x+6y-8=0$
(c) $2x^2+2y^2-2x+4y+1=0$
(d) $x^2+y^2-x+2y+4=0$

123. $\frac{x-1}{3x+4}<\frac{x-3}{3x-2}$ **holds, for all x in the interval**
(a) $\left(\frac{-4}{3},\frac{2}{3}\right)$ (b) $\left(-\infty,\frac{-5}{4}\right)$
(c) $\left(\frac{3}{3},\infty\right)$. (d) $\left(-\infty,\frac{-5}{4}\right)\cup\left(\frac{3}{4},-\infty\right)$

124. **There are 10 intermediate stations on a railway line between two particular stations. The number of ways that a train can be made to stop at 3 of these intermediate stations so that no two of these halting stations are consecutive is**
(a) 56 (b) 20 (c) 126 (d) 120

125. **The figure formed by the pairs of lines $6x^2+13xy+6y^2=0$ and $6x^2+13xy+6y^2+10x+10y+4=0$, is a**
(a) Square (b) Parallelogram
(c) Rhombus (d) Rectangle

126. **If the point of intersection of the tangents drawn at the points where the line $5x+y+1=0$ cuts the circle $x^2+y^2-2x-6y-8=0$ is (a,b), then $5a+b=$**
(a) 3 (b) -44 (c) -1 (d) 4

127. **If a, b and c are non-zero vectors such that a and b are not perpendicular to each other, then the vector r which is perpendicular to a and satisfying $r\times b=c\times b$ is**
(a) $\frac{(a\times b)\times c}{c.a}$ (b) $\frac{b\times(a\times c)}{b.c}$
(c) $\frac{(b\times c)\times a}{a\cdot b}$ (d) $\frac{(c\times b)\times a}{a\cdot c}$

128. **The tangents to the parabola $y^2=4ax$ from an external point P make angles θ_1 and θ_2 with the axis of the parabola. Such that $\tan\theta_1+\tan\theta_2=b$, where b is constant. Then P lies on**
(a) $y=x+b$ (b) $y+x=b$
(c) $y=\frac{x}{b}$ (d) $y=bx$

129. **The points on the straight line $3x-4y+1=0$ which are at a distance of 5 units from the point $(3,2)$ are**
(a) $\left(-2,-\frac{7}{4}\right),\left(-3,\frac{-5}{2}\right)$
(b) $\left(4,\frac{11}{4}\right),(-1,-1)$
(c) $\left(1,\frac{1}{2}\right),\left(2,\frac{5}{4}\right)$
(d) $(7,5),(-1,-1)$

130. $\lim_{x\to0}\frac{(1-\cos 2x)(3+\cos x)}{x\tan 4x}=$
(a) $\frac{-1}{4}$ (b) $\frac{1}{2}$ (c) 1 (d) 2

131. **An angle between the curves $x^2=3y$ and $x^2+y^2=4$ is**
(a) $\tan^{-1}\frac{5}{\sqrt{3}}$ (b) $\tan^{-1}\sqrt{\frac{5}{3}}$
(c) $\tan^{-1}\frac{2}{\sqrt{3}}$ (d) $\frac{\pi}{3}$

132. If a, b, c are non-zero real numbers and if the equations $(a-1)x = y+z, (b-1)y = z+x, (c-1)z = x+y$ have a non-trivial solution, then $ab+bc+ca =$

(a) $a^2b^2c^2$ (b) 0

(c) abc (d) $a+b+c$

133. The number of different ways of preparing a garland using 6 distinct white roses and 5 distinct red roses such that no two red roses come together is

(a) 21600 (b) 43200

(c) 86400 (d) 151200

134. If a cylindrical vessel of given volume V with no lid on the top is to be made from a sheet of metal, then the radius (r) and height (h) of the vessel so that the metal sheet used is minimum, is

(a) $r = \sqrt[3]{\frac{\pi}{V}}, h = \sqrt[3]{\frac{\pi}{V}}$

(b) $r = \sqrt{\pi V}, h = \sqrt{\pi V}$

(c) $r = \sqrt[3]{\frac{V}{\pi}}, h = \sqrt[3]{\frac{V}{\pi}}$

(d) $r = \sqrt{\frac{V}{\pi}}, h = \sqrt{\frac{V}{\pi}}$

135. $\int \frac{x+\sin x}{1+\cos x}dx =$

(a) $x\tan\frac{x}{2} + C$

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

(c) $x\tan\frac{x}{2} + \sec\frac{x}{2} + C$

(d) $x\sec\frac{x}{2} + \tan\frac{x}{2} + C$

136. If $I_n = \int \frac{\sin nx}{\cos x}dx$, then $I_n =$

(a) $\frac{-2}{n-1}\cos(n-1)x - I_{n-2}$

(b) $\frac{2}{n-1}\cos(n-1)x + I_{n-2}$

(c) $\frac{-2}{n+1}\sin(n+1)x - I_{n-2}$

(d) $\frac{-2}{n+1}\cos(n-1)x - I_{n-2}$

137. If $\tan\alpha$ and $\tan\beta$ are the roots of the equation $x^2 + px + q = 0$, then the value of $\sin^2(\alpha+\beta) + p\cos(\alpha+\beta)\sin(\alpha+\beta) + q\cos^2(\alpha+\beta)$ is

(a) $p+q$ (b) p

(c) q (d) $\frac{p}{p+q}$

138. If ω is a complex cube root of unity, then for any $n > 1$, $\sum_{r=1}^{n-1} r(r+1-\omega)(r+1-\omega^2) =$

(a) $\frac{n^2(n+1)^2}{4}$

(b) $\frac{n(n+1)(2n+1)}{6}$

(c) $\frac{n(n-1)}{4}(n^2+3n+4)$

(d) $\frac{n(n+1)(2n+1)}{4}$

139. Let N be the set of all -natural numbers, Z be the set of all integers and $\sigma: N \to Z$ be defined by

$$\sigma(n) = \begin{cases} \frac{n}{2}, & \text{if } n \text{ is even} \\ -\frac{n-1}{2}, & \text{if } n \text{ is odd} \end{cases}$$. Then,

(a) σ is onto but not one-one

(b) σ is one-one but not onto

(c) σ is neither one-one nor onto
(d) σ is one-one and onto

140. $^{37}C_4 + \sum_{r=1}^{5}(42 - r)_{C_r} =$
(a) $^{41}C_4$ (b) $^{39}C_4$
(c) $^{38}C_4$ (d) $^{42}C_4$

141. The variance of the following data is

x_i	6	10	14	18	24	28	30
f_i	2	4	7	12	8	4	3

(a) 33.4 (b) 34.3
(c) 43.4 (d) 44.3

142. The differential equation corresponding to the family of circles in the plane touching the Y-axis at the origin, is
(a) $\frac{dy}{dx} = \frac{y^2 - x^2}{2xy}$ (b) $\frac{dy}{dx} = \frac{2xy}{x^2 + y^2}$
(c) $\frac{dy}{dx} = \frac{x^2 - y^2}{2xy}$ (d) $\frac{dy}{dx} = \frac{x^2 + y^2}{2xy}$

143. $p, x_1, x_2 \ldots, x_n$ **and** $q, y_1, y_2, \ldots, y_n$ **are two arithmetic progressions with common differences a and b respectively. If** α **and** β **are the arithmetic means of** $x_1, x_2, \ldots . x_n$, **and** $y_1, y_2, \ldots, y_n$ **respectively. Then the locus of** $P(\alpha, \beta)$ **is**
(a) $a(x - p) = b(y - q)$
(b) $b(x - p) = a(y - q)$
(c) $\alpha(x - p) = \beta(y - q)$
(d) $p(x - \alpha) = q(y - \beta)$

144. $\alpha \neq 0$ **and the mean deviation of the observations** $\{k\alpha\}$, **for** $k = 1, 2, \ldots \ldots, 50$ **about its median is 50 , then** $|\alpha| =$
(a) 4 (b) 3 (c) 2 (d) 5

145. $2kx + 3y - 1 = 0, 2x + y + 5 = 0$ **are conjugate lines with respect to the circle** $x^2 + y^2 - 2x - 4y - 4 = 0$, **then** $k =$
(a) 3 (b) 4 (c) 1 (d) 2

146. If $\frac{5x^2+2}{x^3+x} = \frac{A_1}{x} + \frac{A_2 x + A_3}{x^2+1}$, **then** $(A_1, A_2, A_3) =$
(a) (0,2,3) (b) (3,0,2)
(c) (2,3,0) (d) (2,0,3)

147. The sum of first n terms of $\frac{1}{2.5} + \frac{1}{5.8} + \frac{1}{8.11} + \cdots$ **is**
(a) $\frac{3n}{2(3n+2)}$ (b) $\frac{3n}{3n+2}$
(c) $\frac{n}{2(3n+2)}$ (d) $\frac{n}{3n+2}$

148. The equations of the parabola whose axis is parallel to the X-axis and which passes through the points $(-2, 1), (1, 2)(-1, 3)$ **is**
(a) $18y^2 - 12x - 21y - 21 = 0$
(b) $5y^2 + 2x - 21y + 20 = 0$
(c) $15y^2 + 12x - 11y + 20 = 0$
(d) $25y^2 - 2x - 65y + 36 = 0$

149. In $\triangle ABC$, **if** θ **is any angle, then** $b\cos(C + \theta) + c\cos(B - \theta) =$
(a) $a\cot\theta$ (b) $a\cos\theta$
(c) $a\tan\theta$ (d) $a\sin\theta$

150. The number of solutions of the trigonometric equation $1 + \cos x \cdot \cos 5x = \sin^2 x$ **in** $[0, 2\pi]$ **is**
(a) 8 (b) 12 (c) 10 (d) 6

151. If α, β, γ are the roots of $x^3 + px^2 + qx + r = 0$, then the value of $(1+\alpha^2)(1+\beta^2)(1+\gamma^2)$ is

(a) $(r-p)^2 + (r-q)^2$

(b) $(1+p)^2 + (1+q)^2$

(c) $(r+p)^2 + (q+1)^2$

(d) $(r-p)^2 + (q-1)^2$

152. If a system of three linear equations in three unknowns, which is in the matrix equation form of $AX = D$, is inconsistent, then $\frac{\text{rank of}}{\text{rank of AD}}$ is

(a) less than one

(b) greater than or equal to one

(c) one

(d) greater than one

153. The angle between the two circles, each passing through the centre of the other is

(a) $\frac{2\pi}{3}$ (b) $\frac{\pi}{2}$ (c) $\frac{\pi}{6}$ (d) π

154. If $\log_{\frac{1}{\sqrt{3}}}\left\{\frac{|z|^2-|z|+1}{2+|z|}\right\} > -2$, then z lies inside

(a) a triangle (b) an ellipse

(c) a circle (d) a square

155. A circle having centre at the origin passes through the three vertices of an equilateral triangle the length of its median being 9 units. Then the equation of that circle is

(a) $x^2 + y^2 = 9$ (b) $x^2 + y^2 = 18$

(c) $x^2 + y^2 = 36$ (d) $x^2 + y^2 = 81$

156. $1 + \cos 10^\circ + \cos 20^\circ + \cos 30^\circ =$

(a) $4\sin 10^\circ \sin 20^\circ \sin 30^\circ$

(b) $4\cos 5^\circ \cos 10^\circ \cos 15^\circ$

(c) $4\cos 10^\circ \cos 20^\circ \cos 30^\circ$

(d) $4\sin 5^\circ \sin 10^\circ \sin 15^\circ$

157. The set of all values of a such that both the points $(1, 2)$ and $(3, 4)$ lie on the same side of the line $3x - 5y + a = 0$

(a) $\{x \in \mathbb{R}: x > 11\}$

(b) $\{x \in RR: x > 11\} \cup \{x \in RR: x < 7\}$

(c) $\{x \in \mathbb{R}: x < 7\}$

(d) ϕ

158. If $x = \frac{1\cdot3}{3\cdot6} + \frac{1\cdot3\cdot5}{3\cdot6\cdot9} + \frac{1\cdot3\cdot5\cdot7}{3\cdot6\cdot9\cdot12} + \cdots$ to infinite terms, then $9x^2 + 24x =$

(a) 31 (b) 11 (c) 41 (d) 21

159. The triad (x, y, z) of real number such that

$(3\hat{i} - \hat{j} + 2\hat{k}) = (2\hat{i} + 3\hat{j} - \hat{k})x +$

$(\hat{i} - 2\hat{j} + 2\hat{k})y + (-2\hat{i} + \hat{j} - 2\hat{k})z$ is

(a) $(-2,5,3)$ (b) $(2,-5,3)$

(c) $(2,5,3)$ (d) $(2,5,-3)$

160. If the volume of the tetrahedron formed by the coterminous edges a, b and c is 4 , then the volume of the parallelopiped formed by the coterminous edges $a \times b$, $b \times c$ and $c \times a$ is

(a) 576 (b) 48

(c) 16 (d) 144