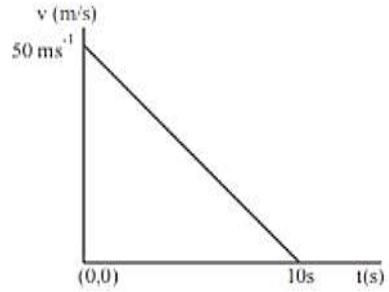
1. **The velocity-time graph for a body of mass 10 kg is shown in the figure. Work done on the body in the first two seconds of motion is:**



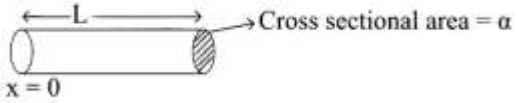
(a) -9300 J (b) 12000 J
(c) -4500 J (d) -12000 J

2. **For a domestic AC supply of 220 V at 50 cycles per sec, the potential difference between the terminals of a two-pin electric outlet in a room is given by**
(a) $V(t) = 220\sqrt{2}\text{Cos}(100\pi t)$
(b) $V(t) = 220\text{Sin}(50t)$
(v) $V(t) = 220\text{Cos}(100\pi t)$
(d) $V(t) = 220\sqrt{2}\text{Cos}(50t)$

3. **A radioactive nucleus decays as follows :**
$X \xrightarrow{\alpha} X_1 \xrightarrow{\beta} X_2 \xrightarrow{\alpha} X_3 \xrightarrow{\gamma} X_4$
If the mass number and atomic number of ' X_4 ' are 172 and 69 respectively, then the atomic number and mass number of ' X ' are
(a) 72,180 (b) 69,170
(c) 68,172 (d) 70,172

4. **A single slit diffraction pattern is obtained using a beam of red light. If red light is replaced by blue light then**
(a) the diffraction pattern will disappear.
(b)fringes will become narrower and crowded together.
(c)fringes will become broader and will be further apart.
(d) there is no change in the diffraction pattern.

5. **The variation of density of a solid cylindrical rod of cross sectional area α and length L is $\rho = \rho_0 \frac{x^2}{L^2}$, where x is the distance from one end of the rod. The position of its centre of mass from one end $(x = 0)$ is**



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

6. **A simple pendulum is taken at a place where its distance from the earth's surface is equal to the radius of the earth. Calculate the time period of small oscillations if the length of the string is 4.0 m . (Take $g = \pi^2$ ms^{-2} at the surface of the earth.)**
(a) 4 s (b) 6 s
(c) 8 s (d) 2 s

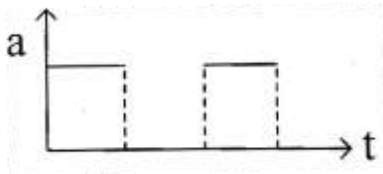
7. **Consider a particle of mass 1 gm and charge 1.0 Coulomb is at rest. Now the particle is subjected to an electric field $E(t) = E_0 \sin \omega t$ in the x-direction, where $E_0 = 2$ Newton/Coulomb and $\omega = 1000$rad/sec. The maximum speed attained by the particle is**
(a) 2 m/sec (b) 4 m/sec
(c) 6 m/sec (d) 8 m/sec

8. **The minimum force required to start pushing a body up a rough (having co-efficient of friction μ) inclined plane is $\vec{F}_1$ while the minimum force needed to prevent it from sliding**

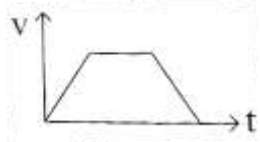
is $\overrightarrow{F_2}$. If the inclined plane makes an angle θ with the horizontal such that $\tan\theta = 2\mu$, then the ratio F_1/F_2 is

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

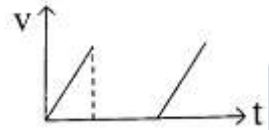
9. Acceleration-time $(a - t)$ graph of a body is shown in the figurd. Corresponding velocitytime $(v - t)$ graph is



(a)

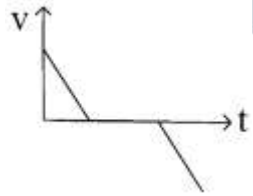


(b)

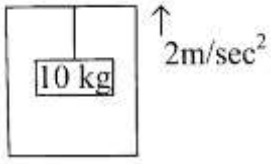


(c)

(d)



10. One end of a stecl wire is fixed to the ceiling of an elevator moving up with an acceleration 2 m/s^2 and a load of 10 kg hangs from the other end. If the cross section of the wire is 2 cm^2, then the longitudinal strain in the wire will be $(g = 10\ m/s^2$ and $Y = 2.0 \times 10^{11}\ N/m^2)$



(a) 4×10^{11} (b) 8×10^{-6}
(c) 3×10^{-6} (d) 2×10^{-6}

11. Ruma reached the metro station and found that the escalator was not working. She walked up the stationary escalator with velocity v_1 in time t_1. On other day if she remains stationary on the escalator moving with velocity v_2, then escalator takes her up in time t_2.

The time taken by her to walk up with velocity v_1 on the moving escalator will be

(a) $\frac{t_1t_2}{t_2-t_1}$ (b) $\frac{t_1t_2}{t_2+t_1}$

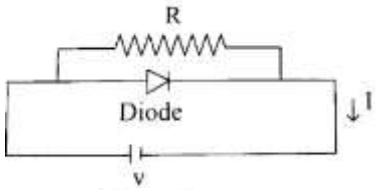
(c) $\frac{t_1-t_2}{t_1+t_2}$ (d) $\frac{t_1+t_2}{2(t_1-t_2)}$

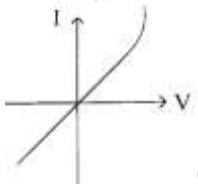
12. A quantity X is given by $\varepsilon_0 L\frac{\Delta V}{\Delta t}$, where ε_0 is the permittivity of free space, L is the length, ΔV is a potential difference and Δt is a time interval. The dimension of X is same as that of

(a) Resistance (b) Charge

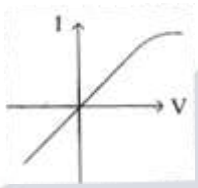
(c) Voltage (d) Current

13. A diode is connected in parallel with a resistance as shown in Figure. The most probable current (I) - voltage (V) characteristic is

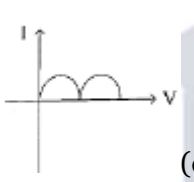




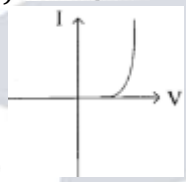
(a)



(b)



(c)



(d)

14. The minimum wavelength of Lyman series lines is P, then the maximum wavelength of these lines is

(a) $\frac{4P}{3}$ (b) $2P$

(c) $\frac{2P}{3}$ (d) ∞

15. An electron in Hydrogen atom jumps from the second Bohr orbit to the ground state and the difference between the energies of the two states is radiated in the form of a photon. This photon strikes a material. If the work function of the material is 4.2 eV , then the stopping potential is (Energy of electron in n-th orbit $= -\frac{13{\cdot}6}{n^2}$ eV)

(a) 2 V (b) 4 V

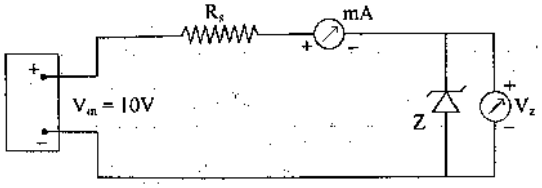
(c) 6 V (d) 8 V

16. A ball falls from a height h upon a fixed horizontal floor. The co-efficient of restitution for the collision between the ball and the floor is ' e '. The total distance covered by the ball before coming to rest is [neglect the air resistance]

(a) $\frac{1-e^2}{1+e^2}h$ (b) $\frac{1+e^2}{1-e^2}h$

(c) $\frac{1-2e^2}{1+e^2}h$ (d) $\frac{1+2e^2}{1-e^2}h$

17. Manufacturers supply a zener diode with zener voltage $V_z = 5.6$ V and maximum power dissipation $P_{z,max} = \frac{1}{4}$ W. This zener diode is used in the following circuit. Calculate the minimum value of the resistance R_s in the circuit so that the zener diode will not burn when the input voltage is $V_{in} = 10$ V.

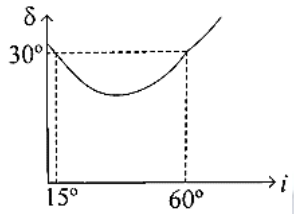


(a) 98.56Ω (b) 170 · 52Ω
(c) 306 · 21Ω (d) 412.37Ω

18. A force $\vec{F} = a\hat{i} + b\hat{j} + c\hat{k}$ is acting on a body of mass m. The body was initially at rest at the origin. The co-ordinates of the body after time ' t ' will be

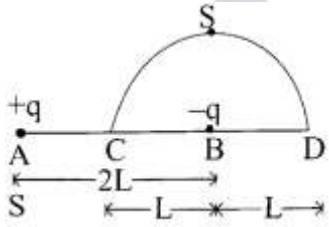
(a) $\frac{at^2}{2m}, \frac{bt^2}{2m}, \frac{ct^2}{2m}$ (b) $\frac{at^2}{2m}, \frac{bt^2}{m}, \frac{ct^2}{2m}$
(c) $\frac{at^2}{m}, \frac{bt^2}{2m}, \frac{ct^2}{2m}$ (d) $\frac{at^2}{2m}, \frac{bt^2}{2m}, \frac{ct^2}{m}$

19. Figure shows the graph of angle of deviation δ versus angle of incidence i for a light ray striking a prism. The prism angle is



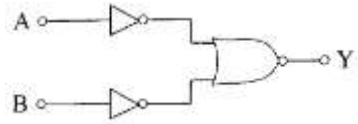
(a) 30° (b) 45°
(c) 60° (d) 75°

20. Two charges $+q$ and $-q$ are placed at points A and B respectively which are at a distance $2L_{ppat}$ C is the mid point of A and B. The workdone in moving a charge $+Q$ along the semicircle CSD(W_V) and along the line CBD(W_2) are



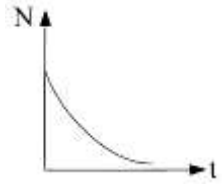
(a) $\frac{qQ}{4\pi\epsilon_0 L}, \frac{qQ}{4\pi\epsilon_0 L}$ (b) $\frac{-Qq}{6\pi\epsilon_0 L}, \frac{-Qq}{6\pi\epsilon_0 L}$
(c) $\frac{-Qq}{6\pi\epsilon_0 L}, \frac{-Qq}{12\pi\epsilon_0 L}$ (d) $\frac{qQ}{4\pi\epsilon_0 L}, 0$

21. Which logic gate is represented by the following combinations of logic gates?

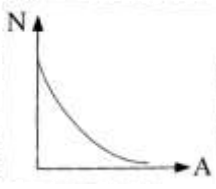


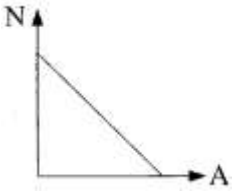
(a) NAND (b) AND
(c) NOR (d) OR

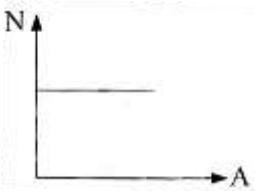
22. The number of undecayed nuclei N in a sample of radioactive material as a function of time (t) is shown in the figure. Which of the following graphs correctly show the relationship between N and the activity ' A '?



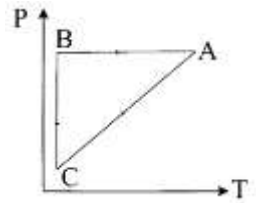
(a) 

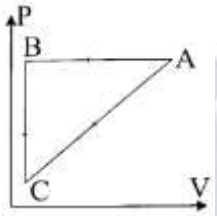
(b) 

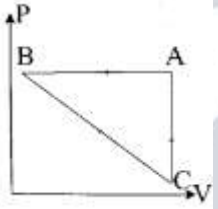
(c) 

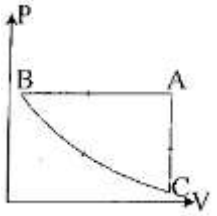
(d) 

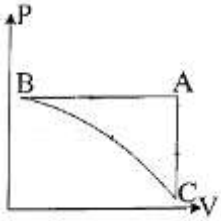
23. For an ideal gas, a cyclic process $ABCA$ as shown in P-T diagram, when presented in P-V plot, would be



(a) 

(b) 

(c) 

(d) 

24. The resistance $R = \frac{V}{I}$ where $V = (25 \pm 0.4)$ Volt and $I = (200 \pm 3)$ Ampere. The percentage error in ' R ' is

(a) 1.5% (b) 1.6%
(c) 3.1% (d) 0.1%

25. A particle of charge ' q ' and mass ' m ' moves in a circular orbit of radius ' r ' with angular speed ' ω '. The ratio of the magnitude of its magnetic moment to that of its angular momentum depends on

(a) ω and q (b) ω, q and m
(c) q and m (d) ω and m

26. The de-Broglie wavelength of a moving bus with speed v is λ. Some passengers left the bus at a stoppage. Now when the bus moves with twice of its initial speed, its kinetic energy is found to be twice of its initial value. What is the de-Broglie wavelength of the bus now?

(a) λ (b) 2λ

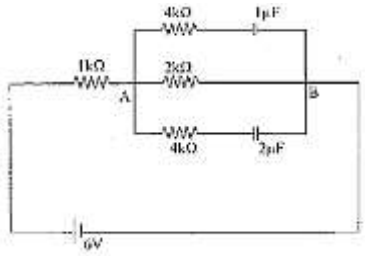
(c) $\frac{\lambda}{2}$ (d) $\frac{\lambda}{4}$

27. The variation of displacement with time of a simple harmonic motion (SHM) for a particle of mass m is represented by $y = 2\sin\left(\frac{\pi t}{2} + \phi\right)$ cm. The maximum acceleration of the particle is

(a) $\frac{\frac{\pi}{2}\text{cm}}{\text{sec}^2}$ (b) $\frac{\frac{\pi}{2m}\text{cm}}{\text{sec}^2}$

(c) $\frac{\pi^2}{2m}$ cm/sec^2 (d) $\frac{\pi^2}{2}$ cm/sec^2

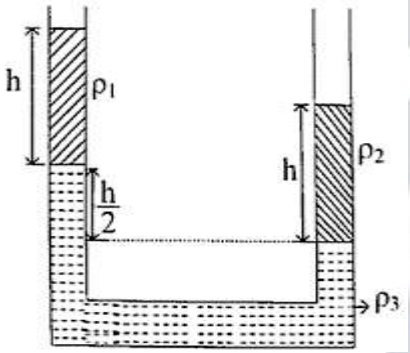
28. What are the charges stored in the 1μ F and 2μ F capacitors in the circuit as shown in figure once the current (I) become steady?



(a) 8μC and 4μC (b) 4μC and 8μC

(c) 3μC and 6μC (d) 6μC and 3μC

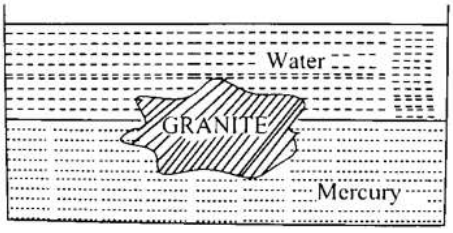
29. Three different liquids are filled in a U-tube as shown in figure. Their densities are ρ_1, ρ_2 and ρ_3 respectively. From the figure we may conclude that



(a) $p_3 = 4(\rho_2 - \rho_1)$ (b) $\rho_3 = 4(\rho_1 - \rho_2)$

(c) $\rho_3 = 2(\rho_2 - \rho_1)$ (d) $\rho_3 = \frac{\rho_1 + \rho_2}{2}$

30. A piece of granite floats at the interface of mercury and water contained in a beaker as in figure. If the densities of granite, water and mercury are ρ, ρ_1 and ρ_2 respectively, the ratio of the volume of granite in water to the volume of granite in mercury is



(a) $\frac{\rho_2 - \rho}{\rho - \rho_1}$ (b) $\frac{\rho_2 + \rho}{\rho_1 + \rho}$

(c) $\frac{\rho_1 \rho_2}{\rho}$ (d) $\frac{\rho_1}{\rho_2}$

31. 10^{20} photons of wavelength 660 nm are emitted per second from a lamp. The wattage of the lamp is (Planck's constant $= 6.6 \times 10^{-34}$Js)

(a) 30 W (b) 60 W
(c) 100 W (d) 500 W

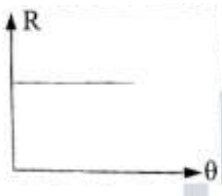
32. The apparent coefficient of expansion of a liquid, when heated in a copper vessel is C and when heated in silver vessel is S. If A is linear coefficient of expansion of copper, then linear coefficient of expansion of silver is

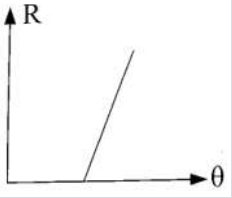
(a) $\frac{C-S-3A}{3}$ (b) $\frac{C+3A-S}{3}$
(c) $\frac{S+3A-C}{3}$ (d) $\frac{C+S+3A}{3}$

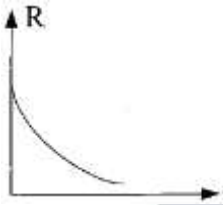
33. The equation of a stationary wave along a stretched string is given by $y = 5\sin\frac{\pi x}{3}\cos 40\pi t$. Here x and y are in cm and t in second. The separation between two adjacent nodes is

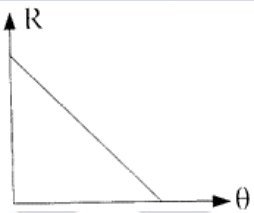
(a) 1.5 cm (b) 3 cm
(c) 6 cm (d) 14 cm

34. Temperature of a body θ is slightly more than the temperature of the surrounding θ_0. Its rate of cooling (R) versus temperature of the body (θ) is plotted. Its shape would be

(a) 

(b) 

(c) 

(d) 

35. Let $\bar{V}, V_{ms}, V_p$ denotes the mean speed, root mean square speed and most probable speed of the molecules each of mass m in an ideal monoatomic gas at absolute temperature T Kelvin. Which statement(s) is/are correct?

(a)No molecules can have speed greater than $\sqrt{2}V_{ms}$.
(b) No molecules can have speed less than $V_p/\sqrt{2}$.
(c) $V_p < \bar{V} < V_{ms}$
(d)Average kinetic energy of a molecule is $\frac{3}{4}mV_P^2$.

36. Let the binding energy per nucleon of nucleus is denoted by ' E'_{bn} and radius of the nucleus is denoted by ' r '. If mass number of nuclei A and B are 64 and 125 respectively, then

(a) $r_A < r_B$ (b) $r_A > r_B$
(c) $E_{bnA} > E_{bnB}$ (d) $E_{bnA} < E_{bnB}$

37. A wave disturbance in a medium is described by $y(x,t) = 0.02\cos\left(50\pi t + \frac{\pi}{2}\right)\cos(10\pi x)$ where x, y are in meters and t is in second. Which statement(s) is/are correct?

(a) A node occurs at $x = 0.15$ m.
(b) An antinode occurs at $x = 0.3$ m.
(c) The speed of the wave is 4 m/sec.
(d) The wavelength of the wave is 0.2 m .

38. If the dimensions of length are expressed as $G^xC^yh^z$, where G, C and h are the universal gravitational constant, speed of light and Planck's constant respectively, then

(a) $x = \frac{1}{2}, y = \frac{1}{2}$ (b) $x = \frac{1}{2}, z = \frac{1}{2}$

(c) $y = \frac{1}{2}, z = \frac{3}{2}$ (d) $y = \frac{3}{2}, z = \frac{1}{2}$

39. Two spheres S_1 and S_2 of masses m_1 and m_2 respectively collide with each other. Initially S_1 is at rest and S_2 is moving with velocity v along x-axis. After collision S_2 has a velocity $\frac{v}{2}$ in a direction perpendicular to the original direction. The sphere S_1 moves after collision

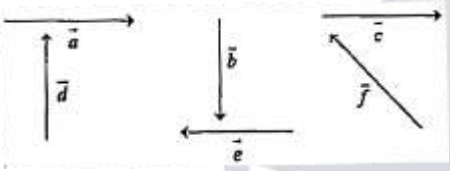
(a) with a velocity of magnitude $\frac{m_2}{m_1}v\frac{\sqrt{5}}{2}$.

(b) with a velocity in the direction $\theta = \tan^{-1}\left(-\frac{1}{3}\right)$ to the x-axis.

(c) with a velocity whose direction makes an angle θ with the x-axis such that $\theta = \tan^{-1}\left(\frac{1}{2}\right)$ or $\theta = \tan^{-1}\left(-\frac{1}{2}\right)$.

(d) with a velocity of magnitude $\frac{m_1}{2m_2}v\sqrt{5}$.

40. Six vectors $\vec{a}, \vec{b}, \vec{c}, \vec{d}, \vec{e}$ and $\vec{f}$ have the magnitudes and directions indicated in the figure. Which of the following statements is true?



(a) $\bar{b} + \bar{e} = \bar{f}$ (b) $\bar{b} + \bar{c} = \bar{f}$

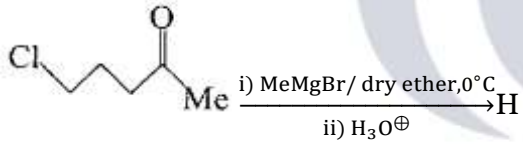
(c) $\bar{d} + \bar{c} = \bar{f}$ (d) $\bar{d} + \bar{e} = \bar{f}$

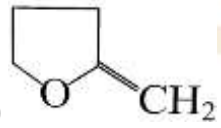
41. The number of lone pair of electrons and the hybridization of Xenon (Xe) in $XeOF_2$ are

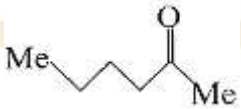
(a) $1, sp^3$ (b) $1, dsp^2$

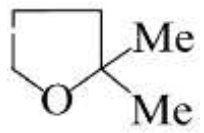
(c) $3, dsp^3$ (d) $2, sp^3$ d

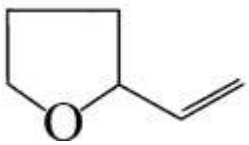
42. In the following reaction, the major product (H) is



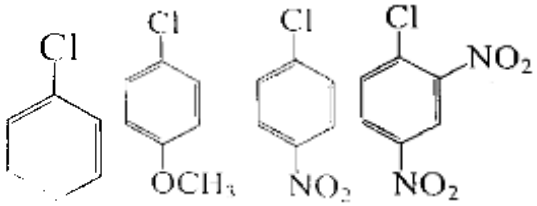
(a) 

(b) 

(c) 

(d) 

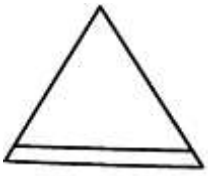
43. Increasing order of the nucleophilic substitution of following compounds



I II III IV

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

44. Which of the following hydrocarbons reacts easily with MeMgBr to give methane?

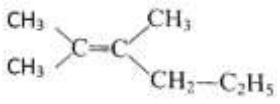
(a)  (b) 

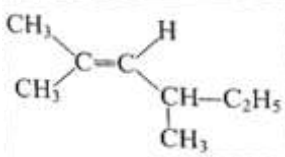
(c)  (d) 

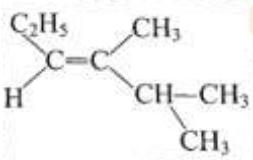
45. Adiabatic free expansion of ideal gas must be

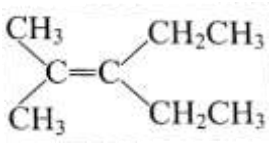
(a) Isobaric (b) Isochoric
(c) Isothermal (d) Isoentropic

46. An optically active alkene having molecular formula C_8H_{16} gives acetone as one of the products on ozonolysis. The structure of the alkene is

(a) 

(b) 

(c) 

(d) 

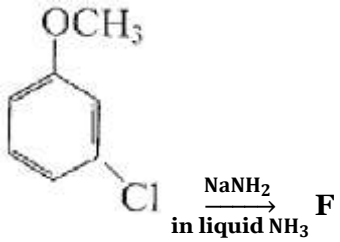
47. 360 cm^3 of a hydrocarbon diffuses in 30 minutes, while under the same conditions 360 cm^3 of SO_2 gas diffuses in one hour. The molecular formula of the hydrocarbon is

(a) CH_4 (b) C_2H_6
(c) C_2H_4 (d) C_2H_2

48. The number of terminal and bridging hydrogens in B_2H_6 are respectively

(a) 4 and 2 (b) 2 and 4
(c) 2 and 2 (d) 4 and 4

49. The major product (F) in the following reaction is



(a) o-Anisidine (b) m-anisidine
(c) p-Anisidine (d) p-Chloro aniline

50. For a chemical reaction, half-life period $\left(t_{\frac{1}{2}}\right)$ is 10 minutes. How much reactant will be left after 20 minutes if one starts with 100 moles of reactant and the order of the reaction be (i) zero, (ii) one and (iii) two?

(a) 0,25,33.33 (b) 25,0,33.33
(c) 33.33,25,0 (d) 25,33.33,0

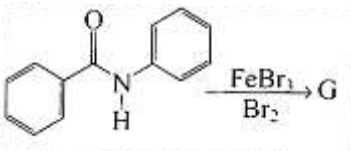
51. Equal volume of two solutions A and B of a strong acid having pH = 6.0 and pH = 4.0 respectively are mixed together to form a new solution. The pH of the new solution will be in the range

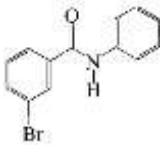
(a) between 5 and 6 (b) between 6 and 7
(c) between 4 and 5 (d) between 3 and 4

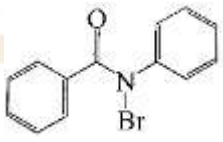
52. P and Q combines to form two compounds PQ_2 and PQ_3. If 1 g PQ_2 is dissolved in 51 g benzene the depression of freezing point becomes $0 \cdot 8^{\circ}C$. On the other hand if 1 g PQ_3 is dissolved in 51 g of benzene, the depression of freezing point becomes $0.625^{\circ}C$. The atomic mass of P and Q are (K_f of benzene = $5 \cdot 1$ K kg mol^{-1})

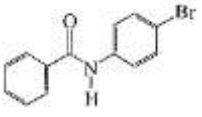
(a) 35,55 (b) 45,45
(c) 55,45 (d) 55,35

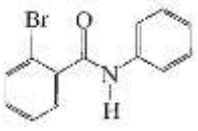
53. Identify the major product (G) in the following reaction



(a) 

(b) 

(c) 

(d) 

54. Increasing order of solubility of AgCl in (i) H_2O, (ii) 1 M NaCl (aq.), (iii) 1 M CaCl 2 (aq.) and (iv) 1M$NaNO_3$ (aq.) solution

(a) $CaCl_2 < NaNO_3 < NaCl < H_2O$
(b) $CaCl_2 > H_2O > NaCl > NaNO_3$
(c) $CaCl_2 > NaCl > H_2O > NaNO_3$
(d) $CaCl_2 < NaCl < H_2O < NaNO_3$

55. Arrange the following compounds in order of their increasing acid strength

I II

$CO_2H(CH_2)_2CO_2H$

III IV

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

56. Which of the following hydrogen bonds is likely to be the weakest?

(a) $C-H\cdots O$ (b) $N-H\cdots O$
(c) $O-H\cdots O$ (d) $O-H\cdots F$

57. How many oxygen atoms are present in 0.36 g of a drop of water at STP?

(a) 6.023×10^{22} (b) 1.205×10^{22}
(c) 6.023×10^{23} (d) 1.205×10^{23}

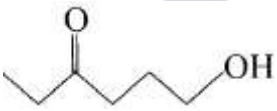
58. The molar conductances of $Ba(OH)_2$, $BaCl_2$ and NH_4Cl at infinite dilution are $523\cdot28, 280\cdot0$ and $129.8\ S\ cm^2\ mol^{-1}$ respectively. The molar conductance of NH_4OH at infinite dilution will be

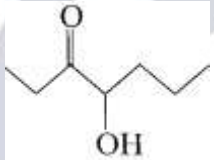
(a) 125.72 S cm^2 mol^{-1}
(b) 251.44 S cm^2 mol^{-1}
(c) 502.88 S cm^2 mol^{-1}
(d) 754.32 S cm^2 mol^{-1}

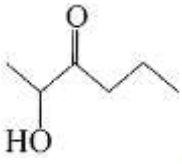
59. The common stable oxidation states of Eu and Gd are respectively

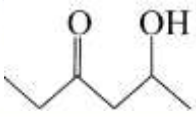
(a) +3 and +3 (b) +3 and +2
(c) +2 and +3 (d) +2 and +2

60. Which one among the following compounds will most readily be dehydrated under acidic condition?

(a) 

(b) 

(c) 

(d) 

61. $_5B^{10} + {}_2He^4 \rightarrow X + {}_0n^1$ In the above nuclear reaction 'X' will be

(a) $_7N^{14}$ (b) $_7N^{13}$
(c) $_6C^{12}$ (d) $_7N^{12}$

62. An LPG (Liquified Petroleum Gas) cylinder weighs 15.0 kg when empty. When full, it weighs 30.0 kg and shows a pressure of 3.0 atm . In the course of usage at 27°C, the mass of the full cylinder is reduced to $24\cdot2$ kg. The volume of the used gas in cubic metre at the normal usage condition (atm and 27°C) is (assume LPG to be normal butane and it behaves ideally)

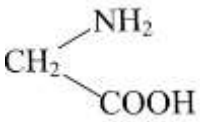
(a) 24.6 m^3 (b) 246 m^3
(c) 0.246 m^3 (d) 2.46 m^3

63. What is the four-electron reduced form of O_2 ?

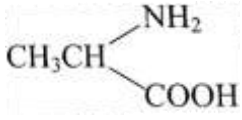
(a) Superoxide (b) Peroxide
(c) Oxide (d) Ozone

64. Kjeldahl's method cannot be used for the estimation of nitrogen in which compound?

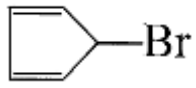
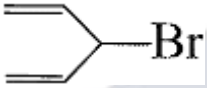
(a) 

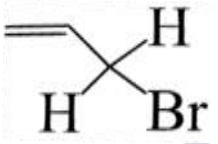
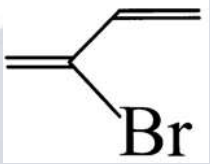
(b) 

(c) $C_6H_5 - N = N - C_6H_5$

(d) 

65. Which of the following compounds is most reactive in S_N1 reaction?

(a)  (b) 

(c)  (d) 

66. The coagulating power of electrolytes having ions Na^+, Al^{3+} and Ba^{2+} for As_2S_3 sol increases in the order

(a) $Al^{3+} < Ba^{2+} < Na^+$ (b) $Na^+ < Ba^{2+} < Al^{3+}$

(c) $Ba^{2+} < Na^+ < Al^{3+}$ (d) $Al^{3+} < Na^+ < Ba^{2+}$

67. If three elements A, B, C crystalise in a cubic solid lattice with B atoms at the cubic centres, C aton at the centre of edges and A atoms at the corners, then formula of the compound is

(a) AB_3C (b) A_3BC

(c) ABC_3 (d) ABC

68. Which of the following oxides is paramagnetic?

(a) SO_2 (b) NO_2

(c) SiO_2 (d) CO_2

69. How many electrons are needed to reduce N_2 to NH_3 ?

(a) 3 (b) 4

(c) 5 (d) 6

70. The bond order of HeH^+ is

(a) 1 (b) 2

(c) 3 (d) 4

71. An egg takes 4.0 minutes to boil at sea level where the boiling point of water is T_1K, where as it takes 8.0 minutes to boil on a mountain top where the boiling point of water is T_2 K. The activation energy for the reaction that takes place during the boiling of egg is

(a) $0.693\frac{T_1-T_2}{T_1T_2}$ (b) $0.693\frac{T_2-T_1}{T_1T_2}$

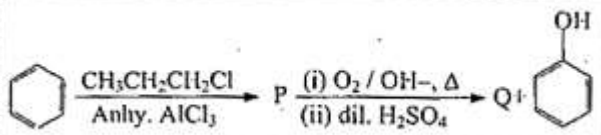
(c) $0.693R\frac{T_1T_2}{T_2-T_1}$ (d) $0.693R\frac{T_1T_2}{T_1-T_2}$

72. As per the following equation, 0.217 g of HgO (molecular mass = 217 g mol^{-1}) reacts with excess iodide. On titration of the resulting solution, how many mL of 0.01 M HCl is required to reach the equivalence point?

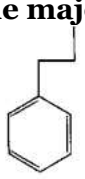
$HgO + 4I^- + H_2O \rightarrow HgI_4^{2-} + 2OH$

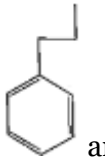
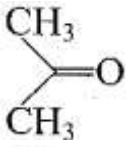
(a) 50 mL (b) 200 mL

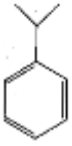
(c) 10 mL (d) 5 mL

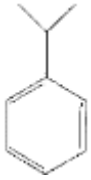


73. The major product ' P ' and ' Q ' in the above reactions are

(a)  and CH_3CH_2CHO

(b)  and 

(c)  and 

(d)  and CH_3CH_2CHO

74. Consider the following chemical equilibrium of the gas phase reaction at a constant temperature : $A(g) \rightleftharpoons B(g) + C(g)$ If p being the total pressure, K_p is the pressure equilibrium constant and α is the degree of dissociation, then which of the following is true at equilibrium?

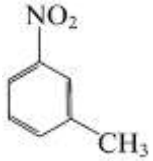
(a) If p value is extremely high compared to K_p, $\alpha \approx 1$

(b) When p increases α decreases

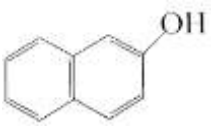
(c) If k_p value is extremely high compared to p, α becomes much less than unity

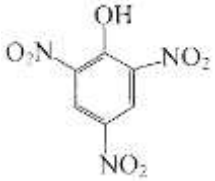
(d) When p increases α increases

75. Compound given below will produce effervescence when mixed with aqueous sodium bicarbonate solution

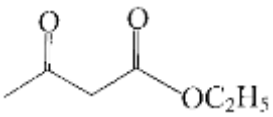
(a) 

(b) CH_3COCH_3

(c) 

(d) 

76. Which of the following statement(s) is/are correct about the given compound?



(a) It exhibits tautomerism.
(b) It does not react with metallic sodium.
(c) It gives reddish-violet coloration with $FeCl_3$ solution.
(d) It gives precipitate with 2,4dinitrophenyl hydrazine solution.

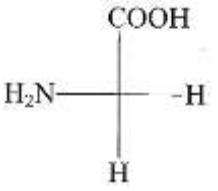
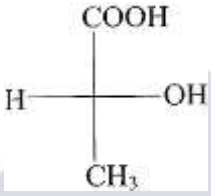
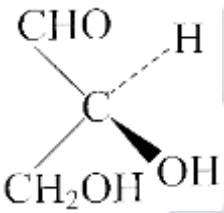
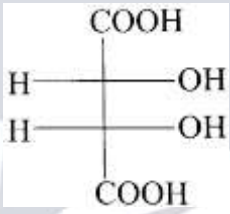
77. X is an extensive property and x is an intensive property of a thermodynamic system. Which of the following statement(s) is (are) correct?

(a) xX is extensive. (b) $\frac{x}{X}$ is intensive.
(c) $\frac{X}{x}$ is extensive. (d) $\frac{dX}{dx}$ is intensive.

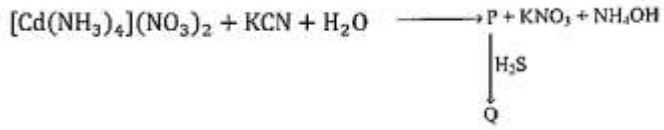
78. Which pair of ions among the following can be separated by precipitation method?

(a) Eu (II) and Dy (III) (b) Gd (III) and Dy (III)
(c) Eu (II) and Yb (II) (d) Eu (II) and Gd (II)

79. The compound(s) showing optical activity is/are

(a) 
(b) 
(c) 
(d) 

80. Identify ' P ' and ' Q ' in the following reaction



(a) $P = K_2[Cd(CN)_4], Q = CdS$
(b) $P = CdS, Q = K_2[Cd(CN)_4]$
(c) $P = Cd(NO_3)_2, Q = CdSO_4$
(d) $P = [Cd(OH_2)_4](NO_3)_2, Q = [Cd(NO :$

81. If $f(x) = \begin{cases} x^2 + 3x + a, & x \le 1 \\ bx + 2, & x > 1 \end{cases}, x \in \mathbb{R}$, is everywhere differentiable, then :

(a) $a = 3, b = 5$ (b) $a = 0, b = 5$
(c) $a = 0, b = 3$ (d) $a = b = 3$

82. Let $p(x)$ be a real polynomial of least degree which has a local maximum at $x = 1$ and a local minimum at $x = 3$. If $p(1) = 6$ and $p(3) = 2$, then $p'(0)$ is equal to :

(a) 8 (b) 9
(c) 3 (d) 6

83. The function $f(x) = 2x^3 - 3x^2 - 12x + 4, x \in \mathbb{R}$ has

(a) two points of local maximum.
(b) two points of local minimum.
(c) one local maximum and one local minimum.
(d) neither maximum nor minimum.

84. Let $\phi(x) = f(x) + f(2a - x), x \in [0, 2a]$ and $f''(x) > 0$ for all $x \in [0, a]$. Then $\phi(x)$ is

(a) increasing on $[0, a]$. (b) decreasing on $[0, a]$.
(c) increasing on $[0,2a]$. (d) decreasing on $[0,2a]$.

85. If $g(f(x)) = |\sin x|$ and $f(g(x)) = (\sin\sqrt{x})^2$, then

(a) $f(x) = \sin^2 x, g(x) = \sqrt{x}$

(b) $f(x) = \sin x, g(x) = |x|$

(c) $f(x) = x^2, g(x) = \sin\sqrt{x}$

(d) $f(x) = |x|, g(x) = \sin x$

86. The expression $2^{4n} - 15n - 1$, where $n \in \mathbb{N}$ (the set of natural numbers) is divisible by

(a) 125 (b) 225

(c) 325 (d) 425

87. If z_1, z_2 are complex numbers such that $\frac{2z_1}{3z_2}$ is a purely imaginary number, then the value of $\left|\frac{z_1 - z_2}{z_1 + z_2}\right|$ is

(a) 1 (b) 2

(c) 3 (d) 4

88. The value of the integral $\int_3^6 \frac{\sqrt{x}}{\sqrt{9-x}+\sqrt{x}}dx$ is

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

(c) 2 (d) 1

89. The line $y - \sqrt{3}x + 3 = 0$ cuts the parabola $y^2 = x + 2$ at the points P and Q. If the coordinates of the point X are $(\sqrt{3}, 0)$, then the value of $XP \cdot XQ$ is

(a) $\frac{4(2+\sqrt{3})}{3}$ (b) $\frac{4(2-\sqrt{3})}{2}$

(c) $\frac{5(2+\sqrt{3})}{3}$ (d) $\frac{5(2-\sqrt{3})}{3}$

90. Let $f(x) = |1 - 2x|$, then

(a) $f(x)$ is continuous but not differentiable at $x = \frac{1}{2}$.

(b) $f(x)$ is differentiable but not continuous at $x = \frac{1}{2}$.

(c) $f(x)$ is both continuous and differentiable at $x = \frac{1}{2}$.

(d) $f(x)$ is neither differentiable nor continuous at $x = \frac{1}{2}$.

91. If 'f' is the inverse function of 'g' and $g'(x) = \frac{1}{1+x^n}$, then the value of $f'(x)$ is

(a) $1 + \{f(x)\}^n$ (b) $1 - \{f(x)\}^n$

(c) $\{1 + f(x)\}^n$ (d) $\{f(x)\}^n$

92. If the matrix $\begin{pmatrix} 0 & a & a \\ 2b & b & -b \\ c & -c & c \end{pmatrix}$ is orthogonal, then the values of a, b, c are

(a) $a = \pm\frac{1}{\sqrt{3}}, b = \pm\frac{1}{\sqrt{6}}, c = \pm\frac{1}{\sqrt{2}}$

(b) $a = \pm\frac{1}{\sqrt{2}}, b = \pm\frac{1}{\sqrt{6}}, c = \pm\frac{1}{\sqrt{3}}$

(c) $a = -\frac{1}{\sqrt{2}}, b = -\frac{1}{\sqrt{6}}, c = -\frac{1}{\sqrt{3}}$

(d) $a = \frac{1}{\sqrt{3}}, b = \frac{1}{\sqrt{6}}, c = \frac{1}{\sqrt{3}}$

93. Let $A = \begin{bmatrix} 5 & 5\alpha & \alpha \\ 0 & \alpha & 5\alpha \\ 0 & 0 & 5 \end{bmatrix}$. If $|A|^2 = 25$, then $|\alpha|$ equals to

(a) 5^2 (b) 1

(c) $\frac{1}{5}$ (d) 5

94. **A function $f: \mathbb{R} \to \mathbb{R}$, satisfies $f\left(\frac{x+y}{3}\right) = \frac{f(x)+f(y)+f(0)}{3}$ for all $x, y \in \mathbb{R}$. If the function 'f' is differentiable at $x = 0$, then f is**

(a) linear (b) quadratic
(c) cubic (d) biquadratic

95. **Let f be a function which is differentiable for all real x. If $f(2) = -4$ and $f'(x) \geq 6$ for all $x \in [2, 4]$, then**

(a) $f(4) < 8$ (b) $f(4) \geq 12$
(c) $f(4) \geq 8$ (d) $f(4) < 12$

96. **If E and F are two independent events with $P(E) = 0.3$ and $P(E \cup F) = 0.5$, then $P\left(\frac{E}{F}\right) - P\left(\frac{F}{E}\right)$ equals**

(a) $\frac{2}{7}$ (b) $\frac{3}{35}$
(c) $\frac{1}{70}$ (d) $\frac{1}{7}$

97. **The set of points of discontinuity of the function $f(x) = x - [x], x \in \mathbb{R}$ is**

(a) Q (b) R
(c) N (d) Z

98. **For what value of 'a', the sum of the squares of the roots of the equation $x^2 - (a - 2)x - a + 1 = 0$ will have the least value?**

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

99. **$\int_{-1}^{1} \frac{x^3+|x|+1}{x^2+2|x|+1} dx$ is equal to**

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

100. **If $\vec{a}, \vec{b}, \vec{c}$ are non-coplanar vectors and λ is a real number then the vectors $\vec{a} + 2\vec{b} + 3\vec{c}, \lambda\vec{b} + 4\vec{c}$ and $(2\lambda - 1)\vec{c}$ are noncoplanar for**

(a) no value of λ.
(b) all except one value of λ.
(c) all except two values of λ.
(d) all values of λ.

101. **Let $\omega(\neq 1)$ be a cubic root of unity. Then the minimum value of the set $\{|a + b\omega + c\omega^2|^2; a, b, c$ are distinct nonzero integers$\}$ equals**

(a) 15 (b) 5
(c) 3 (d) 4

102. **$\int_0^{1.5} [x^2] dx$ is equal to**

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

103. **If the sum of 'n' terms of an A.P. is $3n^2 + 5n$ and its m th term is 164, then the value of m is**

(a) 26 (b) 27
(c) 28 (d) 29

104. **If $x = \int_0^y \frac{1}{\sqrt{1+9t^2}} dt$ and $\frac{d^2y}{dx^2} = ay$, then a is equal to**

(a) 3 (b) 6
(c) 9 (d) 1

105. **If ${}^9P_5 + 5 \cdot {}^9P_4 = {}^{10}P_r$, then the value of '$r$' is**

(a) 4 (b) 8
(c) 5 (d) 7

106. If ' θ ' is the angle between two vectors $\vec{a}$ and $\vec{b}$ such that $|\vec{a}| = 7, |\vec{b}| = 1$ and $|\vec{a} \times \vec{b}|^2 = k^2 - (\vec{a} \cdot \vec{b})^2$, then the values of k and θ are

(a) $k = 1, \theta = 45°$
(b) $k = 7, \theta = 60°$
(c) $k = 49, \theta = 90°$
(d) $k = 7$ and θ is arbitrary

107. Consider three points $P(\cos\alpha, \sin\beta), Q(\sin\alpha, \cos\beta)$ and $R(0,0)$, where $0 < \alpha, \beta < \frac{\pi}{4}$. Then

(a) P lies on the line segment RQ.
(b) Q lies on the line segment PR.
(c) R lies on the line segment PQ.
(d) P, Q, R are non-collinear.

108. An $n \times n$ matrix is formed using 0,1 and -1 as its elements. The number of such matrices which are skew symmetric is

(a) $\frac{n(n-1)}{2}$ (b) $(n-1)^2$
(c) $2^{n(n-1)/2}$ (d) $3^{n(n-1)/2}$

109. Suppose α, β, γ are the roots of the equation $x^3 + qx + r = 0$ (with $r \neq 0$) and they are in A.P. Then the rank of the matrix $\begin{pmatrix} \alpha & \beta & \gamma \\ \beta & \gamma & \alpha \\ \gamma & \alpha & \beta \end{pmatrix}$ is

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

110. Let $f_n(x) = \tan\frac{x}{2}(1+\sec x)(1+\sec 2x) \ldots (1+\sec 2^n x)$, then

(a) $f_5\left(\frac{\pi}{16}\right) = 1$ (b) $f_4\left(\frac{\pi}{16}\right) = 1$
(c) $f_3\left(\frac{\pi}{16}\right) = 1$ (d) $f_2\left(\frac{\pi}{16}\right) = 1$

111. The value of the expression ${}^{47}C_4 + \sum_{j=1}^{5} {}^{52-j}C_3$ is

(a) ${}^{52}C_3$ (b) ${}^{51}C_4$
(c) ${}^{52}C_4$ (d) ${}^{51}C_3$

112. If $\text{adj}B = A, |P| = |Q| = 1$, then $\text{adj}(Q^{-1}BP^{-1}) =$

(a) PQ (b) QAP
(c) PAQ (d) $PA^{-1}Q$

113. Let $\vec{a}, \vec{b}$ and $\vec{c}$ be vectors of equal magnitude such that the angle between $\vec{a}$ and $\vec{b}$ is α, $\vec{b}$ and $\vec{c}$ is β and $\vec{c}$ and $\vec{a}$ is γ. Then the minimum value of $\cos\alpha + \cos\beta + \cos\gamma$ is

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

114. Let $f(x)$ be a second degree polynomial. If $f(1) = f(-1)$ and p, q, r are in A.P., then $f'(p), f'(q), f'(r)$ are

(a) in A.P. (b) in G.P.
(c) in H.P. (d) neither in A.P. or G.P. or H.P.

115. The line parallel to the x-axis passing through the intersection of the lines $ax + 2by + 3b = 0$ and $bx - 2ay - 3a = 0$ where $(a, b) \neq (0, 0)$ is

(a) above x-axis at a distance $\frac{3}{2}$ from it.
(b) above x-axis at a distance $\frac{2}{3}$ from it.
(c) below x-axis at a distance $\frac{3}{2}$ from it.
(d) below x-axis at a distance $\frac{2}{3}$ from it.

116. A function f is defined by $f(x) = 2 + (x-1)^{2/3}$ on $[0, 2]$. Which of the following statements is incorrect?

(a) f is not derivable in (0,2).
(b) f is continuous in [0,2].
(c) $f(0) = f(2)$.
(d) Rolle's theorem is applicable on [0,2].

117. The number of reflexive relations on a set A of n elements is equal to

(a) 2^{n^2} (b) n^2
(c) $2^{n(n-1)}$ (d) $n^2 - n$

118. Let $f(x)$ be continuous on $[0, 5]$ and differentiable in $(0, 5)$. If $f(0) = 0$ and $|f'(x)| \leq \frac{1}{5}$ for all x in $(0, 5)$, then $\forall x$ in $[0, 5]$

(a) $|f(x)| \leq 1$ (b) $|f(x)| \leq \frac{1}{5}$
(c) $f(x) = \frac{x}{5}$ (d) $|f(x)| \geq 1$

119. $\lim_{x\to 0} \frac{\tan([-\pi^2]x^2) - x^2\tan([-\pi^2])}{\sin^2 x}$ equals

(a) 0 (b) $\tan 10 - 10$
(c) $\tan 9 - 9$ (d) 1

120. If $\cos^{-1}\alpha + \cos^{-1}\beta + \cos^{-1}\gamma = 3\pi$, then $\alpha(\beta+\gamma) + \beta(\gamma+\alpha) + \gamma(\alpha+\beta)$ is equal to

(a) 0 (b) 1
(c) 6 (d) 12

121. If $\vec{\alpha} = 3\vec{i} - \vec{k}, |\vec{\beta}| = \sqrt{5}$ and $\vec{\alpha} \cdot \vec{\beta} = 3$, then the area of the parallelogram for which $\vec{\alpha}$ and $\vec{\beta}$ are adjacent sides is

(a) $\sqrt{17}$ (b) $\sqrt{14}$
(c) $\sqrt{7}$ (d) $\sqrt{41}$

122. If $x = -1$ and $x = 2$ are extreme points of $f(x) = \alpha\log|x| + \beta x^2 + x, (x \neq 0)$, then

(a) $\alpha = -6, \beta = \frac{1}{2}$ (b) $\alpha = -6, \beta = -\frac{1}{2}$
(c) $\alpha = 2, \beta = -\frac{1}{2}$ (d) $\alpha = 2, \beta = \frac{1}{2}$

123. If for a matrix A, $|A| = 6$ and adj $A = \begin{bmatrix} 1 & -2 & 4 \\ 4 & 1 & 1 \\ -1 & k & 0 \end{bmatrix}$, then k is equal to

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

124. If a, b, c are positive real numbers each distinct from unity, then the value of the determinant $\begin{vmatrix} 1 & \log_a b & \log_a c \\ \log_b a & 1 & \log_b c \\ \log_c a & \log_c b & 1 \end{vmatrix}$ is

(a) 0 (b) 1
(c) $\log_e(abc)$ (d) $\log_e a \log_e b \log_e c$

125. The straight line $\frac{x-3}{3} = \frac{y-2}{1} = \frac{z-1}{0}$ is

(a) parallel to the x-axis.
(b) parallel to the y-axis.
(c) parallel to the z-axis.
(d) perpendicular to the z-axis.

126. The sum of the first four terms of an arithmetic progression is 56 . The sum of the last four terms is 112 . If its first term is 11, then the number of terms is

(a) 10 (b) 11
(c) 12 (d) 13

127. The value of the integral $\int_0^{\pi/2} \log\left(\frac{4+3\sin x}{4+3\cos x}\right) dx$ is

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

(c) 0 (d) - 2

128. If the sum of the squares of the roots of the equation $x^2-(a-2)x-(a+1)=0$ is least for an appropriate value of the variable parameter a, then that value of ' a ' will be

(a) 3 (b) 2

(c) 1 (d) 0

129. If $\left(1+x-2x^2\right)^6 = 1+a_1x+a_2x^2+\cdots+a_1+a_{12}x^{12}$, then the value of $a_2+a_4+a_6+\cdots+a_{12}$ is

(a) 21 (b) 31

(c) 32 (d) 64

130. Let $\vec{a},\vec{b},\vec{c}$ be unit vectors. Suppose $\vec{a}\cdot\vec{b}=\vec{a}\cdot\vec{c}=0$ and the angle between $\vec{b}$ and $\vec{c}$ is $\frac{\pi}{6}$. Then $\vec{a}$ is

(a) $\vec{b}\times\vec{c}$ (b) $\vec{c}\times\vec{b}$

(c) $\vec{b}+\vec{c}$ (d) $\pm2(\vec{b}\times\vec{c})$

131. The probability that a non-leap year selected at random will have 53 Sundays or 53 Saturdays is

(a) $\frac{1}{7}$ (b) $\frac{2}{7}$

(c) 1 (d) $\frac{2}{365}$

132. If $|Z_1|=|Z_2|=|Z_3|=1$ and $Z_1+Z_2+Z_3=0$, then the area of the triangle whose vertices are Z_1,Z_2,Z_3 is

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

(c) 1 (d) 2

133. Let $f(\theta)=\begin{vmatrix} 1 & \cos\theta & -1 \\ -\sin\theta & 1 & -\cos\theta \\ -1 & \sin\theta & 1 \end{vmatrix}$. Suppose A and B are respectively maximum and minimum values of $f(\theta)$. Then (A,B) is equal to

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

(c) $(\sqrt{2},1)$ (d) $\left(2,\frac{1}{\sqrt{2}}\right)$

134. If $f(x)=\frac{3x-4}{2x-3}$, then $f\left(f(f(x))\right)$ will be

(a) x (b) $2x$

(c) $\frac{2x-3}{3x-4}$ (d) $\frac{3x-4}{2x-3}$

135. Let $f(x)=\max\{x+|x|, x-[x]\}$, where $[x]$ stands for the greatest integer not greater than x. Then $\int_{-3}^{3} f(x)dx$ has the value

(a) $\frac{51}{2}$ (b) $\frac{21}{2}$

(c) 1 (d) 0

136. If a,b,c are in A.P. and if the equations $(b-c)x^2+(c-a)x+(a-b)=0$ and $2(c+a)x^2+(b+c)x=0$ have a common root, then

(a) a^2,b^2,c^2 are in A.P.

(b) a^2,c^2,b^2 are in A.P.

(c) c^2,a^2,b^2 are in A.P.

(d) a^2,b^2,c^2 are in G.P.

137. Let $x-y=0$ and $x+y=1$ be two perpendicular diameters of a circle of radius R. The circle will pass through the origin if R is equal to

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

(c) $\frac{1}{\sqrt{3}}$ (d) $\frac{1}{3}$

138. Let $f(x) = |x-\alpha| + |x-\beta|$, where α, β are the roots of the equation $x^2 - 3x + 2 = 0$. Then the number of points in $[\alpha, \beta]$ at which f is not differentiable is

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

139. The maximum number of common normals of $y^2 = 4ax$ and $x^2 = 4by$ is equal to

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

140. The number of common tangents to the circles $x^2 + y^2 - 4x - 6y - 12 = 0, x^2 + y^2 + 6x + 18y + 26$ is

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

141. The number of solutions of $\sin^{-1} x + \sin^{-1}(1-x) = \cos^{-1} x$ is

(a) 0 (b) 1
(c) 2 (d) 4

142. Let $u + v + w = 3, u, v, w \in \mathbb{R}$ and $f(x) = ux^2 + vx + w$ be such that $f(x+y) = f(x) + f(y) + xy, \forall x, y \in \mathbb{R}$. Then $f(1)$ is equal to

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

143. Let a_n denote the term independent of x in the expansion of $\left[x + \frac{\sin(1/n)}{x^2}\right]^{3n}$, then $\lim_{n\to\infty} \frac{(a_n)n!}{3n P_n}$ equals

(a) 0 (b) 1
(c) e (d) $e/\sqrt{3}$

144. If $\cos(\theta + \phi) = \frac{3}{5}$ and $\sin(\theta - \phi) = \frac{5}{13}, 0 < \theta, \phi < \frac{\pi}{4}$, then $\cot(2\theta)$ has the value

(a) $\frac{16}{63}$ (b) $\frac{63}{16}$
(c) $\frac{3}{13}$ (d) $\frac{13}{3}$

145. If $f(x)$ and $g(x)$ are two polynomials such that $\phi(x) = f(x^3) + xg(x^3)$ is divisible by $x^2 + x + 1$, then

(a) $\phi(x)$ is divisible by $(x-1)$
(b) none of $f(x)$ and $g(x)$ is divisible by $(x-1)$
(c) $g(x)$ is divisible by $(x-1)$ but $f(x)$ is not divisible by $(x-1)$
(d) $f(x)$ io divisible $hv(x-1)$ but $g(x)$ is not divisible by $(x-1)$

146. If the equation $\sin^4 x - (p+2)\sin^2 x - (p+3) = 0$ has a solution, the p must lie in the interval

(a) $[-3, -2]$ (b) $(-3, -2)$
(c) $(2,3)$ (d) $[-5, -3]$

147. If $0 \le a, b \le 3$ and the equation $x^2 + 4 + 3\cos(ax + b) = 2x$ has real solutions, then the value of $(a+b)$ is

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

148. Let $f(x) = x^3, x \in [-1, 1]$. Then which of the following are correct?

(a) 'f' has a minimum at $x = 0$.
(b) 'f' has the maximum at $x = 1$.
(c) 'f' is continuous on $[-1,1]$.
(d) 'f' is bounded on $[-1,1]$.

149. Three numbers are chosen at random without replacement from $\{1, 2, \ldots 10\}$. The probability that the minimum of the chosen numbers is 3 or their maximum is 7 , is

(a) $\frac{5}{40}$ (b) $\frac{3}{40}$

(c) $\frac{11}{40}$ (d) $\frac{9}{40}$

150. The population $p(t)$ at time t of a certain mouse species follows the differential equation, $\frac{dp(t)}{dt} = 0.5p(t) - 450$,If $p(0) = 850$, then the time at which the population becomes zero is

(a) $\log 9$ (b) $\frac{1}{2}\log 18$

(c) $\log 18$ (d) $2\log 18$

151. If P is a non-singular matrix of order 5×5 and the sum of the elements of each row is 1 , then the sum of the elements of each row in P^{-1} is

(a) 0 (b) 1

(c) $\frac{1}{8}$ (d) 8

152. The solution set of the equation $\left(x \in \left(0, \frac{\pi}{2}\right)\right) \tan(\pi \tan x) = \cot(\pi \cot x)$, is

(a) $\{0\}$ (b) $\left\{\frac{\pi}{4}\right\}$

(c) ϕ (d) $\left\{\frac{\pi}{6}\right\}$

153. If $f(x) = \int_0^{\sin^2 x} \sin^{-1}\sqrt{t}dt$ and $g(x) = \int_0^{\cos^2 x} \cos^{-1}\sqrt{t}dt$, then the value of $f(x) + g(x)$ is

(a) π (b) $\frac{\pi}{4}$

(c) $\frac{\pi}{2}$ (d) $\sin^2 x + \sin x + x$

154. The value of $\int_{-100}^{100} \frac{(x+x^3+x^5)}{(1+x^2+x^4+x^6)}dx$ is

(a) 100 (b) 1000

(c) 0 (d) 10

155. Let $f: [0, 1] \to \mathbb{R}$ and $g: [0, 1] \to \mathbb{R}$ be defined as follows:

$$\left.\begin{array}{l} f(x) = 1 \text{ if } x \text{ is rational} \\ \quad\;\; = 0 \text{ if } x \text{ is irrational} \end{array}\right] \text{and}$$

$$\left.\begin{array}{l} g(x) = 0 \text{ if } x \text{ is rational} \\ \quad\;\; = 1 \text{ if } x \text{ is irrational} \end{array}\right] \text{then}$$

(a) f and g are continuous at the point $x = \frac{1}{2}$.

(b) $f + g$ is continuous at the point $x = \frac{2}{3}$ but f and g are discontinuous at $x = \frac{2}{3}$.

(c) $f(x) \cdot g(x) > 0$ for some points $x \in (0,1)$.

(d) $f + g$ is not differentiable at the point $x = \frac{3}{4}$.