46. If E = energy, G = gravitational constant, I = impulse and M = mass, then dimensions of $\frac{GIM^2}{E^2}$ are same as that of

(a) time (b) mass
(c) length (d) force

47. If the first one-third of a journey is travelled at 20 km/h, next one-third at 40 km/h and the last one-third at 60 km/h. The average speed of whole journey will be

(a) 32.7 km/h (b) 35 km/h
(c) 40 km/h (d) 45 km/h

48. A particle starting from the origin (0, 0) moves in a straight line in the (x, y) plane. Its coordinates at a later time are $(\sqrt{3}, 3)$. The path of the particle makes with the x-axis an angle of

(a) 30° (b) 45°
(c) 60° (d) 0°

49. Two stones are projected with the same speed but making different angles with the horizontal. Their horizontal ranges are equal. The angle of projection of one is $\frac{\pi}{3}$ and the maximum height reached by it is 102 m. Then the maximum height reached by the other in metres is

(a) 336 (b) 224
(c) 56 (d) 34

50. The coefficient of friction between the tyres and the road is 0.25. The maximum speed with which car can be driven round a curve of radius 40 m without skidding is (assume $g = 10\ ms^{-2}$)

(a) 40 ms^{-1} (b) 20 ms^{-1}
(c) 15 ms^{-1} (d) 10 ms^{-1}

51. A particle moves along x-axis from $x = x_1$ to $x = x_2$ under the influence of a force given by $F = 2x$. Work done in the progress is

(a) zero
(b) $x_2^2 - x_1^2$
(c) $2x_2(x_2 - x_1)$
(d) $2x_1(x_2 - x_1)$

52. A coin, placed on a rotating turn-table stops, when it is placed at a distance of 9 cm from its centre. If the angular velocity of the turn-table is tripled, it will just stop at a distance r from centre. The value of r is

(a) 1 cm (b) 3 cm
(c) 9 cm (d) 27 cm

53. A particle of mass 0.5 kg is moving in the X-Y plane with uniform speed of 3 m/s parallel to Y-axis and crosses the X-axis at 2 m from origin. The angular momentum about origin is

(a) zero
(b) 3 kg-m^2/s
(c) 1.5 kg-m^2/s
(d) changing with time

54. If v_g, v_x and v_m are the speeds of gamma rays, X-rays and microwaves respectively in vacuum, then

(a) $v_g > v_m > v_x$
(b) $v_g > v_x > v_m$
(c) $v_g = v_x = v_m$
(d) None of these

55. A point source emits sound equally in all directions in a non-absorbing medium. Two points P and Q are at distances of 2 m and 3 m respectively from the source. The ratio of the intensities of the waves at P and Q is

(a) 9 : 4 (b) 2 : 3
(c) 3 : 2 (d) 4 : 9

56. Time period of a simple pendulum of length l is T_1 and time period of a uniform rod of the same length l pivoted about one end and oscillating in a vertical plane is T_2. Amplitude of oscillations in both the cases is small. Then T_1/T_2 is

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

57. An object of mass m is attached to a vertically hanging spring. It is released suddenly from the unstretched position of the spring. The maximum expansion of spring is

(a) $\frac{mg}{k}$ (b) $\frac{2mg}{k}$

(c) $\frac{3mg}{k}$ (d) zero

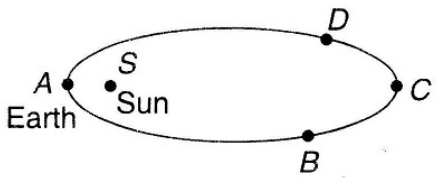
58. The equation of travelling wave in a stretched string is $y = 0.5 \sin \pi \left(\frac{x}{2} - 50t\right)$.

The maximum transverse speed of any point of string will be (x and y are in cm)

(a) 50 π cm/s (b) 100 cm/s

(c) 25 π cm/s (d) 100 π cm/s

59. The earth moves in an elliptical orbit with the sun S at one of foci as shown in the figure. Its rotational kinetic energy is maximum at the point



(a) A (b) B

(c) C (d) D

60. When a copper sphere is heated, then the percentage increase is maximum in

(a) diameter (b) length

(c) volume (d) mass

61. During an adiabatic process, the pressure of a gas is found to be proportional to the cube of its absolute temperature. The ratio C_p/C_V for the gas is

(a) 4/3 (b) 2

(c) 5/3 (d) 3/2

62. Suppose there is a hole in a copper plate. What will you notice when the plate is heated ?

(a) Always increase

(b) Always decrease

(c) Depends upon the substance

(d) No change

63. The work of 146 kJ is performed in order to compress one kilo mole of a gas adiabatically and in this process the temperature of the gas increases by 7°C. The gas is ($R = 8.3\,J\,mol^{-1}\,K^{-1}$)

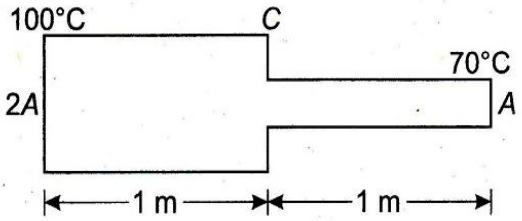
(a) diatomic

(b) triatomic

(c) a mixture of monoatomic and diatomic

(d) monoatomic

64. A metal rod of length 2 m has cross-sectional areas $2A$ and A as shown in figure. The ends are maintained at temperatures 100°C and 70°C. The temperature at middle point C is



(a) 80°C (b) 85°C

(c) 90°C (d) 95°C

65. A beam of electrons moving at a speed of 10^6 m/s along a line produces a current of 1.6×10^{-6} A. The number of electrons in 1 m of the beam is

(a) 10^6 (b) 10^7

(c) 10^{13} (d) 10^{19}

66. Three capacitors of capacitances 3 μF, 10 μF and 15 μF are connected in series to a voltage source of 100 V. The charge on 15 μF capacitor is

(a) 50 μC (b) 100 μC

(c) 200 μC (d) 1500 μC

67. There are five resistances of 1 Ω each. If the initial three resistances are joined in parallel and rest two are joined in series, then the final resistance is

(a) 3 (b) 8

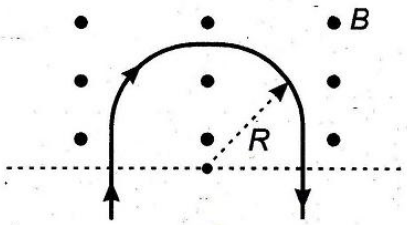
(c) $\frac{7}{3}$ (d) 5

68. The electrochemical equivalent of magnesium is 0.126 mg/C in a solution. If 5 A current is passed upto one hour, the amount of magnesium deposited is

(a) 0.0378 g (b) 0.227 g

(c) 0.378 g (d) 2.27 g

69. The semicircular portion (radius R) of a wire carrying current i is placed in a uniform magnetic field B. The magnetic field is perpendicular to the plane of the circle. The magnitude of the force on the wire is



(a) zero (b) $i\pi RB$
(c) $2i\pi RB$ (d) $2iRB$

70. Two parallel wires carrying currents in the same direction attract each other because of
(a) potential difference between them
(b) mutual inductance between them
(c) electric force between them
(d) magnetic force between them

71. A series combination of R, L, C is connected to an AC source. If the resistance is 3Ω and the reactance is $4\ \Omega$, the power factor of the circuit is
(a) 0.4 (b) 0.6
(c) 0.8 (d) 1.0

72. An object is magnified 10 times using a lens of focal length f when the image is projected on the screen. The distance of the screen from the lens is
(a) $\frac{10}{11}f$ (b) $\frac{f}{10}$
(c) $11f$ (d) $10f$

73. Magnification at least distance of distinct vision of a microscope having a convex lens of focal length 5 cm is
(a) 2 (b) 4
(c) 5 (d) 6

74. Oil floating on water looks coloured due to interference of light. The approximate thickness of oil for such effect to be visible is
(a) 100 Å (b) 10,000 Å
(c) 1 mm (d) 1 cm

75. Two coherent light sources S_1 and S_2 ($\lambda = 6000$ Å) are 1mm apart from each other. The screen is placed at a distance of 25 cm from the sources. The width of the fringes on the screen should be
(a) 0.015 cm (b) 0.025 cm
(c) 0.010 cm (d) 0.030 cm

76. 200 MeV energy is released in the fission of single nucleus of $_{92}U^{235}$, then how many fissions must occur per second to produce a power of 1 kW
(a) 3.125×10^{13} (b) 3.125×10^{7}
(c) 3.125×10^{19} (d) 1.6×10^{13}

77. 1 MeV is
(a) 1.6×10^{-19} J (b) 1.6×10^{-16} J
(c) 1.6×10^{-22} J (d) 1.6×10^{-13} J

78. The binding energy per nucleon for deuteron and an α-particle are x_1 and x_2 respectively. What will be the energy released in the following reaction ?

$$_1^2H + {}_1^2H \longrightarrow {}_2^4He + Q$$

(a) $4(x_2 - x_1)$ (b) $2(x_2 - x_1)$
(c) $4(x_2 + x_1)$ (d) $2(x_1 + x_2)$

79. The first line of Lyman series has a wavelength λ. Then the first line of Balmer series will have a wavelength
(a) $\frac{5}{27}\lambda$ (b) $\frac{27}{5}\lambda$
(c) $\frac{2}{9}\lambda$ (d) $\frac{9}{2}\lambda$

80. The radius of first orbit of hydrogen atom is 0.53 Å. The radius of its fourth orbit will be
(a) 2.12 Å (b) 8.48 Å
(c) 0.13 Å (d) 0.03 Å

81. Plutonium has a half-life of 24000 yr. If plutonium is stored for 72000 yr, then fraction of plutonium that remains is
(a) 1/2 (b) 1/3
(c) 1/4 (d) 1/8

82. During a mean life of a radioactive element the fraction that disintegrates is
(a) e (b) $\frac{1}{e}$
(c) $\frac{e-1}{e}$ (d) $\frac{e}{e-1}$

83. The values +1/2 and −1/2 of spin quantum number show
(a) rotation of e^- clockwise and anticlockwise direction respectively
(b) rotation of e^- anticlockwise and clockwise direction respectively
(c) rotation in any direction according to convention
(d) None of the above

84. An electron with kinetic energy 5 eV is incident on a H-atom in its ground state. The collision
(a) must be elastic
(b) may be partially elastic
(c) may be completely elastic
(d) may be completely inelastic

85. If the half-life of any sample of radioactive substance is 4 days, then the fraction of sample will remain undecayed after 2 days, will be
(a) $\sqrt{2}$ (b) $1/\sqrt{2}$
(c) $\frac{\sqrt{2}-1}{\sqrt{2}}$ (d) $\frac{1}{2}$

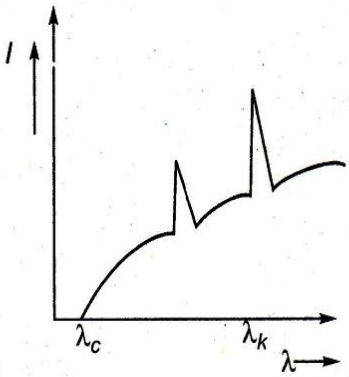
86. What is the Q-value of the reaction

$$p + {}^7\text{Li} \longrightarrow {}^4\text{He} + {}^4\text{He}$$

The atomic masses of ^{1}H, ^{4}He and ^{7}Li are 1.007825 u, 4.002603 u and 7.016004 u respectively
(a) 17.35 MeV (b) 18.06 MeV
(c) 177.35 MeV (d) 170.35 MeV

87. An object 5 cm tall is placed 1 m from a concave spherical mirror which has a radius of curvature of 20 cm. The size of the image is
(a) 0.11 cm (b) 0.50 cm
(c) 0.55 cm (d) 0.60 cm

88. The intensity of X-rays from a coolidge tube is plotted against wavelength as shown in the figure. The minimum wavelength found is λ_c and the wavelength of the K_α line is λ_k. As the accelerating voltage is increased



(a) $(\lambda_k - \lambda_c)$ increases
(b) $(\lambda_k - \lambda_c)$ decreases
(c) λ_k increases
(d) λ_k decreases

89. Find the torque of a force $\vec{F} = -3\hat{i} + 2\hat{j} + 1\hat{k}$ acting at the point $\vec{r} = 8\hat{i} + 2\hat{j} + 3\hat{k}$.
(a) $14\hat{i} - 38\hat{j} + 16\hat{k}$ (b) $4\hat{i} + 4\hat{j} + 6\hat{k}$
(c) $-14\hat{i} + 38\hat{j} - 16\hat{k}$ (d) $-4\hat{i} - 17\hat{j} + 22\hat{k}$

90. The escape velocity for the earth is v_e. The escape velocity for a planet whose radius is $\frac{1}{4}$th the radius of earth and mass half that of the earth is
(a) $\frac{v_e}{\sqrt{2}}$ (b) $\sqrt{2}\,v_e$
(c) $2v_e$ (d) $\frac{v_e}{2}$