PHYSICS

41. In a stationary sound wave produced in air

(a) each air particle executes vibrations with the same amplitude

(b) amplitude of vibration is maximum at some places

(c) air particles are stationary

(d) the particles do not execute periodic motion

42. There are two open organ pipes of exactly the same length and material but different radii. The frequencies of their fundamental notes will be

(a) wider pipe has lower frequency (b) narrower pipe has lower frequency

(c) same for both pipes (d) none of the above

43. A whistle emitting a sound of frequency 440 Hz is tied to a string of 1.5 m length and rotated with an angular velocity of 20 rad/sec in the horizontal plane. Then the range of frequencies heard by an observer stationed at a large distance from the whistle will be (v = 330 m/s)

(a) 400.0 Hz to 484.0 Hz (b) 403.3 Hz to 480.0 Hz

(c) 400.0 Hz to 480.0 Hz (d) 403.3 Hz to 484.0 Hz

44. The critical angle for light going from medium x into medium y is θ. The speed of light in medium x is v. The speed of light in medium y is

(a) $v(1-\cos\theta)$ (b) $v/\sin\theta$ (c) $v/\cos\theta$ (d) $v\cos\theta$

45. An equiconvex lens of refractive index 1.6 has power 4D in air. Its power in water $\left(\mu_w = \frac{4}{3}\right)$ is

(a) 1.5 D (b) 2.0 D (c) 2.7 D (d) 1.33 D

Space for rough work

46. An object is placed 12 cm to the left of a converging lens of focal length 8 cm. Another converging lens of 6 cm focal length is placed at a distance of 30 cm to the right of the first lens. The second lens will produce

(a) a virtual enlarged image (b) no image

(c) a real inverted image (d) a virtual inverted image

47. If the critical angle for the medium of a prism is C, and the angle of the prism is A, then there will be no emergent ray when

(a) $A < 2C$ (b) $A = 2C$ (c) $A > 2C$ (d) $A \overset{>}{\underset{<}{-}} 2C$

48. Four lenses of focal length +15 cm, +20 cm, +150 cm and +250 cm are available for making an astronomical telescope. To produce the largest magnification, the focal length of the eye-piece should be

(a) +15 cm (b) +20 cm (c) +150 cm (d) +250 cm

49. In case of linearly polarized light, the magnitude of the electric field vector

(a) does not change with time (b) varies periodically with time

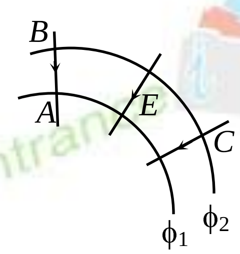
(c) increases and decreases linearly with time

(d) is parallel to the direction of propagation

50. The maximum number of possible interference maxima for slit separation equal to twice the wavelength in Young's double slit experiment is

(a) infinite (b) five (c) three (d) zero

51. In moving from A to B along an electric field line, the electric field does 6.4×10^{-19} J of work on an electron. If ϕ_1, ϕ_2 are equipotential surfaces, then the potential difference $(V_C - V_A)$ is



(a) – 4V (b) 4V

(c) zero (d) 64 V

Space for rough work

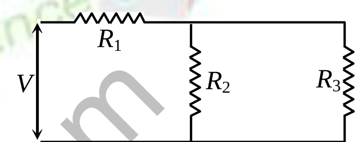
52. A thin metal plate of area $\frac{A}{2}$ is inserted half-way between the plates of a parallel plate capacitor of capacitance C, and plate area A in such a way that it is parallel to the two plates. The capacitance now becomes

(a) C (b) $C/2$ (c) $4C$ (d) none of these

53. Two wires of same metal have same length but their cross sections are in the ratio 3 : 1. They are joined in series. The resistance of the thicker wire is 10 Ω. The total resistance of the combination will be

(a) (5/2)Ω (b) (40/3)Ω (c) 40Ω (d) 100Ω

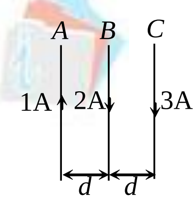
54. For ensuing dissipation of same energy in all the three resistors (R_1, R_2, R_3) connected as shown in the figure, their values must be related as



(a) $R_1 = R_2 = R_3$ (b) $R_2 = R_3$ and $R_1 = 4R_2$

(c) $R_2 = R_3$ and $R_1 = \frac{R_2}{4}$ (d) $R_1 = R_2 + R_3$

55. Three long straight wires A, B and C are carrying currents as shown in the figure. The resultant force on B is directed



(a) towards A
(b) towards C
(c) perpendicular to the plane of paper and inward
(d) perpendicular to the plane of paper and outward

56. A positively charged particle moving due east enters a region of uniform magnetic field directed vertically upwards. This particle will

(a) get deflected in vertically upward direction

(b) move in circular path with an increased speed

(c) move in circular path with decreased speed

(d) move in circular path with uniform speed

Space for rough work

57. In an inductor of self-inductance L = 2 mH, current changes with time according to relation $I = t^2 e^{-t}$. At what time emf is zero?

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

58. For a series LCR circuit, the power loss at resonance is

(a) $\dfrac{V^2}{\omega L - \dfrac{1}{\omega C}}$ (b) $I^2 \omega C$ (c) $I^2 R$ (d) $\dfrac{V^2}{\omega C}$

59. The de Broglie wavelength of an electron in first orbit of Bohr's hydrogen atom is equal to

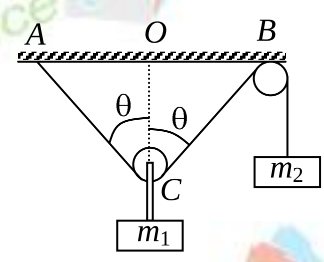
(a) radius of the orbit (b) perimeter of the orbit

(c) diameter of the orbit (d) half of the perimeter of the orbit

60. A sample of radioactive element has a mass of 10 gm at an instant t = 0. The approximate mass of this element in the sample, after two mean live, is

(a) 2.50 gm (b) 3.70 gm (c) 6.30 gm (d) 1.35 gm

61. In the arrangement shown in the figure if v_1 and v_2 are instantaneous velocities of masses m_1 and m_2 respectively and angle $ACB = 2\theta$ at the instant, then



(a) $\theta = \cos^{-1}\left(\dfrac{v_1}{2v_2}\right)$ (b) $\theta = \cos^{-1}\left(\dfrac{v_2}{2v_1}\right)$

(c) $\theta = \tan^{-1}\left(\dfrac{v_1}{2v_2}\right)$ (d) $\theta = \sin^{-1}\left(\dfrac{v_1}{v_2}\right)$

62. Two bodies are thrown up at angles of 45° and 60°, respectively, with the horizontal. If both bodies attain same vertical height, then the ratio of velocities with which these are thrown is

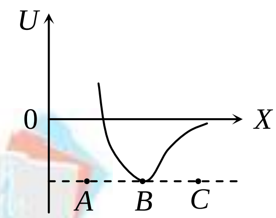
(a) $\sqrt{\dfrac{2}{3}}$ (b) $\dfrac{2}{\sqrt{3}}$ (c) $\sqrt{\dfrac{3}{2}}$ (d) $\dfrac{\sqrt{3}}{2}$

Space for rough work

63. A circular disc of radius R and thickness $R/6$ has moment of inertia I about an axis passing through its centre and perpendicular to its plane. It is melted and recasted into a solid sphere. The moment of inertia of the sphere about its diameter as axis of rotation is

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

64. The potential energy U between two molecules as a function of the distance X between them has been shown in the figure. The two molecules are



(a) Attracted when x lies between A and B and are repelled when X lies between B and C

(b) Attracted when x lies between B and C and are repelled when X lies between A and B

(c) Attracted when they reach B

(d) Repelled when they reach B

65. A car is taking a turn on a level road. It may be thrown outwards because of the

(a) reaction of the ground (b) frictional force

(c) weight (d) lack of centripetal force

66. A train is moving with velocity 20 m/s. On this dust is falling at the rate of 50 kg/minute. The extra force required to move this train with constant velocity will be

(a) 16.66 N (b) 1000 N (c) 166.6 N (d) 1200 N

67. The average acceleration vector (taken over a full circle) for a particle describing circular path of radius r and moving with constant speed v is

(a) a constant vector of magnitude $\frac{v^2}{r}$

(b) a null vector

(c) a vector of magnitude $\frac{v^2}{r}$ directed normal to the plane of the given uniform circular motion

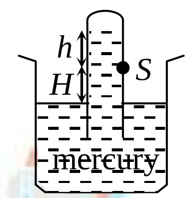
(d) equal to the instantaneous acceleration vector

Space for rough work

68. The escape velocity corresponding to a planet of mass M and radius R is 50 km/s. If the planet's mass and radius were $4M$ and R respectively, then the corresponding escape velocity would be

(a) 100 km/s (b) 50 km/s (c) 200 km/s (d) 25 km/s

69. Consider the barometer shown in figure. Density of mercury is ρ. A small hole is made at point S as shown. The mercury comes out from this hole with speed v equal to



(a) $\sqrt{2gh}$ (b) $\sqrt{2gH}$

(c) $\sqrt{2g(H-h)}$ (d) zero

70. A glass marble dropped from a certain height above the horizontal surface reaches the surface in time t and then continues to bounce up and down. The time in which the marble finally comes to rest is

(a) $e^n t$ (b) $e^2 t$ (c) $t\left[\frac{1+e}{1-e}\right]$ (d) $t\left[\frac{1-e}{1+e}\right]$

71. A wheel of radius r and mass m stands in front of a step of height h. The least horizontal force which should be applied to the wheel to allow it to raise on to the step is

(a) $\frac{mg}{r-h}\sqrt{(2r-h)h}$ (b) $\frac{mg}{r-h}\sqrt{(2r+h)h}$

(c) $\frac{mg}{r+h}\sqrt{(2r-h)h}$ (d) $\frac{mg}{r+h}\sqrt{(2r+h)h}$

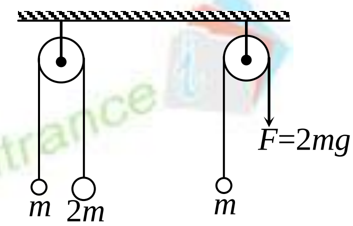
72. The distance travelled by a particle is directly proportional to $t^{1/2}$, where t = time elapsed. What is the nature of motion?

(a) increasing acceleration (b) decreasing acceleration

(c) increasing retardation (d) decreasing retardation

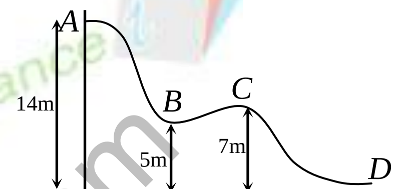
Space for rough work

73. The pulley arrangements shown in the figure are identical, the mass of the rope being negligible. In case I, the mass m is lifted by attaching a mass 2m to the other end of the rope. In case II, the mass m is lifted by pulling the other end of the rope with a constant downward force $F = 2mg$, where g is acceleration due to gravity. The acceleration of mass m in case I is



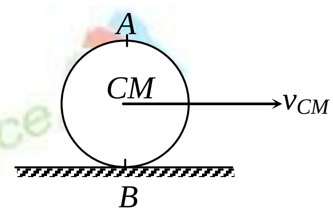
(a) zero
(b) more than that in case II
(c) less than that in case II
(d) equal to that in case II

74. Figure shows the vertical section of frictionless surface. A block of mass 2 kg is released from the position A; its KE as it reaches the position C is



(a) 180 J
(b) 140 J
(c) 40 J
(d) 280 J

75. A wheel of bicycle is rolling without slipping on a level road as shown in the figure. The velocity of the centre of mass is v_{CM}, then the true statement is



(a) the velocity of point A is $2v_{CM}$ and velocity of point B is zero
(b) the velocity of point A is zero and velocity of point B is $2v_{CM}$
(c) the velocity of point A is $2v_{CM}$ and velocity of point B is v_{CM}
(d) the velocities of both A and B are v_{CM}

76. A 20 kg block is initially at rest on a rough horizontal surface. A horizontal force of 75 N is required to set the block in motion. After it is in motion, a horizontal force of 60 N is required to keep the block moving with constant speed. The coefficient of static friction is

(a) 0.38
(b) 0.44
(c) 0.52
(d) 0.60

Space for rough work

77. If we choose velocity V, acceleration A and force F as the fundamental quantities, then the angular momentum in terms of V, A and F would be

(a) $FA^{-1}V$ (b) FV^3A^{-2} (c) FV^2A^{-1} (d) ML^2T^{-1}

78. A wall has two layers A and B each made of different materials. The thickness of both the layers are same. The thermal conductivities of A and B are related as $K_A = 3K_B$. The temperature difference across the wall is 20^0C in thermal equilibrium, then

(a) the temperature difference across A is 15^0C

(b) rate of heat transfer across A is more than across B

(c) rate of heat transfer across both is different

(d) temperature difference across B is 15^0C

79. The efficiency of a Carnot cycle is 1/6, on reducing the temperature of sink by 65K, the efficiency becomes 1/3, the temperatures of the source and the sink are

(a) 117^0C, 52^0C (b) 217^0C, 52^0C

(c) 317^0C, 52^0C (d) 17^0C, 52^0C

80. Which of the following statements is true?

(a) A clock when taken on a mountain can not be made to give correct time even if we change the length of pendulum suitably.

(b) An increase in value of g makes a clock go slow.

(c) If the length of a pendulum is increased, the clock becomes fast.

(d) A clock when taken to a deep mine or carried to the top of a mountain becomes slow.

Space for rough work