PHYSICS

BOOKS - CAREER POINT

UNIT TEST 3

Physics

1. A projectile is fired with a speed u at an angle θ above the horizontal field. The coefficient of restitution between the

projectile and field is e. Find the position from the starting point when the projectile will land at its second collision

A. $\frac{e^2u^2\sin 2\theta}{g}$

B. $\frac{(1-e^2)u^2\sin 2\theta}{g}$

C. $\frac{(1-e)u^2\sin\theta\cos\theta}{g}$

D. $\frac{(1+e)u^2\sin 2\theta}{g}$

Answer: D

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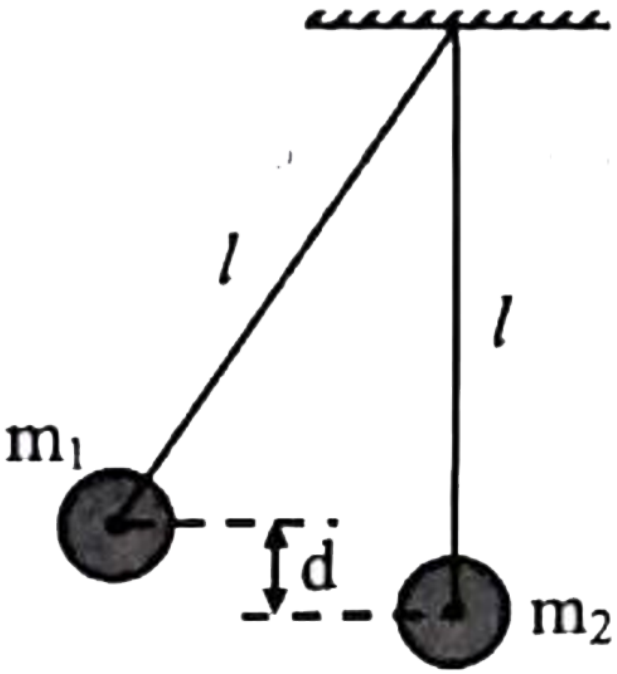
2. Two pendulums each of lengh l are initially situated as shown in figure. The first pendulum is released and strikes the second. Assume that the collision is completely inelastic and neglect the mass of the string and frictional effects. How high does the

centre of mass rise after the collision ?



A. $d\left[\frac{m_1}{(m_1+m_2)}\right]^2$

B. $d\left[\frac{m_1}{(m_1+m_2)}\right]$

C. $\frac{d(m_1+m_2)^2}{m_2}$

D. $d\left[\frac{m_2}{(m_1+m_2)}\right]^2$

Answer: A

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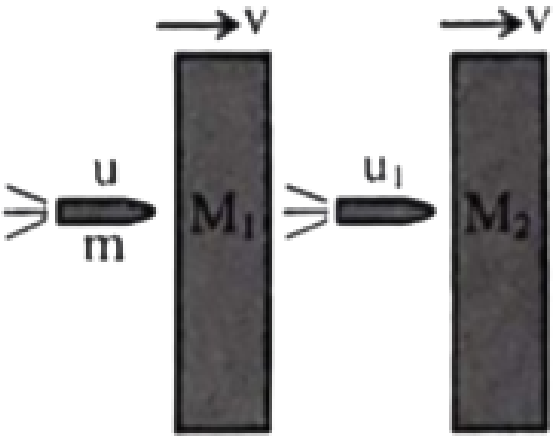
3. A 20 g bullet pierces through a plate of mass $M_1 = 1kg$ and then comes to rest inside a second plate of mass $M_2 = 2.98$ kg as shown in the figure. It is found that the two plates, initially at rest, now move with equal velocities, Find the percentage loss in the initial velocity of the bullet when it is between M_1 and M_2. Neglect any loss of material of

the plates due to the action of bullet



A. 50 %

B. 25 %

C. 100 %

D. 75 %

Answer: B

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4. A body of mass m_1 moving at a constant speed undergoes an elastic head on collision with a body of mass m_2 initially at rest. The ratio of the kinetic energy of mass m_1 after the collision to that before the collision is -

A. $\left(\frac{m_1 - m_2}{m_1 + m_2}\right)^2$

B. $\left(\frac{m_1 + m_2}{m_1 - m_2}\right)^2$

C. $\left(\frac{2m_1}{m_1 + m_2}\right)^2$

D. $\left(\frac{2m_2}{m_1 + m_2}\right)^2$

Answer: A

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5. A body of mass 5 kg explodes at rest into three fragments with masses in the ratio 1 : 1 : 3. The fragments with equal masses fly in mutually perpendicular directions with speeds of 21 m/s. The velocity of the heaviest fragment will be -

A. 11.5 m/s

B. 14.0 m/s

C. 7.0 m/s

D. 9.89 m/s

Answer: D

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6. A beg (mass M) hangs by a long thred and a bullet (mass m) comes horizontally with velocity v and gets caught in the bag. The for the combined (bag+bullet) system -

A. Momentum is $\frac{mvM}{(M+m)}$

B. KE is $\frac{mv^2}{2}$

C. Momentum is $\frac{mv(M+m)}{M}$

D. KE is $\frac{m^2v^2}{2(M+m)}$

Answer: D

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7. A uniform metal dise of radius R is taken and out of it a disc of diameter R is cut off from

the end. The centre of the mass of the remaining part will be:

A. $\frac{R}{4}$ from the centre

B. $\frac{R}{3}$ from the centre

C. $\frac{R}{5}$ from the centre

D. $\frac{R}{6}$ from the centre

Answer: D

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8. A ball is dropped from a height h on the ground. If the coefficient of restitution is e, the hight to which the ball goes up after it rebounds for the n^{th} time is -

A. he^{2n}

B. he^{n}

C. $\frac{e^{2n}}{h}$

D. $\frac{h}{e^{2n}}$

Answer: A

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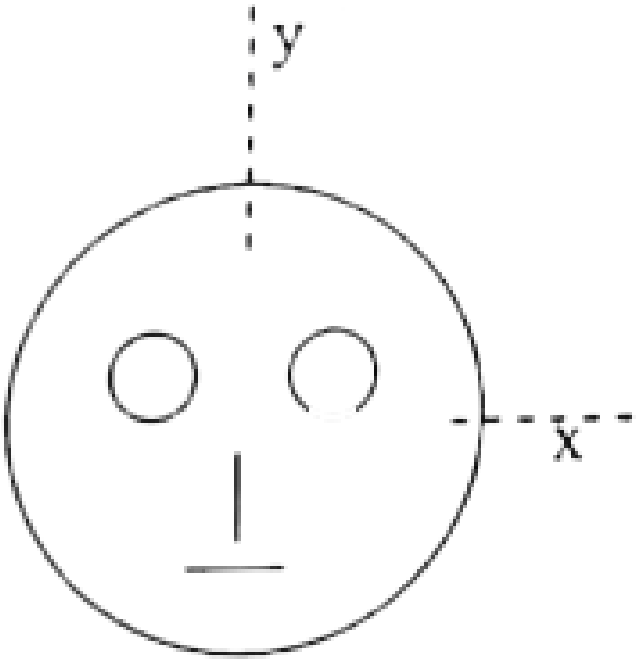
9. Look at the drawing given in the figure which has been drawn with ink of uniform linethickness. The mass of ink used to draw each of the two inner circles, and each of the two lines segments is m. The mass of the ink used to draw the outer circle is 6m. The coordinates of the centers of the different parts are : outer circle (0,0), left inner circle (-a,a),right inner circle (a, a), vertical line (0, 0) and horizontal line (0, -a). The y-coordinate of the centre of mass of the ink in this drawing is

-



A. $\frac{a}{10}$

B. $\frac{a}{8}$

C. $\frac{a}{12}$

D. $\frac{a}{3}$

Answer: A

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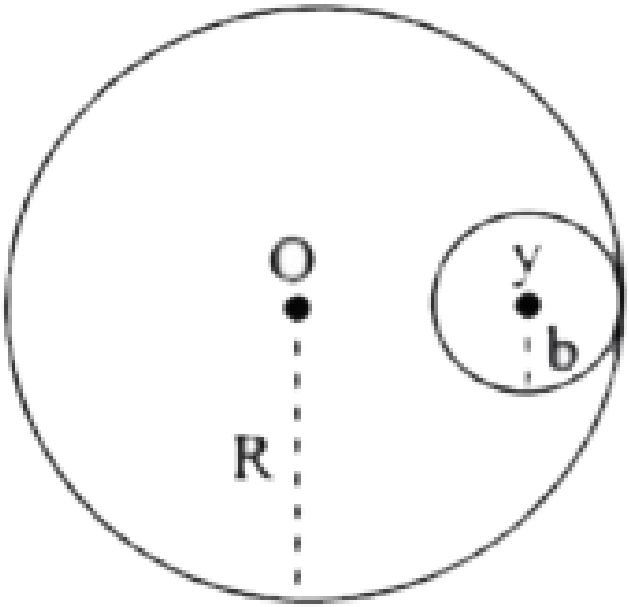
10. A cavity of radius b is made in a disc of mass M, radius R, as ahown in fig. Find the new

COM-



A. $\frac{-b^2}{R+b}$

B. $\frac{-b^2}{R-b}$

C. $\frac{-R}{2R+b}$

D. $\frac{-R}{3R+b}$

Answer: A

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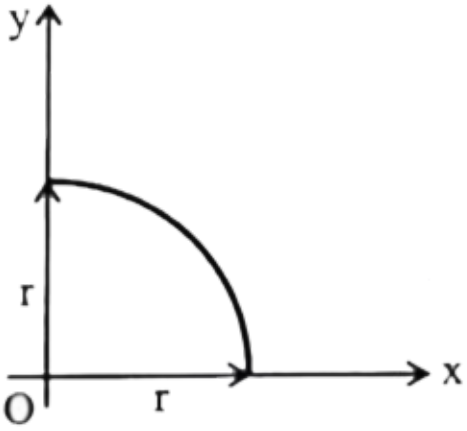
11. The coordinates of centre of mass of the following quarter circular are is -



A. $\left(\frac{r}{2}, \frac{r}{2}\right)$

B. $\left(\frac{2r}{3}, \frac{2r}{3}\right)$

C. $\left(\frac{2r}{\pi}, \frac{2r}{\pi}\right)$

D. $\left(\frac{4r}{\pi}, \frac{4r}{\pi}\right)$

Answer: D

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12. Block C of mass M is moving with velocity V_0 and

collides elastically with block A of mass M and connected to another block B of mass 2M through a spring of spring constant K. What is K if X_0 is the compression of spring when velocity of A and B is same

A. $\frac{mv_0^2}{x_0^2}$

B. $\frac{mv_0^2}{2x_0^2}$

C. $\frac{3}{2}\frac{mv_0^2}{x_0^2}$

D. $\frac{2}{3}\frac{mv^2}{x_0^2}$

Answer: D

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13. A particle of mass m is made to move with uniform speed v_0 along the perimeter of a regular hexagon inscribed in a circle of radius R. The magnitude of impulse applied at each corner of the hexagon is :-

A. $2mv_0 \sin. \frac{\pi}{6}$

B. $mv_0 \sin. \frac{\pi}{6}$

C. $mv_0 \sin. \frac{\pi}{3}$

D. $2mv_0 \sin. \frac{\pi}{3}$

Answer: A

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14. Two men support a uniform horizontal beam at its two ends, if one of them suddenly lets go, the force exerted by the beam on the other man will

A. remain unaffected

B. increase

C. decrease

D. become unequal to the force exerted by him on the beam

Answer: C

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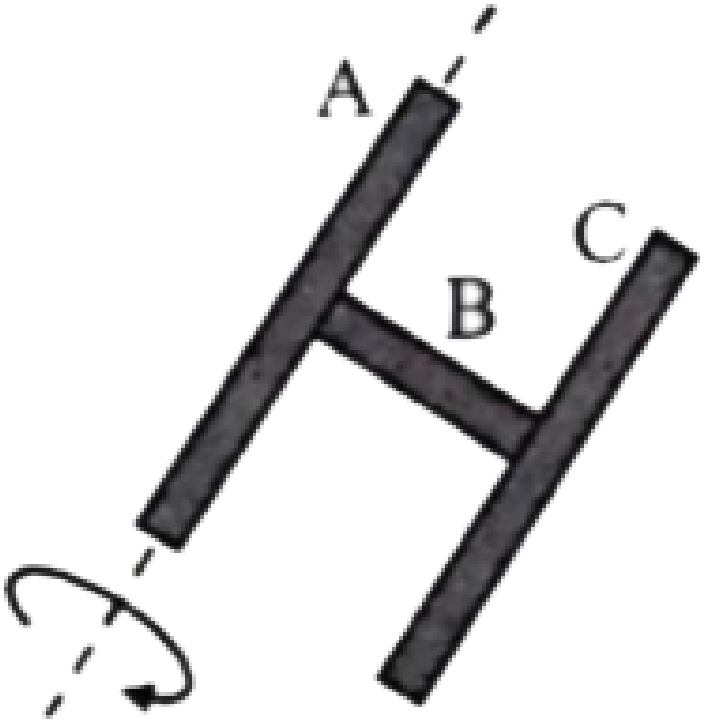
15. A rigid body is made of three identical thin rods, each of length L fastened together in the form of letter H. The body is free to rotate about a horizontal axis that runs along the length of one of the legs of the H. The body is

allowed to fall from rest from a position in which the plane of H is horizontal. What is the angular speed of the body when the plane of H is vertical ?



A. $\sqrt{\frac{g}{L}}$

B. $\frac{1}{2}\sqrt{\frac{g}{L}}$

C. $\frac{3}{2}\sqrt{\frac{g}{L}}$

D. $2\sqrt{\frac{g}{L}}$

Answer: C

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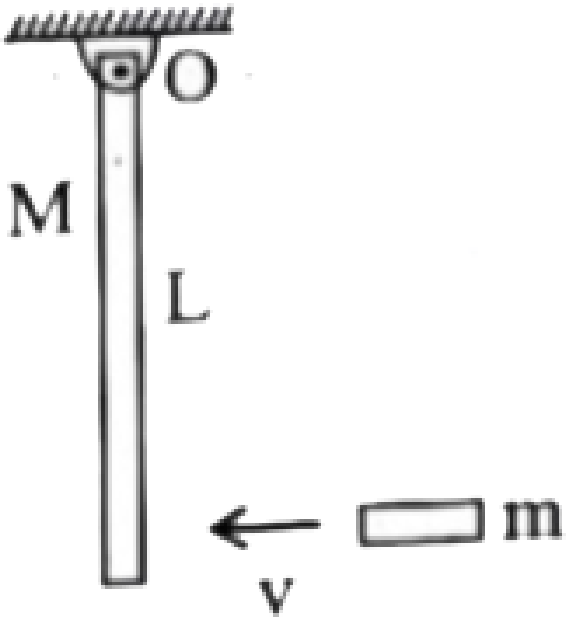
16. A wooden log of mass M&length L is hinged by a frictionless of nail at O. A bullet of mass m strikes with velocity v & sticks to it. Find the angular velocity of the system

immediately after collision -



A. $\frac{mv}{M+m}$

B. $\frac{3mv}{(M+m)L}$

C. $\frac{3mv}{(M+3m)L}$

D. $\frac{mv}{(M+3m)L}$

Answer: C

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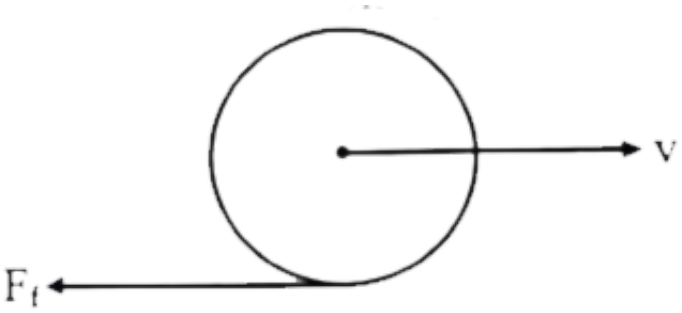
17. A thin spherical shell lying on a rough horizontal surface is hit by a cue in such a way that line of action passes through the centre of the shell. As a result shell starts moving with a linear speed v without any initial angular velocity. Find the linear velocity to the

shell when it starts pure rolling



A. $\frac{3}{5}v$

B. $\frac{2}{5}v$

C. $\frac{4}{5}v$

D. None of these

Answer: B

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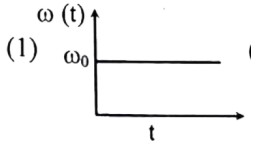
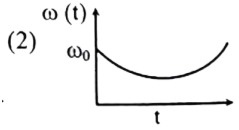
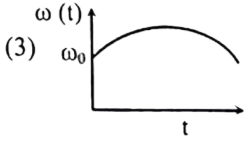
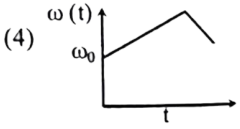
18. A circular platform is free to rotate in a horizontal plane about a vertical axis passing through its centre. A tortoise is sitting at the edge of the platform Now, the platform is given an angular velocity ω_0. When the tortoise moves along a chord of the platform with a constant velocity (with respect to the platform), the angular velocity of the platform will vary with time t as -

A. 

B. 

C. 

D. 

Answer: C

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19. The ratio of the time taken by a solid sphere and that taken by a disc of the same

mass and radius to roll down a smooth inclined plane from rest from the same height

-

A. $15:14$

B. $\sqrt{15}:\sqrt{14}$

C. $14:15$

D. $\sqrt{14}:\sqrt{15}$

Answer: D

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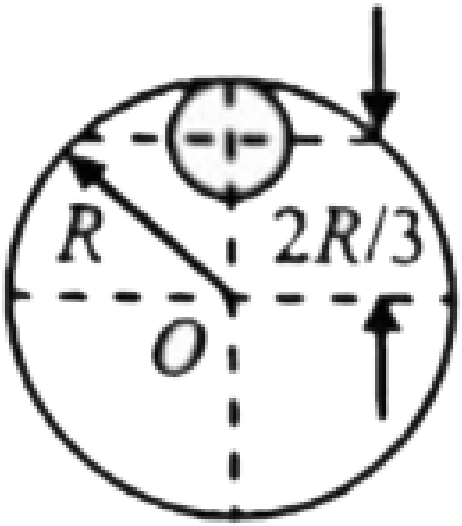
20. A thin disc of mass 9M and radius R from which a disc of radius R/3 is cut shown in figure. Then moment of inertia of the remaining disc about O, perpendicular to the plane of disc is -



A. $4MR^2$

B. $9MR^2$

C. $\frac{37}{9}MR^2$

D. $\frac{40}{9}MR^2$

Answer: A

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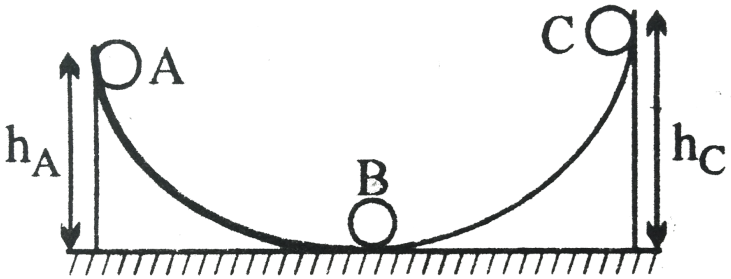
21. A ball moves over a fixed track as shown in the figure. From A to B ball rolls without slipping. Surface BC is frictionless. K_A, K_B and K_C are kinetix energies of the ball at

A, B and C, respectively. Then



A. a,b

B. a,c

C. b,d

D. None of these

Answer: A

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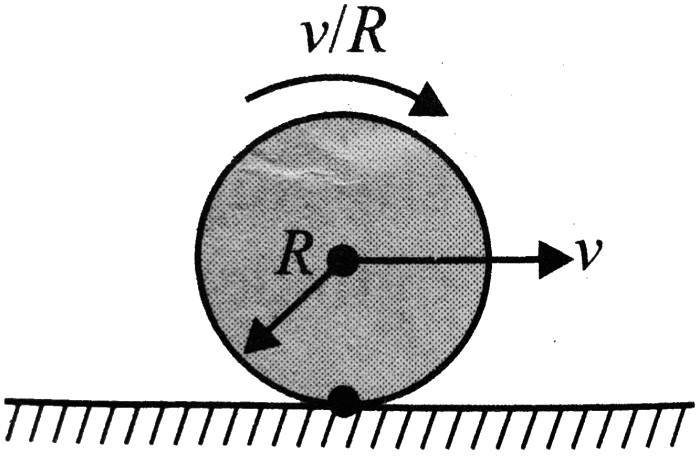
22. A disc is performing pure rolling on a smooth stationary surface with constant angular velocity as shown in Fig,. At any instant, for the lower most point of the disc,



A. Velocity is v, acceleration is zero

B. Velocity is zero, acceleration is zero

C. Velocity is v, acceleration is $\frac{v^2}{R}$

D. Velocity is zero, acceleration is nonzero

Answer: D

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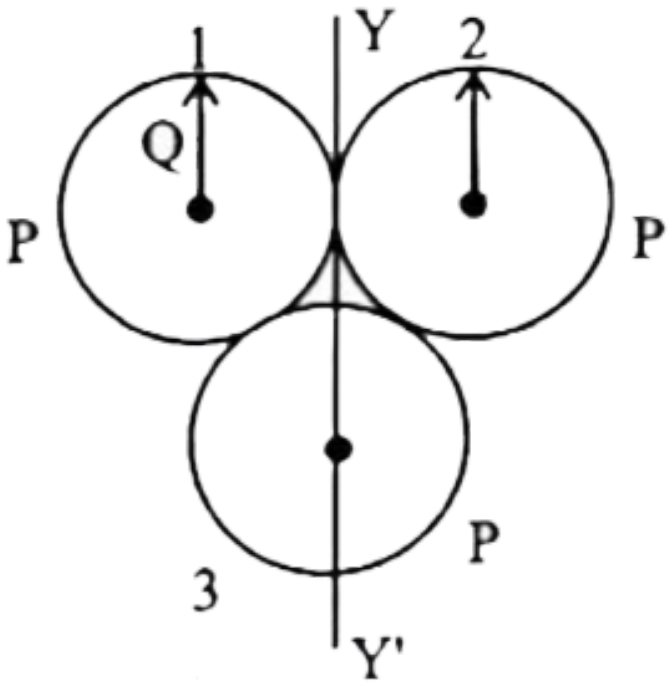
23. Three rings, each of mass P and radius Q are arranged as shown in the figure. The moment of inertia of the arrangement about

YY' axis will be



A. $\frac{7}{2}PQ^2$

B. $\frac{2}{7}PQ^2$

C. $\frac{2}{5}PQ^2$

D. $\frac{5}{2}PQ^2$

Answer: A

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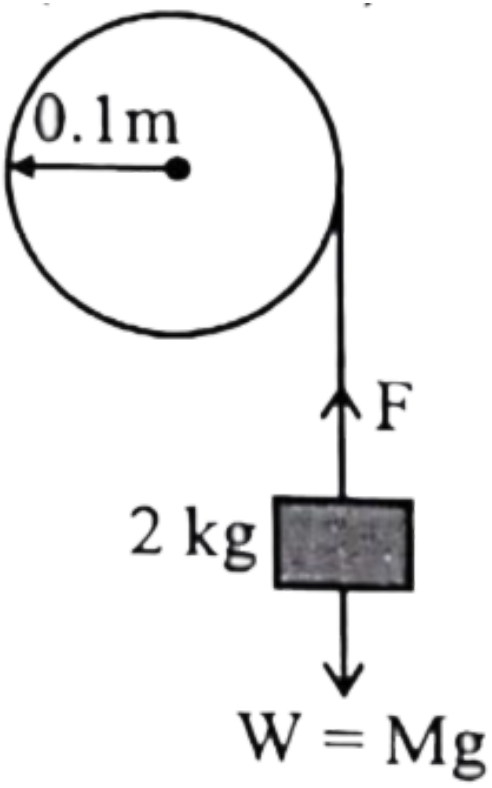
24. The moment of inertia of a solid flywheel about its axis is $0.1kg - m^2$.A tangential force of 2 kg-wt. is applied round the circumference of the flywheel with the help of a string and mass arrangement as shown in the figure. If the radius of the wheel is 0.1 m, find the

acceleration $\left(\text{in rad/sec}^2\right)$ of the mass :



A. 163.3

B. 16.3

C. 81.66

D. 8.16

Answer: B

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25. A ladder of length l and mass m is placed against a smooth vertical wall, but the ground is not smooth. Coefficient of friction between the ground and the ladder is μ. The angle θ at which the ladder will stay in equilibrium is

A. $\theta = \tan^{-1}(\mu)$

B. $\theta = \tan^{-1}(2\mu)$

C. $\theta = \tan^{-1}\left(\frac{\mu}{2}\right)$

D. None of these

Answer: D

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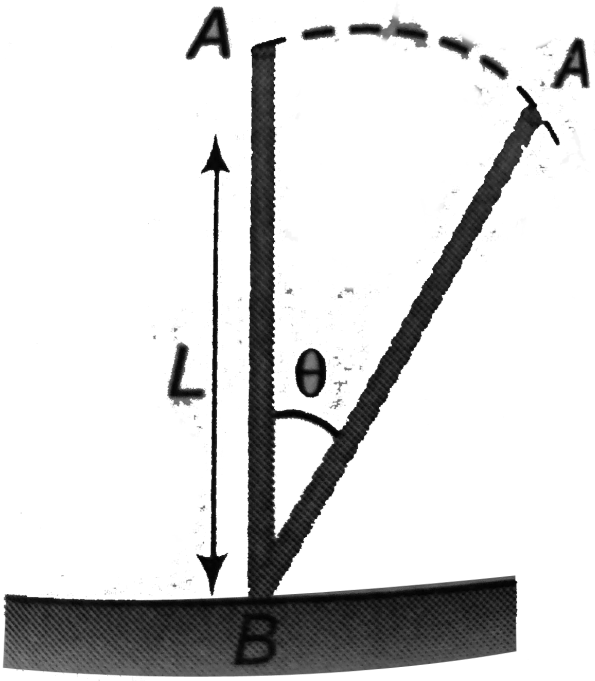

26.

A uniform rod of length L is free to rotate in a vertical plane about a fixed horizontal axis through B. The rod begins rotating from rest. The angular velocity ω at angle θ is given as

A. $\sqrt{\frac{6g}{L}}\sin\theta$

B. $\sqrt{\frac{6g}{L}}\sin.\frac{\theta}{2}$

C. $\sqrt{\frac{6g}{L}}\cos.\frac{\theta}{2}$

D. $\sqrt{\frac{6g}{L}}\cos.\theta$

Answer: B

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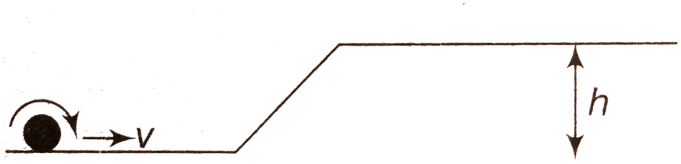
27. A solid sphere is rolling on a frictionless surface, shown in figure with a translational velocity vm/s. If it is to climb the inclined

surface then v should be :



A. $\sqrt{\frac{10}{7}gh}$

B. $\geq \sqrt{2gh}$

C. $2gh$

D. $\frac{10}{7}gh$

Answer: A

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28. A particle moves in a circular path with decreasing speed . Choose the correct statement.

A. Angular momentum remains constant

B. Acceleration $(\bar{a})$ is towards the centre

C. Particle moves in a spiral path with decreasing radius

D. The direction of angular momentum remains constant

Answer: D

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29. Two loops P and Q are made from a uniform wire. The redii of P and Q are r_1 and r_2 respectively, and their moments of inertia are I_1 and I_2 respectively, If $I_2 = 4I_1$, then $\frac{r_2}{r_1}$ equals-

A. $4^{2/3}$

B. $4^{1/3}$

C. $4^{-2/3}$

D. $4^{-1/3}$

Answer: B

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30. If the distance between H and Cl ions in HCl molccule is x, then its moment of incrtia about an axis passing through the centre of mass and perpendicular to the bond length, is-

A. $35x^2$

B. $36x^2 / 35$

C. $35x^2 / 36$

D. $x^2 / 35$

Answer: C

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