PHYSICS

BOOKS - D MUKHERJEE PHYSICS (HINGLISH)

CIRCULAR,ROTATIONAL & SIMPLE HARMONIC MOTION

Others

1. A particle of mass m is tied to light string and rotated with a speed v along a circular path of radius r. If T=tension in the string and $mg =$ gravitational force on the particle then actual forces acting on the particle are

A. mg and T only

B. mg, T and an additional force of mv^2/r directed inwards

C. mg, T and an additational force of mv^2/r directed outwards

D. only a force mv^2/r directed outward

Answer: a

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2. A particle of mass m is tied to a light string of length l and rotated along a vertical circular path. What should be the minimum speed at the highest point of its path so that the string does not become slack at any position ?

A. $\sqrt{2gl}$

B. $\sqrt{gl}$

C. zero

D. $\sqrt{gl/2}$

Answer: b

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3. A simple pendulum has a string of length l and bob of mass m. When the bob is at its lowest position , it is given the minimum horizontal speed necessary for it to move in a

circular path about the point point of suspension. The tension in the string at the lowest position if the bob is

A. 3mg

B. 4mg

C. 5mg

D. 6mg

Answer: d

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4. In the previous question, when the string is horizontal, the net force on the bob is

A. mg

B. 3mg

C. $\sqrt{10mg}$

D. 4mg

Answer: c

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5. In a simple pendulum, the breaking strength of the string is double the weight of the bob. The bob is released from rest when the string is horizontal. The string breaks when it makes an angle θ with the vertical.

A. $\theta = \cos^{-1}(1/3)$

B. $\theta = 60^\circ$

C. $\theta = \cos^{-1}(2/3)$

D. $\theta = 0$

Answer: c

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6. A particle of mass m is fixed to me one end of a light right rod of length l and rotated in a vertical circular path about its other end. The minmum speed of the particle at its highest point must be

A. zero

B. $\sqrt{gl}$

C. $\sqrt{1.5gl}$

D. $\sqrt{2gl}$

Answer: a

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7. In the previous question, if the particle is released from rest at its highest position then the tension in the road

A. is zero when it is vertical

B. is zero when it is horizontal

C. is zero when it is msking an angle of $\cos^{-1}(2/3)$ with the vertical

D. cannot be in any position

Answer: c

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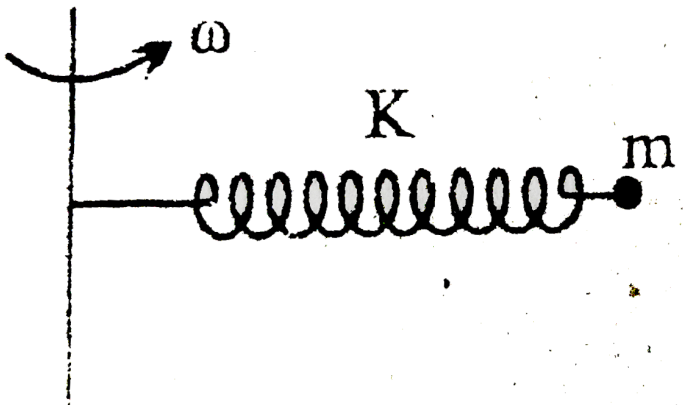
8. A particles of mass m is fixed to one end of a light spring of force constant k and unstreatched length l. the system is rotated about the other end of the spring with an

angular velocity ω in gravity free space. The increase in length of the spring is



A. $\frac{m\omega^2 l}{k}$

B. $\frac{m\omega^2 l}{k - m\omega^2}$

C. $\frac{mn\omega^2 l}{k + m\omega^2}$

D. none of these

Answer: b

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9. A particle of mass m is moving in a circular path of constant radius r such that its centripetal acceleration a_c is varying with time t as $a_c = k^2rt^2$, where k is a constant. The power delivered to the particle by the forces acting on it is :

A. $2\pi mk^2r^2t$

B. mk^2r^2t

C. $\frac{1}{3}mk^4r^2t^5$

D. 0

Answer: b

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10. A car is moving in a circular horizonta track of radius 10m with a constant speed of 10 m/s. A pendulum bob is suspended from the roof

of the cat by a light rigid rod of length 1.00m.

The angle made by the rod with track is

A. zero

B. 30°

C. 45°

D. 60°

Answer: c

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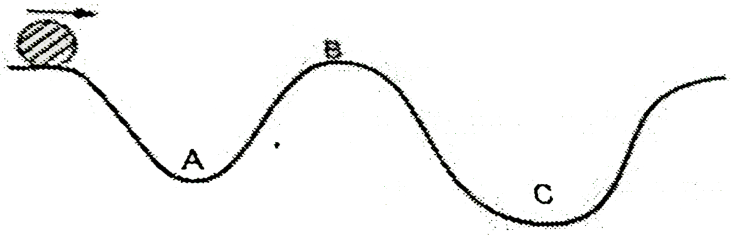
11. 

A body moves along an uneven horizontal road surface with constant speed at all points. The normal reaction of the road on the body is

A. maximum at A

B. maximum at B

C. minimum at C

D. the same at A, B and C

Answer: a

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12. In gravity free space, a particle is in constant with the inner surface of a hallow cylinder and moves in a circular path along the surface. There is some friction between the particles and the surface. The retardation of the particle is :

A. zero

B. independent of its celocity

C. proportional to its velocity

D. proportional to the square of its velocity

Answer: d

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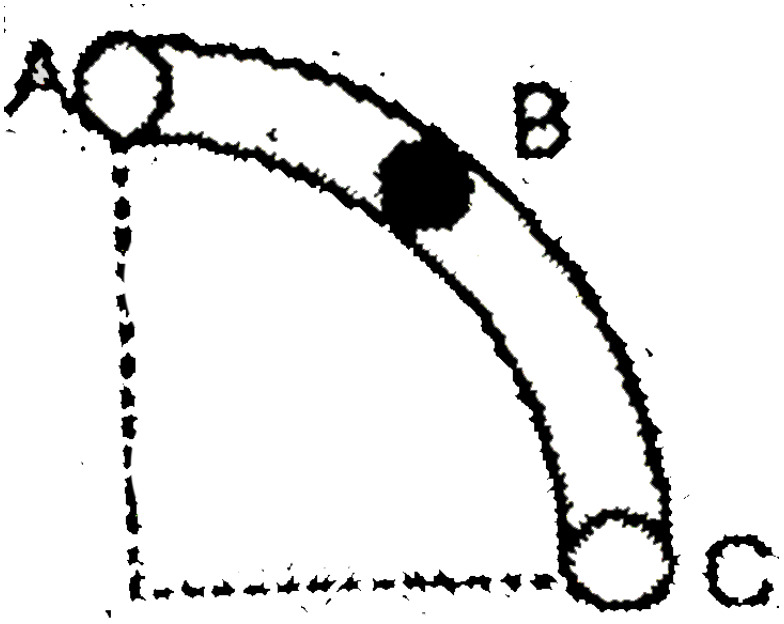
13. The narrow tube AC forms a quarter circles in a vertical plane. A ball B has an area of cross-section slighly smaller than that of the tube and can move without friction through it.

B is placed at A and displaced slightly. During the motion from A to C it will :



A. always be in contact with the inner wall of the tube

B. always be in contact the outer wall of the tube

C. intially be in contant with the inner wall and later with the outer wall

D. intially be in contact with the and later with the inner wall

Answer: c

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14. A car moves along a horizontal circular road of radius r with constant speed v. The coefficient of friction between the wheels and

the road is μ. Which of the following statement is not true ?

A. The car will slip if $v > \sqrt{\mu r g}$

B. The car will slip if $\mu < \frac{v \wedge (2)}{rg}$

C. The car will slip if $r > \frac{v^2}{\mu g}$

D. The car will slip at a lower speed, if it mioves with some tangential acceleration, than if it moves at constant speed.

Answer: c

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15. When a car negotiates a curve, the normal force exerted on the inner and outer wheels are N_2 and N_1 respectively. Then N_1 / N_2 is

A. N_1 is always greater than N_2

B. N_2 is always equal to N_2

C. N_1 is always equal to N_2

D. Either (a) or (b) depending on the car and the radius curvature of the road.

Answer: b

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16. A curved section of a road is banked for a speed v. If there is no friction between the road and the tyres then.

A. a car moving with with speed v will not slip on the road

B. a car is more likely to slip on the road at speed lower higher than v, than at

speeds lower than

C. a car is more likely to slip on the road at speed lower higher than v, than at speeds higher than

D. a car can remain stationary on the road without slipping

Answer: a

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17. A railway track is banked for a speed v, by making the height of the outer rail h higher than that of the inner rail. The distance between the rails is d. The radius of the curvature of the track is r

A. $\frac{h}{d} = \frac{v^2}{rg}$

B. $\tan\left(\frac{\sin^{-}(h)}{d}\right) = \frac{v^2}{rt}$

C. $\tan^{-1}\left(\frac{h}{d}\right) = \left(\frac{v^2}{rg}\right)$

D. $\frac{h}{r} = \frac{v^2}{dg}$

Answer: b

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18. A cyckist moves along a curved road with a velocity v. The road is banked for speed v. The angle of banking is θ. Which of the following statement is not true?

A. The cyclist will lean away from the vertical at an angle θ

B. The normal reaction of the road will pass through the centre of gravity of the

cycle plus cyclist' system

C. There will be no force of friction between the tyres and the road.

D. The cyclist is in equlibrium with respect to the ground.

Answer: d

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19. Two point masses m and M are separated bya distance L . The distance of the centre of mass of the system from m is

A. $L(m/M)$

B. $L(M/m)$

C. $L\left(\frac{M}{m+M}\right)$

D. $L\left(\frac{m}{m+M}\right)$

Answer: c

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20. A man stands at one end of a boat which is stationary in water. Neglect water resistance. The man now moves to the other end of the boat and again becomes stationary. The centre of mass of the man plus boat system will remain stationary with respect to water.

A. in all cases

B. only when the man is stationary intially and finally

C. only if the man moves without acceleration on the boat

D. only if the man and the boat have equal masses

Answer: a

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21. A strick is thrown in the air and lands on the ground at some distance from the centre

of mass of the stick will move along a paranolic path

A. in all cases

B. only if the stick is uniform

C. only if the stick has linear motion but no rotational motion

D. only if the stick has a shape such that its centre of mass is located at some point on it and not outside it

Answer: a

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22. A man hangs from a rope attached to a hot-air balloon. The mass of the man is greater than the mass of the balloon and its constents. The system is stationary in air. If the man now clims up to the balloon using the rope, the centre of mass of the man plus balloon system will

A. remain stationary

B. move up

C. move down

D. first move up and then return to its intial position

Answer: a

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23. There are some passeger inside a stationary railway compartment. The centre of mass of the compartment itself (without the passngers) is C_1 while the centre of mass of

the compartment plus passengers system is C_2 if passenger move about inside the comparment

A. both C_1 and C_2 will move with respect to the groud

B. neither C_1 nor C_2 will move with respect to the ground

C. C_1 will move but C_2 will be stationary with respect to the ground

D. C_2 will move but C_1 will be stationary with respect to the ground

Answer: c

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24. For a system to be in equilibrium, the torques acting on it must balance. This is true only if the torques are taken about

A. the centre of the system

B. the centre of mass of the system

C. any point on the system

D. any point on the system or outside it

Answer: d

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25. A uniform horizontal meter scale of mass m is susopended by two certical string attached to its two ends. A body of mass 2m is

place on the $75 - cm$ mark. The tensions in the two strings are in the ratio

A. $1:2$

B. $1:3$

C. $2:3$

D. $3:4$

Answer: a

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26. The line of action of the resultant of two like parallel forces shifts by one-fourth of the distance between the forces when the two forces are interchanged. The ratio of the two forces is:

A. $1:2$

B. $2:3$

C. $3:4$

D. $3:5$

Answer: d

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27. A uniform meter scale balance s at the 40-cm mark when weihgt of 10g and 20g are suspended from the 10-cm and 20-cm marks respectively. The weight of the meter scale is

A. 50g

B. 60g

C. 70g

D. 80g

Answer: c

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28. Weights of 1g, 2g,...., 100g are suspended from the 1-cm, 2-cm,....., 100-cm marks respectively of a light meter scale. Where should it be supported for the system to be in equilibrium ?

A. 55-cm mark

B. 60-cm mark

C. 66-cm mark

D. 72-cm mark

Answer: c

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29. A rectangular block has a square base measuring $a \times a$, and its height is h. It moves with a speed v on a smooth horizontal surface.

A. It will topple if $v > \sqrt{2gh}$

B. It will topple if $v > \sqrt{2ga}$

C. It wil topple if $v\sqrt{2ga^2/h}.$

D. It will not topple for any value of v.

Answer: d

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30. A rectangular block has a square base measuring $a \times a$ and its height is h. It moves on a horizontal surface in a direction

perpendicular to one of the edges. The coefficient of friction is μ. It will topple if

A. $\mu > \frac{h}{a}$

B. $\mu > \frac{a}{h}$

C. $\mu > \frac{2a}{h}$

D. $\mu > \frac{a}{2h}$

Answer: b

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31. A flywheel rotates with a uniform angular acceleration. Its angular velocity increases from $20\pi rad/s$ to $40\pi rad/s$ in 10 seconds. How many rotations did it make in this period ?

A. 80

B. 100

C. 120

D. 150

Answer: d

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32. When a ceiling fan is switched on, it makes 10 rotations in the first 3 seconds. Assuming a uniform angular acceleration, how many rotation it will make in the next 3 seconds?

A. 10

B. 20

C. 30

D. 40

Answer: c

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33. When a celling fan is switched off, its angular velocity falls to half while it makes 36 rotations. How many more rotations will it make before coming to rest ?

A. 36

B. 24

C. 18

D. 12

Answer: d

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34. A flywheel rotates about an axis. Due to friction at the axis, it experiences an angular retardation proportional to its angular velocity. If its angular velocity falls to half while it makes n rotations, how many more rotations will it make before coming to rest?

A. 2n

B. n

C. n/2

D. n/3

Answer: b

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35. A flywheel rotating about an axis experinces an angular retardation proportional to the angular through which it

rotates its rotational kinetic energy gets reduced by ΔE while it rotates through an angular θ then

A. $\Delta E \propto \theta^2$

B. $\Delta E \propto \sqrt{\theta}$

C. $\Delta E \propto \theta$

D. $\Delta E \propto \theta^{3/2}$

Answer: a

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36. An external device, e.g an electric motor supplies constant power to a rotating system e.g., a flywheel through a torque τ power angular velocity of the system is ω Both τ and ω are variable

A. $\omega \propto \tau$

B. $\omega \propto \frac{1}{\tau}$

C. $\omega \propto \sqrt{\tau}$

D. $\omega \propto \frac{1}{\sqrt{\tau}}$

Answer: b

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37. Two identical rods are joined to form an $'X'$. The smaller angle between the rods is θ. The moment of inertia of the system about an axis passing through point of intersection of the rods and perpendicular to their plane is proportional to:

A. $\propto \theta$

B. $\propto \sin^2 \theta$

C. $\propto \cos^2 \theta$

D. independent of θ

Answer: d

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38. A uniform rod of mass m and length l makes a constant angle θ with an axis of rotation which passes through one end of the rod. Its moment of inertia about this axis is

A. $\frac{ml^2}{3}$

B. $\frac{ml^2}{3}\sin\theta$

C. $\frac{ml^2}{3}\sin^2\theta$

D. $\frac{ml^2}{3}\cos^2\theta$

Answer: c

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39. A disc of mass m and radius R has a concentric hole of radius r. Its moment of inertia about an axis through its center and perpendicular to its plane is

A. $\frac{1}{2}m(R-r)^2$

B. $\frac{1}{2}m\left(R^2-r^2\right)$

C. $\frac{1}{2}m(R+r)^2$

D. $\frac{1}{2}m\left(R^2+r^2\right)$

Answer: d

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40. The radius of gyration of a thin disc of radius 4 cm about a diameter is

A. 4cm

B. $2\sqrt{2}cm$

C. 2cm

D. $\sqrt{2}cm$

Answer: c

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41. The radius of gyration of a solid shapere of radius r about a certain axis is r. The distance of this axis from the centre of the shpere is

A. remain stationary

B. 0.5r

C. $\sqrt{0.6}r$

D. $\sqrt{0.4}r$

Answer: c

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42. Three identical rods, each of length L, are joined to form a rigid equilateral triangle. Its radius of gyration about an axis passing

thorugh a corner and perpendicular to plane of triangle is

A. $l/2$

B. $\sqrt{\frac{2}{2}l}$

C. $l/\sqrt{2}$

D. $l/\sqrt{3}$

Answer: c

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43. Let I be the moment of interia of a uniform square plate about an axis AB that passses through its centre and is parallel to two its sides. CD is a line in the plane of the plate that passes through the centre of the plate and makes an angle θ with AB. The moment of inertia of the plate about the axis CD is then equal to-

A. I

B. $I\sin^2\theta$

C. $I\cos^2\theta$

D. $I\cos^2\left(\frac{\theta}{2}\right)$

Answer: a

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44. If radius of the earth contracts to half of its present value without change in its mass, what will be the new duration of the day?

A. 6h

B. 12h

C. 48h

D. 96h

Answer: a

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45. A man spinning in free space can change the moment of inrtia of his body (I) by charging its shape. In this process,

A. he will have to expend some energy to increases I

B. he will have to expend some energy to decreases I

C. he does not have to expend any energy to change I

D. either (a) or (b) depending on the intial value of I

Answer: b

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46. A small ball strikes a stationery uniform rod, which is free to rotate, in gravity-free space. The ball does not stick to the rod. The rod will rotate about

A. its centre of mass

B. the centre of mass of rod' plus ball

C. the point of impact of the ball on the rod

D. the point about which the moment of inertia of the rod plus ball is minimum

Answer: a

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47. Three identical solid spheres move down three incline A, B and C are all of the same dimensions. A is without friction, the friction between B and a sphere is sufficient to cause rolling without slipping, the friction between

C and a sphere causes rolling with slipping. The kinetic energies, of A, B, C at the bottom of the inclines are E_A, E_B, E_C.

A. $E_A = E_B = E_C$

B. $E_A = E_B > E_C$

C. $E_A > E_B > E_C$

D. $E_A > E_B = E_C$

Answer: b

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48. A mass m moving with a constant velocity along a line parallel to the axis, away from the origin. Its anguarl momentum with respect to the origin

A. is zero when it is vertical

B. remain constant

C. goes on increasing

D. goes on decreasing

Answer: b

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49. A stone of mass m tied to the end of a string, is whirled around in a horizontal circle. (Neglect the force due to gravity). The length of the string is reduced gradually keeping the angular momentum of the stone about the centre of the circle constant. Then, the tension in the string is given by $T = Ar^n$ where A is a constant, r is the instantaneous radius of the circle and n=....

A. 1

B. -1

C. -2

D. -3

Answer: d

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50. For a particle undergoing SHM, the velocity is plotted aginst displacement. The curve will be

A. a straight line

B. a parabola

C. a circle

D. an ellipse

Answer: d

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51. A particle undergoes SHM with a time period of 2 second in how much time it travel

from its mean position to a displacement equal to half of its amplitude?

A. $\frac{1}{2}s$

B. $\frac{1}{3}s$

C. $\frac{1}{4}s$

D. $\frac{1}{6}s$

Answer: d

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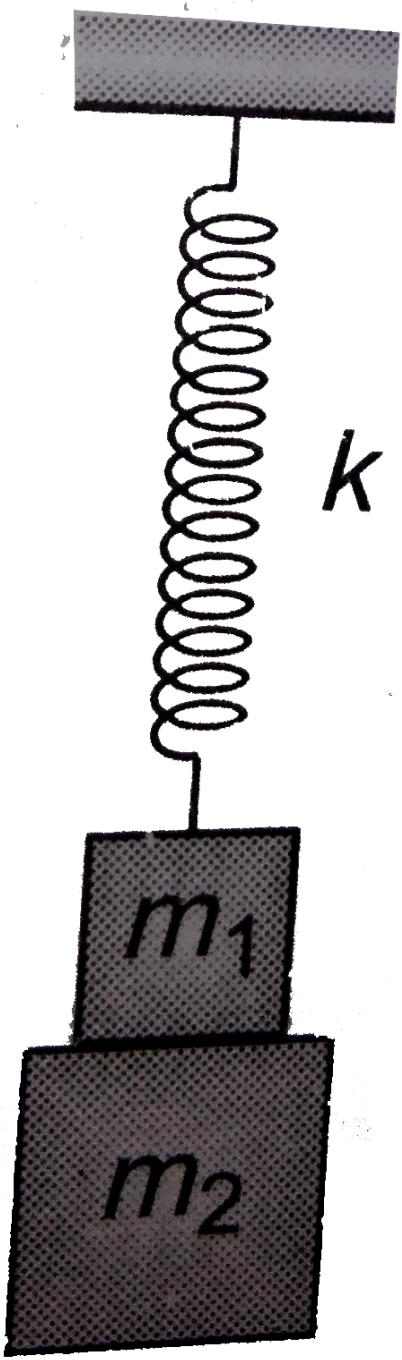
52. Two blocks of masses m_1 and m_2 are attached to the lower end of a light vertical spring of force constant k. The upper end of the spring is fixed. When the system is in equilibrium, the lower block (m_2) drops off.

The other block (m_1) will


k
m_1
m_2

A. remain undisturbed

B. move up through a distance $m_2 g / k$ and come to rest

C. undergo vertical SHM with a period of $2\pi\sqrt{m_1 / k}$

D. undergo vertical SHM with time period of $2\pi\sqrt{(m_1 + m_2) / k}$

Answer: c

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53. The displacement y of a particle executing periodic motion is given by

$$y = 4\cos^2\left(\frac{1}{2}t\right)\sin(1000t)$$

This expression may be considereed to be a result of the superposition of

A. 2

B. 3

C. 4

D. 5

Answer: b

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54. A simple pendulum has a bob of mass m and swings with an angular amplitude ϕ. The tension in thread is T. At a certain time the string makes an angle θ with the vertical $(\theta \leq \phi)$

A. $T = mg\cos\theta$, for all value of θ

B. $T = mg\cos\theta$, only for $\theta = \phi$

C. $T = mg$ for

$$\theta = \cos^{-1}\left[\frac{1}{3}(2\cos\phi + 1)\right]$$

D. T will be large for smaller value of θ .

Answer: b, c, d

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55. A siple pendulum rotates in a horizontal plane with an angular velocity of ω about a fixed point P I gravity-free space. There is a negative charge at P. The bob gradully emits

photoelectrons (disregard the energy and momentum of the incident photons and emitted electrons). The total force acting on the bob is T.

A. T will decreases,ω will decrease.

B. T will decrease, ω will remain constant.

C. T and ω will remain unchanged.

D.

Answer: c, d

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56. A simple pendulum of length l is set in motion such that the bob, of mass m, moves along a horizontal circualar path , and the string makes a constant angle θ with the vertical. The time period of rotation of the bob is l and the tension in the thread is T

A. $t = 2\pi\sqrt{l/g}$

B. $t = 2\pi\sqrt{l\cos\theta/g}$

C. $T = \frac{4\pi^2 ml}{t^2}$

D. The bob is in equilibrium

Answer: b, c

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57. A stone tied to a string of length L is whirled in a vertical circle with the other end of the string at the centre. At a certain instant of time the stone is at lowest position and has a speed u . Find the magnitude of the change in its velocity as it reaches a position, where the string is horizontal.

A. $\sqrt{u^2 - 2gL}$

B. $\sqrt{2gL}$

C. $\sqrt{u^2 - gL}$

D. $\sqrt{2(u^2 - gL)}$

Answer: d

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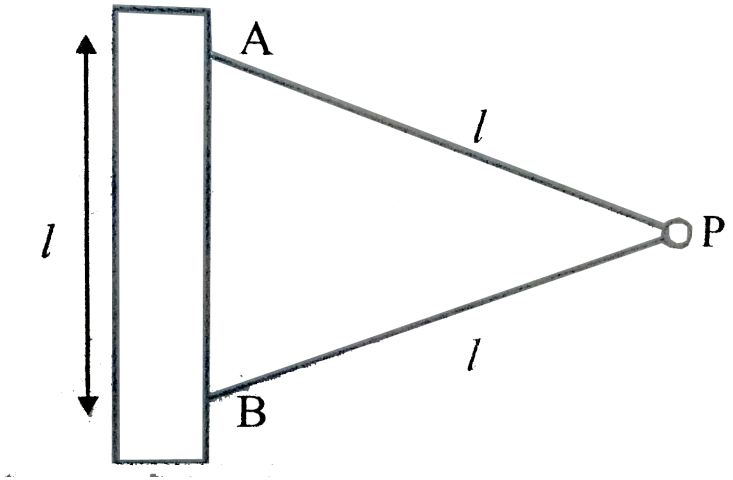
58. A particle P of mass m is attached to a vertical axis by two strings AP and BP of legth l each. The separation $AB = l$, rotates

around the axis with an angular velocity ω. The tension in the two string are T_1 and T_2. Then



A. $T_1 = T_2$

B. $T_1 + T_2 = m\omega^2 l$

C. $T_1 - T_2 = 2mg$

D. BP will remain taut only if $\omega \geq \sqrt{2g/l}$

Answer: b, c, d

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59. A uniform rod of mass m and length l rotates in a horizontal plane with an angular velocity ω about a vertical axis passing through one end. The tension in the rod at a distance x from the axis is

A. $\frac{1}{2}m\omega^2 x$

B. $\frac{1}{2}m\omega^2 \frac{x^2}{l}$

C. $\frac{1}{2}m\omega^2 l\left(1-\frac{x}{l}\right)$

D. $\frac{1}{2}.\left(\frac{m\omega^2}{l}\left[l^2-x^2\right]\right.$

Answer: d

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60. A tube of length L is filled completely with an incomeressible liquid of mass M and closed at both the ends. The tube is then rotated in a horizontal plane about one of its ends with a

uniform angular velocity ω. The force exerted by the liquid at the other end is

A. $\frac{1}{2}M\omega^2 L$

B. $M\omega^2 L$

C. $\frac{1}{4}M\omega^2 L$

D. $\frac{1}{2}M\omega^2 L^2$

Answer: a

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61. A ring of mass m and radius R is being rotated about its axis with constant angular velocity ω in the gravity free space. Find tension in the ring.

A. zero

B. $\frac{1}{2}m\omega^2r^2$

C. $m\omega^2r^2$

D. $mr\omega^2$

Answer: c

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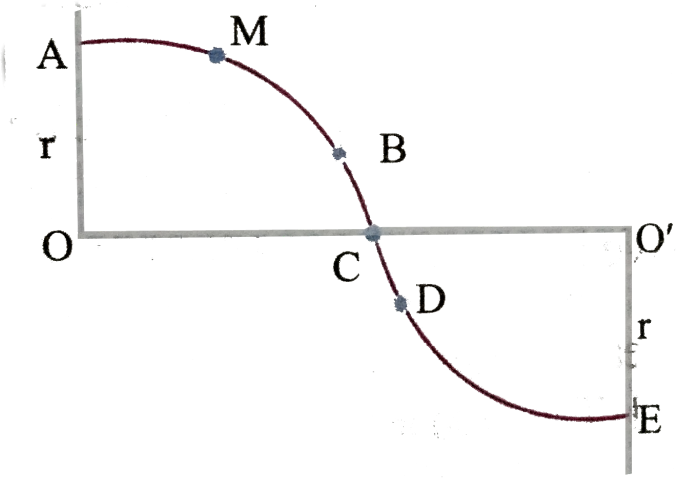
62. $ABCDE$ is a smooth iron track in the vertical plane. The sections ABC and CDE are quarter circles. Points B and D are very close to C. M is a small magnet of mass m. The force of attraction between M and the track is F, which is constant and always normal to the track. M starts from rest at A,

then:



A. If M is not leave the track at C then

$F \geq 2mg$.

B. At B, the normal reaction of the track is

$F - 2mg$.

C. At D =, the normal reaction of the track is

$F + 2mg$.

D. The normal reaction of the track is equal to F at some point between A and B.

Answer: a, b, c, d

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63. The earth rotates from west to east. A wind mass begins movings due north from the equator, along the earth's surface. Neglect all

effects other than the rotation of the earth. The wind mass will

A. always move due north

B. shift a little to the east as it moves to higher latitudes

C. shift a little to the west as it moves to higher latitudes

D. move along a loop and return to its starting point on the equator

Answer: b

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64. A geostationary staellite S is stationed above a point P on equator. A particle is fired from S directly towards P.

A. With resoect to the the axis of rotation of the earth, P and S have the same angular velocity but different linear velocities.

B. The particle will hit P.

C. The particle will hit the equator east of P.

D. The particle will hit the equator west of P.

Answer: a, c

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65. A body moves on a horizontal circular road of radius r, with a tangential acceleration a_t. The coefficient of friction between the body and the road surface Is μ. It begins to slip

when its speed is v.

(i) $v^2 = \mu r g$

(ii) $\mu g = \left(\frac{v^4}{r^{92}} \right) + a_t \Bigg)$

(iii) $\mu^2 g^2 = \left(\frac{v^4}{r^2 + a_t^2} \right.$

(iv) The force of friction makes an angle $\tan^{-1}\left(v^2 / a_t r\right)$ with the direction of motion at the point of slipping.

A. $v^2 = \mu r g$

B. $\mu g = \frac{v^2}{r} + a_t$

C. $\mu^2 g^2 = \frac{v^4}{r^2} + a_t^2$

D. The force of friction makes on angle $\tan^{-1}\left(v^2\right)/\left(a_t r\right)$ with the direction of motion at the point of slipping .

Answer: c, d

 Watch Video Solution

66. The density of a rod AB increases linearly from A to B its midpoint is O and its centre of mass is at C. four axes pass through A, B, O and C, all perpendicular to the length of the

rod. The moment of inertial of the rod about these axes are I_A, I_B, I_O and I_C respectively.

A. $I_A > I_B$

B. $I_A < I_B$

C. $I_0 > I_C$

D. $I_0 < I_C$

Answer: a, c

Watch Video Solution

67. A square plate lies in the xy plane with its centre at the origin and its edges parallel to the x and y axes. Its moments of inertia about the x, y and z axes are I_x, I_y and I_Z respectively, and about a diagonal it is I_D

A. $I_x = I_y = \frac{1}{2} I_z$

B. $I_x = I_y = 2I_z$

C. $I_D + I_X$

D. $I_D = I_z$

Answer: a, c

Watch Video Solution

68. Four identical rods each of mass m and length l are joined to form a rigid square frame. The frame lies in the xy plane, with its centre at the origin and the sides parallel to the x and y axes. Its moment of inertial about

A. the x-axis is $\frac{2}{3}ml^2$

B. the z-axis is $\frac{4}{3}ml^2$

C. an axis parallel to the z-axis and passing through a corrner is $\frac{10}{3}ml^2$

D. one side is $\frac{5}{2}ml^2$

Answer: a, b, c, d

Watch Video Solution

69. P is the centre of mass of four point masses A,B, C and D which are lying in the same length but not along the same straight line then.

A. P may or may not coincide with one of the point masses.

B. P must lie within the quadrilatered ABCD.

C. P must lie within or on the edge of at least one of the tringles formed by taking A, B, C and three at a time

D. P must lie on a line joined two of the points A, B, C, D.

Answer: a, c

Watch Video Solution

70. When slightly different weights are placed on the two pans of a beam balance, the beam comes to rest at an angle with the horizontal. The beam is supported at a single point P by a pivot.

A. The net torque about P due to the two weights is nonzero at the equilibrium position .

B. The whole system does not continue to rotate about P because it has a large moment of inertia.

C. The centre of mass of the system lies below P .

D. The centre of mass of the system lies above P.

Answer: a, c

Watch Video Solution

71. A body is in equilibrium under the influence of a number of forces. Each has a different line of action. The minimum number of forces required is.

A. 2, if their lines of action pass through the centre of mass of the body

B. 3, if their lines of action are not parallel

C. 3, if their lines of action are parallel

D. 4, if their lines of action are parallel and all the force have the same magnitude

Answer: b, c, d

Watch Video Solution

72. A block with a square base measuring axa and height h, is placed on an inclined place. The coefficient of friction is m. The angle of inclination (θ) of the plane is gradually increased. The block will.

A. topple before sliding $\mu > \frac{a}{h}$

B. topple before sliding if $\mu > \frac{a}{h}$

C. slide before topple if $\mu > \frac{a}{h}$

D. slide before toppling if $\mu < \frac{a}{h}$

Answer: a, d

Watch Video Solution

73. 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. decreases

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

Answer: c

 Watch Video Solution

74. A uniform rod kept vetically on the ground falls from rest. Its foot does not slip on the ground.

A. No part of the rod can have acceleration greater than g in any position.

B. At any one position of the rod, different points on it have different accelertions.

C. Any one particular point on the rod has different acceleration at different positions of the rod.

D. The maximum acceleration of any point on the rod, at any position, is 15 g

Answer: B::C::D

View Text Solution

75. A man spinning in free space changes the shape of his body, eg. By spreading his arms or curling up. By doing this, he can change his.

A. moment of inertia

B. angular momentum

C. angular velocity

D. rotational kinetic energy

Answer: a, c, d

Watch Video Solution

76. A man standing on a platform holds weights in his outstretched arms. The system is rotated about a central vertical axis. If the

man now pulls the weights inwards close to his body then

A. the angular velocity of the system will increase

B. the angular momentum of the system will decrease

C. the kinetic energy of the system will increase

D. he will have to expand some energy to draw the weights in

Answer: a, c, d

Watch Video Solution

77. A horizontal disc rotates freely about a vertical axis through its centre. A ring, having the same mass and radius as the disc, is now gently placed on the disc. After some time, the two rotate with a common angular velocity, then

A. Some friction exists between the disc and the ring

B. The angular momentum of the 'disc plus ring' is conserve

C. The final common angular velocity is $\frac{2}{3}rd$ of the initial angular velocity of the disc

D. $\frac{2}{3}rd$ of the initial kinetic energy changes to heat.

Answer: a, b, d

Watch Video Solution

78. Two horizontal discs of different radii are free to rotate about their central vertical axes: One is given some angular velocity, the other is stationary. Their rims arc now brought in contact. There is friction between the rims. Then

A. The force of friction between the rims will disappear when the discs rotate with equal angular speeds.

B. The force of friction between the rims will disappear when they have equal linear velocities

C. The angular momentum of the system will be conserved.

D. The rotational kinetic energy of the system will not be conserved

Answer: b, d

 Watch Video Solution

79. A constant external torque τ acts for a very brief period $\triangle t$ on a rotating system having moment of inertia I then

A. the angular momentum of the system will changed by $\tau\Delta t$.

B. the angular velocity of the system will change by $\frac{\tau\Delta t}{I}$

C. If the system was initially at rest, it will acquire rotational kinetic energy $\frac{(\tau\Delta t)^2}{2I}$

D. The kinetic energy of the system will change by $\frac{(\tau \Delta t)^2}{I}$

Answer: a, b, c,

Watch Video Solution

80. Two identical spheres A and B are free to move and I, rotate about their centres. They are given the same impel J. The lines of action of the impulses pass through tht centre of A and away from the centre of B, then

A. A and B will have the same speed

B. B will have greater kinetic energy than A.

C. They will have the same kinetic energy , but the linear kinetic energy of B will be less then that of A

D. The kinetic enrgy of B will depend on the point of impact of the impulse on B

Answer: a, b, d

 Watch Video Solution

81. The motion of a sphere moving on a rough horizontal surface changes from pure sliding (without rolling) to pure rolling (without slipping). In this process, the force of friction

(i) intially acts opposite to the direction of motion and late in the direction of motion

(ii) cause linear retardation

(iii) causes angular acceleration

(iv) stops acting when pure rolling begins

A. initially acts opposite to the direction of motion and later in the direction of

motion

B. causes linear retardation

C. causes angular acceleration

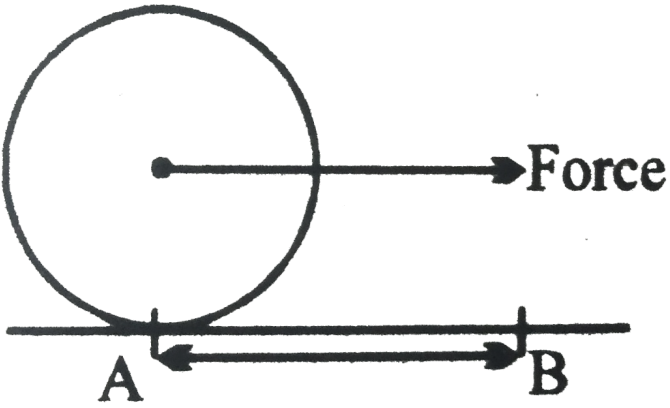
D. stops acting when pure rolling begins

Answer: b, c, d

Watch Video Solution

82. A disc of circumference s is at rest at a point A on a horizontal surface when a constant horizontal force begins to act on its

centre. Between A and B there is sufficient friction toprevent slipping, and the surface is smooth to the right of B. $AB = s$. The disc moves from A to B in time T. To the right of B,



A. the angular acceleration of the disc will disappear, linear acceleration will remain

unchanged

B. linear acceleration of the disc will increase

C. the disc will make one rotation in time T/2

D. the disc will cover a distance greater than s in a further time T.

Answer: b, c, d

Watch Video Solution

83. A solid sphere starts from rest at the top of an incline of height h and length l, and moves down. The force of friction between the sphere and the incline is F. This is insufficient to prevent slipping. The kinetic energy of the sphere at the bottom of the incline is W.

A. The work done against the force of friction is Fl.

B. The heat produced is Fl.

C. W=mgh-Fl

D. $W > (\mathrm{mgh\text{-}Fl})$

Answer: a, d

View Text Solution

84. A ring (R), a disc (D), a solid sphere (S) and a hollow sphere with thin walls (H), all having the same mass but different radii, start together from rest at the top of inclined plane and roll down without slipping. Then

A. All of them will reach the bottom of the inclined together.

B. The body with the maximum radius will reach the bottom first.

C. They will reach the bottom in the order S, D, H,R.

D. All of them will have the same kinetic energy at the bottom of the imcline.

Answer: a, d

 Watch Video Solution

85. A solid sphere rolls without slipping on a rough horizontal floor, moving with a speed v. It makes an elastic collision with a smooth vertical wall. After impact

A. it will move with a seed v initially

B. its motion will be rolling without slipping

C. its motion will be rolling with slipping initially and its rotational motion will

stop momentarily at some instant

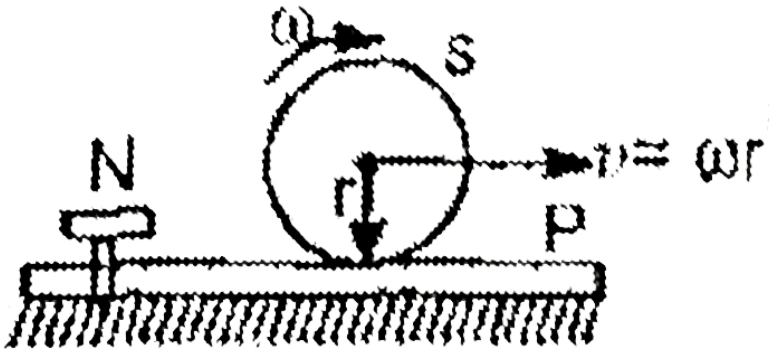
D. its motion will be rolling without slipping only after some time

Answer: a, c, d

Watch Video Solution

86. A sphere S rolls without slipping with a constant speed on a plank P. The friction between the upper surface of P and the sphere is sufficient to prevent slipping, while

the lower surface of P is smooth and rest on the ground. Initially P is fixed on the ground by a pin N. If N is suddenly removed



A. S will begin to slip on P

B. P will begin to move backwards

C. the speed of S will decrease and its angular velocity will increase

D. there will be no change in the motion of

S and P will still be at rest

Answer: d

Watch Video Solution

87. A ring rolls without slipping on the ground. Its centre C moves with a constant speed u. P is any point on the ring. The speed of P with respect to the ground is v.

A. $0 \leq v \leq 2u$

B. v=u, if CP is horizontal.

C. v=u, if CP makes an angle of 60° with the horizontal and P is below the horiozontal level of C.

D. $v = \sqrt{2}u$, if CP is horizontal

Answer: a, c, d

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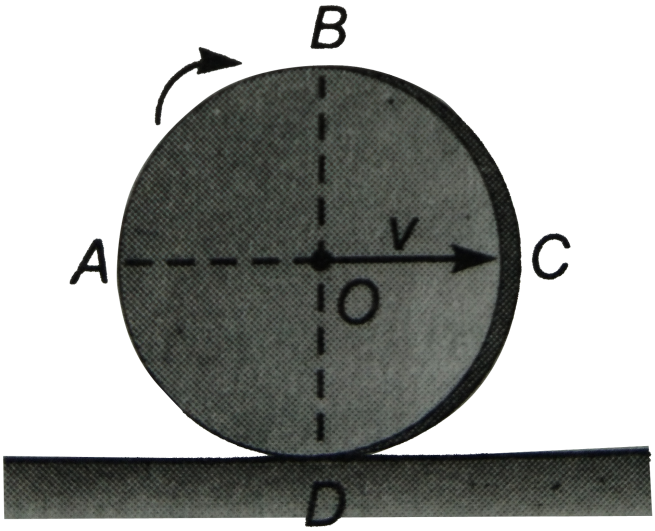


88.

A uniform circular ring rolls without slipping on a horizontal surface. At any instant, its position is as shown in the figure. Then

A. Section ABC has greater kinetic energy than section ADC.

B. Section BC has greater kinetic energy than section CD.

C. Section BC has the same kinetic energy as section DA.

D. The section AB, BC, CD and DA have the same kinetic energy.

Answer: a, b

Watch Video Solution

89. A wheel of radius r rolls without slipping with a speed v on a horizontal road. When it is at a point A on the road, a small blob of mud separates from the wheel at its highest point and lands at point B on the road:

A. $AB = v\sqrt{r/g}$

B. $AB = 2v\sqrt{r/g}$

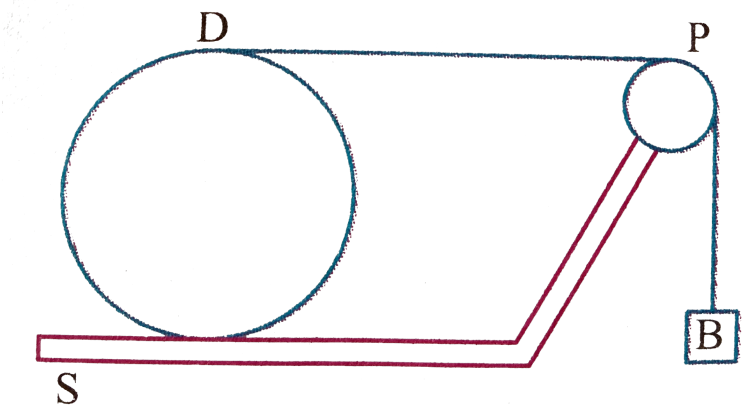
C. $AB = 4v\sqrt{r/g}$

D. If $v > \sqrt{4rg}$, the blob of mud will land on the wheel and not on the road.

Answer: c

Watch Video Solution

90. In the figure, the disc D does not slip on the surface S, the pulley P has mass and the string does not slip on it. The string is wound around the disc.



A. The acceleration of the block B is doubled the acceleration of the centre of D.

B. The force of friction exerted by D on S acts to the left.

C. The horizontal and the vertical sections of the string have the same tension.

D. The sum of the kinetic energies of D and B is less than the loss in the potential energy of B as it moves down.

Answer: a, c, d

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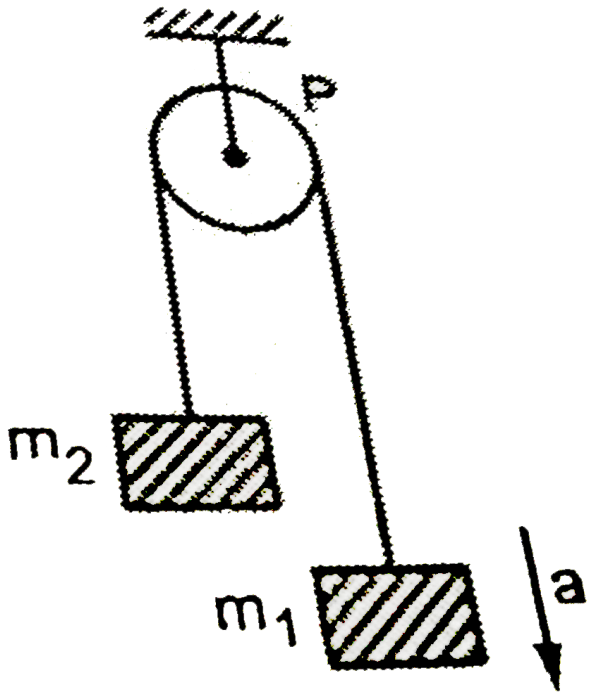

91.

In the figure, the blocks have unequal masses m_1 and $m_2(m_1 > m_2)$. m_1 has a downward acceleration a . The pulley P has a radius r, and

some mass. The string does not slip on the pulley.

A. The two sections of the string have unequal tensions.

B. The two blocks have acceleration of equal magnitude.

C. The angular acceleration of P is a/r.

D. $a < \left(\frac{m_1 - m_2}{m_1} + m_2 \right)$

Answer: a, b, c, d

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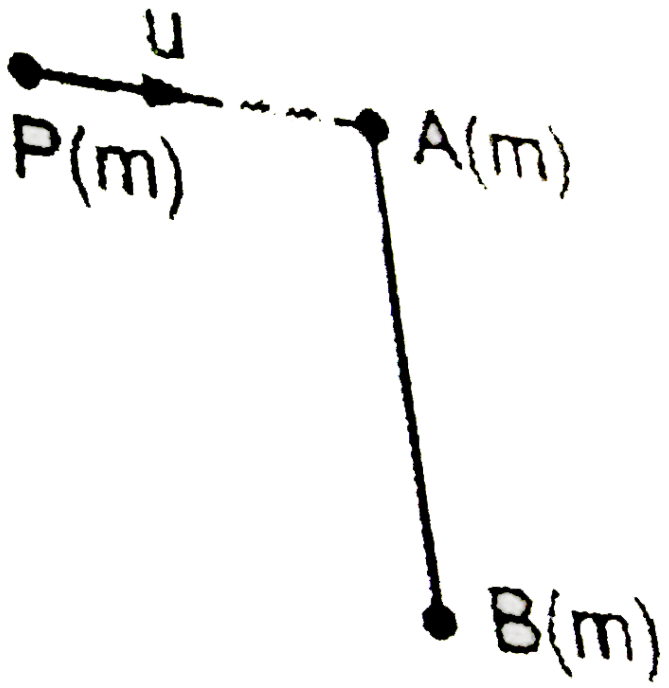

92.

Two particle A and B, of mass m each, are joined by a rigid massless rod of length l. A particle P mass m, moving with a speed u

normal to AB, strikes A and sticks to it. The centre of mass of the 'A+B+P' system is C.

A. The velocity of C before impact is u/3.

B. The velocity of C after impact is u/3

C. The velocity of 'A+P' immediately after impact is u/2.

D. The velocity of B immediately after impact is zero.

Answer: a, b, c, d

View Text Solution

93. In the previous question, immediately after the impact,

A. AC=l/3

B. the angular momentum of the 'A+B+P' system about C is $\frac{1}{3}$mul

C. the moment of inertia of the 'A+B+P' system about C is $\frac{2}{3}ml^2$

D. the angular velocity of the 'A+B+P` system is u/2l

Answer: a, b, c, d

View Text Solution

94. In Q. No. 92, immediately after impact,

A. the velocity of 'A+P` with respect of C is u/6, to the right

B. the angular velocity of 'A+P' with respect to C is u/2l

C. the velocity of B with respect to C I u/3, to the left

D. the angular velocity B with respect to C is u/2l,clockwise

Answer: a, b, c, d

View Text Solution

95. A thin uniform rod of mass m and length l is free to rotate about its upper end. When it is at rest, it receives an impulse J at its lowest

point, normal to its length. Immediately after impact,

A. the angular momentum of the rod is Jl

B. the angular velocity of the rod is 3J/ml

C. the kinetic energy of the rod is $3J^2/2m$

D. the linear velocity of the midpoint of the rod is $3J/2m$

Answer: a, b, c, d

View Text Solution

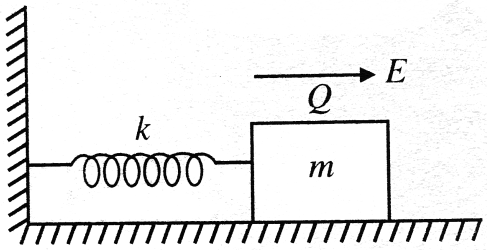

Fig. 4.176

96.

A spring block system undergoes SHM on a smooth horizontal surface, the block is now given some charge and a uniform horizontal electric field E is switched on as shown in Fig. As a result

A. the time period of oscillation will increase

B. the time period of oscillation will decrease

C. the time period of oscillation will remain unaffected

D. the mean position of simple harmonic motion will shift to the right

Answer: c, d

 Watch Video Solution

97. A simple pendulum has a time period T. The bob is now given some positive charge –

(1) If some positive charge is placed at the point of suspension, T will increases

(2) If some positive charge is placed at the point of suspension, T will not change

(3) If a uniform downward electric field is switched on, T will increase

(4) If a uniform downward electric field is switched on, T will decrease

A. If some positive charge is placed at the point of suspension, T will increase.

B. If some positive charge is placed at the point of suspension, T will not change

C. If a uniform downward electric field is switched on , T will increase.

D. If a uniform downward electric field is switched on , T will decrease.

Answer: b, d

Watch Video Solution

98. A coin is placed on a horizontal platform, which undergoes horizontal simple harmonic motion about a mean position O. The coin does not slip on the platform. The force of friction acting on the coin is F.

(i) F is always directed towards O

(ii) F is directed towards O when the coin is moving away from O, and away from O when the coin moves towards O

(iii) $F = 0$ when the coin and platform come to rest momentarily at the extreme position of

the harmonic motion

(iv) F is maximum when the coin and platform come to rest momentarily at the extreme position of the harmonic motion

A. F is always directed towards O.

B. F is directed towards O when the coin is moving away from O, and away form O when the coin moves towards O.

C. F=0 when the coin and platform come to rest momentrily at the extreme position of the harmonic motion.

D. F is maximum when the coin and platform come to rest momentrily at the extreme position of the harmonic motion.

Answer: a, d

Watch Video Solution

99. In the previous question, the angular frequency of the simple harmonic motion is ω. The coefficient of friction between the coin

and the platform is μ. The amplitude of oscillation is gradually increased. The coin will begin to slip on the platform for the first time

(i) at the extreme positions of oscillations

(ii) at the mean position

(iii) for an amplitude of $\frac{\mu g}{\omega^2}$

(iv) for an amplitude of $\frac{g}{\mu\omega^2}$

A. at the extreme position of oscillation

B. at the mean position

C. for an amplitude of $\mu g / \omega^2$

D. for an amplitude of $g / \mu\omega^2$

Answer: a, c

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100. A coin is placed on a horizontal platform which undergoes vertical simple harmonic motion of angular frequency ω. The amplitude of oscillation is gradually increased. The coin will leave contact with the platform for the first time

A. at the highest position of the platform

B. at the mean position of the platform

C. for an amplitude of g/ω^2

D. for an amplitude of $\sqrt{g}/\omega$

Answer: a, c

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