Rotational Mechanics

Exercise Solutions

Solution 1:
we are given that, $\omega_0 = 0$,
Final angular velocity, ω' =100 revs/s .
t = time = 4 s.

Let α be angular acceleration.

Now, $\omega' = \omega_0 + \alpha t$

Where ω_0 is initial angular velocity

or $\alpha = 25$ rev/s^2

Again, from second equation of kinematics.

$\theta = \omega_0 + (1/2)\ \alpha t^2$

[angle rotated during 4 seconds, so t = 4 sec]

$\theta = 400\ \pi$ radians

Solution 2:

Given: $\theta = 50$
time = t = 5 sec.

By equation of kinematics,

$\theta = \omega t + (1/2)\ \alpha\ t^2$

or $\alpha = 4$ rev/s^2

Let After 5 second angular velocity will be ω'.

$\omega' = \omega + \alpha t$

=> $\omega = 20$ rev/s

Solution 3:
Time duration = t =10sec.
angle rotation = θ

Maximum angular velocity = 4 x 10 = 40 rad/s

Area under the curve will decide the total angle rotated.

Area under the curve = (1/2)x10x40 + 40x10 + (1/2)x40x10 = 800 rad = total angle rotated.

Solution 4:
rom first equation of kinematics-

$\omega = \omega_0 + \alpha t$ ...(1)
Where Initial angular velocity= ω_0 = 5 rad/s and Final angular velocity = ω = 15 rad/s and α = 1 rad/s^2

(1) => t = 10 sec

Again,from second equation of kinematics.

$\theta = \omega_0 t + (1/2) \alpha t^2$

Here θ is the total angle rotated

=> θ = 100 rad.

Solution 5:
α = 2 rev/s^2, θ = 5 rev, ω_o = 0 and ω = ?

Change in angular velocity

$\omega^2 = 2\theta\alpha$ ...(1)

=> $\omega = 2\sqrt{5}$ rev/s

or $\theta = 10\pi$ rad and

$\alpha = 4\pi$ rad/s^2

then (1)=> $\omega = 2\sqrt{5}$ rev/s

Solution 6:

Radius of disc = 10 cm = 0.1 m and Angular velocity = 20 rad/s

(a) linear velocity of the rim = ω_r = 20x0.1 = 2 m/s

(b) Linear velocity at the middle of radius

$\omega_r/2$ = (20x0.1)/2 = 1 m/s

Solution 7:
t = 1 sec and r = 1 cm = 0.01 m

Tangential acceleration:

a_T = r x a = 0.01 x 4 rad/s^2

Angular velocity : ω = α t = 1 x 4 = 4 rad/s

Radial acceleration: $a_r = \omega^2$ x r = 0.16 m/s^2 or 16 cm/s^2

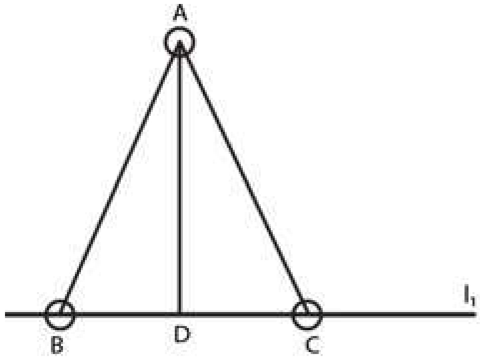
Solution 8:
Relation between angular speed and linear speed

v = r x ω

Where, Angular speed of the disc = ω = 10 rad/s and Radius of the disc = r = 20 cm or 0.20 m

v = 10 x 0.20 = 2 m/s

Solution 9:



The perpendicular distance from the axis AD = √3/2 x 10 = 5√3 cm

Moment of inertia about BC = I = mr^2
=200 K $(5\sqrt{3})^2$ gm-cm^2

= 1.5 x 10^{-3} kg-m^2

(b) Let's take AD as perpendicular side.

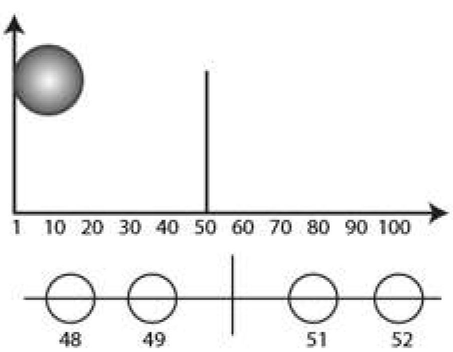
moment of inertia along BC

I = $2mr^2$

= 2 x 200 x 10^2 gm-cm^2

= 4 x 10^{-3} kg-m^2

Solution 10:



Consider the two particles at the position 49 cm and 51 cm

Moment of inertia due to these 2 particles = $49x1^2 + 51 + 1^2 = 100$ gm-cm^2

Similarly, if consider 48th and 52nd term, we have 100 x 2^2 gm-cm^2

Thus, we will get 49 such set and one alone partcle at 100 cm.

Total Moment of inertia = $100(1^2 + 2^2 + ... + 49^2) + 100(50)^2$

= 4292500 gm-cm^2

= 0.43 kg-m^2

Solution 11:
Moment of inertia of the first body and the 2nd body about the respective tangents becomes

$MI_1 = mr^2 + (2/5)\ mr^2$ and $MI_2 = mr^2 + (2/5)\ mr^2 = (7/5)\ mr^2$

Net moment of inertia is:

$MI_{net} = (7/5)\ mr^2 + (7/5)\ mr^2 = (14/5)\ mr^2$ units

Solution 12:

Length of the rod =L= 1 m, and its mass = 0.5 kg
Let r = distance between the parallel axes.
Let at a distance x from the center the rod is moving

$I_B = I_A + I_A.\ r^2$

[parallel axis theorem]

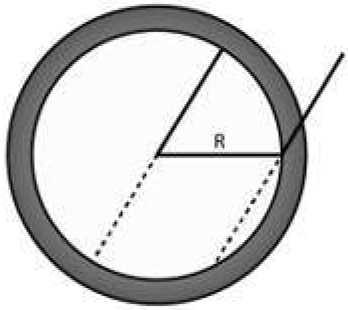
the moment of inertial at d

$(mL^2/1^2) + md^2 = 0.10$

On Putting values, we have

d = 0.342 m

Solution 13:
First let's take a point on the rim, this point is perpendicular to the ring and moment of Inertia



$I = mr^2$

About a point on a rim of the ring and the axis perpendicular to the plane of the ring, the moment of inertia = $mR^2 + mR^2 = 2\ mR^2$

=> $mK^2 = 2mR^2$
[Paralel axis theorem]

=> $K = \sqrt{(2R^2)} = 2R$

Solution 14:
Moment of inertia : $I = mr^2/2$

Let us take a line parallel to this axis and at a distance d. Then the radius of gyration becomes r

Moment of inertia = $I' = L + md^2$

$I' = mr^2/2 + md^2$

Also, $I' = mr^2$ (Given)
Equating above equations, we have

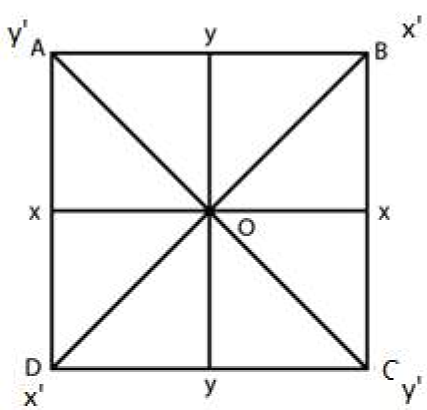
$d^2 = r^2/2$

or $d = r/\sqrt{2}$

Solution 15:

mass of that cross sectional area = $m/a^2 \times (a x dx)$

moment of inertia along xx'



Therefore, for two lines

$I = 2m \times a^2/12$

$= ma^2/6$

Moment of inertia for pair of perpendicular diagonals:

$I' = 2m \times a^2/12 = ma^2/6$

Moment of inertia: $I' = 2I$
[perpendicular axis theorem]

$I = ma^2/12$

Solution 16:

The inertia of the body for a point of mass is the product of the square of the radius with the mass of the body.

$I = mAr$

Where, I = moment of Inertia, A = area of the object and r = radius of the object.

The moment of inertia of a disc:

$$I = \int_0^a (A + Br) 2\pi r dr$$

$$I = \int_0^a 2\pi A r^3 dr + \int_0^a 2\pi B r^4 dr$$

$$I = 2\pi\alpha^4 \left[\left(\frac{A}{4}\right) + \left(\frac{B\alpha}{5}\right)\right]$$

$$I = 2\pi\left(\frac{A\alpha^4}{4} + \frac{B\alpha^5}{5}\right)$$

Solution 17:
Formula used is that of a torque which tells us the mechanics of force which helps the object to rotate.

Torque = F. r ·······(1)

F = force applied on the object and r = radius of the object turning.

The force of the object when in motion in linear path = τ = mgr/2
and radius is

$$r = \left(u^2.\frac{\sin 2\,\theta}{g}\right)$$

$$r = \left(u^2.\frac{2\sin\theta.\cos\theta}{g}\right)$$

(1)=>

$$\tau = F.r$$

$$\tau = \frac{mg}{2}.\left(u^2.\frac{2\sin\theta.\cos\theta}{g}\right)$$

$$\tau = mu^2\sin\theta\cos\theta$$

Solution 18:
Torque = F.r

The pendulum bob rotates at a distance of "l" from the center which is also the radius in terms of torque, the force, F = W

If angle of turning is θ, the radius in terms of turning angle is r = l sin θ

Torque = F.l sin θ = W. l sinθ

At lowest point the θ = 0, turning the torque equal to zero at the lowest point.

Solution 19:

The force exerted into the wrench is F= 6N, the angle of motion is 30^o. The distance from the nut to the wrench end is 16 cm.
Therefore, total torque acting at A about the point 0.

Torque = F.r sinθ = 6 x 0.08 x sin 30^o = 6 x 0.08 x (1/2)

Torque acting on the point B

6 x 0.08 x (1/2) = F.r sinθ

6 x 0.08 x (1/2) = F x 0.16 sinθ

F = 1.5 N

Solution 20:
A torque which tells us the mechanics of force which helps the object to rotate.

Torque = F r sinθ

The torque acting on the point O due to the force of 15N:

$\tau_{15} = 15 \times 6 \times 10^{-2} \sin 37^o = 0.54$ Nm

The torque acting on the point O due to the force of 10N:

$\tau_{10} = 10 \times 4 \times 10^{-2} = 0.40$ Nm

The torque acting on the point O due to the force of 20N

$\tau_{20} = 20 \times 4 \times 10^{-2} \sin 30^o = 0.40$ Nm

Due to torque negation between τ_{10} and τ_{20} which leaves them to zero, leaving the resultant torque equivalent to 0.54 Nm.

Solution 21:
a torque which tells us the mechanics of force which helps the object to rotate.

Torque = F r sinθ

The block of mass "m" moves with a uniform velocity on an inclined plane of angle θ, the force applied on the block.

F = mg sinθ

For the block not to roll the sum of the product of torque and force applied downwards and reactionary force due to the mass of the block should be zero.

$\tau F + \tau F_N = 0$

$F(a/2) = -F_N$

or $- F_N = (a/2)$ mg sinθ

Torque on the sliding object is (-a/2) mg sinθ

Solution 22:
A torque which tells us the mechanics of force which helps the object to rotate.
Torque = Fr sinθ and $I = mL^2/12$

The mass of rod is given as "m" and length "L". So the torque acting on the rod:

$\tau = F \times L/4$

And, The moment of Inertia

$I = mL^2/12$

The angle of rotation in terms of angular acceleration:

$\alpha = \tau/I$

$= 3F/mL$

and angle of rotation in term of angular length is

$\theta = ut + (1/2)\alpha t^2$

Substituting the value of α and u = 0.

=> $\theta = (1/2)(3F/mL)\ t^2$

Solution 23:
The mass of the plate is 120g, the edges of the square is 5.0 cm and the angular acceleration is 0.2 rad/sec^2

A torque which tells us the mechanics of force which helps the object to rotate.

Torque = Fr sinθ and $I = mL^2/12$

The moment of Inertia of the plate:

$$I_{edge} = I + M\left(\frac{a}{2}\right)^2$$

$$I_{edge} = \frac{Ma^2}{12} + M\left(\frac{a}{2}\right)^2$$

By substituting the values of variables of mass and edge length

=> I = (0.12x0.05x0.05)/3

Torque produced by the plate: T = Iα

T = 0.0001 x 0.2 = 2 x 10^{-5} Nm

Solution 24: Moment of inertia of a square plate abut its diagonal is $ma^2/12$
Where m = mass of square plate and a = edges of the square

Torque produced = $(ma^2/12) \times \alpha$

= $[120\times10^{-3}\times5^2\times10^{-4}]/[12\times0.2]$

= 0.5 x 10^{-5} N-m

Solution 25:

A flywheel of moment of inertia 5.0 kg-m^2 is rotated at a speed of 60 rad/s.

Average torque = $I\alpha$

Calculation of work done from the torque of the flywheel:

$W = (1/2)\ I\omega^2$

The angular momentum of the wheel : $L = I\ \omega$

Now, let us calculate the angular acceleration:

$\alpha = -(60/5 \text{ x } 60)\ rad/s^2 = -0.2\ rad/s^2$

(a)the average torque of the flywheel

average torque = $I\alpha$ = -Nm

and work done by the torque of the flywheel

$W = (1/2)\ I\omega^2$

W = 9 KJ

(b) angular momentum of the wheel in a time span of 4 minutes

$\omega = \omega_o + \alpha t$

= 60 - 240/5 = 12 rad/s

So, angular momentum = $L = I\omega$ = 5x12 = 60 kg/m^2

Solution 26:

The earth’s angular speed decreases by 0.0016 rad/day in 100 years (Given)

and 1 year = 365 x 56400 sec

Torque produced by ocean water in decreasing earth's angular velocity is

$\tau = I\alpha$

$=(2/5)\ mr^2 \times (\omega - \omega_o)/t$

$= (2/5) \times 6 \times 10^{24} \times 64^2 \times 10^{10} \times [0.0016/26400^2 \times 100 \times 365]$

$= 5.678 \times 10^{20}$ N-m

Solution 27:

The relationship of velocity and acceleration in basic kinematics.

$\omega = \omega_o + \alpha t$

The angular velocity is taken in terms of rad/sec which is 10 and the time taken to rotate is 10 sec

$0 = 10 + 10\alpha$

$\Rightarrow \alpha = -1$ rev/s^2

Angular deceleration after 5 seconds we get

$\omega_{dec} = \omega + \alpha t$

$\Rightarrow \omega_{dec} = 5$ rev/s

Solution 28:

A torque which tells us the mechanics of force which helps the object to rotate.

Torque = Fr sin θ and I = (1/2) Mr^2

where, F = force applied on the object; r= radius of the object turning.
Let θ be the turning angle and I = moment of Inertia,
Also, L is the length at which the force is applied.

let us find the acceleration using below formula:

$\omega' = \omega^2 - 2\theta\alpha$

[ω = 100 rev/min = (5/8) rev/s = 10π/3 rad/s]
[0 = 10 rev = 20π rad and r = 0.2 m]

$0 = (3.22)^2 - 2\alpha(10)$

=> α = 10π/36 rad/s^2

Moment of inertia: I = (1/2) Mr^2 = (1/2)(10)$(0.2)^2$ = 0.2 kg m^2

Therefore, force applied to the wheel = T = Fa

=> T = Fr

or Iα = Fr

=> F = 2π/36 x (1/0.2)

F = 0.87 N

Solution 29:
A cylinder rotating at an angular speed of 50 rev/s is brought in contact with an identical stationary cylinder.
The wheel rotates at a speed angular speed of 50 rev/s, at constant torque both acting in positive and negative acceleration.

For the 1st cylinder = $\omega = 50-\alpha t$

=> $t = (\omega-50)/-1$ ...(1)

For the 2nd cylinder =$\omega = \alpha_{2t}$

=> $t = \omega/\alpha_2 = \omega/1$ ...(2)

From (1) and (2),

$\omega = 25$ rev/s

and (2)=> $t = 25/1 = 25$ sec

Solution 30:
Initial angular velocity = 20 rad/s
So, $\alpha = 2$ rad/s^2

=> $t_1 = \omega_1/\alpha_1 = 20/2 = 10$ sec

As, the time taken for the torque to be equal to the kinetic energy

Here initial angular velocity = angular velocity at that instant

Time require to come to that angular velocity, $t_2 = \omega_2/\alpha_2 = 20/2 = 10$ sec

Total time requires = $t_1 + t_2 = 10 + 10 = 20$ sec

Solution 31:
A light rod of length 1 m is pivoted at its centre and two masses of 5 kg and 2 kg are hung from the ends.
Here,
$\tau = I\alpha$
Where τ = average frictional torque, I = moment of inertia and α =angular acceleration.

The torque produced on both the ends is:

5g x (l/2) - 2g x (l/2) = Iα

α = 6/7 g or 8.4 rad/s^2

Solution 32:
The given is that, the problem the ord has a mass 1 kg.

The angular acceleration is: $\tau_{net} = I_{net} + \alpha$

The moment of the inertia = I = ml^2/12

=> I = 1/12 kg m^2

and total moment of inertia = I = 1.75 + 1/12 = 1.833 kg m^2

(a) The angular acceleration of the rod at initial moment = α = T/I = 1.5 x (9.8/1.833) = 8 rad/s^2

(b)
For 2 kg mass

T - 2g = 2a

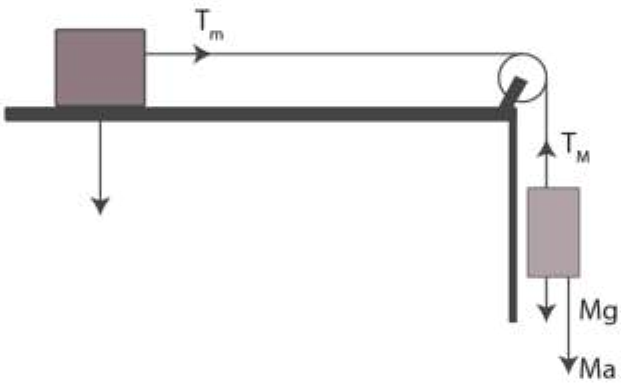
T = 19.6 + 8 = 27.6 N

For 5 kg mass
T - 5g = 5a
= 49 - 20
= 29 N

Solution 33:
The blocks are of "m" and "M" masses, with radius of r pulley and moment of Inertia "I"

Using second law of Newton when the Force/Tension applied is equivalent to the product of mass and acceleration

F = ma



Tension applied on the first block: $T_1 = M(g-a)$

Tension applied on the 2nd block of mass: $T_2 = ma$

Torque applied on the pulley : $\tau = I\alpha = Ia/r$

Solving above equations, we get

$$Mg = Ma + ma + I.\frac{a}{r^2}$$

$$a = \frac{Mg}{M + m + \frac{I}{r^2}}$$

Solution 34:

A string is wrapped on a wheel of moment of inertia = I = 0.20 kg-m^2 and radius = r = 10 cm or 0.1 m.

Mass of the block = m = 2 kg

We know, mg - T = ma

and $T = Ia/r^2$

From above equations,

$mg = (m + I/r^2)a$

=> a = [2x9.8] / [2+0.2/0.01] = 0.89 m/s^2, which is the acceleration of the block.

Solution 35:
The moment of the inertia of the wheel, I = 0.20 and radius, r=10 cm and mass block of block, m = 2 kg. (Given)

We know, $mg - T_1 = ma$ ..(1)
$(T_1 - T_2)r_1 = I_1 \alpha$ ....(2)
$T_2 r_2 = I_2 \alpha$ ....(3)

(2)=>
$(T_1 - I_2 \alpha/r_1)r_2 = I_1 \alpha$

[Using value of T_2]

=> $T_1 = [I_1/r_1^2 + I_2/r_2^2]a$

on substituting T_1 in (1)

$$a = \frac{mg}{[(I_1/r_1^2)+(I_2/r_2^2)]+m}$$

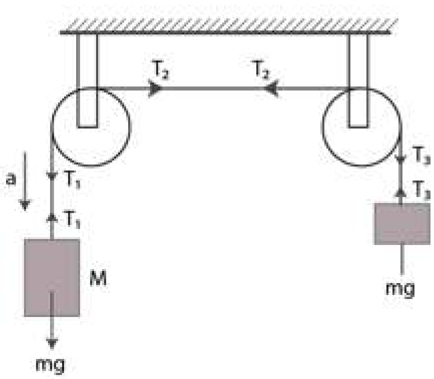
$$a = \frac{2\times 9.8}{(0.1/0.0025)+(0.2/0.01)+2}$$

$$= 0.316\ m/s^2$$

$$T_2 = I_2a/r_2^2 = \frac{0.20\times 0.316}{0.01}$$

$$= 6.32\ N$$

Solution 36:



From statement given,
$Mg - T_1 = Ma$ ...(1)

$(T_2 - T_1)R = Ia/R$ ...(2)

$(T_2 - T_3)R = Ia/R^2$ ...(3)

and $T_3 - mg = ma$ ....(4)

From (2) and (3)

$(T_1 - T_3) = 2Ia/R^2$ .....(5)

Adding (1) and (4)

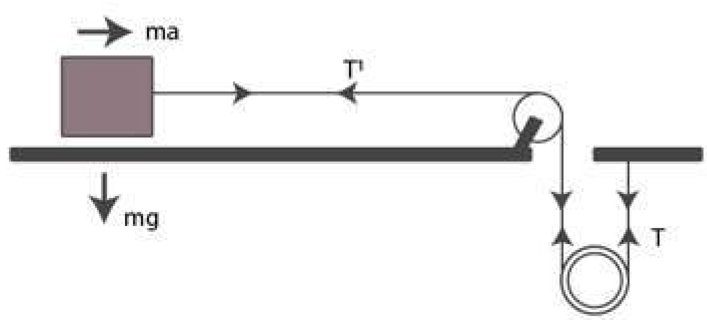
$-mg + Mg + (T_3 - T_1) = Ma + ma$ ....(6)

Using equation (5), equation (6) implies

$Mg - mg = Ma + ma + 2Ia/R^2$

or $a = [(M-m)G]/[(M+m+2I/R^2]$

Solution 37:



Let T is the tension of plane and T' of the side.

The angular acceleration of the pulley = α = (a/0.4) m/s^2

So, the torque applied by the pulley due to the mass: I = (T - T') x 0.20

= 0.20 kgm^2

Again, α = T/I

=> (a/0.4) = (T - T') x 0.20/0.20
=> (T - T') = -25 a ....(1)

Find the value of mass M using the moment of Inertia

I = $Mr^2/2$

or M = 10 kg

Now, Mg - T - T' = Ma/2
Here M = 10 and g = 9.8

=> T + T' = 98 - 5a ...(2)

Adding (1) and (2) we get

2T = 98 - 5a - 2.5a
[Using formula, T = ma = 1xa = a]

2a = 98 - 5a - 2.5a

or a = 10.31 m/s^2 .

Solution 38:

The radius of the pulley = 10 cm
Inertia = 0.5
Mass of the blocks are given as 2 kg and 4 kg.

The mass and tension relationship of the 4 kg block and the 2kg block :

$m_1 g \sin\theta - T_1 = m_1 a$ . .....(1)
$T_1 - T_2 = Ia/r^2$ ...(2)
$T_2 - m_2 g \sin\theta = m_2 a$ ....(3)

(1)+(3)=>
$m_1 g \sin\theta - m_2 g \sin\theta + (T_2 - T_1) = (m_1 + m_2)a$

using equation (2) in above, we have

$$a = \frac{(m_1 - m_2) g \sin\theta}{(m_1 + m_2 + I/r^2)}$$

$= 0.248 \ m/s^2$

Solution 39:
Form the above question's figure,
$m_1 g \sin\theta - T_1 = m_1 a$ ...(1)

$T_1 - T_2 = Ia/r^2$ ....(2)

$T_2 - (m_2 g \sin\theta + \mu m_2 g \cos\theta) = m_2 a$ ...(3)

(1)+(3)=>

$m_1 g \sin\theta - (m_2 g \sin\theta + \mu m_2 g \cos\theta) + (T_2 - T_1) = m_1 a + m_2 a$

Given, $m_1 = 4$ kg, $m_2 = 2$ kg, $g = 9.8$, $\sin\theta = \cos\theta = 1/\sqrt{2}$, $\mu = 0.5$ and $r = 0.1$
Using (2), and substituting above values, we get

$a = 0.125 \ m/s^2$

Solution 40:
Given, m_1 = 200g, l = 1 m, m_2 = 20g
The total tension formed due to the suspended weights: $T_1 + T_2 = 2 + 0.2 = 2.2$ ...(1)

The rod is kept at an equilibrium when the rod is at rest

$- T_1 + T_2 = 0.04/0.5 = 0.08$ ...(2)

Form (1) and (2)

$T_2 = 1.14$ N

and (2)=> $T_1 = (1.14 - 0.08) = 1.06$N

Solution 41:
The length of the ladder = 10 m
Mass of the ladder is 16 kg which makes angle of 37° and also given
Weight of the electrician is 60 kg, which stays at height of 8 cm.

Since the ladder should not slip or rotate, the torques expression is

$mg(8 \sin 37^{\circ}) + Mg(5 \sin 37^{\circ}) = F_2 (10 \cos 37^{\circ}) = 0$ and

$60 \times 9.8 \times (8 \sin 37^{\circ}) + 16 \times 9.8 (5 \sin 37^{\circ}) - F_2 (10 \cos 37^{\circ}) = 0$
Where F_1 and F_2: forces of the masses in terms of reactionary force

=> F_2 = 412N

let f be the friction force which is equal to the F_2 due to equilibrium of the ladder

=> f = 412 N

Normal force = $F_1 = (m + M)g = (60+16) \times 9.8 = 744.8$ N

Now,

The minimum coefficient of friction = μ

=> $\mu = f/F_1$
[on substituting the values]

$\mu = 0.553$. Answer!!

Solution 42:

The value of the reactionary force = R_2 = 16g + mg and another value of R_2 is R_1/μ

The relationship between R_1 and R_2 is

R_1 x 10 cos 37° = 16g x 5 sin 37° + mgx 60g x 8 x sin 37°

The value of the reactionary forces = R_1 is

$$R_1 = \frac{48g + \frac{24}{5}mg}{8}$$

$$R_2 = \frac{48g + \frac{24}{5}mg}{8 \times 0.54}$$

=>

$$16g + mg = \frac{48g + \frac{24}{5}mg}{8 \times 0.54}$$

Or m = 44 kg

Which is the mass of the mechanic that can go up the ladder.

Solution 43:

The length of the ladder = 6.5m

Weight of the man = 60kg and

(a) Torque is exerted at the upper end of the ladder and the there is no friction against the wall.

Torque due to weight of body

τ = Fr sinθ

τ = mg r sinθ

$\tau = 60x10x\ 6.5.2\ \sin\surd[1-(6/6.5)^2]$ = 750 N

(b)

force exerted by the man through the ladder on the ground

F= mg = 60x10 = 600 N

Solution 44:

The force exerted by the two hinges: $F_1 + F_2 = mg$

or $F_1 + F_2 = 8g$

When $F_1 = F_2$

=> $F_1 = 40$
[Using $g = 10\ m/s^2$]

The reactionary forces of the first hinge = $M_1 \times 4 = 8g \times 0.75$

=> $M_1 = 15$ N

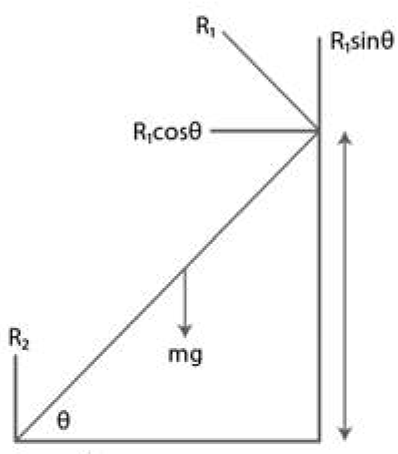
the resultant force due to force and reactionary forces:

$R = F_1^2 + N_1^2$

$= 40^2 + 15^2$

or R = 43 N

Solution 45:



The vertical and the horizontal component of the reactionary forces of the rod:
$R_2 = mg - R_1 \cos\theta$ and $R_1 \sin\theta = \mu R_2$

$$R_1 = \frac{\frac{mgL}{2}\cos\theta}{(\cos^2\theta/\sin\theta)h + \sinh\theta)}$$

$$R_1\cos\theta = \frac{\frac{mgL}{2}\cos\theta^2\sin\theta}{(\cos^2\theta/\sin\theta)h + \sinh\theta)}$$

The coefficient of friction: $\mu = [R_1 \sin\theta]/R_2$

Using above equations, we get

$$\mu = \frac{L\cos\theta\sin^2\theta}{2h - L\cos^2\theta\sin\theta}$$

Solution 46:
(a) The average momentum
$L = I\omega$

We are given, $I = mr^2/3$

=> $L = mr^2/3 \times \omega$

=> $L = (0.3 \times 0.5^2 \times 2)/3$

=> $L = 0.05\ kgm^2/S$

(b) Speed of the center of rod

$v = \omega r$

=> $v = 2 \times (50/2) = 50$ cm/s

(c) K.E. generated

K.E. = $(1/2) \times (0.025^2 = 0.05$ J

Solution 47:

Here $(ma^2/12) \times \alpha = 0.10$ N - m

and $\omega = 60x5 = 300$ rad/s

Therefore, average momentum = L = $I\omega$

=> L = (0.10/60) x 300 = 0.5 kgm^2/s

Then, the K.E. = $(1/2) I\omega^2$

= (0.10/60) x 300^2

= 75 J

Solution 48:

The angular momentum of earth about its axis:

(2/5) mR^2 x (2π x 35400)

And the value of moment of inertia of earth: I = (2/5) MR^2

Now the value of the sun's average mass: mR(2π/86400 x 365)

Now, the ratio of the mass of sun and the mass of earth :

$$\text{ratio} = \frac{\frac{2}{5}\text{mR}^2 \times \left(\frac{2\pi}{36400}\right)}{\text{mR}^2 \times \frac{2\pi}{36400 \times 365}}$$

$$= 2.65 \times 10^{-7}$$