PHYSICS

DPP

DAILY PRACTICE PROBLEMS

DPP No. 22

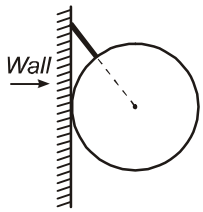
Total Marks : 26

Max. Time : 26 min.

Topics : Newton's Law of Motion, Rectilinear Motion,Projectile Motion

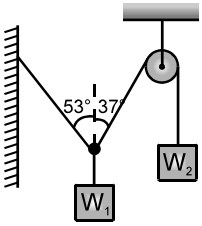
Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.6	(3 marks, 3 min.)	[18, 18]
Multiple choice objective ('–1' negative marking) Q.7 to Q.8	(4 marks, 4 min.)	[8, 8]

1. A uniform sphere of weight w and radius 3 m is being held by a string of length 2 m. attached to a frictionless wall as shown in the figure. The tension in the string will be:



(A) 5w/4 (B) 15w/4 (C) 15w/16 (D) none of these

2. Two weights W_1 and W_2 in equillibrium and at rest, are suspended as shown in figure. Then the ratio $\frac{W_1}{W_2}$ is:

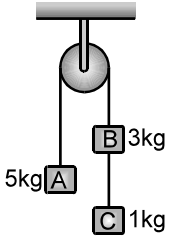


(A) 5/4 (B) 4/5 (C) 8/5 (D) none of these

3. If $v = x^2 - 5x + 4$, find the acceleration of the particle when velocity of the particle is zero.

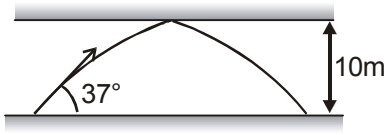
(A) 0 (B) 2 (C) 3 (D) none of these

4. Three weights are hanging over a smooth fixed pulley as shown in the figure. What is the tension in the string connecting weights B and C?



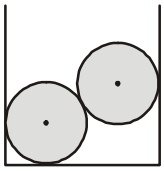
(A) g (B) g/9 (C) 8g/9 (D) 10g/9

5. A ball is shot in a long hall having a roof at a height of 10 m with 25 m/s at an angle of 37° with the floor. The ball lands on the floor at a distance of ..... from the point of projection. (Assume elastic collisions if any)



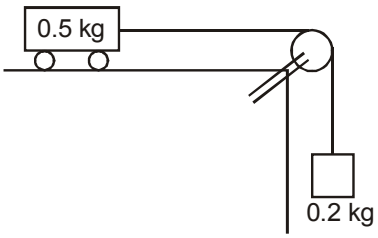
(A) 40 m (B) 60 m (C) 45/4 m (D) 20 m

6. Two smooth spheres each of radius 5 cm and weight W is in equilibrium inside a fixed smooth cylinder of radius 8 cm as shown in the figure. The reactions between the spheres and the vertical side of the cylinder are:



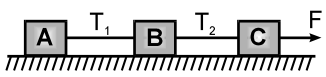
(A) W/4 & 3W/4
(B) W/4 & W/4
(C) 3W/4 & 3W/4
(D) W & W

7. A cart of mass 0.5 kg is placed on a smooth surface and is connected by a string to a block of mass 0.2 kg. At the initial moment the cart moves to the left along a horizontal plane at a speed of 7 m/s. (Use g = 9.8 m/s^2)



(A) The acceleration of the cart is $\frac{2g}{7}$ towards right.
(B) The cart comes to momentary rest after 2.5 s.
(C) The distance travelled by the cart in the first 5s is 17.5 m.
(D) The velocity of the cart after 5s will be same as initial velocity.

8. Three blocks are connected by light strings as shown in figure and pulled by a force F = 60 N. If m_A = 10 kg, m_B = 20 kg and m_C = 30 kg, then :



(A) acceleration of the system is 2 m/s^2
(B) T_1 = 10 N
(C) T_2 = 30 N
(D) T_1 = 20 N & T_2 = 40 N

Answers Key

DPP NO. - 22

1. (A) **2.** (A) **3.** (A) **4.** (D) **5.** (A)
6. (C) **7.** (A), (B), (C) **8.** (B), (C)

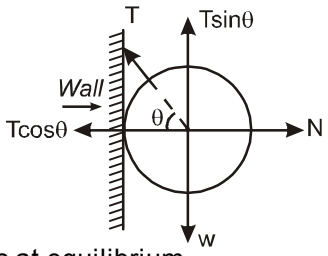
Hint & Solutions

DPP NO. - 22

1. From geometry :

$\cos\theta = \frac{3}{5}$

$\sin\theta = \frac{4}{5}$



As sphere is at equilibrium,

$T\sin\theta = w$

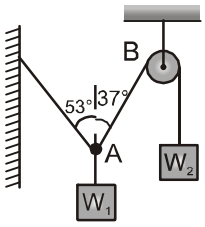
$T\left(\frac{4}{5}\right) = w$

$T = \frac{5w}{4}$.

2. Resolving forces at point A along string AB

$w_1 \cos 37° = w_2$

$\frac{w_1}{w_2} = \frac{5}{4}$



3. $v = 0 \Rightarrow x^2 - 5x + 4 = 0$

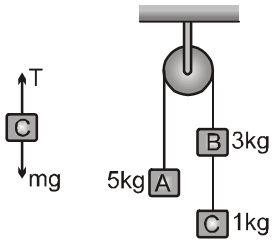
$x = 1m$ & $4m$

$\frac{dv}{dt} = (2x - 5)\, v = (2x - 5)(x^2 - 5x + 4)$

at $x = 1$ m and 4m ; $\frac{dv}{dt} = 0$

4. $a = \left(\frac{5-4}{5+4}\right)g = \frac{g}{9}$

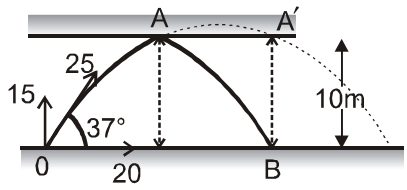
$T - mg = ma$



$T = m(g + a)$

$= 1\left(g + \frac{g}{9}\right) = \frac{10g}{9}$.

5. Time taken by ball from O to A is same as that from A to B.



$10 = 15\,t - \frac{1}{2}(10)\,t^2$

$5t^2 - 15\,t - 10 = 0$

$t^2 - 3t - 2 = 0$

$t = 1, 2$

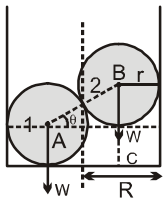
$t = 2$ is invalid as it is the time taken by the ball to come at A' if there was no roof.

$\therefore$ $t = 1$ seconds.

During this the ball will travel $V \times t = 20 \times 2$

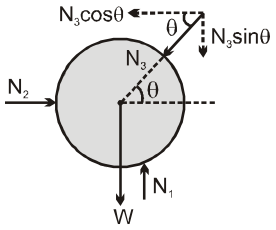
$= 40$ m on the floor.

6.



$r = 5$cm ; $R = 8$cm

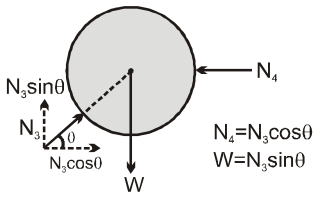
FBD of sphere 1



$N_1 = W + N_3 \sin\theta$

$N_2 = N_3 \cos\theta$

FBD of sphere 2



$AC = 2R - 2r$

$AB = 2r$

$$\cos\theta = \frac{AC}{AB} = \frac{R-r}{r}$$

$N_4 = N_3 \cos\theta$

$W = N_3 \sin\theta$

Ans. $N_4 = W \cot\theta$

$N_3 = W \operatorname{cosec}\theta$

$N_2 = W \cot\theta$

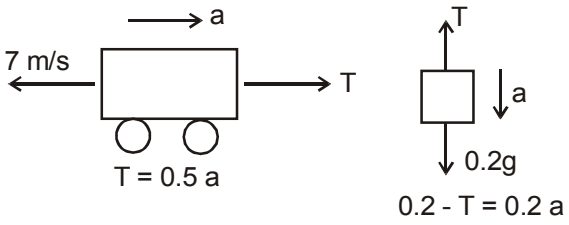
$N_1 = 2W.$

7. $\Rightarrow$ $0.2\ g = 0.7\ a$

$$\Rightarrow a = \frac{2g}{7}\ m/s^2$$

For the case, it comes to rest when V = 0

$$0 = 7 + \left(-\frac{2g}{7}\right)t \quad \Rightarrow t = \frac{49}{2g} = 2.5\ s$$



Distance travelled till it comes to rest

$$0 = 7^2 + 2\left(-\frac{2g}{7}\right)s$$

S = 8.75 m

So in next 2.5s, it covers 8.75 m towards right.

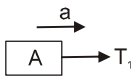
Total distance = 2 x 8.75 = 17.5 m

After 5s, it speed will be same as that of initial (7 m/s) but direction will be reversed.

8. Acceleration of system $a = \frac{F}{m_A + m_B + m_C}$

$$a = \frac{60}{10+20+30} = 1 m/s^2$$

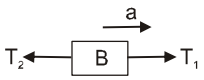
FBD of A :



$T_1 = m_A.a$

$T_1 = 10(1) = 10N$

FBD of B :



$T_2 - T_1 = m_B a$

$T_2 - 10 = 20(1)$

$T_2 = 30$ N.