DPP
DAILY PRACTICE PROBLEMS

CLASS : XIth
DATE :

Solutions

SUBJECT : PHYSICS
DPP No. : 4

Topic :- LAWS OF MOTION

1 **(a)**

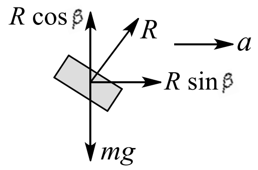
As m_2 moves with constant velocity, there is no acceleration in the centre of mass. Net force should be zero. For this $N = m_1 g + m_2 g$

2 **(a)**

Acceleration of the system

$a = \frac{P}{M+m}$ (i)

The FBD of mass m is shown in the figure



$R\sin\beta = ma$ (ii)

$R\cos\beta = mg$ (iii)

From Eqs. (ii) and (iii), we get

$a = g\tan\beta$

Putting the value of a in (i), we get

$P = (M+m)g\tan\beta$

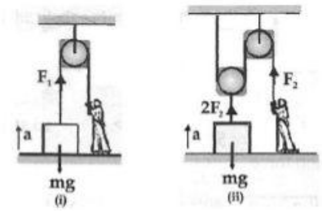
3 **(a)**

Since, $h = \frac{1}{2}at^2$, a should be same in both cases, because h and t are same in both cases as given

In figure (i), $F_1 - mg = ma \Rightarrow F_1 = mg + ma$

In figure (ii), $2F_2 - mg = ma$ $F_2 = \frac{mg+ma}{2}$

$\therefore F_1 > F_2$



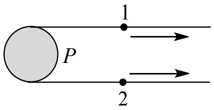
4 **(c)**

Tx(Hanged part) $= 2Tx'$(Sliding part)

$\therefore\ x = 3x' \Rightarrow x = 3 \times 0.6 = 1.8$ ms^{-1}

5 **(c)**

If we take two points 1 and 2 on the string near the pulley P as shown, then velocities of both points 1 and 2 will be same. Hence, P does not rotate but only translate



6 **(a)**

Initial force $= 2\text{g} = 20$ N

Initial acceleration $= \frac{\text{Force}}{\text{Mass}} = \frac{20}{5+1} = \frac{20}{6}$ms^{-2}

Final force=(load + mass of thread) × g

$= (2+1) \times 10 = 30$ N

$\therefore$ final acceleration $= \frac{30}{6}$ms^{-2}

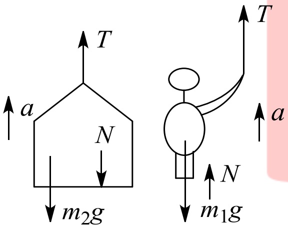
7 **(d)**

Same solution for both

$m_1 = 100$ kg, $m_2 = 50$ kg, $a = 5$ ms^{-2}

$T + N - m_1\text{g} = m_1 a, T - N - m_2\text{g} = m_2 a$

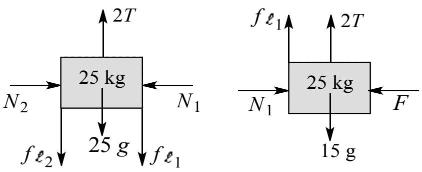
Solving these : $T = -1125$ N and $N = 375$ N



8 **(c)**

In the absence of friction, we can find that 15 kg will accelerate downwards and 25 kg upwards. So various forces acting on these will be as shown

$N_2 = N_1 = F, f_{\ell_1} = \mu N_1 = 0.4F, f_{\ell_2} = \mu N_2 = 0.4\ F$



For 15 kg: $T + f_{l_1} + 15\text{ g} \Rightarrow T + 0.4\ F = 15$ g (i)

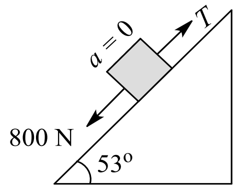
For 25 kg: $2T = f_{\ell_1} + f_{\ell_2} + 25\text{g}$

$\Rightarrow 2T = 0.8\ F + 25\text{g}$ (ii)

Solve (i) and (ii) to get $F = 31.25$ N

9 **(c)**

For block to be stationary, $T = 800$ N



If man moves up by acceleration ‘a

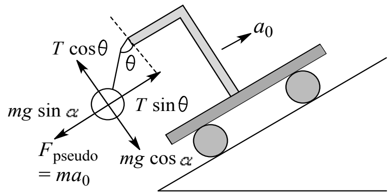
$T - mg = ma$

$800 - 500 = 50a \quad a = 6\text{ms}^{-2}$

10 **(d)**

As in figure

$T \sin\theta \ = ma_0 + mg \sin\alpha$



$T \cos\theta \ = mg \cos\alpha$

$\tan\theta \ = \dfrac{a_0 + \text{g} \sin\alpha}{\text{g} \cos\alpha}$

11 **(a)**

If the plane makes an angle θ with horizontal, thentan $\theta = 8/15$. If R is the normal reaction

$R = 170\ g \cos\theta \ = 170 \times 10 \times \left(\dfrac{15}{17}\right) = 1500\ N$

Force of friction on $A = 1500 \times 0.2 = 300$ N

Force of friction ob $B = 1500 \times 0.4 = 600$ N

Considering the two blocks as a system, the net force parallel to the plane is

$= 2 \times 170\text{gsin}\,\theta - 300 - 600 = 1600 - 900 = 700$ N

$\therefore$ Acceleration $= \dfrac{700}{340} = \dfrac{35}{17}\text{ms}^{-2}$

Consider the motion of A alone

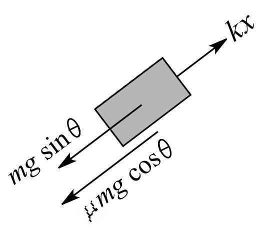
$170 \text{ g} \sin\theta \ - 300 - P = P\ 170 \times \dfrac{35}{17}$

(where P is pull on the bar)

$P = 500 - 350 = 150$ N

12 **(a)**

Let m start moving down and extension produced in spring be x at any time. Value of x required to move the block m is



$kx = \mu\, mg \cos\theta + mg \sin\theta$

$\Rightarrow kx = 0.5\, mg \frac{4}{5} + mg \frac{3}{5} = mg$

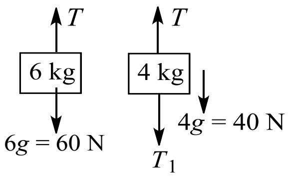
Fore minimum M, it will stop after producing extension in the spring x

$Mgx = \frac{1}{2}kx^2 \Rightarrow Mg = \frac{1}{2}kx$

$\Rightarrow Mg = \frac{1}{2}mg \Rightarrow M = \frac{m}{2}$

13 **(a)**

$T = 60$ N, $T = T_1 + 40$



$\Rightarrow 60 = T_1 + 40 \Rightarrow T_1 = 20$ N

14 **(d)**

$a_1 = \frac{(m_2 - m_1)g}{(m_1 + m_2)}$ and $a_2 = \frac{(m_2 - m_1)g}{m_1}$

Hence $\frac{a_1}{a_2} = \frac{m_1}{(m_1 + m_2)} = \frac{1}{\left(1 + \frac{m_2}{m_1}\right)} \Rightarrow \frac{a_1}{a_2} < 1$

As $T_1 = \frac{2m_1 m_2 g}{(m_1 + m_2)}$ and $T_2 = m_2 g$

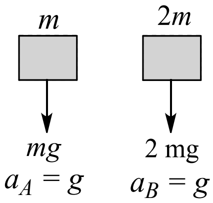
Hence $\frac{T_1}{T_2} = \frac{2m_1}{(m_1 + m_2)} = \frac{2}{\left(1 + \frac{m_2}{m_1}\right)}$

$\frac{T_1}{T_2}$ will depend upon the values of m_1 and m_2 $N = 2T_1$, $N_2 = 2T_2$

So the relation of N_1/N_2 will, be same as $\frac{T_1}{T_2}$

15 **(a)**

In this case, spring force is zero initially. FBD of A and B are shown below

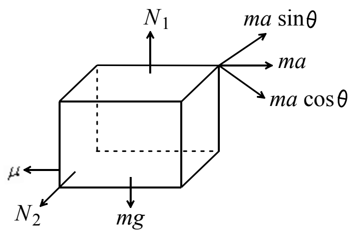


Tension in the string and spring will be zero just after release

16 **(a)**

Making FBD of block with respect to disc

Let A be the acceleration of block with respect to disc



$N_1 = mg$

$N_2 = m\,a\sin\theta$

$$A = \frac{m\,a\cos\theta - \mu N_2 - \mu N_1}{m} = 10 m/s^2$$

17 **(b)**

Acceleration of cylinder down the plane is

$a = (g\sin 30°)(\sin 30°) = 10\left(\frac{1}{2}\right)\left(\frac{1}{2}\right) = 2.5\ \text{ms}^{-1}$

Time taken $t = \sqrt{\frac{2s}{a}} = \sqrt{\frac{2\times 5}{2.5}} = 2\text{s}$

18 **(a)**

Spring balance reads the tension in the string connected to its hook side. As the spring balance is light, the tension in the string on its either side is same. Now the only thing that remains to be found is the tension in the string which could be found easily by using Newton's second law

19 **(d)**

The minimum value of F required to be applied on the blocks to move is $0.2 \times (2+4) \times 10 = 12$ N. since the applied force is less than the minimum value of force required to move the blocks together, the blocks will remain stationary

20 **(d)**

Force acting on plate, $F = \frac{dp}{dt} = v\left(\frac{dm}{dt}\right)$

Mass of water reaching the plate per $sec = \frac{dm}{dt}$

$= Av\rho = A(v_1 + v_2)\rho = \frac{V}{v_2}(v_1 + v_2)\rho$

($v = v_1 + v_2 =$ velocity of water coming out of jet $w.r.t.$ plate)

$\left[A = \text{Area of cross section of jet} = \frac{V}{v_2}\right]$

$$\therefore F = \frac{dm}{dt}v = \frac{V}{v_2}(v_1 + v_2)\rho \times (v_1 + v_2) = \rho\left[\frac{V}{v_2}\right](v_1 + v_2)^2$$

ANSWER-KEY										
Q.	1	2	3	4	5	6	7	8	9	10
A.	A	A	A	C	C	A	D	C	C	D
Q.	11	12	13	14	15	16	17	18	19	20
A.	A	A	A	D	A	A	B	A	D	D