DPP
DAILY PRACTICE PROBLEMS

CLASS : XIth
DATE :

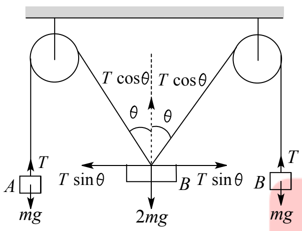
Solutions

SUBJECT : PHYSICS
DPP No. : 1

Topic :- LAWS OF MOTION

1 **(c)**

For equilibrium in vertical direction for body B we have



$\sqrt{2}\, mg = 2T\cos\theta \, = 2(mg)\cos\theta$

$T = mg$ (at equilibrium)

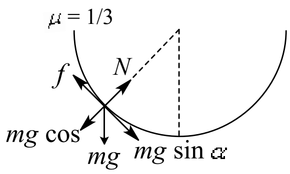
$\therefore \cos\theta = \dfrac{1}{\sqrt{2}} \Rightarrow \theta = 45°$

2 **(a)**

The two forces acting on the insect are mg and N. Let us resolve mg into two components:

$mg\cos\alpha$ balances N

$mg\sin\alpha$ is balanced by the frictional force



$N = mg\cos\alpha$

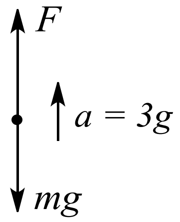
$f = mg\sin\alpha$

But $f = \mu N = \mu\, mg\cos\alpha$

$\Rightarrow \cot\alpha = \frac{1}{\mu} \Rightarrow \cot\alpha = 3\backslash$

3 **(a,b,c,d)**

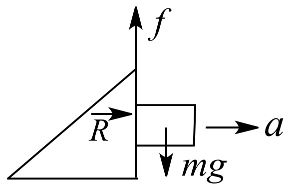
a



F - $mg = ma$

$F = m(g + a) = 4mg = 4W$

b Think of Newton's third law of motion



c $mg < f_{\max}$

or $mg < \mu_s R$ or $mg < \mu_s ma$

or $g < \mu_s a$ or $\mu_s a > g$ or $\mu_s > \frac{g}{a}$

d The jumping away of the man involved upward acceleration. It means an upward force acts on man during jumping. Then from third law, a downward force acts on platform due to which reading first increases

4 **(a,c,d)**

In first case, m will remain at rest.$a_M = F/M$

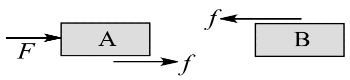
In second case, both will accelerate

$a_m = a_M = F/(M + m)$

In second case, force on $m = ma_m = mF/(M + m)$

5 **(a,b,c)**

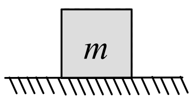
Friction on A and B acts as shown

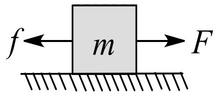


From the figure it is clear that friction on A supports it motion and on B opposes its motion. And friction always opposes relative motion

6 **(a,b,c)**

For (i); Consider a block at rest on a rough surface and no force (horizontal) is acting on it. Now friction force on it would be zero. For (ii): Consider a heavy block, under the application of small force F which is not sufficient to cause its motion, so friction force is static in nature and block doesn't move





For (iii): Refer to concepts and formulae
For (iv): Friction force and normal force always act perpendicular to each other

7 **(a,c)**

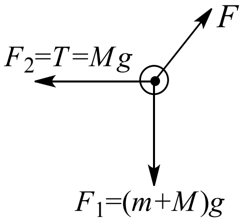
In region AB and CD, slope of the graph is constant *i.e*. velocity is constant. It means no force acting on the particle in this region

8 **(d)**

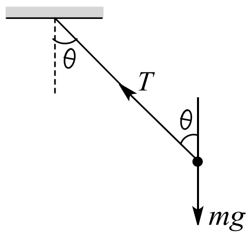
Force on the pulley are

$F = \sqrt{F_1^2 + F_2^2}$

$= \left(\sqrt{(m+M)^2 + M^2}\right)g$



9 **(c)**



FBD of bob is $T\sin\theta = \frac{mv^2}{R}$

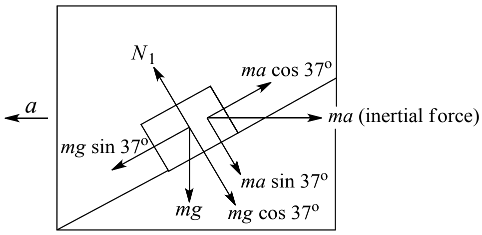
and $T\cos\theta = mg$

$\tan\theta = \frac{v^2}{Rg} = \frac{(10)^2}{(10)(10)}$

$\tan\theta = 1$

or $\theta = 45°$

10 **(a,c)**



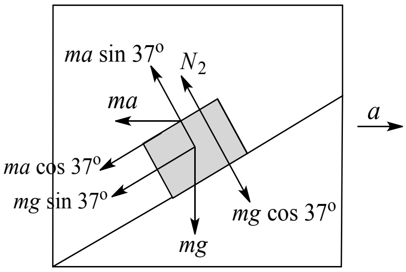
Balancing forces perpendicular to incline

$N_1 = mg\cos 37° + ma\sin 37°$

$N_1 = \frac{4}{5}mg + \frac{3}{5}ma$

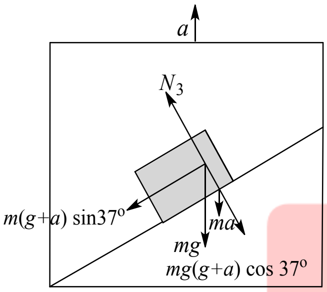
And along incline, $mg\sin 37° - ma\cos 37° = mb_1$

$b_1 = \frac{3}{5}g - \frac{4}{5}a$



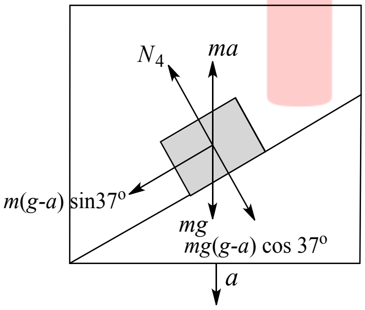
Similarly for this case get $n_2 = \frac{4}{5}MG - \frac{3}{5}MA$

And $b_2 = \frac{3}{5}g + \frac{4}{5}a$



Similarly for this case get $N_3 = \frac{4}{5}mg + \frac{4}{5}ma$

$b_3 = \frac{3}{5}g + \frac{3}{5}a$



Similarly for this case, get $N_4 = \frac{4}{5}mg - \frac{4}{5}ma$

And $b_4 = \frac{3}{5}g - \frac{3}{5}a$

11 **(a,b,c)**

If the block is at rest, then force applied has to be greater than limiting friction force for its motion to begin

$f_L = \mu_s mg = 0.25 \times 3\text{ g} = 7.5\ N < F_{\text{applied}}$

So friction is static in nature and its value would be equal to applied force, i.e., 7 N. if the body is initially moving, then kinetic friction is present ($f_k = \mu_k\, mg = 6\ N$), acting opposite to direction of motion

As $F > f_k$ the block is accelerated with an acceleration of $a = \left[\frac{F - f_k}{m}\right] = \frac{1}{3}\,ms^{-2}$ and hence its speed is continuously increasing

If applied force is opposite to direction of motion, then block is under deceleration of $a = -\left[\frac{F - f_k}{m}\right] = -\frac{13}{3} ms^{-2}$ and hence after some time block stops and kinetic friction vanishes but applied force continuous to act

But as $F < f_L$, the block remains at rest and friction force acquires the value equal to applied force, i.e. friction is static in nature

12 **(a)**

Total mass of 80 wagons

$= 80 \times 5 \times 10^3 = 4 \times 10^5$ kg

Acceleration, $a = \frac{F}{M} = \frac{4 \times 10^5}{4 \times 10^5} = 1 \text{ ms}^{-2}$

Tension in the coupling between 30th and 31st wagon will be due to mass of remaining 50 wagons. Now, mass of remaining 50 wagons

$m = 50 \times 5 \times 10^3 \text{kg} = 25 \times 10^4 \text{kg}$

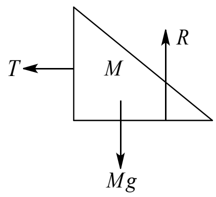
$\therefore$ Required tension, $T = mg = 125 \times 10^4 \times 1$

$= 25 \times 10^4$ N

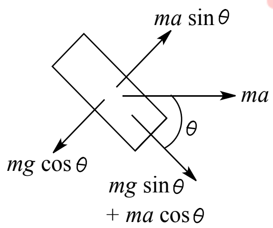
13 **(a,c)**

$M'g - T = M'a$ (i)

$T = Ma$ (ii)



$M'g = a(M + M') \Rightarrow a = \frac{M'g}{(M + M')}$



$ma\sin\theta = mg\cos\theta \rightarrow$ so that normal force is zero

$a = g\cot\theta$

$g\cot\theta = \frac{M'g}{(M + M')} \Rightarrow \cot\theta M + \cot\theta M' = M'$

$\cot\theta M + \cot\theta M' = M'$

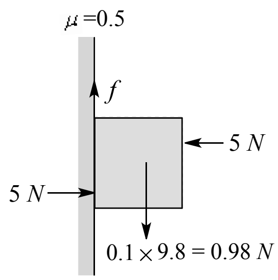
$M' = \frac{M\cot\theta}{(1 - \cot\theta)}, T = Ma = Mg\cot\theta = Mg/\tan\theta$

14 **(b)**

The magnitude of the frictional force f has to balance the weight 0.98 N acting downwards

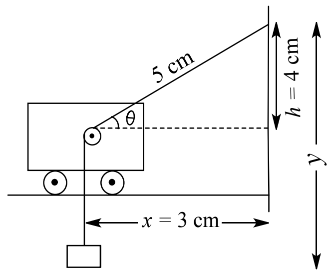
$f_\ell = 0.5 \times 5 = 2.5$ N

$f < F_\ell$



Therefore, the friction force is 0.98 N. Hence, option (b) is the correct option

15 **(c,d)**



$(y - \mathrm{h}) + \sqrt{x^2 + \mathrm{h}^2} = \ell$ or $\dfrac{dy}{dt} + \dfrac{x}{\sqrt{x^2 + \mathrm{h}^2}} \dfrac{dx}{dt} = 0$

$\dfrac{dy}{dt} = -\dfrac{x}{\sqrt{x^2 + \mathrm{h}^2}} \dfrac{dx}{dt} \Rightarrow \dfrac{dy}{dt} = -\dfrac{3}{5}(-v_A)$

$V_B = \dfrac{3}{5} v_A \ (i)$

$\dfrac{d^{2y}}{dt^2} = \dfrac{v_A^2 \mathrm{h}^2}{(x^2 + \mathrm{h}^2)^{3/2}} \quad \Rightarrow a_B = v_A^2 \dfrac{16}{(5)^3}$

$a_B = \frac{16}{125} v_A^2 (\mathrm{ii})$

16 **(b)**

Let the velocity of the block M be v upwards, then $v \cos\theta = U \ \Rightarrow \ v = U/\cos\theta$

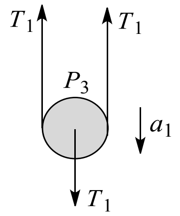
17 **(a,b,d)**

1. Since the body is accelerated, it can't have constant velocity, but it can have constant speed
2. If acceleration of the body is opposite to the velocity, then at some instant its velocity will become zero
3. As the body is accelerated, net force on it can't be zero
4. Forces may act at some angle also

18 **(a,c)**

First of all draw FBD ofP_3. Let tensions, in three strings be T_1, T_2 and T_3, respectively

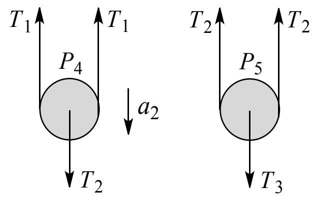
$2T_1 - T_1 = 0 \times a \ \Rightarrow \ T_1 = 0$



Now draw FBD of P_4 and P_5

$2T_1 - T_2 = 0 \Rightarrow T_2 = 0$

$2T_2 - T_3 = 0 \Rightarrow T_2 = T_3 = 0$



So forces acting on P_6 and P_7 will be that of gravity and they will be in free fall. Hence, acceleration of each of them will be g downwards

19 **(b,d)**

In a non uniform field, $\sum \vec{\mathbf{F}} \neq 0$. When dipole is aligned with field $\sum \vec{\tau} = 0$ and when dipole is not aligned, $\sum \vec{\tau} \neq 0$

20 **(b)**

As in clear from figure

$R + T = (m + M)g$

$R = (m + M)g - T$

The system will not move till

$T \leq F$ or $T \leq \mu R$

$T \leq \mu[(m + M)g - T]$

$$T \leq \frac{\mu(m + M)g}{\mu + 1}$$

$$\therefore \; F_{max} = \frac{\mu(m + M)g}{\mu + 1}$$

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