DPP
DAILY PRACTICE PROBLEMS

CLASS : XIth
DATE :

**Solutions**

SUBJECT : PHYSICS
DPP No. : 3

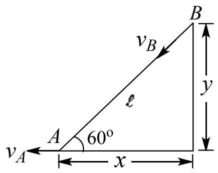
# Topic :- LAWS OF MOTION

1 **(d)**

Due to malfunctioning of engine, the process of rocket fusion stops and hence net force experienced by spacecraft becomes zero. Afterwards the spacecraft continues to move with constant speed

2 **(b)**

Here $y$ is constant $\frac{d\ell}{dt} = v_B$




$$\ell^2 = y^2 + x^2 \Rightarrow 2\ell\frac{d\ell}{dt} = 2x\frac{dx}{dt}$$

$$\Rightarrow v_B = \frac{x}{\ell}v_A = v_A\cos 60° = 1 \text{ ms}^{-1}$$

3 **(a)**

Acceleration of the skaters will be in the ratio

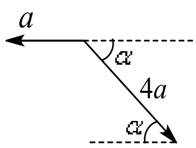
$\frac{F}{4}:\frac{F}{5}$ or 5:4

Now according to the problem, $s = 0 + \frac{1}{2}at^2$

We get $\frac{s_1}{s_2} = \frac{a_1}{a_2} = \frac{5}{4}$

4 **(b)**

If the wedge moves leftwards by $x$, then the block moves down the wedge by $4x$, i.e. w.r.t. wedge the block comes sown by $4x$




So, acceleration of block w.r.t. wedge $= 4a$ along the incline plane of wedge

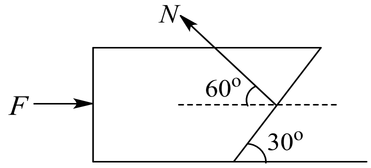
Acceleration of wedge with respect to ground $= a$, alonm gleft. So acceleration of block w.r..t ground is the vector sum of two vectors shown in the figure. That is

$|\vec{a}_{BG}| = \sqrt{a^2 + (4a)^2 + 2 \times a \times 4a \times \cos(\pi - \alpha)}$

$= (\sqrt{17 - 8\cos\alpha})a \text{ ms}^{-2}$

5 **(d)**

Acceleration of two mass system is $a = \frac{F}{2m}$ leftwards. FBD of block $A$ is shown in below




$N\cos 60° - F = ma = \frac{mF}{2m}$

Solving, we get $N = 3F$

6 **(a)**

$\tan\theta = v^2/Rg \Rightarrow \frac{h}{b} = v^2/Rg \Rightarrow h = \frac{v^2 b}{Rg}$

7 **(b)**

The acceleration of the body perpendicular to $OE$ is

$a = \frac{F}{m} = \frac{4}{2} = 2 \text{ ms}^{-2}$

Displacement along $OE$, $s_1 = vt = 3 \times 4 = 12$ m

Displacement perpendicular to $OE$

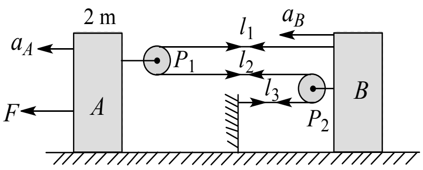
$s_2 = \frac{1}{2}at^2 = \frac{1}{2} \times 2 \times (4)^2 = 16$m

The resultant displacement

$s = \sqrt{s_1^2 + s_2^2} = \sqrt{144 + 256} = \sqrt{400} = 20$ m

8 **(b)**

As in figure




$\ell_1 + \ell_2 + \ell_3 = C$

$\ell'_1 + \ell'_2 + \ell'_3 = 0$

$-V_B + V_A - V_B + V_A - V_B = 0$

$3V_B = 2V_A \Rightarrow 3a_B = 2a_A$

Applying Newton's law on $A$ and $B$

$F - 2T = 2ma_A$, $3T = 2ma_B$

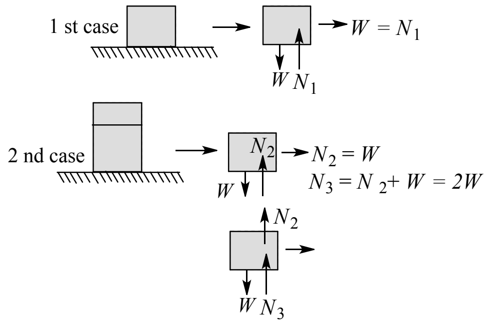
Solve to get $a_B + \frac{3F}{13m}$

9 **(b)**

$\vec{a}_{b,\ell} = \vec{a}_b - \vec{a}_\ell = (g - a)\downarrow \Rightarrow \vec{a}_b = g\downarrow$

10 **(c)**

Let the weight of each block be $W$ (figure)




So, $N_1 = N_2 = \frac{N_3}{2}$

11 **(c)**

Equation of motion for $A$ (figure)

$kx = ma \;\Rightarrow\; a = \frac{kx}{m}$

For $B : F - T = ma'$

$\Rightarrow a' = \frac{F - kx}{m}$

$\Rightarrow$ The relative acceleration $= a_r = |a' - a| = \frac{F - 2kx}{m}$


12 **(d)**

As there is no tendency of relative slipping between the block and cube, the friction force is zero

13 **(d)**

From 0 to$T$, area is positive and from $T$ to 2 $T$, area is negative. Net area is zero. Hence no change in momentum occurs

14 **(c)**

Acceleration is to be downward which is possible in option (c)

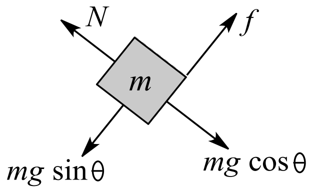
15 **(c)**

Area under the force - time graph is impulse, and impulse is change in momentum

Area of graph=change in momentum

$\Rightarrow \frac{1}{2} TF_0 = 2\,mu \Rightarrow F_0 = \frac{4mu}{T}$

16 **(a)**




$N = mg\cos\theta$ , $f = mg\sin\theta$

Net force applied by $M$ on $m$ (or $m$ on $M$):

$F = \sqrt{N^2 + f^2}$

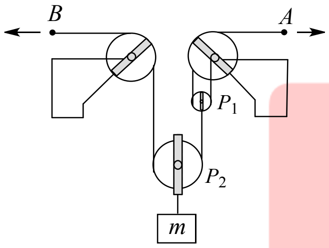
$= \sqrt{(mg\cos\theta)^2 + (mg\sin\theta)^2} = mg$

17 **(a)**

$V_A = 2$ ms$^{-1}$ (towards right)

$\therefore\ V_{P_1} = \frac{V_A}{2} = 1$ ms$^{-1}$ (upwards)

$V_A = 2$ ms$^{-1}$ (towards left)




Now $2V_{P_2} = V_B + V_{P_1}$ $\therefore V_{P_2} = \frac{V_B + V_{P_1}}{2} = \frac{2+1}{2} = 1.5$ ms$^{-1}$

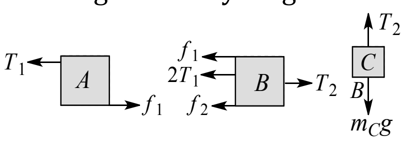
18 **(d)**

Maximum friction that can be obtained between $A$ and $B$ is $f_1 = \mu m_A g = (0.3)(100)(10) = 300\ N$ and maximum

Friction between $B$ and ground is

$f_2 = \mu(m_A + m_B)g = (0.3)(100 + 140)(10) = 720$ N

Drawing free-body diagrams of $A$, $B$ and $C$ in limiting case




Equilibrium of A gives

$T_1 = f_1 = 300$ N (1)

Equilibrium of B gives

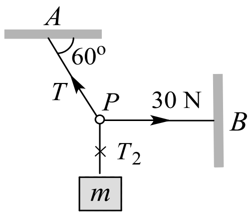
$2T_1 + f_1 + f_2 = T_2$

or $T_2 = 2(300) + 300 + 720 = 1620$ N (2)

and equilibrium of $C$ gives $m_C g = T_2$

or $10\ m_C = 1620$ or $m_C = 162$ kg

19 **(c)**




$T\cos 60^\circ = 30\text{ N} \Rightarrow T = 60\text{ N}$

$T\sin 60^\circ = T_2 = W \Rightarrow W = 60\frac{\sqrt{3}}{2} = 30\sqrt{3}\text{ N}$

20 **(a)**

On the system of particle if,

$\sum \mathbf{F}_{\text{ext}} = 0$

then $\mathbf{P}_{\text{system}} = \text{constant}$

No other conclusions can be drawn.

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