PHYSICS

DPP

DAILY PRACTICE PROBLEMS

DPP No. 23

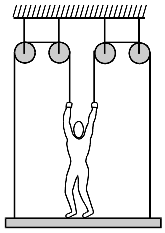
Total Marks : 27

Max. Time : 29 min.

Topics : Newton's Law of Motion, Relative Motion

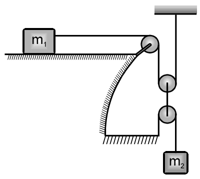
Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.5	(3 marks, 3 min.)	[15, 15]
Multiple choice objective ('–1' negative marking) Q.6	(4 marks, 4 min.)	[4, 4]
Subjective Questions ('–1' negative marking) Q.7 to Q.8	(4 marks, 5 min.)	[8, 10]

1. A man of mass m stands on a platform of equal mass m and pulls himself by two ropes passing over pulleys as shown. If he pulls each rope with a force equal to half his weight, his upward acceleration would be :



(A) g/2 (B) g/4
(C) g (D) zero

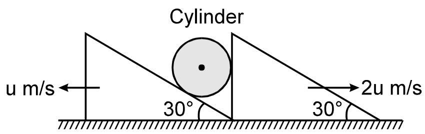
2. Two blocks of masses m_1 and m_2 are connected as shown in the figure. The acceleration of the block m_2 is (pullyes and strings are ideal) :



(A) $\frac{m_2 g}{m_1+m_2}$ (B) $\frac{m_1 g}{m_1+m_2}$

(C) $\frac{4m_2 g - m_1 g}{m_1+m_2}$ (D) $\frac{m_2 g}{m_1+4m_2}$

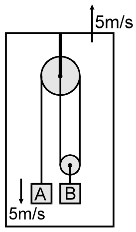
3. In the system shown in figure assume that cylinder remains in contact with the two wedges. The velocity of cylinder is -



(A) $\sqrt{19-4\sqrt{3}}\,\frac{u}{2}$ m/s (B) $\frac{\sqrt{13}\,u}{2}$ m/s

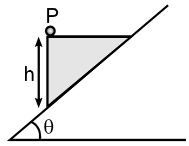
(C) $\sqrt{3}\,u$ m/s (D) $\sqrt{7}\,u$ m/s

4. A system is as shown in the figure. All speeds shown are with respect to ground. Then the speed of Block B with respect to ground is :



(A) 5 m/s (B) 10 m/s (C) 15 m/s (D) 7.5 m/s

5. A wedge of height 'h' is released from rest with a light particle P placed on it as shown. The wedge slides down an incline which makes an angle θ with the horizontal. All the surfaces are smooth, P will reach the surface of the incline in time:

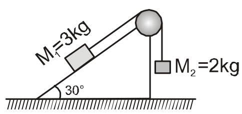


(A) $\sqrt{\frac{2h}{g\sin^2\theta}}$ (B) $\sqrt{\frac{2h}{g\sin\theta\cos\theta}}$ (C) $\sqrt{\frac{2h}{g\tan\theta}}$ (D) $\sqrt{\frac{2h}{g\cos^2\theta}}$

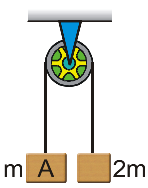
6. A block of weight 9.8N is placed on a table. The table surface exerts an upward force of 10 N on the block. Assume g = 9.8 m/s^2.

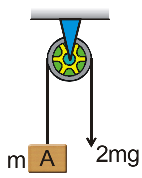
(A) The block exerts a force of 10N on the table
(B) The block exerts a force of 19.8N on the table
(C) The block exerts a force of 9.8N on the table
(D) The block has an upward acceleration.

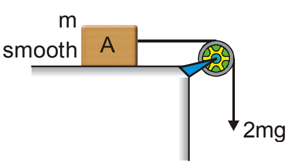
7. A block of mass M_1 = 3 kg on a smooth fixed inclined plane of angle 30^0 is connected by a cord over a small frictionless pulley to a second block of mass 2 kg hanging vertically. The tension in the cord and the acceleration of each block are ________ and ________ respectively.

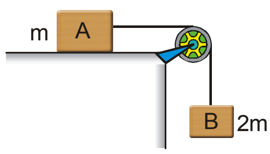


8. In which of the following cases the magnitude of acceleration of the block A will be maximum (Neglect friction, mass of pulley and string)

(i)


(ii)


(iii)


(iv)


Answers Key

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

Hint & Solutions

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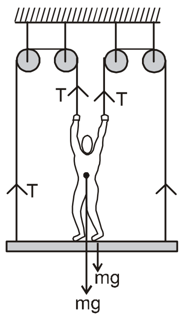
1. for (man + platform) system :
$2mg - 4T = 2m(a)$



$\Rightarrow \; 2mg - 4\left(\frac{mg}{2}\right) = 2m\,(a)\;[\because\; T = \frac{mg}{2}]$

$\Rightarrow \; a = 0$

2. Let a = acceleration of m_1

then acceleration of pulley = $\frac{a+0}{2} = \frac{a}{2}$

If acceleration of $m_2 = b$

Then $0 + \frac{b}{2} = \frac{a}{2}$

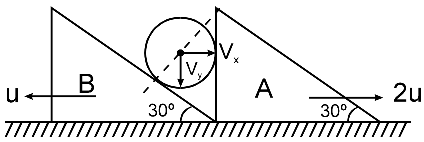
Hence $a = b$
$T = m_1 a$, $m_2 g - T = m_2 a$

$\therefore \; a = \frac{m_2 g}{m_1 + m_2}$

3. **Method - I**

As cylinder will remains in contact with wedge A

$V_x = 2u$



As it also remain in contact with wedge B

$u \sin 30° = V_y \cos 30° - V_x \sin 30°$

$V_y = V_x \dfrac{\sin 30°}{\cos 30°} + \dfrac{U \sin 30°}{\cos 30°}$

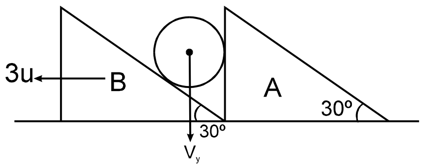
$V_y = V_x \tan 30° + u \tan 30°$

$V_y = 3u \tan 30° = \sqrt{3}\, u$

$V = \sqrt{V_x^2 + V_y^2} = \sqrt{7}$ **u Ans.**

Method - II

In the frame of A



$3u \sin 30º = V_y \cos 30º$

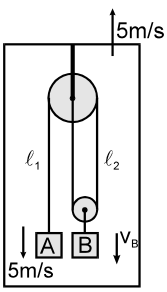
$\Rightarrow \; V_y = 3u \tan 30º = \sqrt{3}\, u$

and व $V_x = 2u$

$\Rightarrow \; V = \sqrt{V_x^2 + V_y^2} = \sqrt{7}\, u$ **Ans.**

4. $\ell_1 + 2\ell_2$ = constant

$\therefore \; \dfrac{d\ell_1}{dt} + \dfrac{2d\ell_2}{dt} = 0$



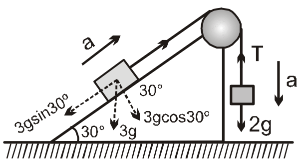
$(5 + 5) + 2(5 + v_B) = 0$ or $v_B = 10$ m/s

5. Assume that acceleration of particle is a_p
and acceleration of wedge is a_w
Then, $a_w = g\sin\theta$
From wedge constant
$a_p = a_w \sin\theta = g\sin^2\theta$

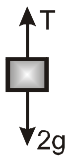
$h = \frac{1}{2} g \sin^2\theta\, t^2$

$t = \sqrt{\frac{2h}{g\sin^2\theta}}$.

6. From Newtons third law, the force exerted by table on block is equal to that exerted by block on the table. Therefore block exerts a 10 N force on table. Since the upward force on the block is larger than downward force, it moves upwards.

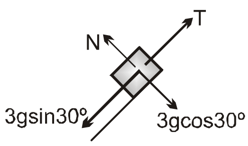
7. 

FBD of block $M_2 = 2kg$



$20 - T = 2a$ ....(i)

FBD of block $M_1 = 3kg$



$= \quad 3 \times \frac{10\sqrt{3}}{2}$

$= \quad 15\sqrt{3}$ N.

$=$ 15 N

$T - 15 = 3a$ ....(ii)

(i) + (ii)

$5 = 5a$

$\Rightarrow \quad a = 1 m/s^2 \quad ; \quad T = 18$ N.

8. (i) $a = \dfrac{2mg - mg}{3m} = \dfrac{g}{3}$

(ii) $a = \dfrac{2mg - mg}{m} = g$

(iii) $a = \dfrac{2mg}{m} = 2g$

(iv) $a = \dfrac{2g}{3}$