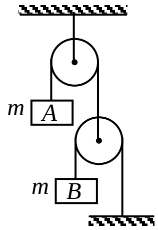
SINGLE CHOICE QUESTION

1. Two blocks A and B of equal masses m are suspended with ideal pulley and string arrangement as shown. The acceleration of mass B is



(A) $\frac{g}{3}$ (B) $\frac{5g}{3}$ (C) $\frac{2g}{3}$ (D) $\frac{2g}{5}$

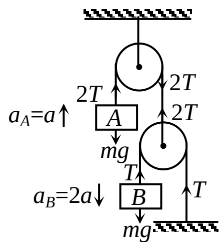
Ans. **(D)**

Sol. $2T - mg = ma$ ...(i)

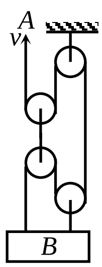
$mg - T = 2ma$ ...(ii)

(i) and (ii) $\Rightarrow$ $a = \frac{g}{5}$

$\therefore$ $a_B = \frac{2g}{5}$



2 In the arrangement shown, end A of light inextensible string is pulled up with constant velocity v. The velocity of block B is

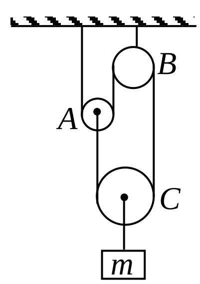


(A) $v/2$ (B) v (C) $v/3$ (D) $3v$

Ans. **(C)**

Sol. From constraint relation $v_B = \frac{v}{3}$

3. In the arrangement shown in figure, thread is inextensible and massless. All the pulleys are also massless. If friction in all pulleys are negligible, then :



(A) Tension in thread is equal to $\frac{mg}{2}$.

(B) Acceleration of pulley C is equal to $\frac{g}{2}$(downward).

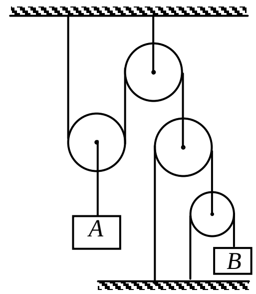
(C) Acceleration of pulley A is equal to $\frac{g}{2}$(upward).

(D) Acceleration of block of mass m is equal to g (downward).

Ans. **(D)**

Sol. $T = 0$, $a = g$

4. Block A moves upward with acceleration $\frac{1}{2}$ m/s^2. The acceleration of block B in downward direction will be

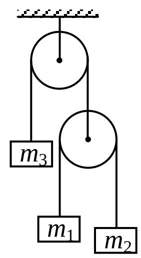


(A) 2 m/s^2 (B) 3 m/s^2 (C) 4 m/s^2 (D) 6 m/s^2

Ans. **(C)**

Sol. From constraint relation, $a_B = 8a_A$

5. In the figure, pulleys are smooth and strings are massless, m_1 = 1 kg and m_2 = $\frac{1}{3}$ kg. To keep m_3 at rest, mass m_3 should be

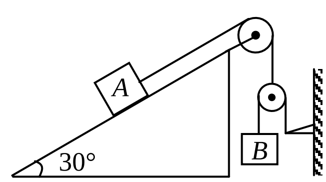


(A) 1 kg (B) $\frac{2}{3}$ kg (C) $\frac{1}{4}$ kg (D) 2 kg

Ans. **(A)**

Sol. $m_3 g = 2T \Rightarrow m_3 = 1$ kg

6. In the system shown in figure m_B = 4 kg and m_A = 2 kg. The pulleys are massless and friction is absent everywhere. The acceleration of block A is (g = 10 m/s^2)

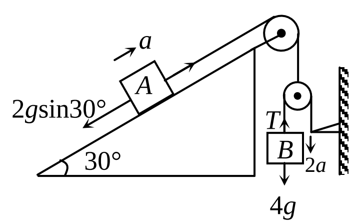


(A) $\frac{10}{3}$ m/s^2 (B) $\frac{20}{3}$ m/s^2

(C) $\frac{35}{9}$ m/s^2 (D) 4 m/s^2

Ans. **(C)**

Sol. If acceleration of block A is a upward along the incline, then acceleration of block B is $2a$ downward.



For block B,

$$4g - T = 8a \qquad \ldots\text{(i)}$$

For block A,

$$2T - 2g\sin 30° = 2a$$

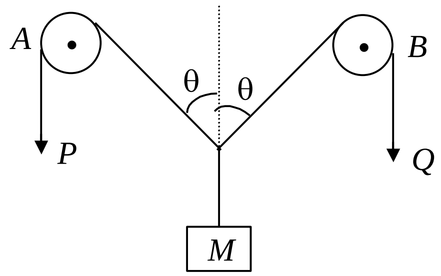
$\Rightarrow \quad T - \frac{g}{2} = a \qquad \ldots$(ii)

From (i) and (ii)

$$9a = \frac{7g}{2}$$

$$a = \frac{70}{18}\ \text{m/s}^2 = \frac{35}{9}\ \text{m/s}^2$$

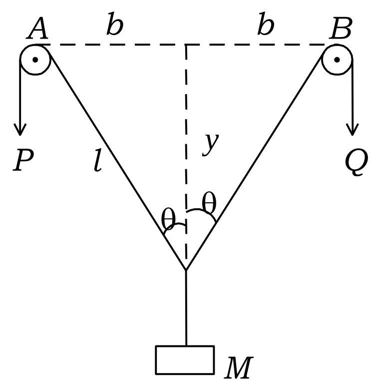
7. In the arrangement shown, the ends P and Q of an inextensible string move downwards with uniform speed v. The pulleys A and B are fixed. The mass M moves upward with a speed



(A) $2v\cos\theta$ (B) $v\cos\theta$ (C) $\frac{2v}{\cos\theta}$ (D) $\frac{v}{\cos\theta}$

Ans. **(D)**

Sol. As P and Q move down, the length l decreases at the rate of v m/s.



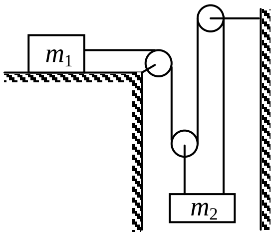
From the figure, $l^2 = b^2 + y^2$

Differentiating with respect to time

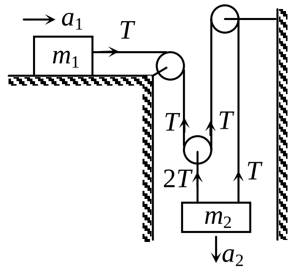
$$2l\frac{dl}{dt} = 2y\frac{dy}{dt}\ ;\ \frac{dy}{dt} = \frac{l}{y}\frac{dl}{dt} = \frac{1}{\cos\theta}\frac{dl}{dt}$$

Velocity of mass $M = \frac{v}{cos\theta}$

8. Two blocks m_1 and m_2 of equal masses as shown in figure. Assume ideal pulleys and strings and neglect friction at all the surfaces. The acceleration of the two blocks will be



(A) $\frac{4g}{13}, \frac{g}{13}$ (B) $\frac{2g}{7}, \frac{g}{7}$ (C) $\frac{3g}{10}, \frac{g}{10}$ (D) $\frac{g}{4}, \frac{g}{4}$



Ans. **(C)**

Sol. $a_1 = 3a_2$ ...(i)

$T = m_1 a_1$ ...(ii)

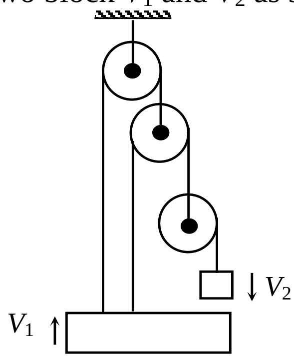
$m_2 g - 3T = m_2 a_2$ ...(iii)

$m_1 = m_2 = m$ ...(iv)

Solving above equation we get,

$a_1 = \frac{3g}{10}$, $a_2 = \frac{g}{10}$

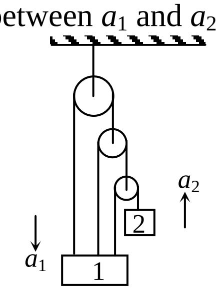
9. The relation between velocity of two block V_1 and V_2 as shown in the figure is given by



(A) $7V_1 - V_2 = 0$ (B) $V_1 + V_2 = 0$ (C) $7V_1 + V_2 = 0$ (D) $V_1 + 3V_2 = 0$

Ans. **(A)**

10. Using constraint equations relation between a_1 and a_2 will be



(A) $a_1 = 3a_2$ (B) $a_2 = 3a_1$ (C) $a_2 = 6a_1$ (D) $a_2 = 7a_1$

Ans. **(D)**

Sol. Total length of string is constant.

$x_2 = 7x_1$

$a_2 = 7a_1$