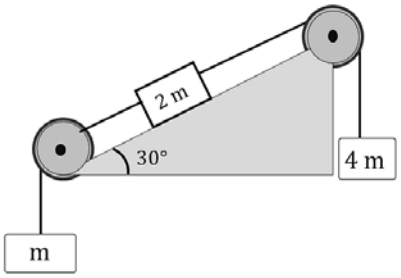
Chapter 6

Newton's Laws of Motion

Exercise

Acceleration

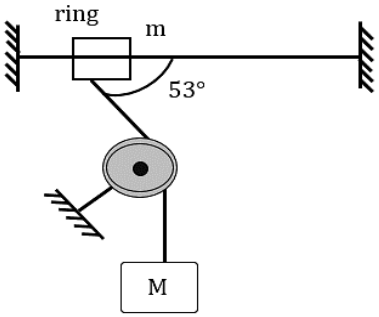
Q.1 Find the acceleration of the system shown in the figure.



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

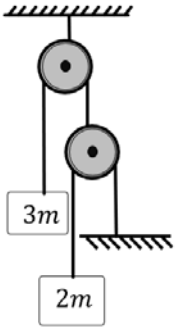
Constrained motion

Q.2 Find the tension in the string connecting block of mass m and m at the instant shown. Assume all surfaces to be frictionless and ring is constrained to move along the wire only. M = 25 kg; m = 9 kg and g = 10 m/s^2



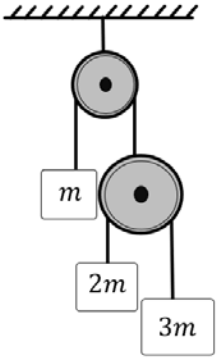
(**A**)50 N (**B**)100 N (**C**)125 N (**D**)150 N

Q.3 Find the tension (in N) in the string connecting the 2m mass. (Strings are massless and inextensible)



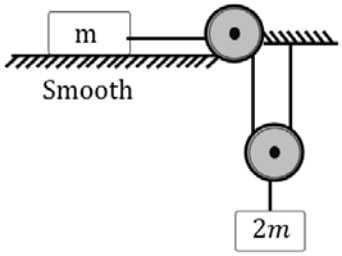
(**A**) $\frac{15\ mg}{11}$ (**B**) $\frac{18\ mg}{13}$ (**C**) $\frac{18\ mg}{11}$ (**D**) $\frac{15\ mg}{13}$

Q.4 Find the tension (in N) acting on 2m mass when the system is released from rest. Assume that the pulleys are ideal and strings are inextensible.



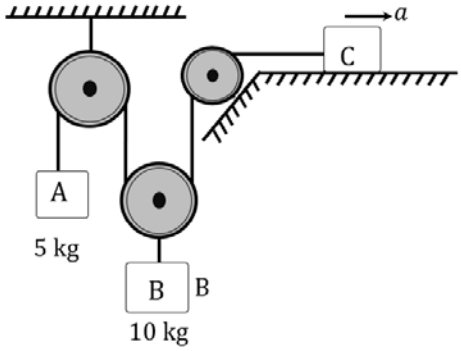
(**A**) $\frac{24\ mg}{23}$ (**B**) $\frac{23\ mg}{24}$ (**C**) $\frac{25\ mg}{23}$ (**D**) $\frac{23\ mg}{25}$

Q.5 Find the acceleration of the block of mass $2m$ as shown in the figure. (Strings are massless and inextensible)



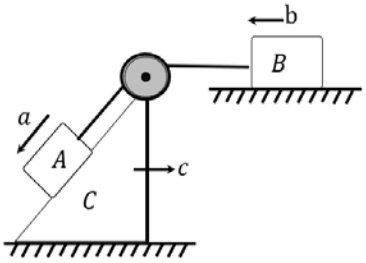
(**A**) $\frac{2g}{3}$ (**B**) $\frac{g}{3}$ (**C**) $\frac{g}{4}$ (**D**) $\frac{g}{5}$

Q.6 Find the acceleration of block A if block C is moving with acceleration a = 3 m/s^2 as shown in the figure. Assume the surface to be frictionless and pulleys and string ideal. Take g = 10 m/s^2.



(**A**)2 m/s^2 (**B**)3 m/s^2 (**C**)4 m/s^2 (**D**)5 m/s^2

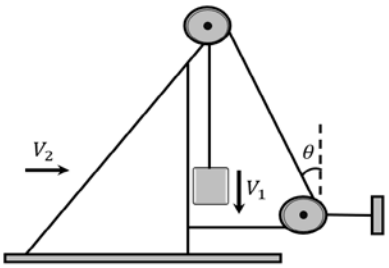
Q.7 In the figure, accelerations of block A, B and C are indicated by a, b and c respectively. Acceleration a, b and c are w.r.t to the ground. Find the acceleration of the body A in terms of b and c with respect to ground if the surface is smooth and pulley and string is ideal.



(**A**)$\sqrt{(b+c)^2+a^2}$ (**B**)$c-(a+b)\cos\theta$

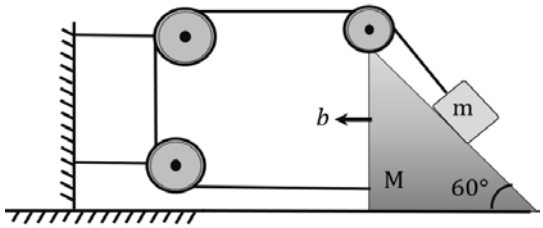
(**C**)$\sqrt{(b+c)^2+c^2-2(b+c).c.\cos\theta}$ (**D**)$\sqrt{(b+c)^2+c^2+2(b+c).c.\cos\theta}$

Q.8 In the shown figure, the block moves downwards with velocity V_1, the wedge moves rightwards with velocity V_2. Assuming the surface to be smooth and pulley and string to be ideal, the correct between V_1 and V_2 is



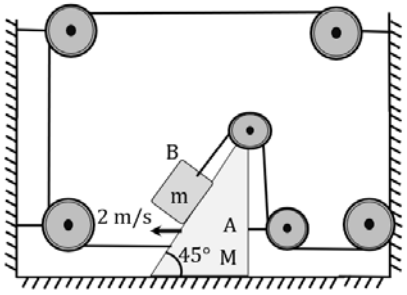
(**A**)$V_2 = V_1$ (**B**)$V_2 = V_1\sin\theta$ (**C**)$2V_2\sin\theta = V_1$ (**D**)$V_2(1+\sin\theta) = V_1$

Q.9 Find the acceleration of block of mass m (in m/s^2) along the plane (w.r.t ground). If acceleration of bock of mass M is $b\ m/s^2$. Assume the surface to be smooth and string inextensible.



(**A**)b (**B**)$\frac{b}{2}$ (**C**)$\frac{3b}{2}$ (**D**)2b

Q.10 Find the speed of block B if the speed of wedge A is 2 m/s as shown in the figure. Assume that surface to be smooth and siring inextensible.

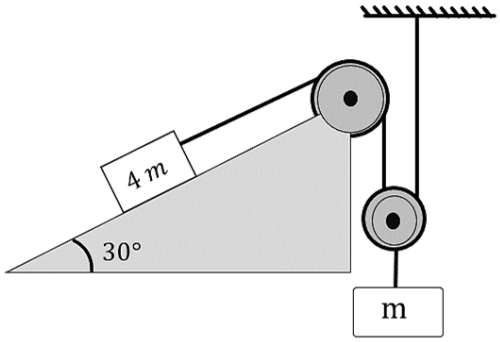


(**A**)$\sqrt{2}$ m/s (**B**)1 m/s (**C**)2 m/s (**D**)4 m/s

WORKSHEET

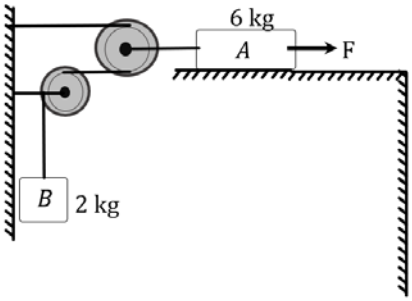
Constrained motion

Q.1 Find the acceleration of block of mass $4m$, assuming that the surface and pulley is smooth and string in inextensible.



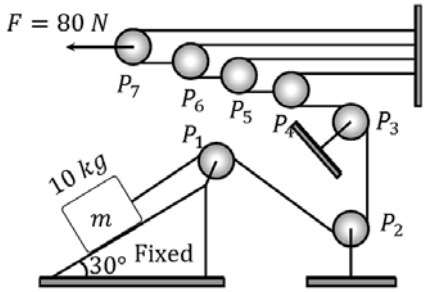
(**A**) $\frac{6g}{17}$ (**B**) $\frac{3g}{17}$ (**C**) $\frac{2g}{17}$ (**D**) $\frac{g}{17}$

Q.2 The system starts from rest and block A attains a velocity of 5 m/s after it has moved 5 m towards right. Assuming the arrangement to be frictionless everywhere and pulley & string to be light, find the value of the constant force F applied on block A. (Take g = 10 m/s^2)



(**A**)50 N (**B**)75 N (**C**)100 N (**D**)96 N

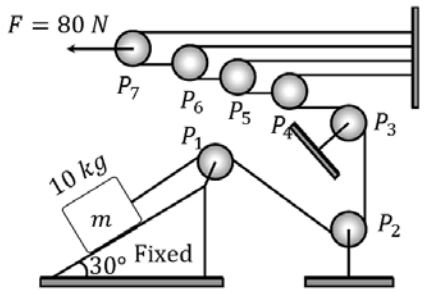
Q.3 In the figure shown, all pulleys are massless and the strings are light and inextensible. Find the tension in the string attached to the block m of mass 10 kg? (All surfaces are smooth and take $g = 10\ m/s^2$)



(**A**)40 N (**B**)10 N (**C**)20 N (**D**)5 N

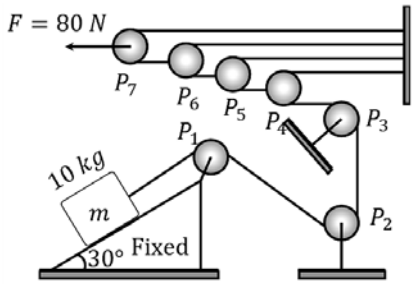
Acceleration

Q.4 In the figure shown, all pulleys are massless and the strings are light. What is the acceleration of block m having mass 10 kg? (All surfaces are smooth and take g = 10 m/s^2).



(**A**)4.5 m/s^2 down the plane (**B**)4.5 m/s^2 up the plane (**C**)5 m/s^2 down the plane (**D**)5 m/s^2 up the plane

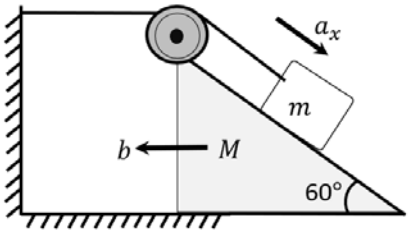
Q.5 In the figure shown, all pulleys are massless and the strings are light and inextensible. What is the acceleration of the pulley P_4? (All surfaces are smooth and take g = 10 m/s^2).



(**A**)2.25 m/s^2 towards left (**B**)2.25 m/s^2 towards right
(**C**)9 m/s^2 towards left (**D**)9 m/s^2 towards right

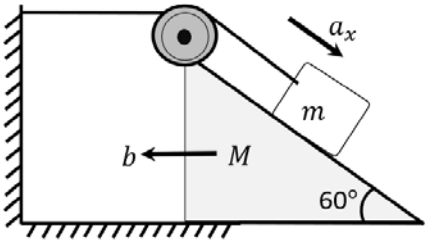
Acceleration

Q.6 Find the acceleration of block of mass m along the inclined plane (a_x) if the acceleration of wedge, b = 4 m/s^2. All accelerations are w.r.t. to ground and assume that surface and pulley are both smooth and string is inextensible.



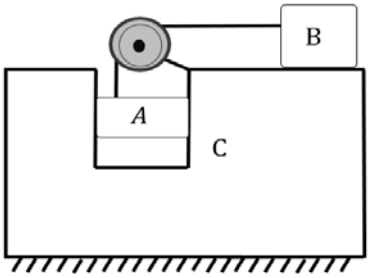
(**A**)2 m/s^2 (**B**)3 m/s^2 (**C**)4 m/s^2 (**D**)1 m/s^2

Q.7 Find the acceleration of block of mass m w.r.t. to ground if acceleration of M is $b = 4\ m/s^2$. (Assume all surfaces to be smooth and string inextensible)



(**A**)2 m/s^2 (**B**)3 m/s^2 (**C**)4 m/s^2 (**D**)1 m/s^2

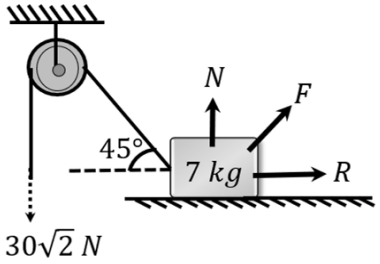
Q.8 In the system shown, mass of block A, B and C are $m_A = 4m$, $m_B = 3m$ and $m_C = 8m$. If the system is released from rest, find the acceleration of block B. Assume all surfaces to be smooth and string inextensible.



(**A**) $\frac{g}{8}$ (**B**) $\frac{g}{2}$ (**C**) $\frac{g}{4}$ (**D**) g

Constrained motion

Q.9 In an arrangement shown below, the pulley is light and the string is inextensible and light as well, the contact force between ground and the block is F. If the system is in equilibrium and $g = 10\ m/s^2$, the value of F (in Newtons) will be_____ (Given: F is the resultant of N and R)

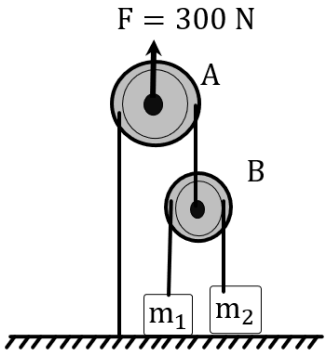


Acceleration

Q.10 Two blocks of mass m_1 and m_2 connected by a light string passing over a pulley B are shown in figure. The center of pulley B is connected to the floor by another light string passing over pulley A. Both the pulleys are massless. If $m_1 = 5$ kg and $m_2 = 10$ kg and a force of 300 N acts on pulley A, then choose the correct option(s). (Take $g = 10\ m/s^2$)

(**A**) Acceleration of m_1 will be $10\ m/s^2$ (**B**) Acceleration of m_2 will be $0\ m/s^2$

(**C**) Acceleration of m_1 will be $5\ m/s^2$ (**D**) Acceleration of m_2 will be $5\ m/s^2$



ANSWER KEY

Q.	1	2	3	4	5	6	7	8	9	10
Sol.	(A)	(C)	(A)	(A)	(B)	(B)	(C)	(D)	(C)	(C)
WORK SHEET										
Q.	1	2	3	4	5	6	7	8	9	10
Sol.	(A)	(B)	(D)	(A)	(B)	(B)	(C)	(B)		(B),(C)