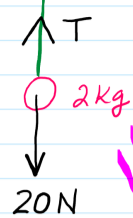


Application of Newton's Laws

Q: The diagram below shows an object of mass 2kg attached to a string.  
Assume  $g = 10 \text{ m/s}^2$



(i) Mark the forces on the diagram

(ii) What is Tension

Tension is the name given to a force which is experienced by a rope/string/chain/thread etc.

(iii) How to mark the direction of Tension

Tension is always directed AWAY from the concerned object.

• Cal T if object is at rest?

REST = EQ = forces balance

$T = 20 \text{ N}$

• Cal T if object moves at constant velocity?

const v/clo = zero acc  $\therefore$  resultant force zero hence forces balanced  $\therefore$

$T = 20 \text{ N}$

• Cal T if object accelerates upwards at  $2 \text{ m/s}^2$

upward acc implies that the upward force > downward force  $\therefore$

$F = ma$

$T - 20 = (2)(2)$

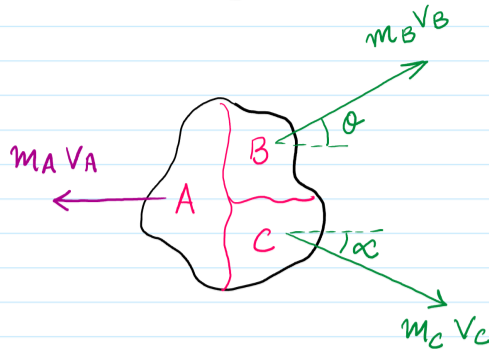
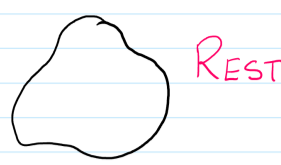
$T = 24 \text{ N}$

• Cal T if object accelerates downwards at  $5 \text{ m/s}^2$

downward acc indicates that downward force > upward force

$F = ma$

$20 - T = (2)(5) \therefore T = 10 \text{ N}$



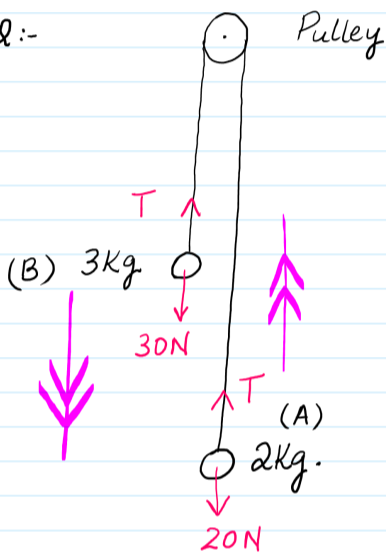
horizontal plane  
+  $\rightarrow$

$0 = m_B V_B \cos \theta + m_C V_C \cos \alpha + m_A (-V_A)$

Vertical plane  
+  $\uparrow$

$0 = (m_B)(V_B \sin \theta) + (m_C)(-V_C \sin \alpha)$

Q:- Pulley



(i) Mark Tension & weight.

(ii) The system is released from REST from the position shown

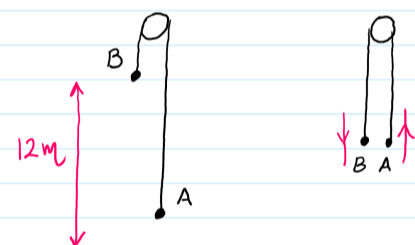
(a) Find "a" & "T"

(B)  $F = ma$   
 $30 - T = 3a$

(A)  $F = ma$   
 $T - 20 = 2a$

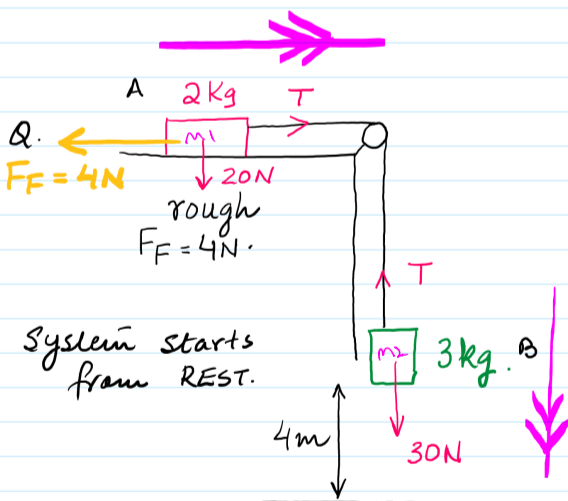
$a = 2 \text{ m/s}^2$   
 $T = 24 \text{ N}$

(iii) Given that initially A and B are separated by 12m. Cal their speed when they cross each other



$u = 0$   
 $v = ?$   
 $a = 2 \text{ m/s}^2$   
 $s = 6 \text{ m}$

$v^2 = u^2 + 2as$   
 $v = 4.9 \text{ m/s}$



$a = \frac{m_2 g - F}{m_2 + m_1}$

(i) Cal Tension & the acceleration

for B  $F = ma$   
 $30 - T = 3a$

for A  $F = ma$   
 $T - 4 = 2a$

$26 = 5a$   
 $a = 5.2 \text{ m/s}^2$   
 $T = 14.4 \text{ N}$

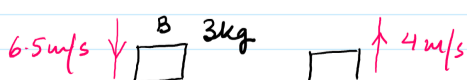
(ii) Cal the speed with which B hits the ground?

$u = 0$   $v = ??$   $a = 5.2$   $s = 4 \text{ m}$   
 $v^2 = 0 + 2(5.2)(4)$   
 $v = 6.5 \text{ m/s}$

stance

(iii) Given that B rebounds back from the ground with 4m/s.

Cal the Impulse while it was in contact with the ground?



Impulse =  $\Delta p = F \times t$

+  $\uparrow \Delta p = p_f - p_i$

$\Delta p = (3)(4) - (3)(-6.5)$

$\Delta p = 31.5 \text{ Ns}$