· Application of Newton's Laws

Q:- The diagram below shows an object of mass 2Kg attached to a string. Assume $g = 10 m/s^2$

(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

$T = 20 N$.

· Cal T if object moves at constant velocity?

const velo = zero acc ∴ resultant force zero hence forces balanced ∴

$T = 20 N$

· Cal T if object accelerates upwards at $2 m/s^2$

upward acc implies that the upward force > downward force ∴

$F = ma$

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

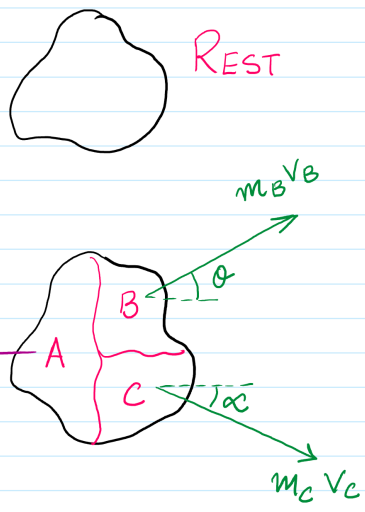
$T = 24 N$

· Cal T if object accelerates downwards at $5 m/s^2$

downward acc indicates that downward force > upward force

$F = ma$

$20 - T = (2)(5)$ ∴ $T = 10 N$



horizontal plane

+ →

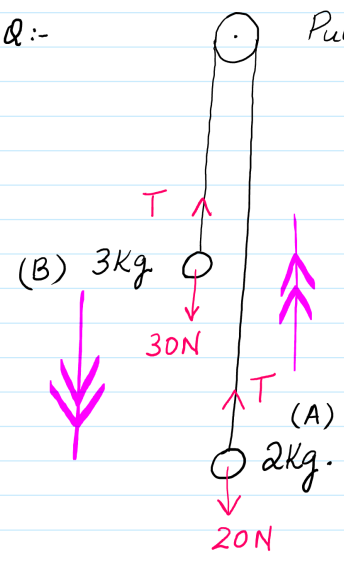
$0 = m_B v_B \cos\theta + m_C v_C \cos\alpha + m_A(-v_A)$

Vertical plane

+ ↑

$0 = (m_B)(v_B \sin\theta) + (m_C)(-v_C \sin\alpha)$

Q:- Pulley



(i) Mark Tension & weight.

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

(a) Find "a" & "T"

(B) $F = ma$

$30 - T = 3a$

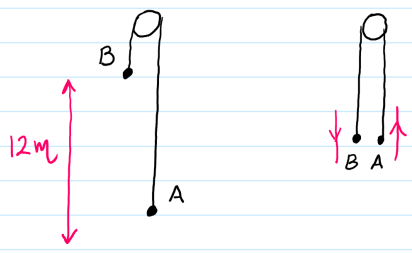
(A) $F = ma$

$T - 20 = 2a$

$a = 2 m/s^2$.

$T = 24 N$.

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



$u = 0$

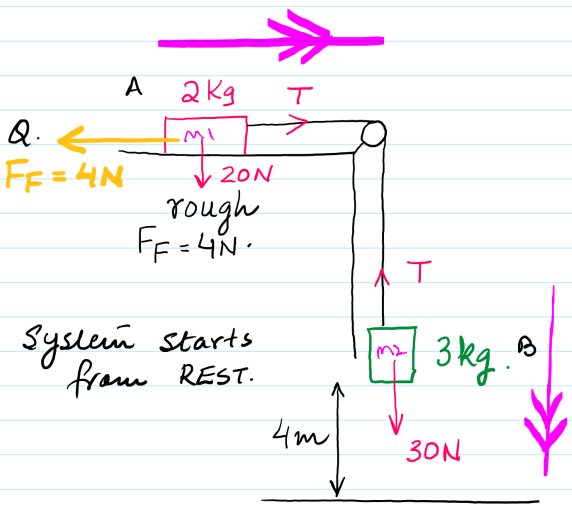
$v = ?$

$a = 2 m/s^2$.

$s = 6 m$ (*)

$v^2 = u^2 + 2as$

$v = 4.9 m/s$.



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

(i) Cal Tension & the acceleration

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

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

$26 = 5a$

$a = 5.2 m/s^2$

$T = 14.4 N$.

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

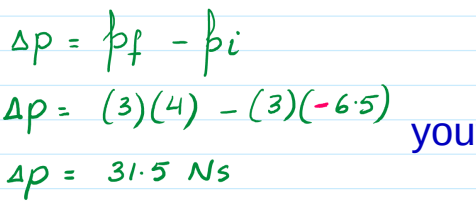
$u = 0$ $v = ??$ $a = 5.2$ $s = 4m$

$v^2 = 0 + 2(5.2)(4)$

$v = 6.5$ m/s.

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

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



Impulse = $\Delta p = Fxt$

+ ↑ $\Delta p = p_f - p_i$

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

$\Delta p = 31.5 Ns$