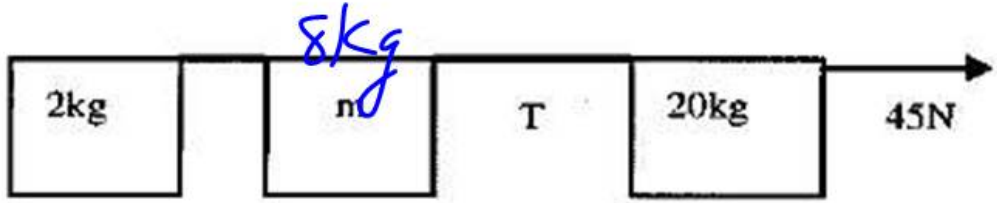
11 A 45 N force pulls three trolleys which are connected by ropes as shown in the diagram. If the system accelerates to the right at 1,5 $m \cdot s^{-2}$ calculate the tension T in the rope and the value of m. Ignore frictional forces.



$m = \frac{\Sigma F}{a}$

$\Sigma F_{net} = m \cdot a \longrightarrow 1,5\ m/s^2$

$45 = (2 + m + 20)\ 1,5$

$45 = (22 + m)\ 1,5$

$22 + m = 45 / 1,5$

$m = 8\ kg.$

$= 45 \div 1,5$

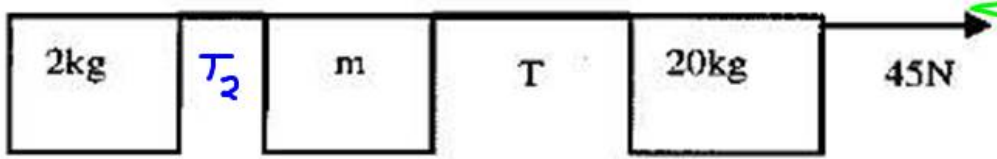
$= 30\ kg$

$30 - 20 - 2$

$= 8\ kg$

A 45 N force pulls three trolleys which are connected by ropes as shown in the diagram. If the system accelerates to the right at 1,5 $m \cdot s^{-2}$ calculate the tension T in the rope and the value of m. Ignore frictional forces.

15N



20k

$F_A > T$

$\Sigma F = m \cdot a$

$F_A - T$

$45 - T = 20 \cdot 1,5$

$T = 45 - (20 \times 1,5)$

$= 15N$

For 2kg block: $\rightarrow T_2$

$T_2 = 2 \times 1,5 = 3N$

For m: $T_2 \leftarrow \bullet \rightarrow T$

$\therefore T - T_2 = m \cdot a$

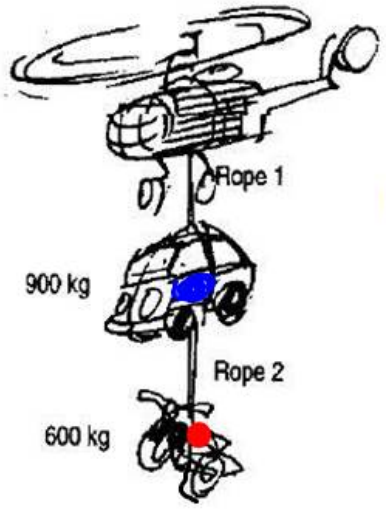
$15 - 3 = m \cdot 1,5$

$m = 12/1,5$

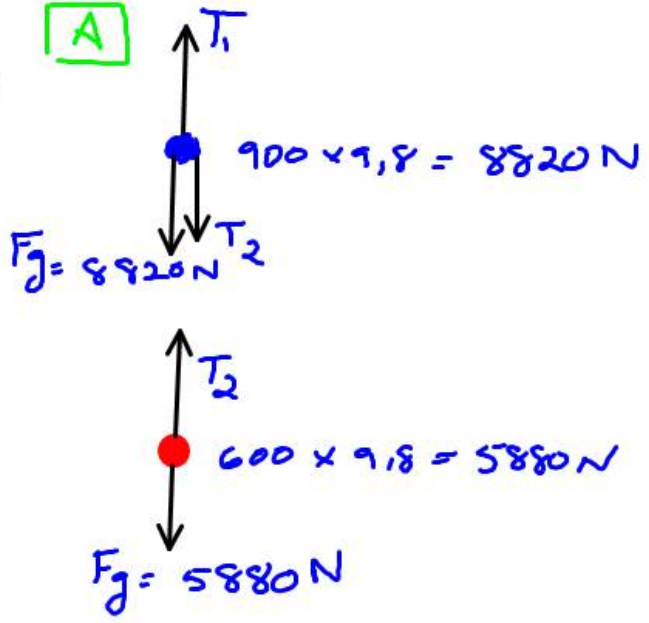
$= 8kg$

8 A helicopter is lifting a car (mass 900kg) and a motorbike (mass 600kg) as shown in the diagram.

8.1 Use Newton's Second Law to obtain equations for the resultant force acting on the car and the resultant force acting on the motorbike.
8.2 If the maximum tension in rope 1 is 18000 N, calculate the maximum acceleration of the helicopter if the rope is not to break.
8.3 Calculate the tension in rope 2 when the helicopter has this acceleration.
8.4 If rope 1 breaks and the car and motorbike fall together what will the tension be in rope 2 if friction is ignored?
8.5 Why would it be wise to use several ropes to suspend the car and the motorbike?



A



B

For 900kg: $\Sigma F = m.a$

$$T_1 - F_g - T_2 = m.a$$

$$18000 - 8820 - T_2 = 900.a$$

$$T_2 = 9180 - 900a \quad \ldots (1)$$

For 600kg: $\Sigma F = m.a$

$$T_2 - F_g = m.a$$

$$T_2 - 5880 = 600.a$$

$$T_2 = 5880 + 600.a \quad \ldots (2)$$

C

$T_2 = T_2$ (Tension in same rope)

(1) = (2)

$\therefore 9180 - 900a = 5880 + 600.a$

$\therefore a = 2{,}2\ m.s^{-2}$

D

Eq (1) … $T_2 = 9180 - 900(2{,}2)$

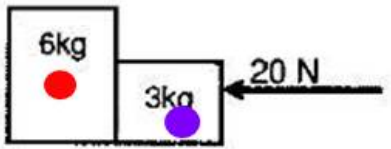
$= 7200\ N$

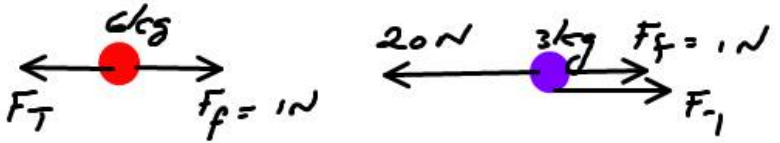
ORDER

12 Two blocks of masses 6 kg and 3 kg, respectively lie on a rough horizontal surface. A horizontal force of 20N is applied to the 3kg block as shown in the diagram. The frictional force between each block and the surface is 1 N.

12.1 Sketch a force diagram for each block and label all the forces.

12.2 Calculate the force exerted by the 6 kg block on the 3 kg block.





For 3 kg: $F_A - F_f - F_T = m.a$

$20 - 1 - F_T = 3.a$

$F_T = 19 - 3a \quad \ldots (1)$

For 6kg: $F_T - F_f = m.a$

$F_T - 1 = 6.a$

$F_T = 6a + 1 \quad \ldots (2)$

$F_T = F_T$ [N^3 Law]

$\therefore (1) = (2)$

$19 - 3a = 6a + 1$

$a = 2\ m.s^{-2}$

Using Eq (2) ... $F_T = 6a + 1$

$= 6(2) + 1 = 13\ N$