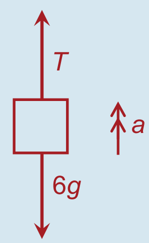
Part 2: Coalescence of 2 kg masses:

$m_1u_1 + m_2u_2 = (m_1 + m_2)v$

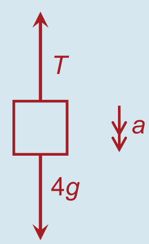
$\Rightarrow 2\sqrt{2g} + 8(0) = 10v$

$\Rightarrow v = \dfrac{\sqrt{2g}}{5}$ m/s ... speed at which connected particles start to move.

Part 3: Calculate acceleration of system (which should be negative):



$T - 6g = 6a$ **Equation 1**



$4g - T = 4a$ **Equation 2**

Adding equations **1** and **2** gives

$-2g = 10a$

$\Rightarrow a = -\frac{1}{5}g$ m/s^2

Part 4: Upward motion of 6 kg mass:

$u = \dfrac{\sqrt{2g}}{5},\quad a = -\frac{1}{5}g,\quad v = 0$

$s = \dfrac{v^2 - u^2}{2a}$

$\Rightarrow s = \dfrac{0 - \frac{2g}{25}}{-\frac{2g}{5}}$

$= \dfrac{2g}{25} \times \dfrac{5}{2g}$

$= \dfrac{1}{5}$ m

$= 20$ cm

Q. 6. (i) Motion of 1 kg mass while falling:

$u = 0,\quad s = 2.5,\quad a = g$

$v = \sqrt{u^2 + 2as}$

$\Rightarrow v = \sqrt{0 + 2g(2.5)}$

$\Rightarrow v = \sqrt{5g}$

$= 7$ m/s

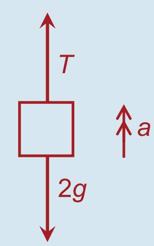
Conservation of momentum once string becomes taut:

$m_1u_1 + m_2u_2 = (m_1 + m_2)v$

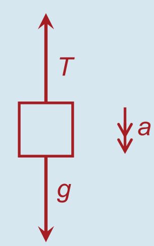
$\Rightarrow (1)(7) + (2)(0) = 3v$

$\Rightarrow v = \frac{7}{3}$ m/s

(ii) Motion of system:



$T - 2g = 2a$ **Equation 1**



$g - T = a$ **Equation 2**

Adding equations **1** and **2** we get:

$-g = 3a$

$\Rightarrow a = -\frac{1}{3}g$ m/s^2

Consider subsequent motion of 1 kg mass:

$u = \frac{7}{3},\quad a = -\frac{1}{3}g,\quad v = 0$

$s = \dfrac{v^2 - u^2}{2a}$

$\Rightarrow s = \dfrac{0 - \frac{49}{9}}{-\frac{2g}{3}} = \dfrac{49}{9} \times \dfrac{3}{2g} = \dfrac{5}{6}$ m

Since the motion of the system began with the 1 kg mass being 1 m from the table, it follows that the 1 kg mass will not reach the table.