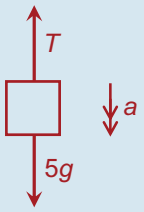
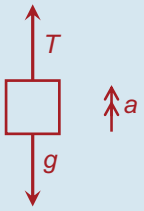
Exercise 6D

Q. 1. (i) Let a = the common acceleration of the particles during the first second.



$5g - T = 5a$ **Equation 1**



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

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

$4g = 6a$

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

After 1 second, the distance travelled by the 5 kg particle will be given by

$s = ut + \frac{1}{2}at^2$

$\Rightarrow s = (0)(1) + \frac{1}{2}\left(\frac{2}{3}g\right)(1)^2$

$\Rightarrow s = \frac{1}{3}g$ m

(ii) Firstly, we must calculate the speed just before the 2 kg mass is picked up:

$v = u + at = 0 + \left(\frac{2}{3}g\right)(1)$

$= \frac{2}{3}g$ m/s

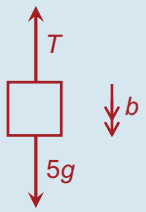
$m_1u = m_2v$

$\Rightarrow 6\left(\frac{2}{3}g\right) = 8v$

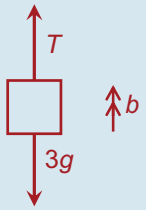
$\Rightarrow 8v = 4g$

$\Rightarrow v = \frac{1}{2}g$ m/s … speed directly after 2 kg mass is picked up.

Let b = the new common acceleration of the particles.



$5g - T = 5b$ **Equation 3**



$T - 3g = 3b$ **Equation 4**

Adding equations **3** and **4** we get:

$2g = 8b$

$\Rightarrow b = \frac{1}{4}g$ m/s^2

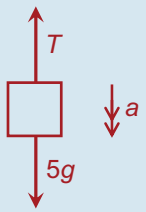
$\Rightarrow$ The distance travelled in the 2nd second is given by

$s = ut + \frac{1}{2}at^2$

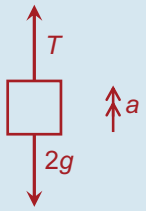
$\Rightarrow s = \left(\frac{1}{2}g\right)(1) + \frac{1}{2}\left(\frac{1}{4}g\right)(1)^2$

$\Rightarrow s = \frac{5}{8}g$ m

Q. 2. Let a = the common acceleration of the particles during the first 3 seconds.



$5g - T = 5a$ **Equation 1**



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