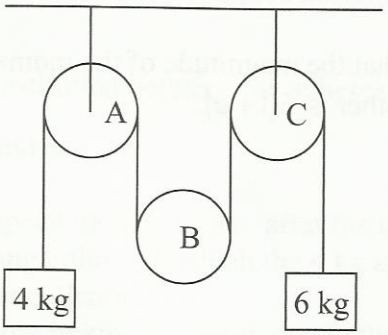
2007 4 **(b)** A light inextensible string passes over a small fixed pulley A, under a small moveable pulley B, of mass m kg, and then over a second small fixed pulley C. A particle of mass 4 kg is attached to one end of the string and a particle of mass 6 kg is attached to the other end.
The system is released from rest.

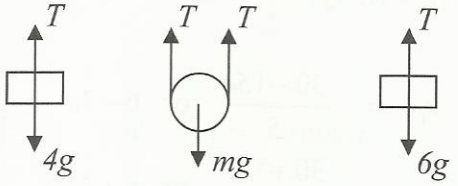


(i) On separate diagrams show the forces acting on each particle and on the moveable pulley B.

(ii) Find, in terms of m, the tension in the string.

(iii) If $m = 9.6$ kg prove that pulley B will remain at rest while the two particles are in motion.

(*i*)



5,5

(*ii*)

$$\left.\begin{aligned} T - 4g &= 4p \\ T - 6g &= 6q \end{aligned}\right\}$$

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$$mg - 2T = m\left\{\frac{1}{2}(p+q)\right\}$$

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$$= \frac{m}{2}\left\{\left(\frac{T}{4} - g\right) + \left(\frac{T}{6} - g\right)\right\}$$

$$\Rightarrow T = \frac{48mg}{5m+48}$$

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(*iii*) $m = 9.6 \Rightarrow T = 47.04$ or $4.8g$

acceleration of 4 kg mass $= p = \frac{T}{4} - g = 0.2g \neq 0$

acceleration of 6 kg mass $= q = \frac{T}{6} - g = -0.2g \neq 0$

acceleration of pulley B $= \frac{1}{2}(p+q) = 0$

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$\Rightarrow$ pulley B will remain at rest while the two particles are in motion.

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