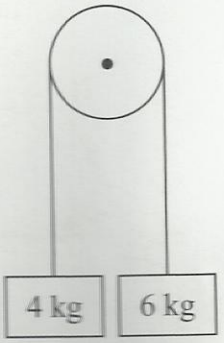
8 **(b)** Masses of 4 kg and 6 kg are suspended from the ends of a light inextensible string which passes over a pulley.
The axis of rotation of the pulley is horizontal, perpendicular to the pulley, and passes through the centre of the pulley.
The moment of inertia of the pulley is 0.08 kg m^2 and its radius is 20 cm.
The particles are released from rest and move vertically.
When each mass has acquired a speed of 1 m/s, find



(i) the common acceleration of the masses

(ii) the tensions in the vertical portions of the string.

(i)

$$\text{Gain in KE} = \tfrac{1}{2}I\omega^2 + \tfrac{1}{2}m_1v^2 + \tfrac{1}{2}m_2v^2$$
$$= \tfrac{1}{2}(0.08)(5^2) + \tfrac{1}{2}(6)(1^2) + \tfrac{1}{2}(4)(1^2)$$
$$= 6$$

5

$$\text{Loss in PE} = 6gh - 4gh$$
$$= 2gh$$

5

$$\text{Gain in KE} = \text{Loss in PE}$$
$$6 = 2gh$$
$$h = \frac{3}{g}$$

5

$$v^2 = u^2 + 2as$$
$$1 = 0 + \frac{6a}{g} \Rightarrow a = \frac{g}{6}$$

5

(ii)

$$6g - T_2 = 6\left(\frac{g}{6}\right) \Rightarrow T_2 = 5g \text{ or } 49 \text{ N}$$

5

$$T_1 - 4g = 4\left(\frac{g}{6}\right) \Rightarrow T_1 = \frac{14g}{3} \text{ or } 45.7 \text{ N}$$

5

30