Particles $P$ and $Q$, of masses $2m$ and $3m$, are attached to the ends of a light inextensible string. The string passes over a small smooth fixed pulley and the masses hang with the string taut. The system is released from rest.

**a** Write down an equation of motion for $P$.

**ii** Write down an equation of motion for $Q$.

**b** Find the acceleration of each mass.

**c** Find the tension in the string.

1. **Draw a diagram**

   ![Diagram of the Pulley System]

2. **Taking the direction of motion to be positive, do $F = ma$ for each particle.**

   $P$: (i) $T - 2mg = 2ma \quad \leftarrow \text{answer to a i}\$

   $Q$: (ii) $3mg - T = 3ma \quad \leftarrow \text{answer to a ii}\$

3. **Solve simultaneously**

   $P + Q \Rightarrow mg = 5ma \Rightarrow a = \frac{g}{5} = 1.96 \text{ m/s}^2 \quad \text{answer to b}\$

   $P \Rightarrow T - 2mg = 2m(1.96) \Rightarrow T = 2mg + 3.92m = 23.52m \quad \text{answer to c}$