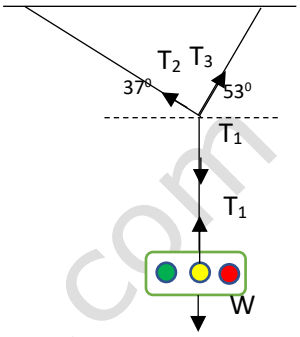
Q- A traffic light weighing 122N hangs from a cable tied to two other cables fastened to a support. The upper cables make angles $37^0$ and $53^0$ with the horizontal. Find the tension in the cables.




The weight W of the light acts downwards and thus for equilibrium the tension in the lower cable $T_1$ must by equal and opposite to it. Thus the magnitude of the tension $\mathbf{T_1 = 122\ N}$.

Resolving tensions in the other two cables horizontally and as the junction point is in equilibrium, the net horizontal force must be zero. Thus, we get

$$T_3 \cos 53^0 - T_2 \cos 37^0 = 0$$

Or $$T_3 = T_2 * \frac{\cos 37^0}{\cos 53^0}$$

Or $$T_3 = T_2 * \frac{4}{5} * \frac{5}{3}$$

Or $$T_3 = T_2 * \frac{4}{3} \qquad \text{---------- (1)}$$

similarly resolving tensions in the other two cables vertically and as the junction point is in equilibrium, the net vertical force must be zero. Thus, we get

$$T_3 \sin 53^0 + T_2 \sin 37^0 - T_1 = 0$$

Or $$T_3 * \frac{4}{5} + T_2 * \frac{3}{5} = 122\ N$$

Substituting the value of $T_3$ from equation we get

$$T_2 * \frac{4}{3} * \frac{4}{5} + T_2 * \frac{3}{5} = 122\ N$$

Or $$\boldsymbol{T_2} = \frac{3}{5} * 122 = \mathbf{73.2\ N}$$

Thus $$\boldsymbol{T_3} = T_2 * \frac{4}{3} = 73.2 * \frac{4}{3} = \mathbf{97.6\ N}$$