A rope suspended from a ceiling supports an object of weight W at its opposite end. Another rope tied to the first at the middle is pulled horizontally with a force of 30N. The junction P of the ropes is in equilibrium. calculate the weight W and the tension T in the upper part of the first rope.

a) 40.5N and 52.5N

b) 16.6N and 27.3N

c) 30.4N and 53.7N

d) 27.2N and 39.2N

Solution.
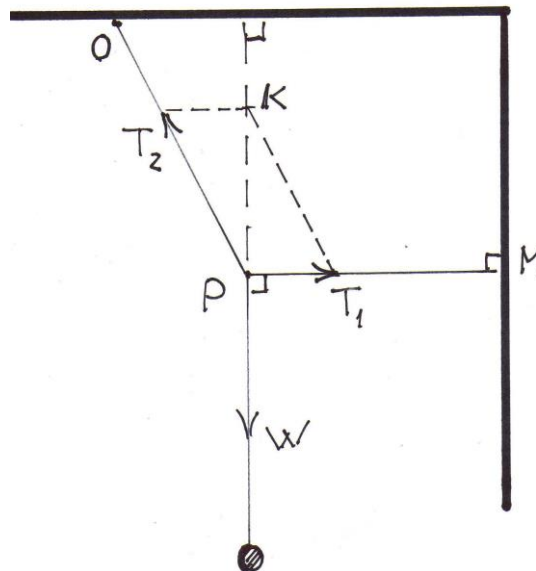

Figure 1

The equilibrium condition for the point P is

$$\vec{T_1} + \vec{T_2} + \vec{W} = 0; \ \vec{T_1} + \vec{T_2} = -\vec{W} = \overrightarrow{PK};$$

We use the Pythagorean theorem for a right triangle PKT_1 (Fig. 1)

$$T_1{}^2 + W^2 = T_2{}^2; \ T_1 = 30N; \ T_2{}^2 - W^2 = 900;$$

We now verify each of the answers:

$a) \ 52.5^2 - 40.5^2 = 2756.25 - 1640.25 = 1116$
$b) \ 27.3^2 - 16.6^2 = 745.29 - 275.56 = 469.73$

c) $53.7^2 - 30.4^2 = 2883.69 - 924.16 = 1959.53$;
d) $39.2^2 - 27.2^2 = 1536.64 - 739.84 = 796.8$;

Thus, all the answers are incorrect.

Answer:

There is no right answer