

Feeling Tense?

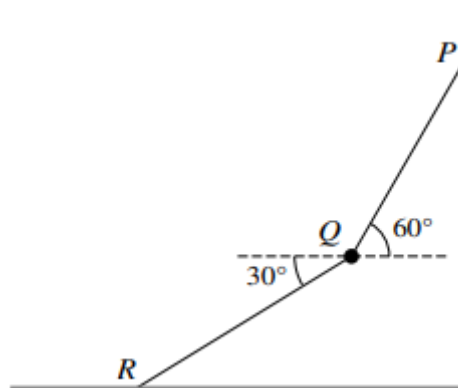
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Question 3 Paper 42 March 2021 Specification 9709

A particle Q of mass 0.2 kg is held in equilibrium by two light inextensible strings PQ and QR. P is a fixed point on a vertical wall and R is a fixed point on a horizontal floor. The angles which strings PQ and QR make with the horizontal are 60° and 30° respectively (see diagram).

Find the tensions in the two strings.

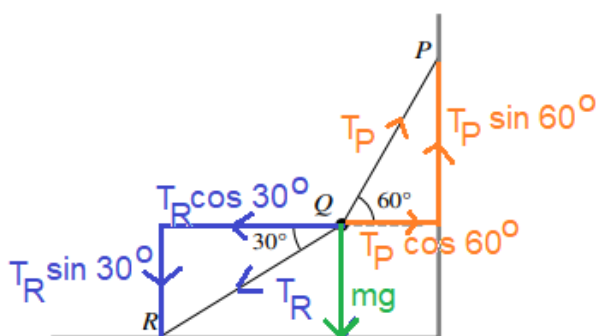
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Workings

Form two simultaneous equations

- using the weight of Q
- the mutually perpendicular components of the T_P and T_R .



Horizontally:

$$T_R \cos 30^\circ = T_P \cos 60^\circ$$

$$\frac{\sqrt{3}}{2} T_R = \frac{1}{2} T_P$$

$$T_P = \sqrt{3} T_R$$

Complete column 2, then substitute for T_R :

$$T_P = \sqrt{3} T_R = 2\sqrt{3}$$

Vertically:

$$T_R \sin 30^\circ + mg = T_P \sin 60^\circ$$

$$\frac{1}{2} T_R + 2 = \frac{\sqrt{3}}{2} T_P$$

$$T_R + 4 = \sqrt{3} T_P$$

Substitute for T_P :

$$T_R + 4 = \sqrt{3} (\sqrt{3} T_R)$$

$$T_R + 4 = 3T_R$$

$$T_R = 2$$

Reflection

Uncomplicated, but remember to include mg . Particularly easy if you have memorised the values of the sine, cosine (and tangent) functions for the angles commonly found in A-level maths problems.