Cambridge International AS & A Level

Mathematics 9709/42

Paper 4 Mechanics October/November 2024

Question No(4)

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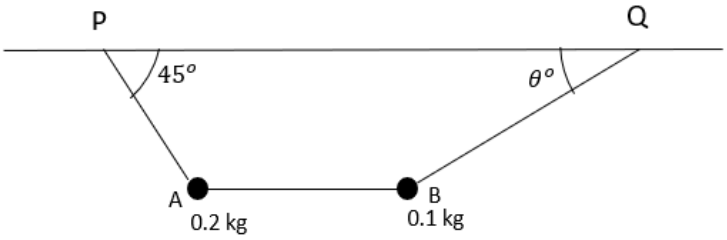


The diagram shows two particles, A and B, of masses 0.2 kg and 0.1 kg respectively. The particles are suspended below a horizontal ceiling by two strings, AP and BQ, attached to fixed points P and Q on the ceiling. The particles are connected by a horizontal string, AB.

Angle APQ = 45^o and BQP= θ^o .

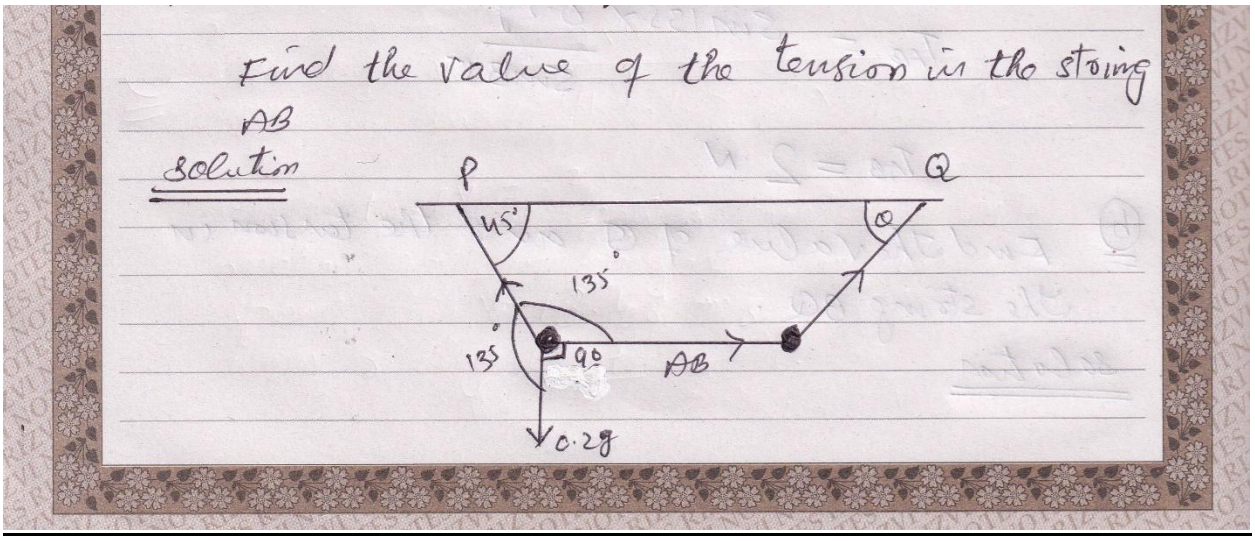
Each string is light and inextensible. The particles are in equilibrium.

(a) Find the value of the tension in the string AB.

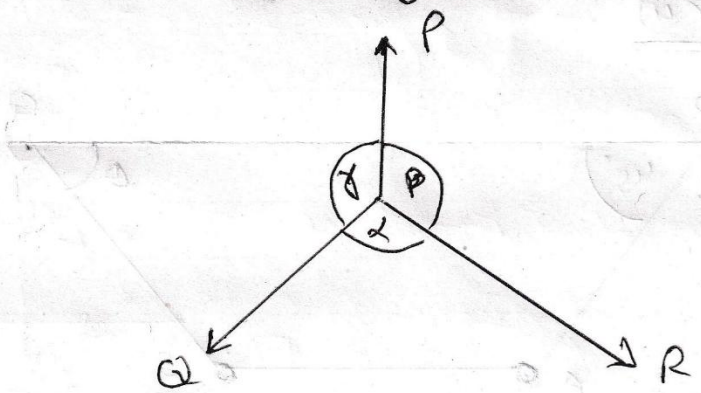
(b) Find the value of θ and the tension in the string BQ.

Solution:

(a)



By using Lami Theorem



$$\frac{P}{\sin\alpha} = \frac{Q}{\sin\beta} = \frac{R}{\sin\gamma}$$

From the given diagram by using Lami theorem, we have.

$$\frac{T_{AB}}{\sin 135} = \frac{0.2g}{\sin 135}$$

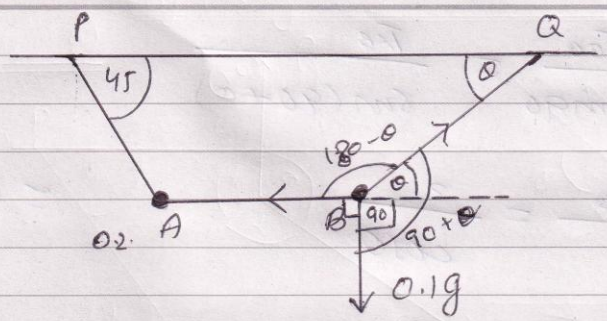
$$T_{AB} = \sin 135 \times \frac{0.2g}{\sin 135}$$

$$T_{AB} = 2\ N$$

(b)

DATE :-

(11)



By using the Lami theorem, we have

$$\frac{T_{BQ}}{\sin 90} = \frac{0.1g}{\sin(180-\theta)} = \frac{T_{AB}}{\sin(90+\theta)}$$

Now for θ, we have

$$= \frac{T_{AB}}{\sin(90+\theta)} = \frac{0.1g}{\sin(180-\theta)}$$

$$\frac{2}{\cos\theta} = \frac{0.1g}{\sin\theta}$$

$$\frac{\sin\theta}{\cos\theta} = \frac{0.1g}{2}$$

$$= \frac{0.1 \times 9.8}{2}$$

$$\tan\theta = 0.49$$

$$\theta = \tan^{-1}(0.49)$$

$$\theta = 26.1$$

(12)

NOW we find the tension T_{BQ}

$$\frac{T_{BQ}}{\sin 90} = \frac{T_{AB}}{\sin(90+\theta)}$$

$$\frac{T_{BQ}}{1} = \frac{2}{\cos\theta}$$

$\because \sin(90+\theta) = \cos\theta$

$$T_{BQ} = \frac{2}{\cos 26.1}$$

$\therefore \theta = 26.1$

$$T_{BQ} = 2.23$$