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Mathematics

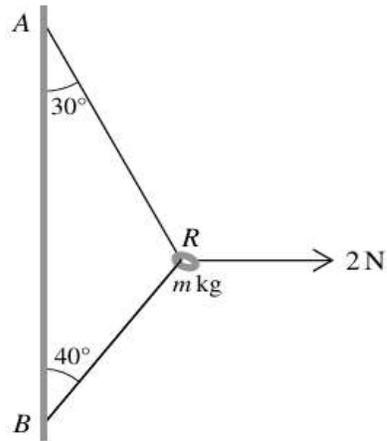
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Paper 4 Mechanics

October/November 2023

Question No (2)

2

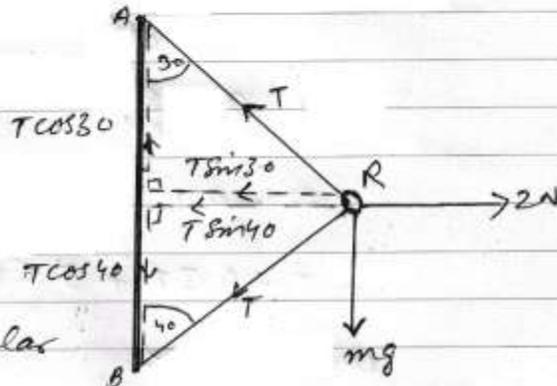


The diagram shows a smooth ring R , of mass m kg, threaded on a light inextensible string. A horizontal force of magnitude 2 N acts on R . The ends of the string are attached to fixed points A and B on a vertical wall. The part AR of the string makes an angle of 30° with the vertical, the part BR makes an angle of 40° with the vertical and the string is taut. The ring is in equilibrium.

Find the tension in the string and find the value of m .

Solution:

Resolve the tension T into its rectangular components.



Resolving the forces perpendicular to wall

Left hand forces = Right hand forces

$$T \sin 30 + T \sin 40 = 2$$

$$T (\sin 30 + \sin 40) = 2$$

$$T = \frac{2}{\sin 30 + \sin 40}$$

$$T = 1.75 \text{ N}$$

Resolving the forces along the wall

upward forces = downward forces

$$T \cos 30 = mg + T \cos 40$$

$$T \cos 30 - T \cos 40 = mg$$

$$1.75 (0.866) - 1.75 (0.766) = 10 m \quad \therefore T = 1.75$$

$$10 m = 0.175$$

$$m = \frac{0.175}{10} = 0.0175 \text{ kg}$$

