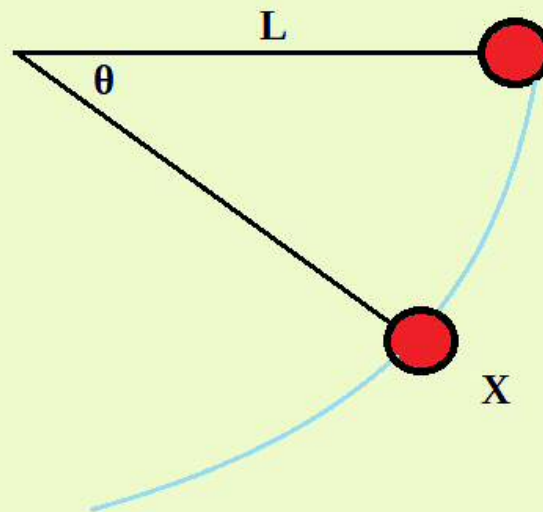


A Problem in Newtonian Mechanics



A pendulum of length L and a bob of mass M is released from the 3 o'clock position as it is shown in the diagram. Gravity is g . What is the tension in the string when the angle is θ ? Write your answer in terms of m , L , g , and θ .

SOLUTION

The PE of the bob when it is released is equal to its KE at point X , when the angle is θ . Therefore:

$$\frac{1}{2} \cdot m \cdot v^2 = m \cdot g \cdot L \cdot \sin \theta$$

At point X , the centripetal force is: $F_c = m \cdot v^2 / L = 2 \cdot m \cdot g \cdot L \cdot \sin \theta / L = 2 \cdot m \cdot g \cdot \sin \theta$

At point X the tension T is: $T = F_c + m \cdot g \cdot \sin \theta$

$$T = 2 \cdot m \cdot g \cdot \sin \theta + m \cdot g \cdot \sin \theta = 3 \cdot m \cdot g \cdot \sin \theta$$

Conclusion: At point X the tension is $T = 3 \cdot m \cdot g \cdot \sin \theta$