

Physics 101 Rec
Quiz # 10f

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Name: Key

Id:

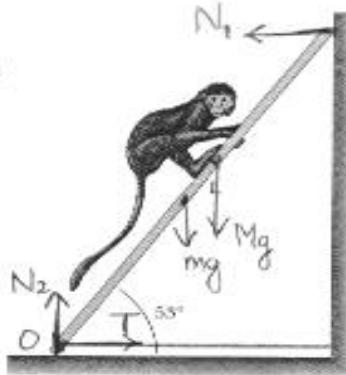
Sect:

A 10 kg monkey climbs up a 120 N uniform ladder of length L as in the figure. The upper and lower ends of the ladder rest on frictionless surfaces. The lower end is fastened to the wall by a horizontal rope that can support a maximum tension of 110 N.

(a) Find the tension in the rope when the monkey is 1/3 the way up the ladder.

$$\begin{aligned} T_0 &= 0 \\ \Rightarrow N_1 \sin 127^\circ - Mg \frac{L}{3} \sin 143^\circ - mg \frac{L}{2} \sin 143^\circ &= 0 \\ \Rightarrow N_1 = \frac{\left(\frac{Mg}{3} + \frac{mg}{2}\right) \sin 143^\circ}{\sin 1^\circ} &= 69.8 \text{ N} \end{aligned}$$

$$\begin{aligned} \sum F_x &= 0 \\ \Rightarrow -N_1 + T &= 0 \Rightarrow T = N_1 = 69.8 \text{ N} \end{aligned}$$



(b) Find the maximum distance d the monkey can walk up the ladder before the rope breaks, expressing your answer in terms of L.

$$T = 110 \text{ N} \Rightarrow d = ?$$

$$T = N_1 = 110 \text{ N}$$

$$N_1 L \sin 127^\circ - Mg d \sin 143^\circ - mg \frac{L}{2} \sin 143^\circ = 0$$

$$(110 \sin 127^\circ - \frac{mg}{2} \sin 143^\circ) L = Mg \sin 143^\circ d$$

$$d = \frac{51.74}{58.98} L = 0.877 L \approx 0.88 L$$

from the bottom of
the ladder.