Problem 6.17

The point of maximum stress will be at the bottom of the arc, so that is the point we need to test. A f.b.d. for that point is shown. Summing forces along the line of tension yields:
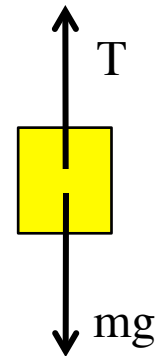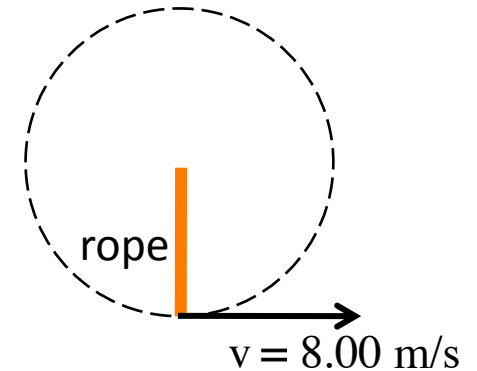
$$\underline{\sum F_c :}$$

$$T_{bottom} - mg = ma_c$$

$$\Rightarrow \quad T_{bottom} = mg + m\left(\frac{v_{max}^2}{R}\right)$$

$$= (85.0 \text{ kg})(9.80 \text{ m/s}^2) + (85.0 \text{ kg})\frac{(8.00 \text{ m/s})^2}{(10.0 \text{ m})}$$

$$= 1380 \text{ N}$$

Given the velocity at the bottom and the radius of the arc, the tension required when at the bottom is greater than the 1000 newtons available, which means the archaeologist is going into the drink.

rope

$v = 8.00$ m/s

T

mg