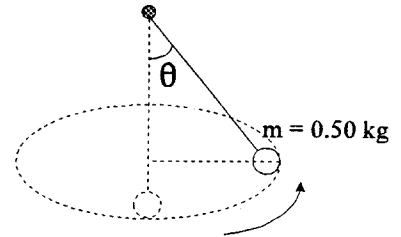


EXAM 2

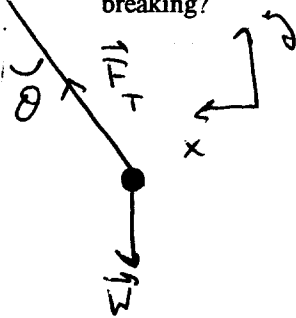
Name: _____ Student ID #: _____

TA (circle one): Costello Flitcroft Laddha Mimoto Tsunoda

A 0.500 mass is tied to the end of a 1.40 m string and whirled in a circle whose plane is parallel to the floor. As the mass is whirled faster and faster the string suddenly breaks when the angle between the string and the vertical is 86.0° .



A. [12 pts.] What is the maximum tension the string can sustain just before breaking?



$$\sum F_y = ma_y = 0$$

$$F_T(\text{MAX}) \cos \theta_{\text{MAX}} - mg = 0$$

$$F_T(\text{MAX}) = \frac{mg}{\cos \theta_{\text{MAX}}} = \frac{(1.5 \text{ kg})(9.8 \text{ m/s}^2)}{\cos 86^\circ}$$

$$F_T(\text{MAX}) = 70.2 \text{ N}$$

B. [12 pts.] What is the speed of the mass at the maximum tension the string can sustain?

$$\sum F_x = ma_c = \frac{mv^2}{r}$$

$$r = l \sin \theta_{\text{MAX}} = (1.40 \text{ m}) \sin 86^\circ = 1.397 \text{ m} \approx 1.40 \text{ m}$$

$$F_T(\text{MAX}) \sin \theta_{\text{MAX}} = \frac{mv^2}{r}$$

$$v^2 = \frac{[(70.2 \text{ N}) \sin 86^\circ](1.40 \text{ m})}{0.5 \text{ kg}} = 196 \text{ m}^2/\text{s}^2$$

$$v = 14.0 \text{ m/s}$$

C. [8 pts.] What is the period of the circular motion at the maximum string tension?

$$v = \frac{2\pi r}{T}$$

$$T = \frac{2\pi r}{v} = \frac{(2\pi)(1.40 \text{ m})}{14 \text{ m/s}}$$

$$T = 0.628 \text{ s}$$