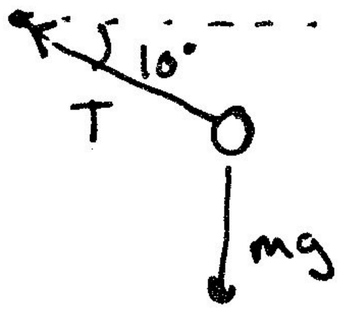
2a – 12) There is a fire show at the amusement park and you see a man whirling a burning ball (mass=100 g) of flame, attached to a chain, around his head as a distance of about 1 meter from his body, and it makes a 10 degree angle with respect to the horizontal. What is the velocity of the ball?



$$x: \quad F_x = ma_x = \frac{mv^2}{r} = T\cos\theta$$

$$y: \quad F_y = ma_y = 0 = T\sin\theta - mg$$

$$\text{so} \quad T = mg/\sin\theta$$

combining: $\frac{mv^2}{r} = \frac{mg\cos\theta}{\sin\theta}$

$$v^2 = \frac{gr}{\tan\theta} \Rightarrow \sqrt{\frac{9.8\ m/s^2 \cdot 1m}{\tan 10^\circ}} = v$$

so $v = 7.5\ m/s$

2b- 13) During the fire show, you meet Spark who offers to show you around San Cruzan. You walk along the beach and look at the ocean which is like glass on the warm evening night. You decide to have a contest to see who can throw rocks the farthest into the ocean. You pick up a 0.5 kg rock and throw it with constant velocity at an angle of 45 degrees from the horizontal and hear it splash 2 seconds later. How far did you throw the rock (ignore the speed of sound)?

$$\Delta x = \frac{v_0^2 \sin 2\theta}{g} \qquad v_{x0} = v_0\cos\theta$$

$$\Delta x = v_0\cos\theta_0 t$$

Combing: $v_0\cos\theta_0 t = \frac{v_0^2 \sin 2\theta_0}{g}$

$$v_0 = \frac{g\cos\theta_0 t}{\sin 2\theta_0} = 13.86\ m/s$$

Substituting, $\Delta x = 19.6\ m$

Note: It is possible to get the correct answer while doing the problem incorrectly. You will not get credit for this.