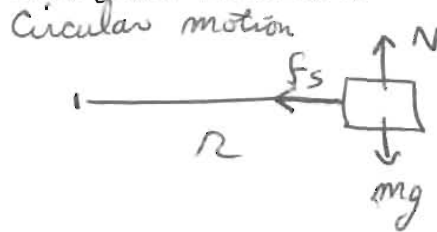4.   (20 pts.) A 0.08 kg block sits on a horizontally-rotating turntable. The turntable takes 1.2 seconds to complete one revolution. The block will stay put if it is placed at a radius less than 0.16m, but it will slide off if it is placed at a radius of 0.16m or greater. What is the coefficient of static friction?

4. (20 pts.) A 0.08 kg block sits on a horizontally-rotating turntable. The turntable takes 1.2 seconds to complete one revolution. The block will stay put if it is placed at a radius less than 0.16m, but it will slide off if it is placed at a radius of 0.16m or greater. What is the coefficient of static friction?

Circular motion

$$\sum F_y = m a_y$$
$$N - mg = 0$$
$$N = mg$$

$$\sum F_x = m a_x$$
$$f_s = \frac{m v^2}{r}$$

$$\mu_s N = \frac{m v^2}{r}$$

$$\mu_s mg = \frac{m v^2}{r}$$

$$\mu_s = \frac{v^2}{rg}$$

$$v = \frac{2\pi r}{1.2} = \frac{2\pi(0.16)}{1.2} = 0.838 \, m/s$$

$$\mu_s = \frac{(0.838)^2}{(0.16)(9.8)} = \boxed{0.448}$$