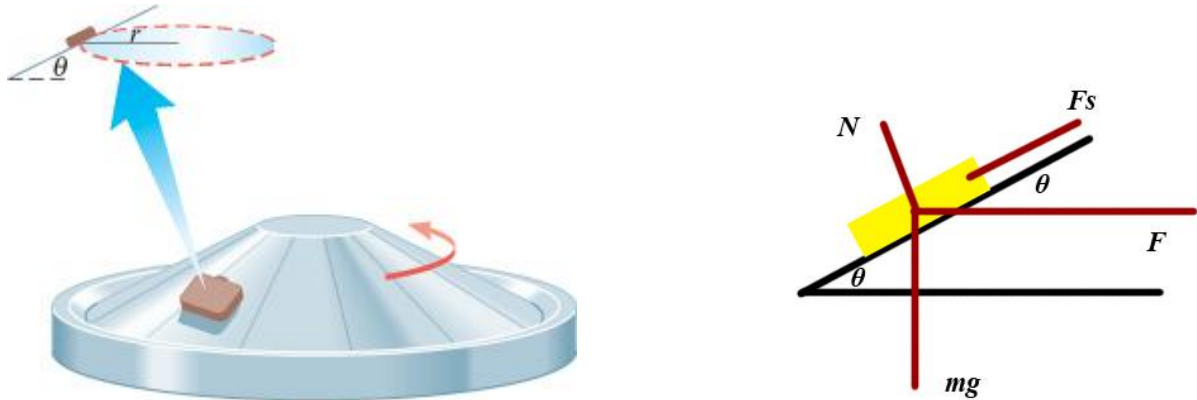


The drawing shows a baggage carousel at an airport. Your suitcase has not slid all the way down the slope and is going around at a constant speed on a circle ($r = 11.0$ m) as the carousel turns. The coefficient of static friction between the suitcase and the carousel is 0.540, and the angle θ in the drawing is 17.6° . What is the minimum time required for your suitcase to go around once?



From the diagram:

$$\begin{aligned}
 N &= mg \cos \theta \\
 F &= F_s \cos \theta \\
 F_s &= \mu_s N \\
 \Rightarrow F &= \mu_s N \cos \theta \\
 \Rightarrow F &= \mu_s mg \cos^2 \theta \\
 \frac{mv^2}{r} &= \mu_s mg \cos^2 \theta \\
 v &= \sqrt{\mu_s g \cos^2 \theta r}
 \end{aligned}$$

And then sub it into $v = \frac{2\pi r}{T}$

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