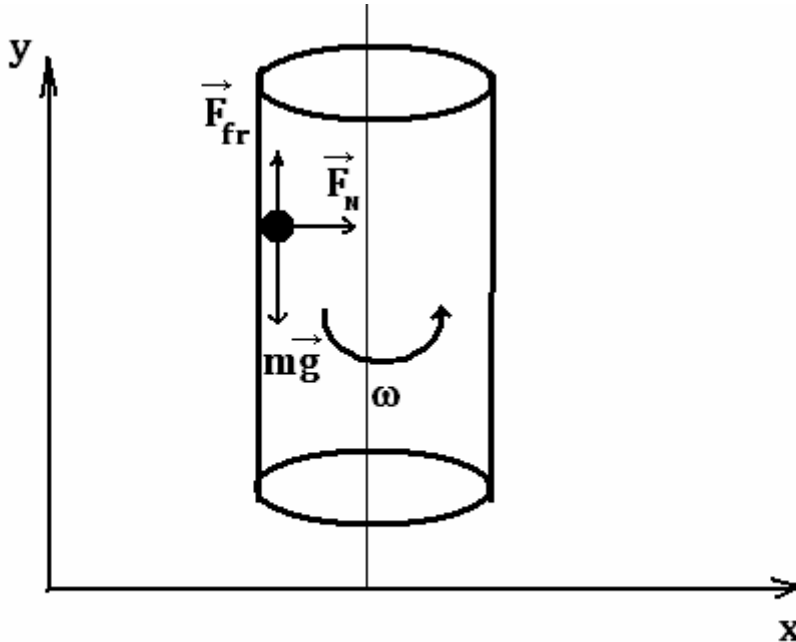**QUESTION:**
A hollow cylinder of radius 10 cm rotates about its axis which is vertical. A small body remains in contact with the inner wall if the frequency of rotation is 200 per minute but falls at lower frequencies. Find the co-efficient of friction between the body and the cylinder

SOLUTION:

Let's draw a sketch:

According to the Newton's second law of motion:

$$\begin{cases} F_N = ma \; (projection \; onto \; x \; axis) \\ F_{fr} - mg = 0 \; (projection \; onto \; y \; axis) \\ F_{fr} = \mu F_N \\ a = \dfrac{v^2}{R} = \dfrac{2v^2}{d} = \dfrac{2(2\pi vd/2)^2}{d} = 2\pi^2 v^2 d \end{cases} \Rightarrow \begin{cases} F_N = 2m\pi^2 v^2 d \\ F_{fr} = mg \\ F_{fr} = \mu F_N \end{cases} \Rightarrow$$

$$mg = \mu F_N$$

$$mg = \mu \cdot 2m\pi^2 v^2 d$$

$$\mu = \dfrac{g}{2\pi^2 v^2 d}$$

$$\mu = 0.45$$

ANSWER:
0.45