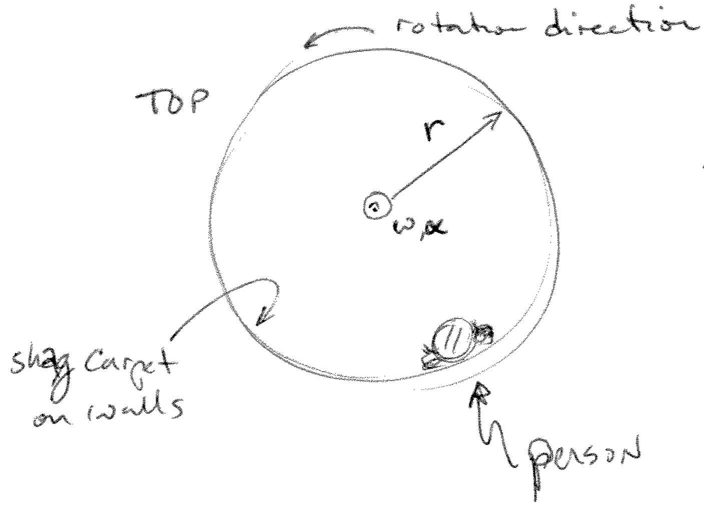
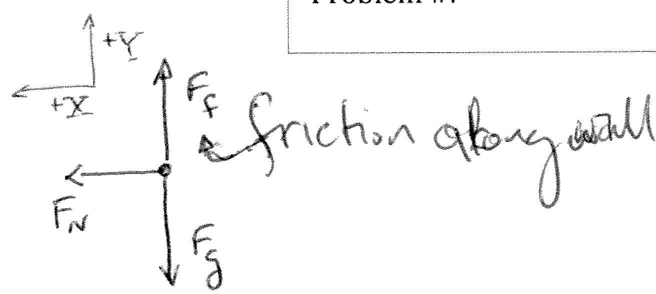
General Problem Solving Guide

Name:	KEY
Lab Time:	
Date:	
Test Code:	PROBLEM 12
Problem #:	

List given information, define variables, sketch picture:





Simplify question, list target quantity:

Find ω_{min} for $F_f = F_g$ (ie. don't slip down wall)

List all related quantitative relationships:

$\sum \vec{F} = m\vec{a}$ $\quad a_c = \frac{v^2}{r}$ $\quad \omega = \frac{v}{r}$ or $v = \omega r$

$F_f = \mu_s F_N$ ← use static (μ_s) since you are not moving.

Outline approach, sketch diagrams if needed (or sketch next to pictures above):

Seperate forces by coordinate system

Use F_g to find F_f

Use F_f to find F_N which is related to v

Use v to find ω

Obtain a general solution:

$$\Sigma F_y = 0 \quad F_f - F_g = 0$$

$$\mu_s F_N = F_f = F_g = mg$$

$$\Sigma F_x = ma_c \quad F_N = m\frac{v^2}{r} = m\omega^2 r$$

Combine equations

$$\mu_s m\omega^2 r = mg$$

$$\omega^2 = \frac{g}{\mu_s r}$$

$$\omega = \left(\frac{g}{\mu_s r}\right)^{1/2}$$

[A] $r = 2m \quad \mu_s = 0.82$

[B] $r = 4m \quad \mu_s = 0.86$

[C] $r = 3m \quad \mu_s = 0.80$

Check Units:

$$\frac{rad}{sec} = \left(\frac{m/s^2}{m}\right)^{1/2} = \frac{1}{sec} \quad ✓$$

Note: rad is unitless (it is a ratio)

Check Limiting Cases:

$g \uparrow \quad \omega \uparrow$ ✓

$r \uparrow \quad \omega \downarrow$ ✓ (linear velocity scales as r)

$\mu_s \uparrow \quad \omega \downarrow$ ✓ ("wall is "stickier")

Obtain a numeric solution:
(i.e. plug in the numbers)

[A] $\omega = 2.44$ rad/sec

[B] $\omega = 1.68$ rad/sec

[C] $\omega = 2.02$ rad/sec

Why is solution reasonable? Explain.

- units check
- limiting cases check