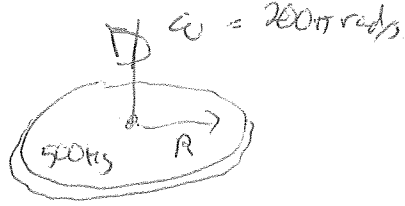
10-39



What's rotational K.E.?

$K.E. = \frac{1}{2} I \omega^2$

What's I? for a disk, it's $\frac{1}{2} MR^2$

So $KE = \frac{1}{2}\left(\frac{1}{2} MR^2\right)\omega^2 = \frac{1}{4}(500kg)(1.0m)^2(200\pi\ rad/s)^2$

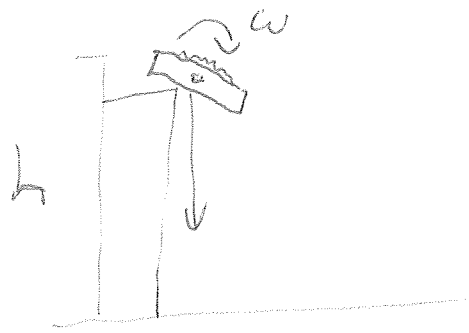
a) $= 4.9 \times 10^7 J$

b) What's power? Energy/time $P = K.E./t$

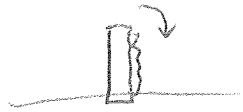
So $t = \frac{K.E.}{P} = \frac{4.9 \times 10^7 J}{8.0 \times 10^3 W} = 6,200$ seconds

or $t \approx 100$ minutes

10-3 | $h = 76\text{cm}$ with $1\text{rev} = 2\pi$ rads



Let's say it starts butter side up, since most people aren't deliberately messy.

It has to rotate at least $\frac{1}{4}$ turn to hit like this: 

and let's say that it's angular momentum will tip it over in the right direction to get dog hair all over your butter.

certainly if it goes $\frac{1}{2}$ turn it's a mess: 

and if it goes $\frac{3}{4}$ turn it could be saved but might still tip: 

although I think momentum would save you.

So: In time t, $\omega \cdot t \geq \frac{1}{2}(2\pi)$ or $\leq \frac{3}{4}(2\pi)$ makes a mess.

What's t? How long does something take to fall 76cm?

From ch. #2, $\Delta y = \frac{1}{2} g t^2$, so $t = \sqrt{\frac{2h}{g}} = 0.394\text{s}$.

so $\omega \cdot t \geq \frac{1}{2}(2\pi) \cdot t \Rightarrow \omega = \frac{\pi}{t} = 4.0\ \text{rads/s}$

and $\omega = \frac{3\pi/2}{t} = 12.0\ \text{rads/s}$