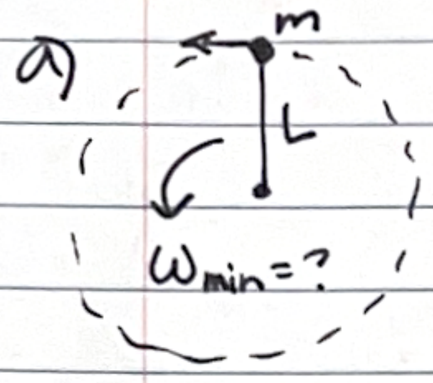
p.201 #52

a)



For speeds greater than ω_{min}, the forces on the ball are

$\vec{T}$ ↓ $\vec{F}_G$

At the moment the string goes slack / doesn't go slack (that critical moment), the forces are:

↓ $\vec{F}_G$

We set $\vec{T}=0$ to find this critical speed when this happens.

Represent mathematically:

$\Sigma F_r = ma_r$

$F_G = m(\omega^2 r)$

$mg = m\omega^2 r$

$\sqrt{\frac{g}{r}} = \omega$

$$\boxed{\sqrt{\frac{g}{L}} = \omega}$$

b) Evaluate ω_{min} for $m=65g, L=1.0m$

$$\omega_{min} = \sqrt{\frac{g}{L}}$$

$$= \sqrt{\frac{9.8 m/s^2}{(1.0m)}}$$

$$= \boxed{3.1 \text{ rad/s}}$$

Need it in rpm:

$$3.1 \frac{\text{rad}}{\text{s}}\left(\frac{60\text{ s}}{1\text{ min}}\right)\left(\frac{1\text{ rev}}{2\pi\text{ rad}}\right) = \boxed{30\text{ rpm}}$$