32. (a) The angular speed in rad/s is

$$\omega = \left(33\frac{1}{3}\,\text{rev/min}\right)\left(\frac{2\pi\,\text{rad/rev}}{60\,\text{s/min}}\right) = 3.49\ \text{rad/s}\ .$$

Consequently, the radial (centripetal) acceleration is (using Eq. 11-23)

$$a = \omega^2 r = (3.49\,\text{rad/s})^2\left(6.0\times 10^{-2}\,\text{m}\right) = 0.73\,\text{m/s}^2\ .$$

(b) Using Ch. 6 methods, we have $ma = f_s \le f_{s,\,\text{max}} = \mu_s mg$, which is used to obtain the (minimum allowable) coefficient of friction:

$$\mu_{s,\,\text{min}} = \frac{a}{g} = \frac{0.73}{9.8} = 0.075\ .$$

(c) The radial acceleration of the object is $a_r = \omega^2 r$, while the tangential acceleration is $a_t = \alpha r$. Thus

$$|\vec{a}| = \sqrt{a_r^2 + a_t^2} = \sqrt{(\omega^2 r)^2 + (\alpha r)^2} = r\sqrt{\omega^4 + \alpha^2}\ .$$

If the object is not to slip at any time, we require

$$f_{s,\text{max}} = \mu_s mg = ma_\text{max} = mr\sqrt{\omega_\text{max}^4 + \alpha^2}\ .$$

Thus, since $\alpha = \omega/t$ (from Eq. 11-12), we find

$$\begin{aligned}
\mu_{s,\text{min}} &= \frac{r\sqrt{\omega_\text{max}^4 + \alpha^2}}{g} \\
&= \frac{r\sqrt{\omega_\text{max}^4 + (\omega_\text{max}/t)^2}}{g} \\
&= \frac{(0.060)\sqrt{3.49^4 + (3.49/0.25)^2}}{9.8} \\
&= 0.11\ .
\end{aligned}$$