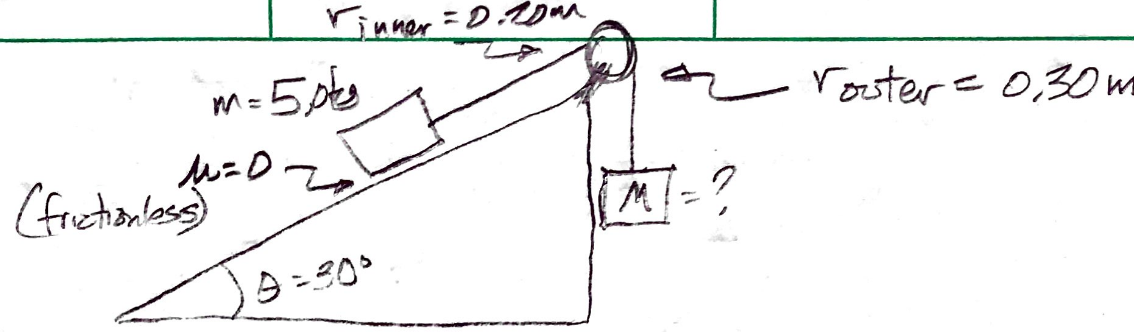
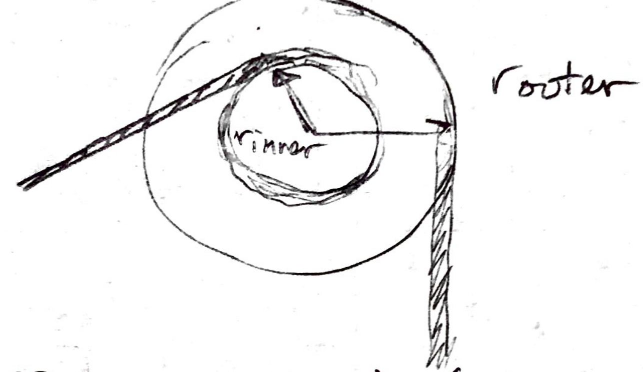
10.75



The problem doesn't explain this, but apparently the hanging mass has its cord running over an outer radius that is different from the radius of an attached, inner pulley.



Torque effects are balanced (pulley isn't rotating), so

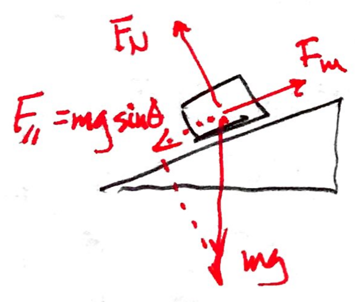
$$\tau_m = \tau_M$$

$$r \times F_m = r \times F_M$$

$$(0.20\text{m})(5\text{kg})(9.8)(\sin 30) = (0.30\text{m})(M)(9.8)$$

$$4.9 = 2.94M$$

$$M = \boxed{1.67\text{kg}}$$



$F_M = Mg$

$$\Sigma F_x = ma_x = 0$$

$$F_m - mg\sin\theta = 0$$

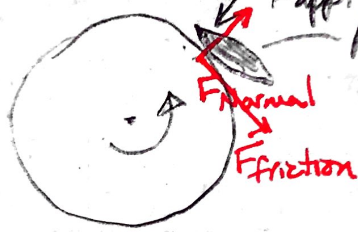
$$F_m = mg\sin 30$$

10.84

$m = 90.0\,kg$
$r = 0.340\,m$

Grindstone (used to grind & polish blades)

$$\omega = \frac{90 \text{ rotations}}{\text{minute}} \times \frac{2\pi \text{ rads}}{1 \text{ rotation}} \times \frac{1 \text{ min}}{60 s} = 9.4248 \text{ rad/sec}$$



$F_{applied} = 20.N$ radial force, so $F_{Normal} = 20.N$ as well!

$\mu = 0.20$, so what is α?

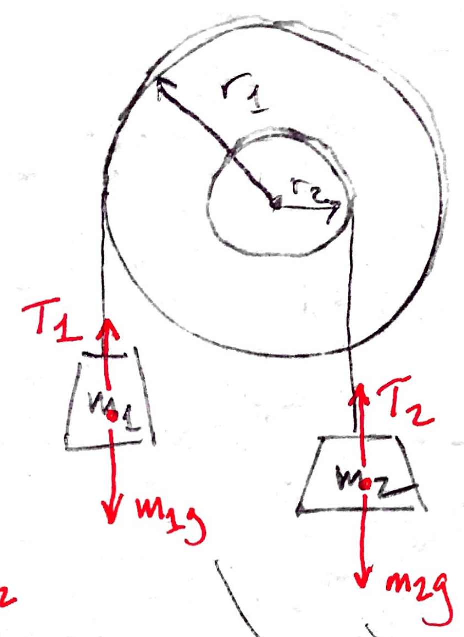
$$F_f = \mu F_N$$
$$= (0.20)(20N)$$
$$F_f = 4.0N$$, which acts as a torque on the spinning wheel.

$$\tau = I\alpha$$
$$rF = \left(\tfrac{1}{2}MR^2\right)\alpha$$
$$\alpha = \frac{2RF}{MR^2}$$
$$= \frac{(2)(4N)}{(90)(0.34)}$$
$$= \boxed{0.261 \text{ rad/s}^2}$$

b) Find θ during slowing down.

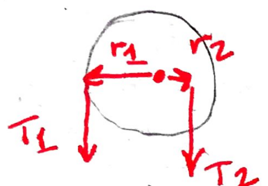
$$\omega_f^2 = \omega_i^2 + 2\alpha\theta$$
$$\theta = \frac{\omega_f^2 - \omega_i^2}{2\alpha} = \frac{0 - (9.4248 \text{ rad/s})^2}{2(-0.261)} = \boxed{170 \text{ rads}}$$

10.92



$I = 2.0\,kg\,m^2$
$r_1 = 0.50\,m$
$m_1 = 1.0\,kg$
$r_2 = 0.20\,m$
$m_2 = 2.0\,kg$

We need to find accelerations, so a Force/Torque analysis is recommended. That implies Free-body diagrams.



$\Sigma F = ma$
$T_2 - m_2 g = m_2 a$

$\Sigma F = ma$
$m_1 g - T_1 = m_1 a$

$\Sigma \tau = I\alpha$
$\tau_1 - \tau_2 = I\alpha$
$r_1 T_1 - r_2 T_2 = I\alpha$

3 equations, so let's substitute & solve!

$T_2 = m_2 a + m_2 g$
$a = r\alpha$, so
$T_2 = m_2 r_2 \alpha + m_2 g$

$T_1 = m_1 g - m_1 a$
$T_1 = m_1 g - m_1 r_1 \alpha$

$r_1(m_1 g - m_1 r_1 \alpha) - r_2(m_2 r_2 \alpha + m_2 g) = I\alpha$

$r_1 m_1 g - m_1 r_1^2 \alpha - r_2^2 m_2 \alpha - r_2 m_2 g = (2)\alpha$

$4.9 - 0.25\alpha - 0.08\alpha + -3.92 = 2\alpha$

$4.9 - 3.92 = 2.33\alpha$

$\alpha = \boxed{0.421\ rad/s^2}$

$a = r\alpha$, so

$a_1 = r_1\alpha$
$= (0.5)(0.421)$
$= \boxed{0.210\ m/s^2}$ down

$a_2 = r_2\alpha$
$= (0.2)(0.421)$
$= \boxed{0.0842\ m/s^2}$ up