LAST Name: Answer.

First Name:

Student Number:

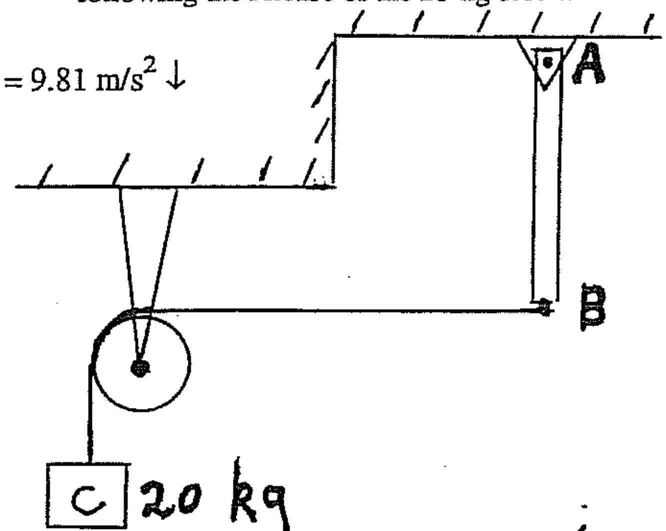
MIE 200F - Quiz number 7a - November 21/00
quiz duration = 25 minutes

A rope is tied between a 20-kg block and a thin rod of mass 10 kg and length 3 meters. The center of the wheel and the point "A" are both pinned to the ceiling. The 20-kg block is released from rest at the position shown.

(a) What is the moment of inertia of the rod about the point "A"?

(b) What will be the angular acceleration of the rod immediately following the release of the 20-kg block?

$g = 9.81\ m/s^2 \downarrow$



$T_2 = T_1 + U_{1\to2}$

$I_{c\,of\,g}$ for a rod $= m L^2/12$ $\qquad I_o = I_{c\,of\,g} + m d^2$

$I_{c\,of\,g}$ for a uniform disk $= m R^2/2$ $\qquad I_{c\,of\,g} = m$

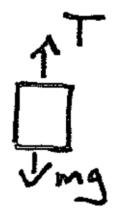
$\vec{V}_P = \vec{V}_Q + \vec{V}_{P/Q}$ $\qquad |\vec{V}_{P/Q}| = \omega R_{PQ}$

$\vec{a}_{P/Q} = -(\omega^2 R_{PQ})\hat{e}_r + (\alpha r)\,\hat{e}_\theta$ $\qquad \vec{a}_P = \vec{a}_Q + \vec{a}_{P/}$

$T = \frac{1}{2} m (v_{c\,of\,g})^2 + \frac{1}{2} I_{c\,of\,g}\,\omega^2 = \frac{1}{2} I_o\,\omega^2$

$\downarrow x$ $\quad \curvearrowleft +$

mass C



$F = ma$

$(mg)_c - T = m_c a$

$T = -20a + 196.2$ ①

Bar AB / $\curvearrowleft +$ $\Sigma M_A = I_A \alpha$

$3T = (\frac{1}{12} mL^2 + (L/2)^2 \alpha$

$3T = \frac{1}{3} m_{AB} L^2 \alpha$

$3T = (\frac{1}{3})(10)(3^2)\alpha$

$T = 10\alpha$ ②

combine ① & ②, using $a = 3\alpha$

$$\left.\begin{array}{l} T = 10\alpha \\ T = -60\alpha + 196.2 \end{array}\right\}$$

$10\alpha = -60\alpha + 196.2$

$\alpha = 2.80\ s^{-2}$ $\curvearrowleft +$

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