(7) ~~(8)~~

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(5)

p314 - Problems

53) $I_1 = 1 \times 10^{-3}$ kg m²   · turntable frictionless air cushion
$\omega_{o1} = 2.0$ rev/s

$m_2 = 1$ g $= 1\times10^{-3}$ kg   a) $\omega_f = ?$
$r = .15$ m

$L_o = L_f$

① $\frac{2.0\,rev}{s}\left(\frac{2\pi\,rad}{1\,rev}\right) = 4\pi$ rad/s

$I_o\omega_o = I_f\omega_f$

$I_o\omega_o = (I_1 + mr^2)\omega_f$

$\omega_f = \frac{I_o\omega_o}{I_1 + mr^2} = \frac{(1\times10^{-3}\,kg\,m^2)(4\pi\,\frac{rad}{s})}{(1\times10^{-3}\,kg\,m^2 + (1\times10^{-3}\,kg)(.15\,m)^2}$

(2)

$= 12$ rad/s

b) $\Delta K = ?$ system

① $K_o = \frac{1}{2}I\omega_o^2 = \frac{1}{2}(1\times10^{-3}\,kg\,m^2)(~~4\pi~~ \text{ 12.6 } \frac{rad}{s})^2$
$= .079$ J

② $K_f = \frac{1}{2}I\omega_f^2 = \frac{1}{2}(I + mr^2)(\omega_f^2)$
$= \frac{1}{2}(1\times10^{-3}\,kg\,m^2 + (1\times10^{-3}\,kg)(.15\,m)^2)(12\,rad/s)^2$
$= .674$ J

③ $\Delta K = K_f - K_o = .074\,J - .079\,J = -.005$ J

online
$\omega = 12.29$ rad/s
$K_o = .07896$
K_f w/ 12.29 rad/s is .07722
so $\Delta K = .002$

→

~~8~~ 7

c) ΔK turntable

$$\Delta K = \frac{1}{2} I \omega_f^2 - \frac{1}{2} I \omega_0^2$$

$$= \frac{1}{2}(1 \times 10^{-3}\, kg\,m^2)\left((12\ rad/s)^2 - (\cancel{4\pi}\ 12.6\ rad/s)^2\right)$$

$$= -.0696\ J$$ $(-.034\ J$ w/ $\omega_0 = 12.29\ rad/s)$

(1)

d) ΔK beetle

$$\Delta K = \frac{1}{2} I_f \omega_f^2 - \cancel{K_0} = \frac{1}{2}(mr^2)\omega^2$$

$$= \frac{1}{2}(1 \times 10^{-3}\, kg)(.15\, m)^2(12\ rad/s)^2$$

$$= .00162\ J$$

~~8~~ 7

62) merry go round disk shaped platform

$m_p = 120kg$ · starts at rest
$m_1 = 60kg$ · student running clockwise
$r_1 = 4.0m$
$v_1 = 2.0 m/s$ a) $\omega_{platform} = ?$

① $\omega_1 = \frac{V_1}{r_1} = \frac{2.0m/s}{4.0m}$ $L_o = L_f$

$= .50 rad/s$ $0 \ kg\frac{m^2}{s} = L_p + L_1 = I_p\omega_p + I_1\omega_1$

$0 \ kg\frac{m^2}{s} = \frac{1}{2} m_p r_p^2 \omega_p + m_1 r_1^2 \omega_1$
platform person

(2) $-\frac{1}{2}(120kg)(4.0m)^2(\omega_p) = (60kg)(4.0m)^2(-.50 \frac{rad}{s})$

$\omega_p = +.5 rad/s$

b) ΔK system

$\Delta K = K_f - K_o = \frac{1}{2}I\omega^2 + \frac{1}{2}mv^2$

$\frac{1}{2}(\frac{1}{2}m_p r^2)\omega^2 + \frac{1}{2}mv^2$

$= \frac{1}{2}(\frac{1}{2})(120kg)(4.0m)^2(.5 rad/s)^2$

$+ \frac{1}{2}(60kg)(2.0m/s)^2$

$= 240J$