

HW 76 p 313 Problems 42, 43, 44

①
⑥

p 313 - Problems

⑤
④

42) disk shaped flywheel

a) $m = 10 \text{ kg}$
 $r = 9.0 \text{ cm} = 0.090 \text{ m}$
 $\omega = 320 \text{ rad/s}$

~~④~~ $L = ?$

$$L = I\omega = \frac{1}{2}mr^2\omega$$

$$\frac{1}{2}(10 \text{ kg})(0.090 \text{ m})^2(320 \text{ rad/s})$$

$$L = 13 \text{ kg m}^2/\text{s}$$

②

b) solid sphere $\omega = ?$ for same L

$m = 10 \text{ kg}$
 $r = 9 \text{ cm} = 0.09 \text{ m}$
 $\omega = ?$

$$L = I\omega$$

$$\omega = \frac{L}{I} = \frac{L}{\frac{2}{5}mr^2}$$

$$= \frac{13 \text{ kg m}^2/\text{s}}{\frac{2}{5}(10 \text{ kg})(0.09 \text{ m})^2}$$

$$= 400 \text{ rad/s}$$

or $L = L$
 $I_{\text{disk}}\omega_{\text{disk}} = I_{\text{sphere}}\omega_{\text{sphere}}$
$$\omega_{\text{sphere}} = \frac{I_{\text{d}}}{I_{\text{s}}}\omega = \frac{\frac{1}{2}mr^2}{\frac{2}{5}mr^2}\omega = \frac{5}{4}\omega_{\text{disk}} = \frac{5}{4}(320 \text{ rad/s})$$

$$= 400 \text{ rad/s}$$

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43) Ballet - arms + one leg extended
draws arms + leg in

$$\omega_0 = 1 \text{ rev/s}$$

$$I_0 = ?$$

$$I_f = 0.80 \text{ kg m}^2$$

$$\omega_f = 4.0 \text{ rev/s}$$

$$L_0 = L_f$$

$$I_0 \omega_0 = I_f \omega_f$$

$$I_0 = \frac{I_f \omega_f}{\omega_0} = \frac{(0.80 \text{ kg m}^2)(4.0 \text{ rev/s})}{(1 \text{ rev/s})}$$

$$= 3.2 \text{ kg m}^2$$

44) ~~measuring~~

$$m = 0.20 \text{ kg}$$

$$l = 0.50 \text{ m}$$

$$\omega_0 = 2.0 \text{ rad/s}$$

$$r_f = 0.20 \text{ m}$$

• block at end string along
circular path on frictionless
table

• string pulled through hole

$$L_0 = L_f$$

$$I_0 \omega_0 = I_f \omega_f$$

$$M r_0^2 \omega_0 = M r_f^2 \omega_f$$

$$\omega_f = \frac{r_0^2 \omega_0}{r_f^2} = \frac{(0.50 \text{ m})^2}{(0.20 \text{ m})^2} (2.0 \text{ rad/s})$$

$$= 13 \text{ rad/s}$$

$$b) v_{Tf} = ? \quad v_T = \omega r = (13 \text{ rad/s})(0.2 \text{ m})$$

$$= 2.6 \text{ m/s}$$

$$\left[(12.5 \text{ rad/s})(0.2 \text{ m}) = 2.5 \text{ m/s} \right]$$

(1)

(2)