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General Physics I, Quiz 3
PHYS1000AA, Class year102
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SN:_____, Name:_____

Chapter 11-13 Serway; ABSOLUTELY NO CHEATING!
Please write the answers on the blank space or on the back of this paper to save resources.

1. (a) For an axis of rotation passing through the center of mass, the magnitude of the angular momentum is given by

$$L = I\omega = \left(\frac{1}{2}MR^2\right)\omega = \frac{1}{2}(3.00\text{ kg})(0.200\text{ m})^2(6.00\text{ rad/s})$$

$$= \boxed{0.360\text{ kg}\cdot\text{m}^2/\text{s}}$$

(b) For a point midway between the center and the rim, we use the parallel-axis theorem to find the moment of inertia about this point. Then,

$$L = I\omega = \left[\frac{1}{2}MR^2 + M\left(\frac{R}{2}\right)^2\right]\omega$$

$$= \frac{3}{4}(3.00\text{ kg})(0.200\text{ m})^2(6.00\text{ rad/s}) = \boxed{0.540\,\text{kg}\cdot\text{m}^2/\text{s}}$$

2. The gravitational force on a small parcel of material at the star's equator supplies the necessary centripetal acceleration:

$$\frac{GM_s m}{R_s^2} = \frac{m\upsilon^2}{R_s} = mR_s\omega^2$$

so $$\omega = \sqrt{\frac{GM_s}{R_s^3}} = \sqrt{\frac{\left(6.67\times10^{-11}\text{ N}\cdot\text{m}^2/\text{kg}^2\right)\left[2\left(1.99\times10^{30}\text{ kg}\right)\right]}{(10.0\times10^3\text{ m})^3}}$$

$$\omega = \boxed{1.63\times10^4\text{ rad/s}}$$