

NAME \_\_\_\_\_

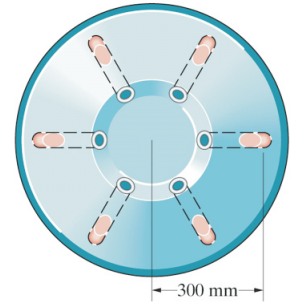
DATE \_\_\_\_\_

**WEEK:** \_\_\_\_\_

**PROBLEM:** \_\_\_\_\_

**GIVEN:**

Suppose you want to design a medical centrifuge to subject samples to normal accelerations of  $1000 g$ 's. (a) If the distance from the center of the centrifuge to the sample is 300 mm, what speed of rotation in rpm is necessary? (b) If you want the centrifuge to reach its design rpm in 1 min, what constant angular acceleration is necessary?



**REQUIRED:**

**SOLUTION:**

- (a) The normal acceleration at a constant rotation rate is  $a_n = R\omega^2$ , giving

$$\omega = \sqrt{\frac{a_n}{R}} = \sqrt{\frac{(1000)9.81}{0.3}} = 180.83 \text{ rad/s.}$$

The speed in rpm is

$$N = \omega \left( \frac{\text{rad}}{\text{s}} \right) \left( \frac{1 \text{ rev}}{2\pi \text{ rad}} \right) \left( \frac{60 \text{ s}}{1 \text{ min}} \right) = 1730 \text{ rpm}$$

- (b) The angular acceleration is

$$\alpha = \frac{\omega}{t} = \frac{180.83}{60} = 3.01 \text{ rad/s}^2$$