

40. We use conservation of angular momentum: $I_m\omega_m = I_p\omega_p$. The respective angles θ_m and θ_p by which the motor and probe rotate are therefore related by

$$\int I_m\omega_m dt = I_m\theta_m = \int I_p\omega_p dt = I_p\theta_p$$

which gives

$$\theta_m = \frac{I_p\theta_p}{I_m} = \frac{(12\text{ kg}\cdot\text{m}^2)(30^\circ)}{2.0 \times 10^{-3}\text{ kg}\cdot\text{m}^2} = 180000^\circ .$$

The number of revolutions for the rotor is then $1.8 \times 10^5/360 = 500$ rev.