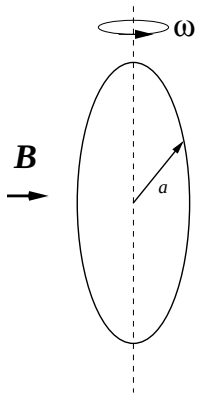
Q2 A circular loop of wire of radius a, resistance R, and moment of inertia I is rotating around an axis in the plane of the loop, initially at an angular frequency ω_0. A uniform static magnetic field $\mathbf{B}$ is applied perpendicular to the rotation axis.



a) What is the initial kinetic energy of the loop?
b) What is the current induced in the loop? (You may assume that R is large enough that you can ignore the self-inductance of the loop)
c) Assuming that all energy loss goes into the Joule heating of the loop, compute the rate at which the kinetic energy of the loop is dissipated.
d) Either by using your energy-loss equation from part (c) or by another method, derive a differential equation that describes the time dependence of the angular position, $\theta(t)$, of the loop.
e) Assuming that the energy dissipated per cycle is small, estimate how long will it take for $\dot{\theta} = \omega(t)$ to fall to e^{-1} of its initial value.