DEPARTMENT OF PHYSICS
INDIAN INSTITUTE OF TECHNOLOGY, MADRAS

PH1020 Physics II

Tutorial 7 (19.3.2018)

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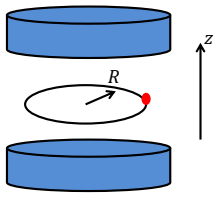
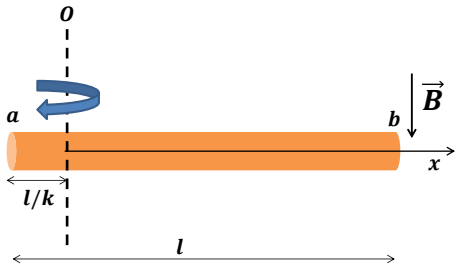
1. A charge q is moving in a circular orbit of radius R about the center of a cylindrically symmetrical magnet, as shown. Assume that the orbit

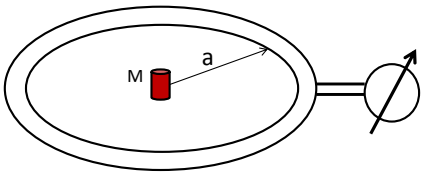


of the charge lies in the median plane between the poles of the magnet and hence the only component of magnetic field that it sees is in the z direction. The field is now allowed to increase with time. Determine the condition under which the particle will accelerate without any change in the radius of the orbit.

2. A horizontal metallic rod of length l rotates at a frequency ν about a vertical axis which is at a distance l/k from one of its ends. Find the potential difference between the ends of the rod if it rotates in a uniform vertical magnetic field $\mathbf{B}$. Assume that $k = 3$, $l = 12$ m, $\nu = 6$ s^{-1} and B $= 10^{-2}$ Tesla.



3. A tiny magnet M is placed at the center of a thin coil of radius a containing N turns. The coil is connected to a ballistic galvanometer. The resistance of the circuit is R. When the magnet was rapidly removed away from the coil a charge q passed through the galvanometer. Find the magnetic moment of the magnet. You may assume the magnetic field in the plane of the coil to be nearly uniform when a current is passed through it.



4. Consider a long straight wire placed in the same plane of a circular loop of radius a and at a distance D from its center. Find the mutual inductance.