

## Answer to Question #70009, Physics / Electromagnetism

### Question:

A conducting rod of length  $l$  is hinged at point  $O$ . It is free to rotate in a vertical plane. There exists a uniform magnetic field  $B$  (into the plane) in horizontal direction. The rod is released from the position shown. The potential difference between the two ends of the rod is proportional to

### Solution:

In general the potential difference between two points on the conductor moving in the magnetic field can be calculated as

$$U = -\frac{d\Phi}{dt}$$

Where  $\frac{d\Phi}{dt}$  is the rate of change of the magnetic flux

In this task

$$\frac{d\Phi}{dt} = \frac{d(SB)}{dt} = B \frac{d\left(\frac{l^2}{2}\varphi\right)}{dt} = \frac{l^2 B}{2} \left(\frac{d\varphi}{dt}\right)$$

**So the potential difference between the two ends of the rod is proportional to**

**$l^2$  and  $B$**