Answer on Question 61813, Physics, Electric Circuits

Question:

A rod of 5.0 m length is held horizontally and with its axis in an east-west direction. It is allowed to fall straight down. What is the emf induced in it when its speed is 3.0 m/s if the Earth's magnetic field is $0.6 \cdot 10^{-4} T$ with a dip angle of 53 degrees?

Solution:

We can find the emf induced from the definition of the motional emf:

$$\mathcal{E} = B_{\perp} lv = Blvcos\theta,$$

here, B is the Earth's magnetic field, $B_{\perp} = Bcos\theta$ is the component of the Earth's magnetic field which is perpendicular to the plane of the rod, θ is the angle between the magnetic field and the normal to the plane of the rod, l is the length of the rod and v is the speed of the rod.

Then, from this formula we get:

$$\mathcal{E} = Blvcos\theta = 0.6 \cdot 10^{-4} T \cdot 5.0\, m \cdot 3.0\, ms^{-1} \cdot cos53^{\circ} = 5.41 \cdot 10^{-4}\, V.$$

Answer:

$\mathcal{E} = 5.41 \cdot 10^{-4}\, V.$