Electromagnetic Induction

- **Faraday's Law:**

Michael Faraday discovered that a changing magnetic flux will induce a voltage in a conductor.

$$\text{Induced Voltage: } \mathcal{E}_{ind} = \frac{-N\,\Delta\,\Phi}{\Delta t}$$

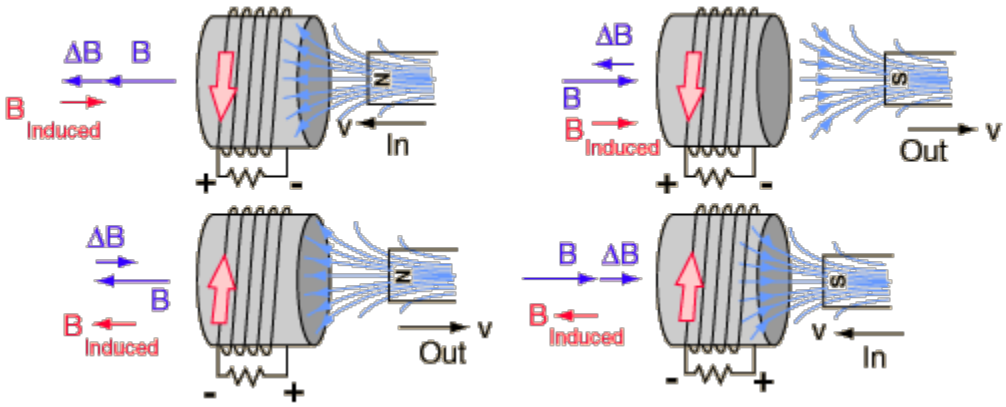
"Special Case" – a conducting rod moves through a magnetic field:

$$\mathcal{E}_{ind} = B\ell v$$

- In other words, if you do something to change the number of field lines in a magnetic field near a conductor, the conductor will behave like a battery with a + and – terminal.
- If the conductor is in a loop (closed circuit) electric current is induced:

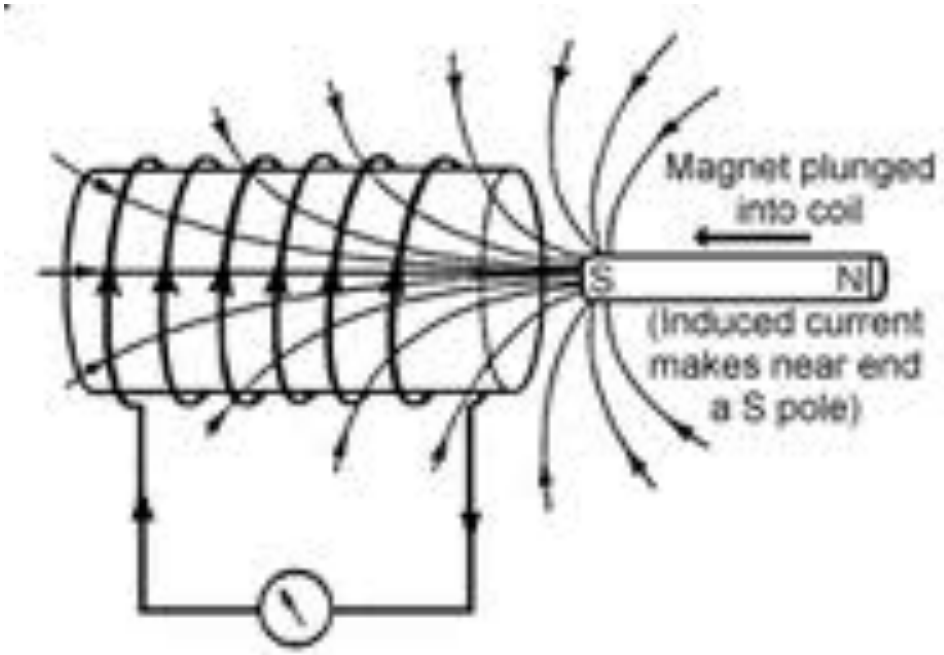
- Direction of the induced current is given by the **Lenz's Law:**

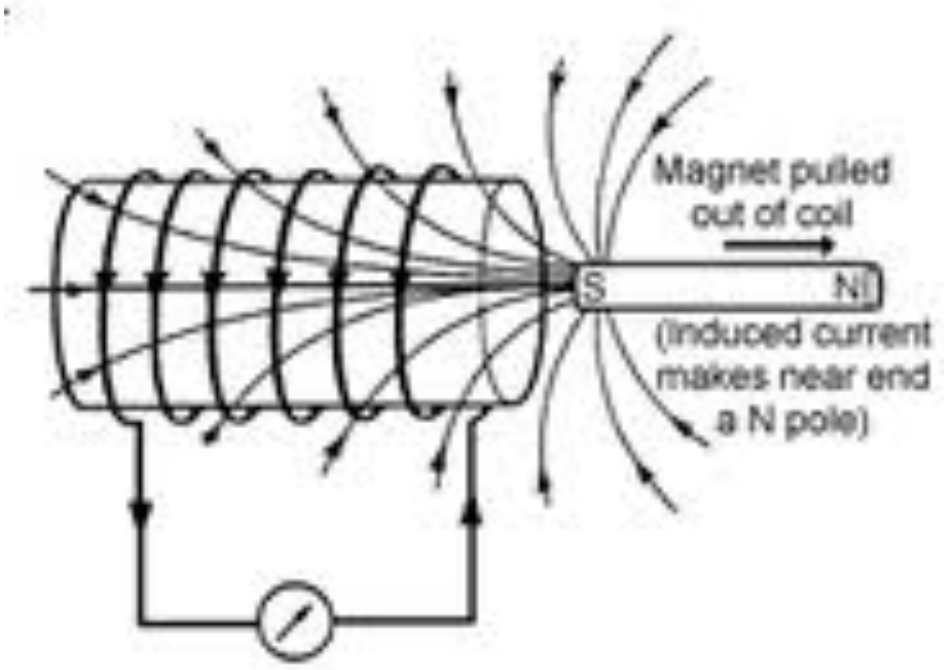
A current produced by an induced emf moves in a direction so that its magnetic field OPPOSES the original change in flux



MAGNETIC FLUX = number of magnetic field lines passing through the loop of a wire

Symbol: _____ Units:_____ = _____





1. A straight wire, 0.20 m long, moves at a constant speed of 7.0m/s perpendicular to a magnetic field of strength 8.0×10^{-2}T.

a) Find the emf induced in the wire.

b) If the wire is part of a circuit that has a resistance of 0.50Ω. What is the current through the wire?

2. A straight wire, 25m long, is mounted on an airplane flying at 125m/s. The wire moves in a perpendicular direction through Earth's magnetic field ($B=5.0 \times 10^{-5}$T). What emf is induced in the wire?