

Physics 12 Electromagnetic Induction Worksheet

Name: _____

Magnetic Field Strength of a solenoid $B =$

[Tesla]

$$\mu_0 \frac{NI}{L}$$

$4\pi \times 10^{-7}$ — number of wraps
— current.
 L — length.

Induced EMF in a wire = $\mathcal{E} =$

$$Bv\ell$$

— velocity

$B + v$ must be \perp

Faraday's Law = $\mathcal{E} =$

$$-N \frac{\Delta\Phi}{\Delta t} = -N \frac{(B_f A_f - B_i A_i)}{\Delta t}$$

— mag field strength
— area

Magnetic Field Strength of a solenoid

1. A solenoid has 40 wraps over a length of 10 cm and carries a current of 3 A. What is the magnetic field strength inside the solenoid?

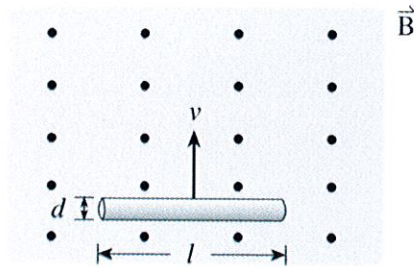
2. You want to create a solenoid (electromagnet) with a magnetic field strength of 2 T. The solenoid is 20 cm long and has 50 wraps. How much current will you need?

Induced EMF in a wire

An aircraft with a wingspan of 24 m flies at 85 m/s perpendicular to a magnetic field. An emf of 0.19 V is induced across the wings of the aircraft. What is the magnitude of the magnetic field?

- A. 9.3×10^{-5} T
- B. 5.4×10^{-2} T
- C. 6.7×10^{-1} T
- D. 3.9×10^2 T

A length of conducting wire is moving perpendicular to a magnetic field as shown below.



Which of the following does not affect the size of the emf produced between the ends of the wire?

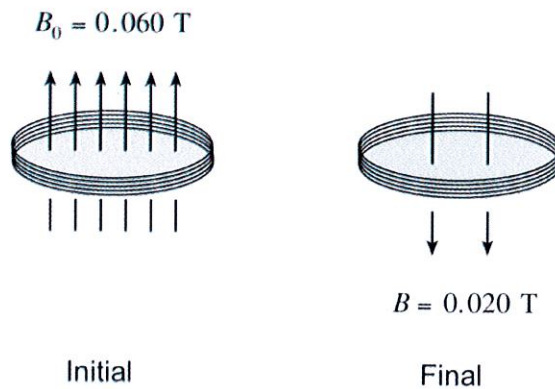
- A. speed of wire
- B. length of wire
- C. thickness of wire
- D. magnetic field strength

Faraday's Law

A coil having 150 turns and a cross-sectional area of 0.042 m^2 is oriented with its plane perpendicular to a 0.12 T magnetic field. If the field increases to 0.66 T in 0.25 s , what emf is induced in the coil?

- A. 9.8 V
- B. 14 V
- C. 20 V
- D. 320 V

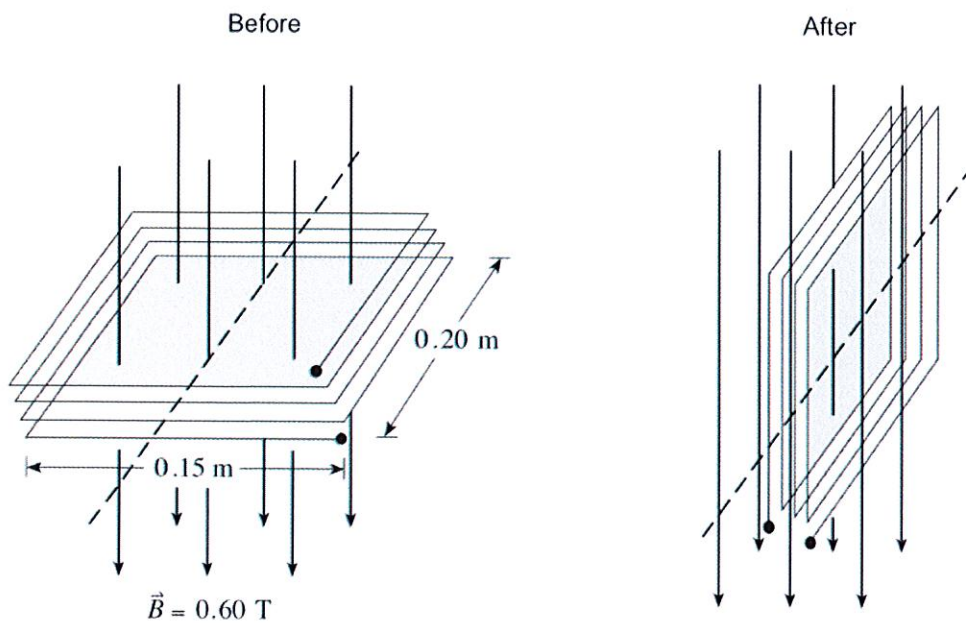
A 500-turn circular coil with an area of $1.54 \times 10^{-2} \text{ m}^2$ is perpendicular to a 0.060 T field. The magnetic field changes to 0.020 T in the opposite direction in 0.12 s .



What is the average emf induced in the coil?

- A. $5.1 \times 10^{-3} \text{ V}$
- B. $1.0 \times 10^{-2} \text{ V}$
- C. 2.6 V
- D. 5.1 V

The diagram shows a coil with 25 windings and dimensions 0.15 m by 0.20 m. Its plane is perpendicular to a magnetic field of magnitude 0.60 T.



If the coil rotates 90° in 4.17×10^{-2} s so that its plane is now parallel to the magnetic field, what average emf is induced during this time? **(7 marks)**