



Name: _____

Due Date _____

Assignment 5.03: Magnetic Induction

1. A magnetic field is directed into the page. There is a circular loop of wire with radius 0.25m in the plane of the page. The magnetic field strength is increasing at a rate of 0.1 T/s.
 - (a) Does the induced current flow in a clockwise or counterclockwise direction? Explain your reasoning.

 - (b) What is the magnitude of the induced EMF?

2. A magnetic field is directed out of the page, and is changing in strength. There is a square-shaped piece of wire with each side having a length of 0.25 m. The current induced in the wire is 0.2 Amps in a counterclockwise direction. The resistance of the wire is 1Ω .
 - (a) Is the magnetic field getting stronger or weaker? Explain your reasoning.

 - (b) At what rate is the magnetic field changing?

3. An equilateral triangle is oriented in the plane of the page. A magnetic field is changing at a rate of 2 T/s, directed into the page. The current that flows in the triangle is 1.5A and the resistance of the triangle is 2Ω .
 - (a) Does the induced current flow clockwise or counterclockwise?

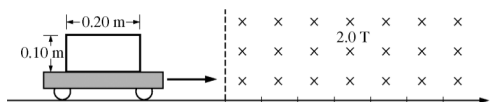
 - (b) What is the length of the sides of the equilateral triangle?



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4. A hollow rectangle of metal is attached to all-plastic wheels. As shown in the diagram, it then rolls to the right at a speed of 0.75 m/s , into a region of magnetic field. The strength of magnetic field is 2T .



- (a) When the front edge of the cart has entered the magnetic field, but the back edge has not, what direction does current flow in the wire?
- (b) The resistance of the rectangle is 0.2Ω . What is the current in the wire?
- (c) Calculate the force exerted on the cart as it enters the magnetic field.
- (d) What is the force exerted on the cart when it is completely in the magnetic field?
5. Induction stoves work by generating a rapidly oscillating magnetic field. This causes current to flow in a ferromagnetic pot above it. As current flows, resistive losses due to Ohm's Law cause the pot to heat up. Suppose a magnetic field oscillates from 0.01 T to -0.01 T at a rate of 24 kHz .
- (a) Determine the average rate of change of the magnetic field.
- (b) If a frying pan is a circle with a radius of 8cm , what is the EMF induced in the pan?
- (c) Determine the power that is delivered to the pan if its resistance is 0.25Ω .
- (d) If the frying pan is made of Cast Iron ($c = 450 \frac{\text{J}}{\text{kg}^\circ\text{C}}$), and has a mass of 0.6 kg , how long would it take to heat up from 20°C to 100°C