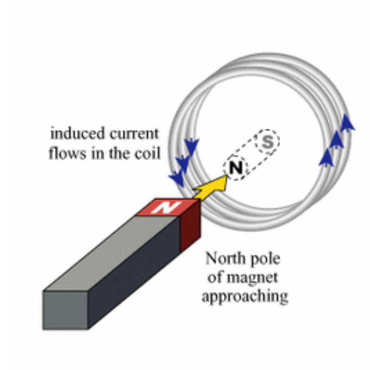
Electromagnetic Induction Self-TEST

1. Describe how you can generate current in a coil of wire using a magnet.

2. Describe what magnetic flux is and indicate what units it has?

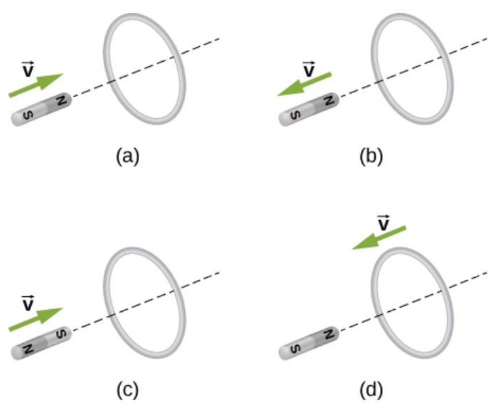


3. What are the units for Magnetic field?

4. What does $\frac{\Delta \Phi}{\Delta t}$ in this unit mean?

5. Describe what Lenz's law state

6. Determine the direction that current would be induced in each of the loops below using lenz's law. (clockwise or counter clock-wise)…hint: pretend each loop is part of a solenoid.



7.

24. A 50-turn coil has a diameter of 15 cm. The coil is placed in a spatially uniform magnetic field of magnitude 0.50 T so that the face of the coil and the magnetic field are perpendicular. Find the magnitude of the emf induced in the coil if the magnetic field is reduced to zero uniformly in

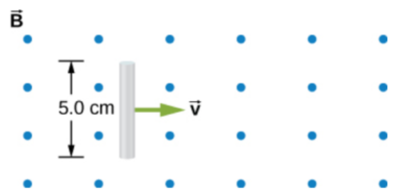
(a) 0.10 s,

8.

40. A coil of 1000 turns encloses an area of$25 cm^2$. It is rotated in 0.010 s from a position where its plane is perpendicular to Earth's magnetic field to one where its plane is parallel to the field. If the strength of the field is $6.0 \times 10^{-5} T$, what is the average emf induced in the coil?

9.

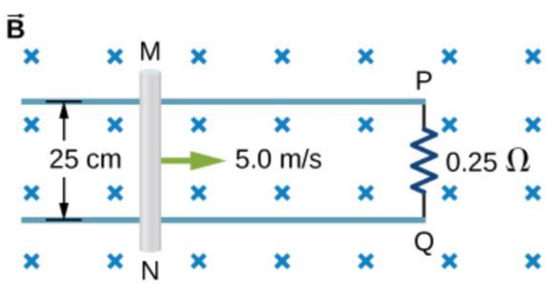
42. The rod shown in the accompanying figure is moving through a uniform magnetic field of strength $B = 0.50T$ with a constant velocity of magnitude $v = 8.0m/s$.. What is the potential difference between the ends of the rod? Which end of the rod is at a higher potential?



10.

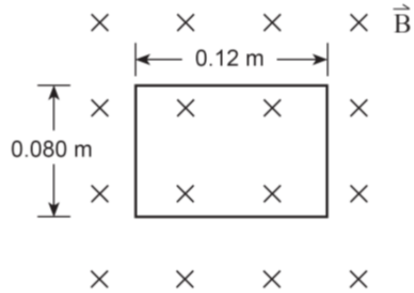
69. The conducting rod shown in the accompanying figure moves along parallel metal rails that are 25-cm apart. The system is in a uniform magnetic field of strength 0.75 T, which is directed into the page. The resistances of the rod and the rails are negligible, but the section PQ has a resistance of **0.25Ω.**

(a) What is the emf (including its sense) induced in the rod when it is moving to the right with a speed of 5.0 m/s?



11.

A rectangular coil measuring $0.12\ \text{m}$ by $0.080\ \text{m}$ is placed perpendicular to a $0.85\ \text{T}$ magnetic field as shown.



What is the magnetic flux through the coil?

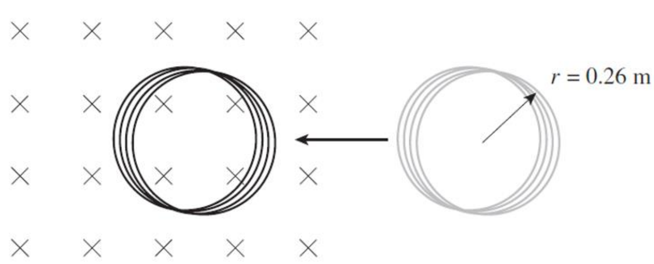
A. $0\ \text{Wb}$
B. $8.2 \times 10^{-3}\ \text{Wb}$
C. $6.8 \times 10^{-2}\ \text{Wb}$
D. $1.0 \times 10^{-1}\ \text{Wb}$

12.

A rectangular coil of wire containing 250 loops is placed in a magnetic field. Each loop measures $0.075\ \text{m}$ by $0.28\ \text{m}$. The magnetic field changes over a time interval of $0.36\ \text{s}$ producing an average emf of $1.3\ \text{V}$. What is the change in the magnetic field strength?

A 520-turn circular coil of radius 0.26 m is initially outside a 0.56 T magnetic field. The coil is moved into the magnetic field, inducing an average emf of 47 V.

13.



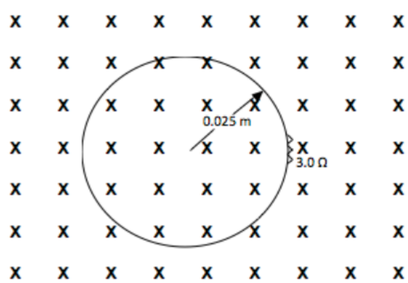
How much time does it take to move the coil to its new position?

A. $2.5 \times 10^{-3}\ \text{s}$
B. $1.3\ \text{s}$
C. $1.6\ \text{s}$
D. $2.6\ \text{s}$

14.

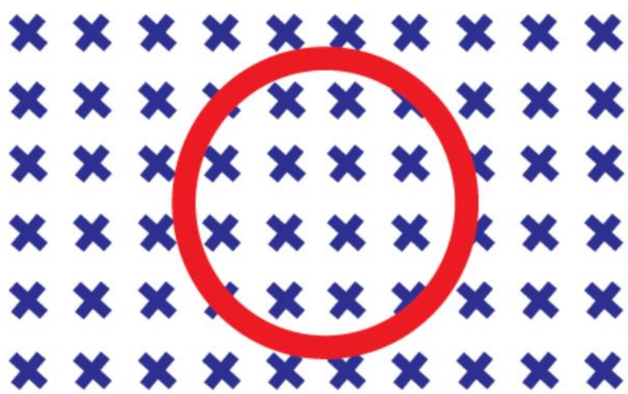
A circular loop of wire has a radius of 0.025 m and a resistance of 3.0 Ω. It is placed in a 1.6 T magnetic field which is directed in through the loop as shown and then turned off uniformly over a period of 0.10 s. What is the current in the wire during the time that the magnetic field changes from 1.6 T to zero?

Figure 1:



15.

The current in 10-cm-diameter loop (see figure) is 0.02 A. The resistance of the loop is 10 Ohm. Find the rate of change of the magnetic field strength.



16.

A conducting straight wire of length 20 cm is moving with a constant speed perpendicular to uniform 0.1 T magnetic field. The wire is perpendicular to the magnetic field. The voltage across the wire is 0.5 V. Find the speed of the wire.

17. The north pole of a bar magnet is moved along the normal toward a 40 turn circular coil of wire. As the magnet moves, the field increases over the area of the coil from 0.0125 T to 0.450 T in 0.250 s. If the radius of the coil is 3.05 cm and the resistance of its wire is 3.55 Ω, find the magnitude of a) the induced emf (Ans. 0.204 V) and b) the induced current. (Ans. 0.0576 A)

Answers:

1.
Any changing magnetic field near a coil of wire will induce current. Just move the magnet near the coil of wire
2. Magnetic flux is the strength of a magnetic field multiplied by an area it is passed through
3. Webers
4. Rate of change of Magnetic flux with respect to time.
5. To create electric current you must do work. The current formed in a conductor by a changing magnetic field will form another magnetic field which opposing the change in the original magnetic field.
6.
a) CCW
b) CW
c) CW
d) CCW

7. a) 17.7V

8. 150 V

9. 0.2 V (lower end has higher potential – “positive particles” pushed to bottom of rod

10. 0.9375 V

11. 8.16×10^{-3}

12. 0.89 T/s

13. 1.3 seconds

14. 0.0314 Volts

15. 25.5 T/s

16. 25 m/s