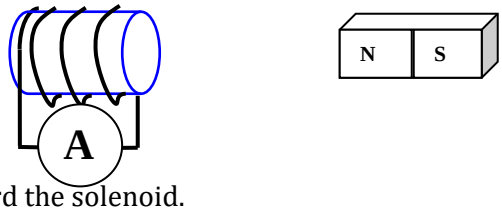
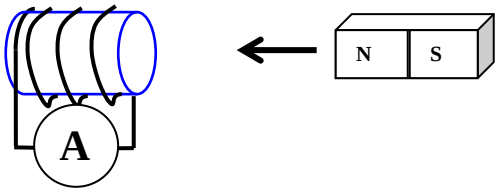
Lenz's Law Practice

1. For the following scenarios, determine whether the magnetic flux the coil sits in changes or stays the same. If the flux changes: indicate whether it is increasing or decreasing

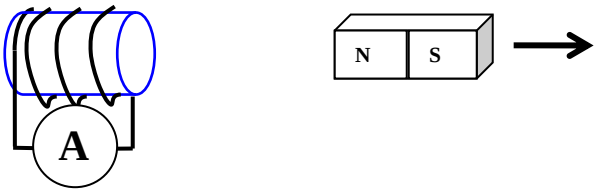
a. The magnet is held stationary to the solenoid.



b. The magnet is moving toward the solenoid.



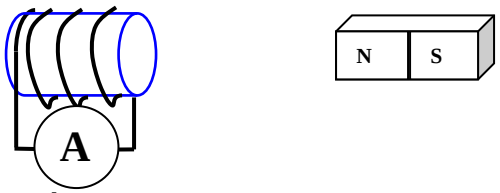
c. The magnet is moving away from the solenoid.



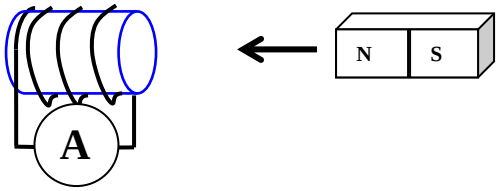
2. for the situations below, indicate ***at which side of the coils a north end of the "new" electro-magnet would form*** in order to oppose the motion of the permanent magnet.

3. *Find the direction of the induced current* in the solenoids shown below, when the permanent magnet is moved as shown. (use the right hand rule for solenoids).

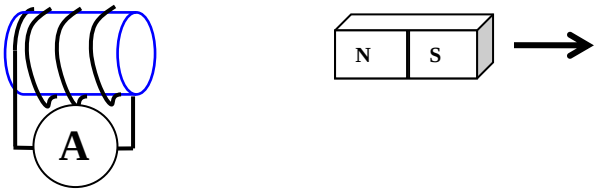
a. stationary to the solenoid.



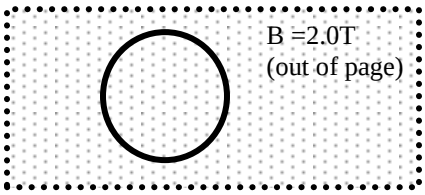
b. moving toward the solenoid.



c. moving away from the solenoid.



3. A circular loop (radius of 10 cm or 0.10 m) is placed in a uniform magnetic field of magnitude, B = 2.0 T, where the face of the loop is perpendicular to the direction of the magnetic field.



a. Determine the magnetic flux through the loop.

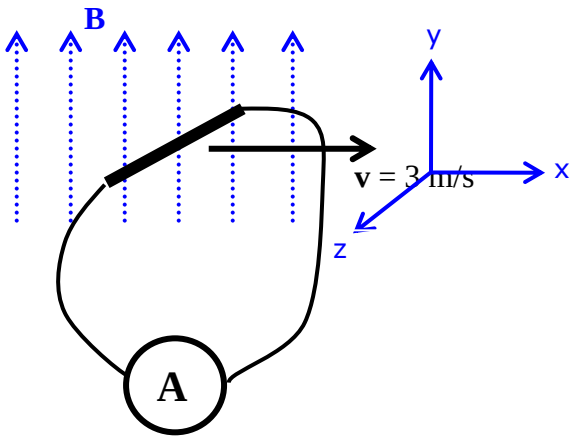
b. The loop is then rotated 90° in 3.0 seconds. What is the magnetic flux through the loop at the end of the 3.0 seconds?

c. What is the induced emf in the loop during the rotation?

4. A person moves a 2-m rod at a constant velocity of 3 m/s in a magnetic field, B= 2.0 T. The rod is perpendicular to the direction of the **B** field.

a. What is the direction of induced current in the rod?

b. Determine the induced emf in the rod.

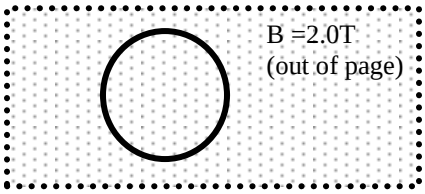


c. The resistance in the rod (and connecting wires) is 2-Ω. What is the current in the rod?

Answers:

1. a)no change b) increasing c) decreasing
2. a) no magnet formed b) right side of coil
   c)left side of coil
3. a) no current induced b) down the front
   coils c) up the front coils

4. A circular loop (radius of 10 cm or 0.10 m) is placed in a uniform magnetic field of magnitude, B = 2.0 T, where the face of the loop is perpendicular to the direction of the magnetic field.



a. Determine the magnetic flux through the loop.

Ans. $= 0.628\ T \cdot m^2$

b. The loop is then rotated 90° in 3.0 seconds. What is the magnetic flux through the loop at the end of the 3.0 seconds?

Ans. $= 0\ T \cdot m^2$

c. What is the induced emf in the loop during the rotation?

Ans. $0.0209\ \frac{T \cdot m^2}{s}$ (or V)

5. A person moves a 2-m rod at a constant velocity of 3 m/s in a magnetic field, B= 2.0 T. The rod is perpendicular to the direction of the **B** field.

a. What is the direction of induced current in the rod?

Ans. in the +z direction

b. Determine the induced emf in the rod.

Ans. $\mathcal{E} = vBL = 12\ V$

c. The resistance in the rod (and connecting wires) is 2-Ω. What is the current in the rod?

Ans. $= 6A$