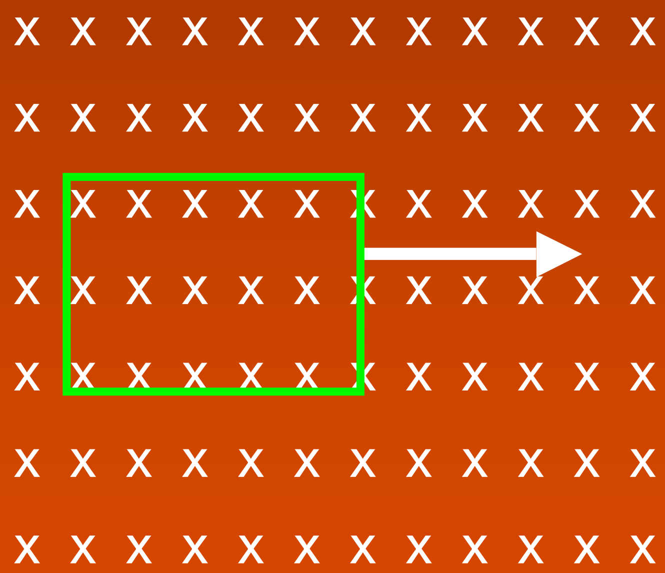
ConcepTest 30.3a Moving Wire Loop I

A wire loop is being pulled through a uniform magnetic field. What is the direction of the induced current?

1) clockwise
2) counterclockwise
3) no induced current



ConcepTest 30.3a Moving Wire Loop I

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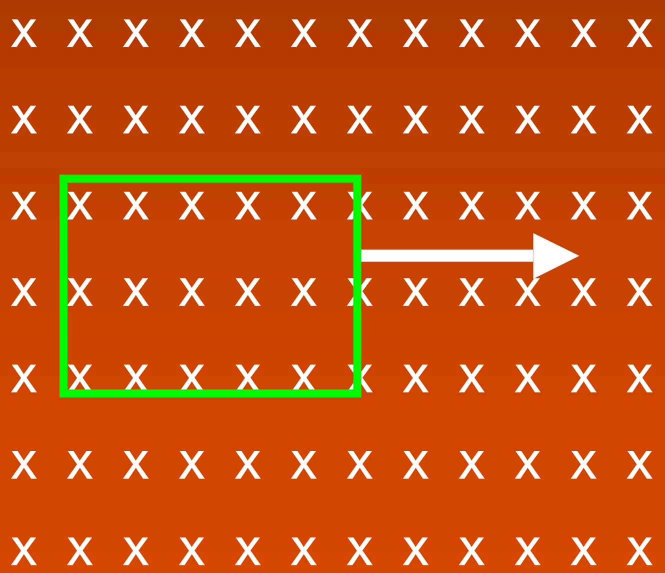


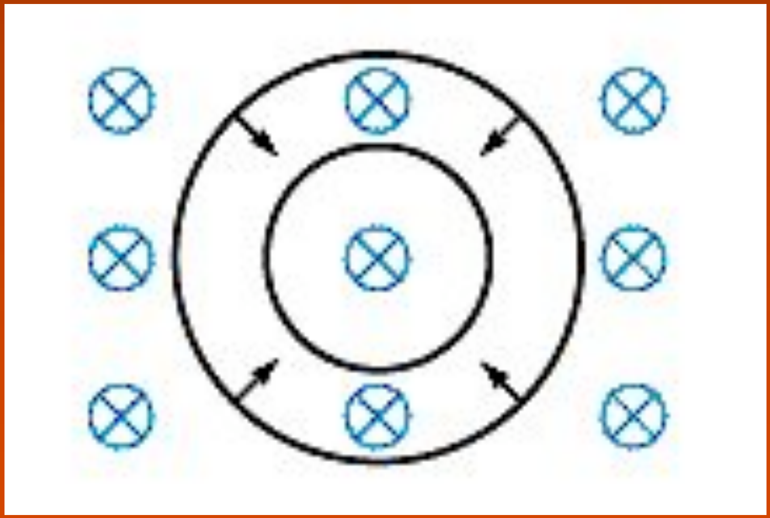
Since the magnetic field is uniform, the magnetic flux through the loop is not changing. Thus no current is induced.

Follow-up: What happens if the loop moves out of the page?

ConcepTest 30.4 Shrinking Wire Loop

If a coil is shrinking in a magnetic field pointing into the page, in what direction is the induced current?

1) clockwise
2) counterclockwise
3) no induced current

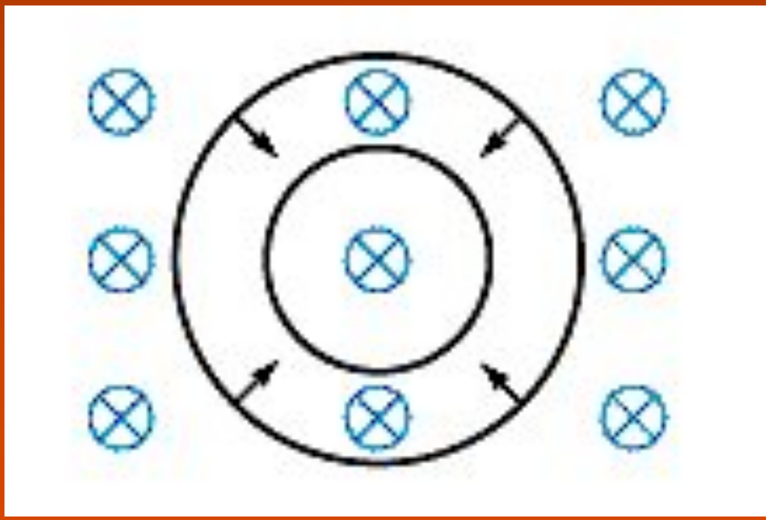


ConcepTest 30.4 Shrinking Wire Loop

If a coil is shrinking in a magnetic field pointing into the page, in what direction is the induced current?

1) clockwise
2) counterclockwise
3) no induced current

The magnetic flux through the loop is ***decreasing***, so the induced B field must try to reinforce it and therefore points in the same direction — ***into the page***. According to the right-hand rule, an induced ***clockwise*** current will generate a magnetic field **into the page**.

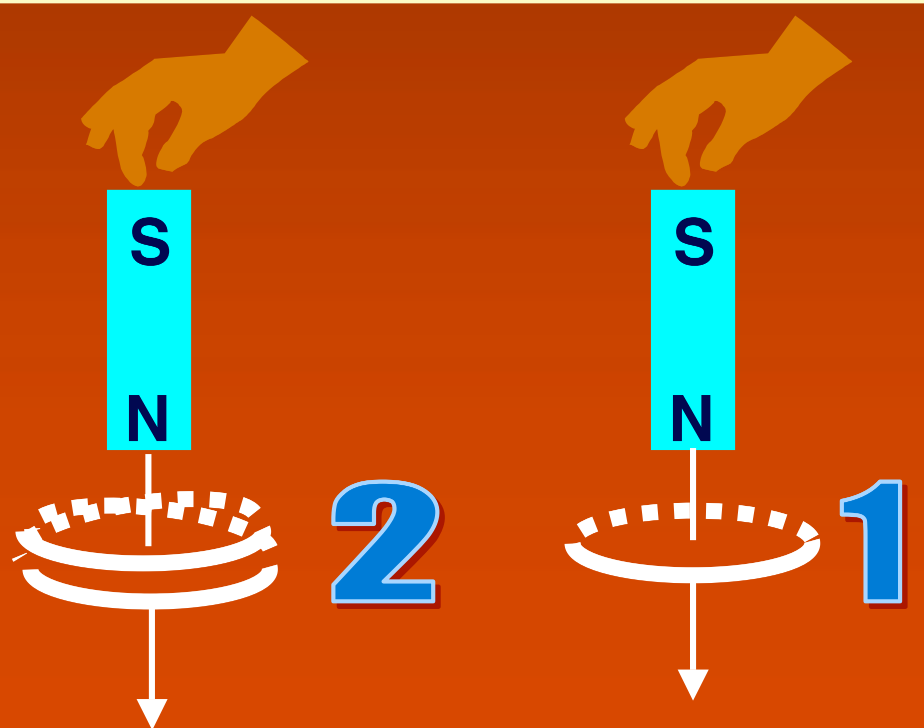


Follow-up: What if the *B* field is oriented at 90° to its present direction?

ConcepTest 30.6b Voltage and Current II

Wire #1 (length *L*) forms a **one-turn loop**, and a bar magnet is dropped through. **Wire #2** (length 2*L*) forms a **two-turn loop**, and the same magnet is dropped through. Compare the magnitude of the **induced currents** in these two cases.

1) $I_1 > I_2$
2) $I_1 < I_2$
3) $I_1 = I_2 \neq 0$
4) $I_1 = I_2 = 0$



ConcepTest 30.6b Voltage and Current II

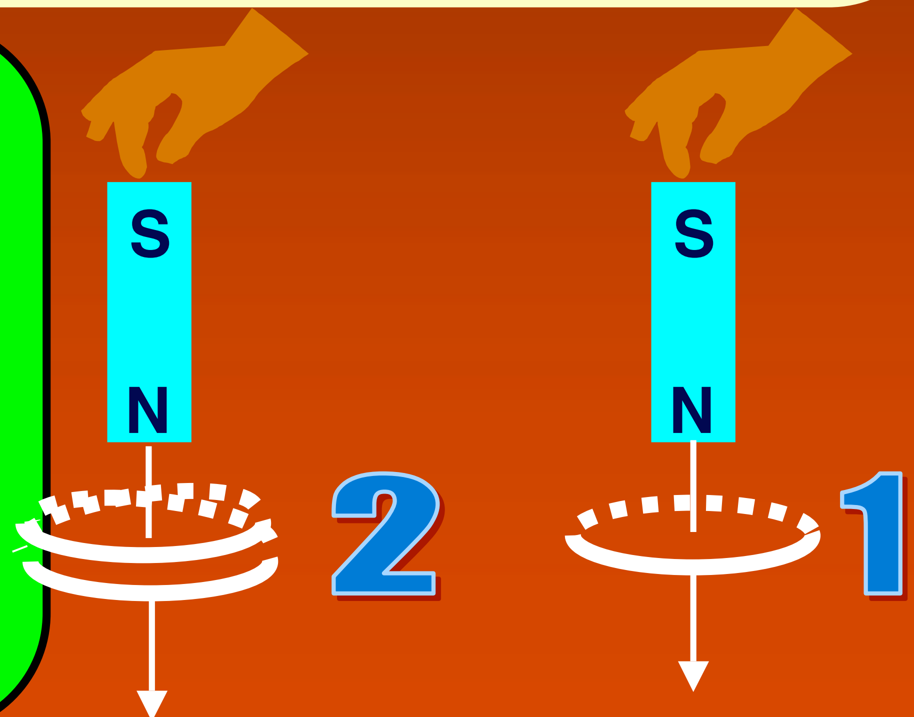
Wire #1 (length *L*) forms a **one-turn loop**, and a bar magnet is dropped through. **Wire #2** (length 2*L*) forms a **two-turn loop**, and the same magnet is dropped through. Compare the magnitude of the **induced currents** in these two cases.

1) $I_1 > I_2$
2) $I_1 < I_2$
3) $I_1 = I_2 \neq 0$
4) $I_1 = I_2 = 0$

Faraday's law:

$$\varepsilon = -N \frac{\Delta \Phi_B}{\Delta t}$$

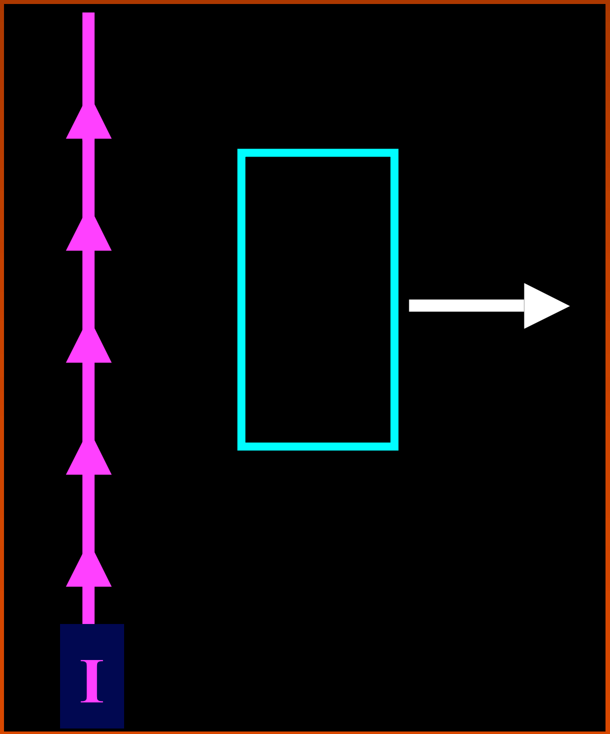
says that the **induced emf is twice as large in the wire with 2 loops**. The current is given by Ohm's law: $I = V/R$. Since **wire #2 is twice as long as wire #1, it has twice the resistance**, so the current in both wires is the same.



ConcepTest 30.8a Loop and Wire I

A wire loop is being pulled away from a current-carrying wire. What is the direction of the induced current in the loop?

1) clockwise
2) counterclockwise
3) no induced current



ConcepTest 30.8a Loop and Wire I

A wire loop is being pulled away from a current-carrying wire. What is the direction of the induced current in the loop?

1) clockwise
2) counterclockwise
3) no induced current

The magnetic flux is *into the page* on the right side of the wire and *decreasing* due to the fact that the loop is being pulled away. By Lenz's Law, the induced *B* field will *oppose this decrease*. Thus, the new *B* field points *into the page,* which requires an induced *clockwise* current to produce such a *B* field.