Current From Change

Use changing magnetic flux to find induced current.

HS-PSII-7.3 "Apply Ohm's Law, Faraday's Law, and Lenz's Law to determine the amount and direction of current induced by a changing magnetic flux in a loop of wire or simple loop circuit."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline the rules for finding induced voltage and current, then circle the statements that help you determine current direction.

A Loop at the Museum

1. At a science museum, a coil powers a tiny lamp as a magnet moves nearby. In this investigation, imagine one wire loop viewed from the front. Magnetic flux measures the magnetic field passing through the loop. Record outward flux as positive and inward flux as negative. A change in either direction can induce current.

2. Faraday's law gives the magnitude of induced voltage: the absolute change in flux divided by the elapsed time. Ohm's law then gives current: induced voltage divided by circuit resistance. For example, a flux change of 0.06 weber in 0.30 second produces 0.20 volt. With 10 ohms of resistance, the current is 0.020 ampere.

3. Lenz's law sets the current's direction: the induced magnetic field opposes the change in flux, not necessarily the original field. Viewed from the front, counterclockwise current produces a field outward; clockwise current produces a field inward. A changing flux can cross zero and reverse sign. Use the signed difference to decide what change the induced field opposes.

FLUX CHANGES IN ONE-LOOP CIRCUITS

Event	Initial flux (Wb)	Final flux (Wb)	Time (s)	Resistance (Ω)
A	+0.10	+0.30	0.20	4
B	−0.10	−0.30	0.40	5
C	+0.30	+0.10	0.10	2
D	−0.30	+0.10	0.20	4

2 ANSWER WITH EVIDENCE

Use the passage

1. For event A, calculate the current and state its direction as viewed from the front. Show how you found the induced voltage.

2. For event B, calculate the current and state its direction as viewed from the front. What change does the induced field oppose?

3. For event C, calculate the current and state its direction as viewed from the front. Explain your direction choice.

4. In event D, the flux reverses sign. Calculate the current and state its direction as viewed from the front.

3 YOUR TURN

Your own words

Design a flux change that produces 0.40 A clockwise in a 5 Ω loop over 0.25 s, starting from zero flux. State the final signed flux, show your calculation, and explain the direction.

Current From Change

PART 1 · READ AND MARK

Underline the rules for finding induced voltage and current, then circle the statements that help you determine current direction. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	For event A, calculate the current and state its direction as viewed from the front. Show how you found the induced voltage.	**Voltage = 0.20 Wb ÷ 0.20 s = 1.0 V; current = 1.0 V ÷ 4 Ω = 0.25 A, clockwise.**
2	For event B, calculate the current and state its direction as viewed from the front. What change does the induced field oppose?	**Current = (0.20 Wb ÷ 0.40 s) ÷ 5 Ω = 0.10 A, counterclockwise. Its outward field opposes the increasing inward flux.**
3	For event C, calculate the current and state its direction as viewed from the front. Explain your direction choice.	**Current = (0.20 Wb ÷ 0.10 s) ÷ 2 Ω = 1.0 A, counterclockwise. Its outward field opposes the decrease in outward flux.**
4	In event D, the flux reverses sign. Calculate the current and state its direction as viewed from the front.	**The signed flux increases by 0.40 Wb. Current = (0.40 Wb ÷ 0.20 s) ÷ 4 Ω = 0.50 A, clockwise.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

The required voltage is (0.40 A)(5 Ω) = 2.0 V, so the flux must change by (2.0 V)(0.25 s) = 0.50 Wb. The final flux is +0.50 Wb because increasing outward flux induces an inward field and a clockwise current.

Accept equivalent calculations and direction explanations based on opposing the signed flux change. For Your Turn, the final signed flux must be +0.50 Wb.