

13 Faraday's and Lenz's laws – Part 2

Name: _____ Class: _____ Date: _____

Vocabulary

Write each word three times.

English

Write it 3 times (English)

Faraday's law

Lenz's law

Recall

In Part A you saw that a changing magnetic flux drives a current. Now the two laws that describe it:

- One law gives the **size** of the induced voltage.
- The other gives its **direction**.

Each idea has a worked example before the Practice.

New ideas

■ 1 Faraday's law

Faraday's law

says the induced voltage equals how fast the flux changes:

$$\varepsilon = \frac{\Delta\Phi}{\Delta t}.$$

A coil of N turns gives N times as much.

Worked example. If one turn would give 0.40 V, a 50-turn coil gives $50 \times 0.40 = 20$ V.

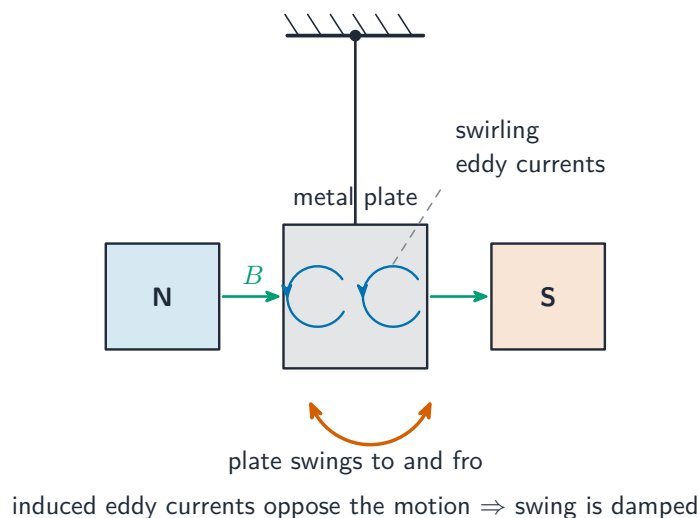
■ 2 Lenz's law

Lenz's law

gives the direction: the induced current flows so as to **oppose** the change that caused it.

■ 3 It is energy conservation

Lenz's law is really energy conservation – you must do work to push the magnet against this opposing effect, and that work becomes the electrical energy.



■ 4 Generators

Spinning a coil in a magnetic field constantly changes the flux, inducing a current – this is how a **generator** turns motion into electricity.

Watch out: the induced current always **opposes** the change (Lenz's law). If it helped the change instead, you would get energy for free – which is impossible.

Practice

Try these in order. The methods are all above.

2.1 State what Faraday's law says the induced voltage depends on. [2]

2.2 A coil has 20 turns; one turn would give 0.30 V. Find the coil's voltage. [2]

2.3 State what Lenz's law tells you about the direction of an induced current. [2]

2.4 Explain why Lenz's law is really a statement of energy conservation. [2]

2.5 State how a generator produces electricity. [2]
