

LENZ'S LAW

OCR A LEVEL PHYSICS H556

Module 6: Particles and medical physics

6.3 Electromagnetism

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c) ... and Lenz's law

d) $\text{emf} = -\text{rate of change in flux linkage}$

Outline = induced emfs oppose the change causing them

Apparatus = magnetic on stick, square coil and ed spot galvanometer

Text book reference = pages 193-199

Independent study = page 199 questions

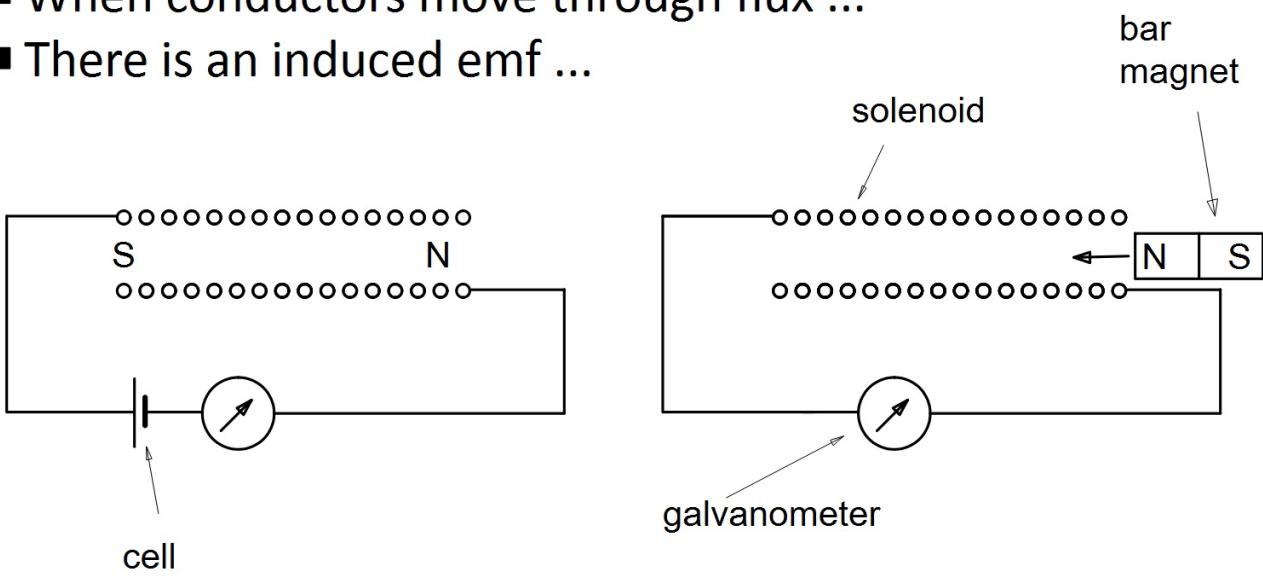
What is this lesson about?

- When conductors move through flux an emf is induced.
- This is described by Faraday's law.
- But what about the polarity of the induced emf?
- Do we need to add something to Faraday's law?
- Lenz's law.

LENZ'S LAW

Lenz's law [demo]

- When conductors move through flux ...
- There is an induced emf ...



Lenz's law [concept]

- When a conductor moves through a magnetic field
- An emf is induced
- And a current can flow
- Proportional to the flux density
- Proportional to the relative speed
- At a maximum if conductor is perpendicular to field
- And the polarity is predictable.
- Producing a current with its own magnetic field.
- That opposes the change (in flux linkage) causing it.

LENZ'S LAW

Lenz's law [definition]

The polarity of the induced emf is so as to oppose the change causing it.

Faraday's law incorporating Lenz's law [formula]

$$\boldsymbol{\varepsilon} = -\Delta\Phi/\Delta t^*$$

Where:

ε = induced emf / V

Φ = flux linkage / Wb

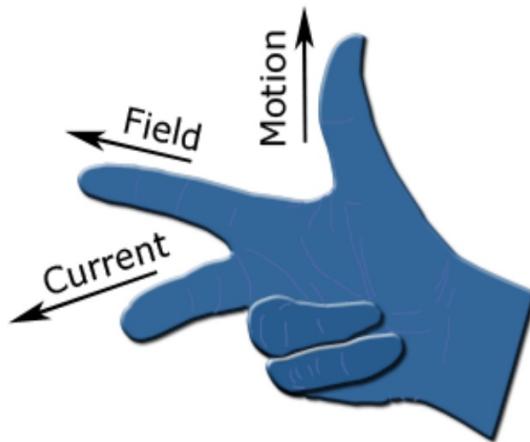
t = time for change to occur / s

*the '-' implies the emf opposes the change causing it

LENZ' LAW

Fleming's right hand rule

- Thumb and fingers are at right angles
- Thumb = thrust (force)
- First finger = field
- Second finger = current
- Field from N to S
- Current is conventional



Further investigations ...

- Lenz's law tube
- Aluminium rings in u-magnets
- Waltenhoffen pendulum

Independent study

- Page 199 questions from your text book

Further thoughts?