Electromagnetic induction: moving a magnet

Student activity • investigation and reasoning

YEAR 11 / LESSON 86 / PHYSICS + SCIENCE (DOUBLE AWARD)

The question

Which changes produce an induced voltage across a coil?

Move a small bar magnet relative to a coil and compare signed voltage pulses using a suitable voltage sensor.

Equipment

- Small low-strength bar magnet, coil, supports and sensitive high-input-resistance voltage logger
- Booklet and original generator diagram

Use small classroom magnets and secure coils. Keep fingers clear and do not drop or strike magnets into coils. Keep magnets away from sensitive devices and follow medical-device guidance; provide recorded traces if needed. No supply, mains generator or powered rotating machinery is used.

Course coverage: Shared Physics / Double Award: 6.15–6.16. Induced voltage and electricity generation.

Plan, model or apparatus sketch

Draw labelled coils, field directions, motion and circuit connections as relevant.

Method and reasoning

Read the whole sequence before starting

YEAR 11 / LESSON 86 / PHYSICS + SCIENCE (DOUBLE AWARD)

1. Staff connect a labelled coil to a sensitive high-input-resistance voltage logger. No power supply is connected. Secure the coil horizontally and mark equal travel limits for the magnet without allowing it to strike the coil.

2. Record the reading with the magnet stationary outside the coil and then stationary inside it. Keep the same sensor range and leads throughout.

3. Move the north pole into the coil slowly and then withdraw it along the same path. Record the sign and peak size of each voltage pulse, retaining the trace.

4. Repeat the same travel more quickly, keeping the pole, coil, distance and alignment fixed. Repeat each speed comparison three times in a continuation table; speed is a qualitative category unless separately measured.

5. Turn the magnet around and repeat one insertion at a similar speed. Compare the pulse sign. Explain why the marked sign depends on both pole/motion and the chosen sensor lead connection.

6. Draw a generator with a rotating coil in a magnetic field. Explain how changing field linkage produces an alternating voltage and how faster rotation affects the signal. Keep this diagram distinct from the linear-motion evidence.

Cleanup

- Disconnect loggers, return magnets and retain labelled traces.

Record your evidence

Blank spaces are for your own work

YEAR 11 / LESSON 86 / PHYSICS + SCIENCE (DOUBLE AWARD)

Reference and task data

Use a voltage sensor, not a current reading labelled as voltage. A stationary magnet ideally gives no induced voltage. Peak readings depend on motion and sample rate; the exercise does not establish an exact voltage–speed law.

Condition	Voltage sign	Peak / V	Comment
Stationary outside			
Stationary inside			
Slow insertion			
Slow withdrawal			
Faster insertion			
Opposite pole in			

Show your calculations, labelled model or correction here.

Explain and evaluate

Use evidence and show calculation steps where relevant

YEAR 11 / LESSON 86 / PHYSICS + SCIENCE (DOUBLE AWARD)

1. What happens with a stationary magnet?

2. Why does insertion produce a pulse?

3. What happens on withdrawal?

4. What usually changes with faster comparable motion?

5. What happens if the magnet pole is reversed?

6. Why can a rotating coil generate alternating voltage?