# Direct and alternating signals: reading an oscilloscope

Student activity • observation and reasoning

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## The question

**What does an oscilloscope trace show about a changing voltage?**

Observe staff comparing a small cell with an isolated low-voltage signal generator, then relate the voltage trace to current in a resistor.

## Equipment

- Staff oscilloscope, approved leads, small cell and isolated low-voltage signal generator
- Booklet, ruler and calculator

Staff make all instrument connections. Use only the small cell and isolated low-voltage generator; never connect to mains outlets or exposed mains circuits. Check the oscilloscope input and common-earth arrangement before connecting equipment.

Course coverage: Shared Physics / Double Award: 2.6, 2.10, 2.11. Direct and alternating current.

## Plan, model or apparatus sketch

**Draw a labelled setup or force diagram; include the measured quantities.**

# Method and reasoning

Read the whole sequence before starting

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**1.** Observe staff setting the oscilloscope to DC coupling and identifying the zero-voltage reference with no signal applied. Record the vertical and time scales.

**2.** Staff connect the instrument across a small cell using the approved input arrangement. Sketch the steady line relative to the zero reference; do not move the reference to hide the cell voltage.

**3.** Staff disconnect the cell and connect an isolated low-voltage sine-wave generator, limited to 2 V peak and set near 50 Hz. No mains waveform is measured.

**4.** Read the time for one complete cycle using the displayed scale. Calculate frequency from f = 1/T and compare it with the generator setting.

**5.** Explain how the voltage changes sign. For a resistor, use this to infer a current that reverses direction; distinguish a voltage trace from a direct current measurement.

**6.** Use the previous sensor results to predict current changes at a fixed DC voltage when an NTC thermistor warms or an LDR receives more light.

## Cleanup

- Staff disconnect signals and switch off instruments; return calculators.

# Record your evidence

Blank spaces are for your own work

YEAR 10 / LESSON 43 / PHYSICS + SCIENCE (DOUBLE AWARD)

## Reference and task data

Practice trace only: one period occupies two divisions at 10 ms per division, so T = 0.020 s and f = 50 Hz. A DC signal can vary in magnitude without reversing polarity; an alternating signal changes polarity. The classroom generator models a waveform, not mains voltage.

| Signal | Vertical scale | Time scale | Observed shape / period |
|---|---|---|---|
| Zero reference | | | |
| Small cell | | | |
| Sine generator | | | |

**Show your calculations, labelled model or correction here.**

# Explain and evaluate

Use evidence and show calculation steps where relevant

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**1.** What is the vertical axis showing?

**2.** Why establish zero first?

**3.** Find the practice period.

**4.** Find its frequency.

**5.** Does this activity measure mains electricity?

**6.** At fixed DC voltage, how does warming an NTC device affect current?