# OCR A Physics A-Level

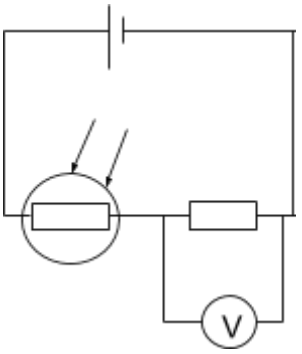
## PAG 4.3

Using non-ohmic devices as sensors

**Equipment**

- Cell
- LDR
- Thermistor
- Resistor
- Leads
- Voltmeter
- Lamp with dimmer switch
- Digital light sensor
- Ice
- Kettle
- Thermometer
- Beaker

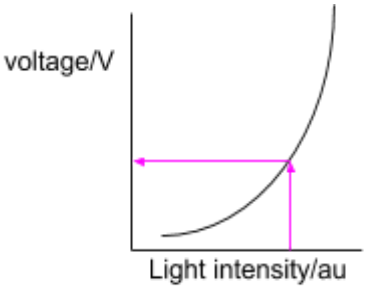
**Method**




1. Set up the circuit as shown in the diagram.
2. Make the area surrounding the circuit as dark as possible, record the value of this light intensity using the digital light sensor.
3. Record the voltage across the resistor for this light intensity.
4. Using the lamp with a dimmer switch increase the light intensity slightly and record the new value recorded by the sensor and record the voltage across the resistor.
5. Repeat this process until the light intensity cannot be increased any further.

**Calculations**

- Plot a graph of voltage across the resistor against light intensity and draw a line of best fit.
- This can be used as a **calibration curve**.
- Move the circuit to an area of unknown light intensity and record the voltage across the resistor.
    - Using the calibration curve, find the corresponding light intensity to this voltage.



**Using a thermistor**

- The method for using the thermistor to find an unknown temperature is broadly similar to that used with the LDR but certain alterations must be made:
    - The LDR in the circuit must be replaced with a waterproof thermistor.
    - Rather than light intensity being altered it is temperature that must be altered. Begin by placing the thermistor in boiling water from the kettle and record the voltage across the resistor as before, take readings of the voltage for every 5° degrees the temperature falls, using ice to further lower the temperature as much as possible.
    - Plot a graph of voltage against temperature and use this calibration curve to find an unknown temperature.

**Safety**

- Be careful not to be scalded by boiling water by not letting it splash.
- Do not look directly into the lamp.
- Be careful not to trip when the room is dark.

**Notes**

- To increase the accuracy of the calibration curve, take as many readings as possible over a wide range so that there are as many data points as possible.
- The resistance of the LDR and thermistor decreases with the increase in light intensity and temperature respectively.
- Ohm's law is that the current between two points is directly proportional to the potential difference across those points, as R=V/I this means the resistance between those points is constant, a non-ohmic device doesn't obey ohm's law.
- The potential difference provided by the cell is shared between the resistor and the non-ohmic (changes resistance) devices. A greater proportion of the voltage is shared across the resistor as the resistance of the non-ohmic device decreases.