

# WJEC England Physics A Level

SP C2 02 : Resistance

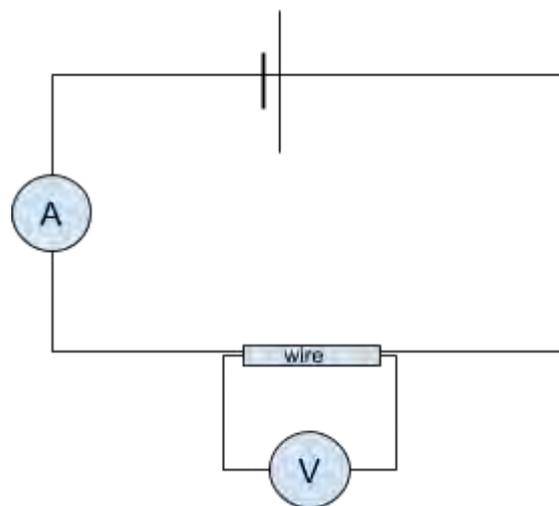
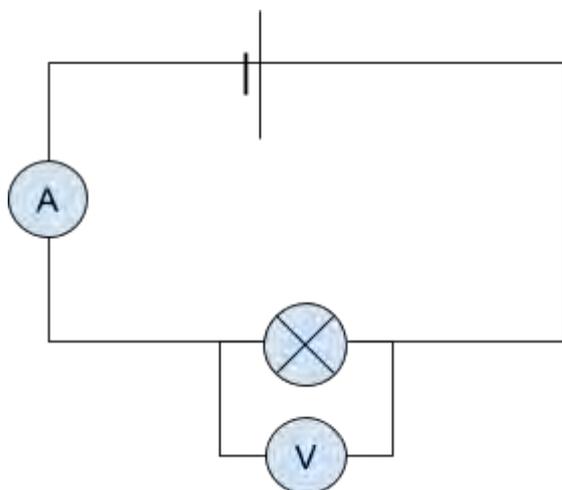
Practical notes



## 1. Investigation of the IV Characteristics of the Filament of a Lamp and a Metal Wire at Constant Temperature

### Equipment:

- Filament lamp
- Metal wire
- Leads
- Crocodile clamps
- Ammeter
- Voltmeter
- Variable power supply

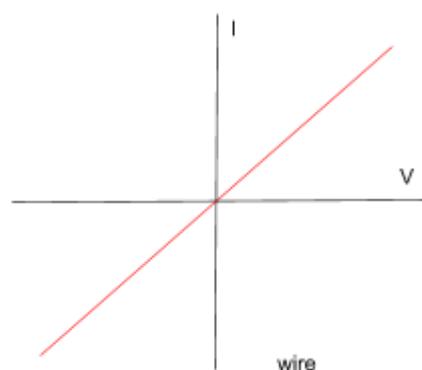
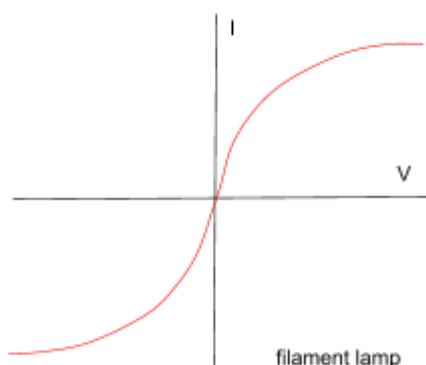


### Method:

1. Set up the circuit above with the filament lamp and a variable power supply.
2. Set the power supply to 6V and turn it on. Take current and voltage readings.
3. Adjust the variable power supply at 1V intervals to 0V. Then, reverse the connections to obtain negative readings down to -6V.
4. Repeat with the wire in place of the filament lamp as shown in the right hand diagram.
5. Plot graphs of current,  $I$ , against voltage,  $V$ , for each component.

### Tips:

- Turn off the power supply between readings to ensure that the apparatus does not heat up. Temperature must be controlled for the investigation to be valid.



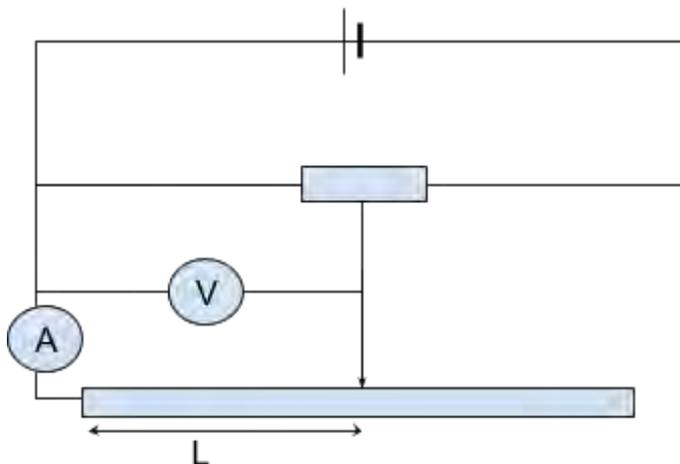
## 2. Determination of the Resistivity of a Metal

### Equipment:

- Resistance wire (metal to be tested)
- Micrometer (or Vernier calliper)
- Leads
- Crocodile clips
- Power supply
- Voltmeter
- Ammeter
- Variable resistor

### Method:

1. Measure and cut a 1m length of wire.
2. Connect the circuit as shown in the diagram.
3. Adjust the crocodile clip so the length of wire,  $L$ , connected to the circuit is 10cm.
4. Turn on the power supply and record the current and voltage.
5. Repeat for different lengths of wire (20cm, 30cm etc).
6. Current should remain the same, so plot a graph of  $V$  against  $L$ .
7. Draw a line of best fit and determine the gradient.
8. Use the micrometer to work out the diameter of the wire. Take readings at multiple points along the wire and calculate the mean diameter.
9. Calculate the cross sectional area.



10. Calculate resistivity ( $p$ ):
 
$$A = \pi r^2 \quad \text{where } r \text{ is the wire's radius (half the average diameter).}$$

$$V/I = pL/A \quad \text{now divide both sides by } L \text{ and multiply both sides by } I$$

$$V/L = pI/A \quad V/L \text{ is the gradient of the voltage-length graph}$$

$$p = (\text{gradient} \times A)/I$$



### 3. Investigation of the Variation of Resistance with Temperature for a Metal Wire

#### Equipment:

- Bunsen burner
- Tripod and gauze
- Glycerol
- Water
- Ice
- Boiling tube
- Beaker
- Thermometer
- Ohmmeter

#### Method:

1. Set up the circuit with the wire connected to the ohmmeter and place the wire and thermometer in a boiling tube of glycerol.
2. Fill a beaker with water and place the boiling tube inside the beaker. Set up on the gauze and tripod.
3. Record the resistance of the wire.
4. Heat the beaker using the Bunsen burner. Every time the temperature rises by 2 degrees, take a resistance reading and record the temperature.
5. Plot a graph of resistance against temperature.

#### Safety:

- The Bunsen burner may cause burns or fires. Ensure hair and loose clothing is tied back/secure, and take care to use the safety flame when not heating.
- If hot glycerol is split on skin it will cause serious burns - take extreme care and if a spillage does happen rinse immediately with cold water.

#### Tips:

- Take the temperature reading from eye level to avoid parallax error.
- Stir the glycerol with the thermometer before taking readings.

