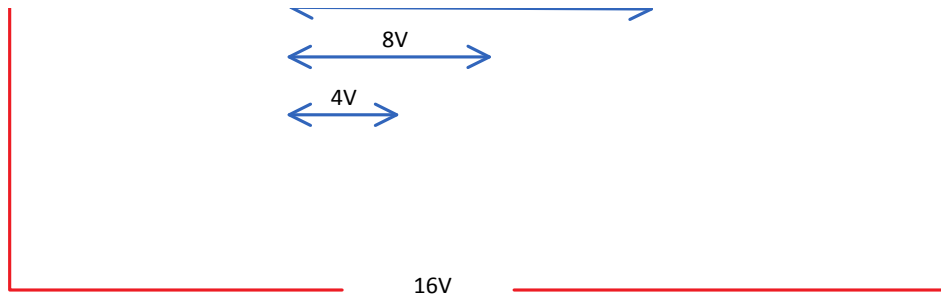


- Distribution of charge
  - Electric charge
    - Spreads out
  - Connected to earth
    - Spreads out a lot
      - Disappears
      - Earthing
  - Metal object
    - Charge flows on outside
    - Curved/spherical
      - Evenly spread charge
  - Point effect
    - Wherever an object is less curved, and particular sharp points, there will be a build up of charge. This is the point effect.
  - Point discharge
    - Point effect
      - Leads to discharge
      - Air
        - ◆ Becomes ionised
        - ◆ Charged
        - ◆ Negative charge attracted to point
        - ▶ Cancel positive
    - Lightning conductors
      - ◆ Purposes
        - ◆ Path for lightning Earthing
        - ◆ Discharge air
          - ◆ Opposite of point discharge
- Van de Graff generator
  - Used
    - Build up static charge
  - Charge
    - Transferred
      - Rotating belt
        - ◆ Friction
        - ◆ Point effect
      - To metal dome
    - Belt
      - Small charge
    - Metal
      - Large charge

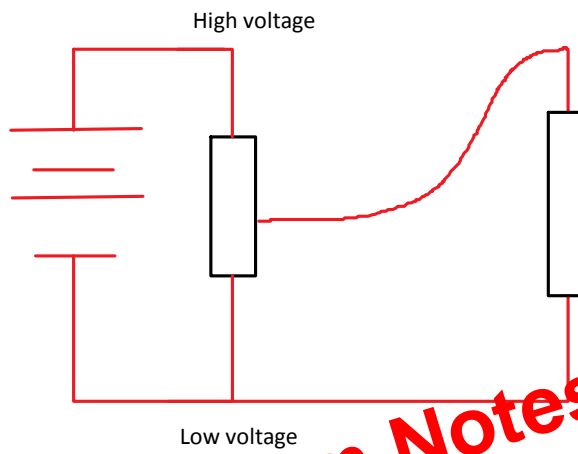
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### Electric fields

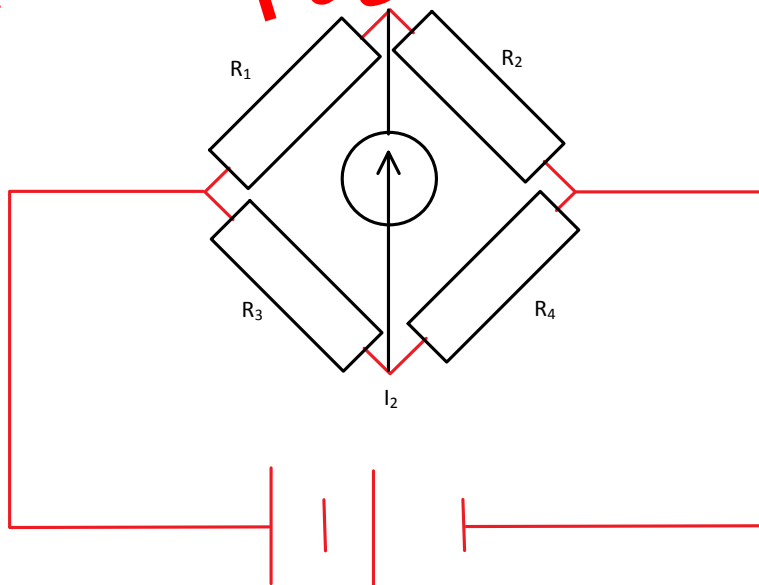
- Area around a charge where its felt
- Drawing
  - Path a positive charge would take



- Potential divider
  - Two connections to a resistor
    - Current flows
  - Smaller voltages supplied

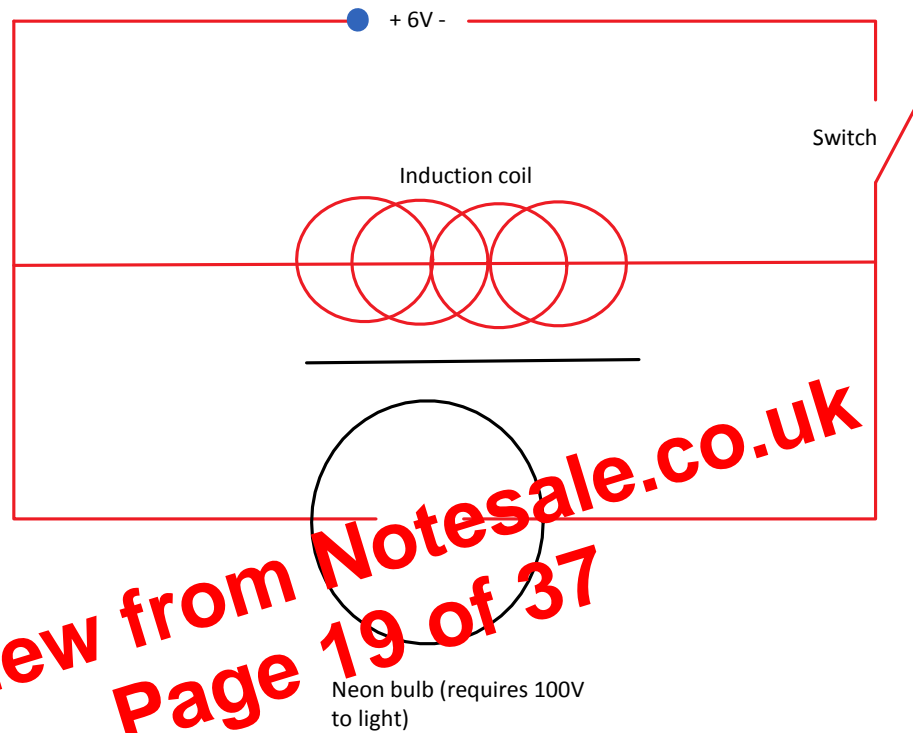


- Wheatstone bridge



- Balanced
  - No current flows through galvanometer
  - Formula
    - $\frac{R_1}{R_2} = \frac{R_3}{R_4}$

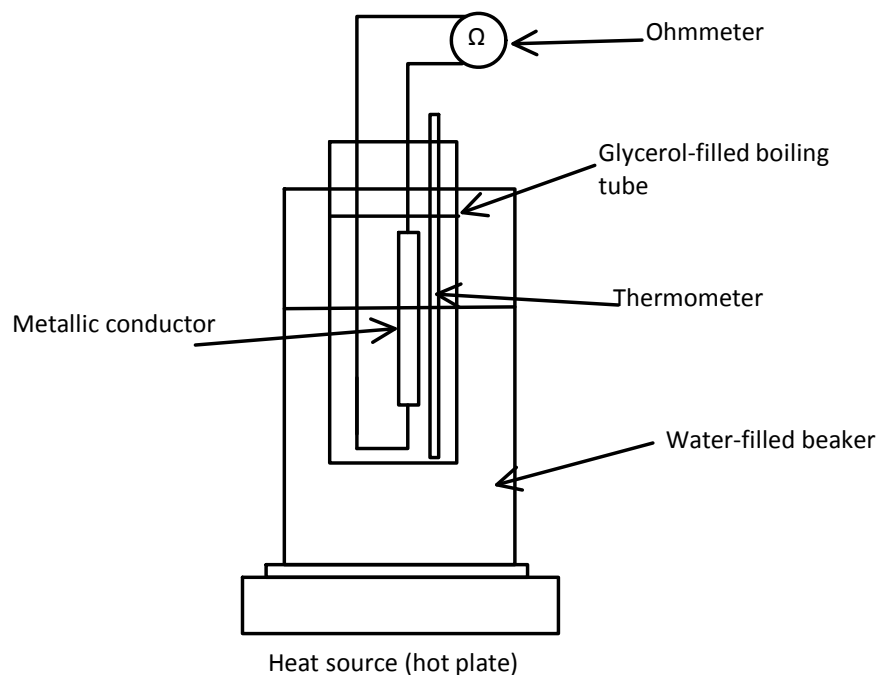
- ◆ Induced emf opposes change
    - ◇ Self induction
- Significance
  - Alternating current
    - Coil
      - ◆ Resistor
      - ◆ Reduces current flowing through
- Demonstrated



- Switch closed
  - Nothing
  - Voltage insufficient
- Switch open
  - Circuit broken
  - Bulb lights
    - Moment
    - Because
      - ◆ Current through coil
        - ◇ Magnetic field
      - ◆ Current falls to zero
        - ◇ Magnetic field disappears
        - ◇ Coil
          - ▶ Centre of changing magnetic field
      - ◆ Changing magnetic field
        - ◇ Induces
          - ▶ Voltage large to light bulb

To investigate the variation of the resistance of a metallic conductor with temperature

### Apparatus

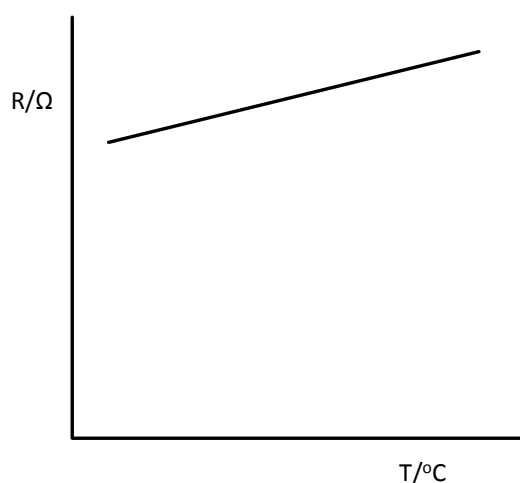


### Method

1. Set up the apparatus as shown in the diagram.
2. Use the thermometer to note the temperature of the glycerol, which is also the temperature of the coil.
3. Record the resistance of the coil of wire using the ohmmeter.
4. Slowly heat the beaker.
5. For each  $10^\circ\text{C}$  rise in temperature record the resistance and temperature using the ohmmeter and the thermometer.

### Conclusion

Plot the graph of resistance against temperature.



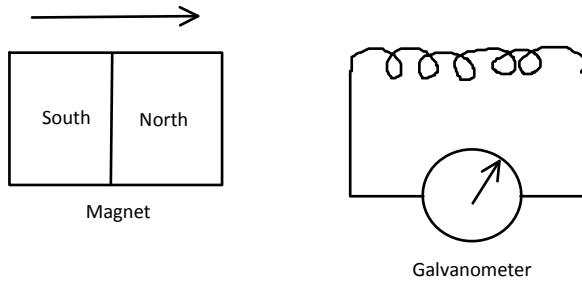
### Accuracy

- It is important to slowly heat the water, to avoid the situation where the liquid will be much hotter than the wire.

The ampere is the current that, if maintain in two infinitely long wire of negligible cross section placed one metre apart in a vacuum would produce between the wires a force of  $2 \times 10^{-7}$  newtons per metre length of wire.

### To demonstrate electromagnetic induction

#### Apparatus



#### Method

1. Set up the circuit as shown.
2. Move the magnet towards the coil at varying speed.

#### Observation

When the magnet is in motion, a current is shown on the galvanometer.

#### Conclusion

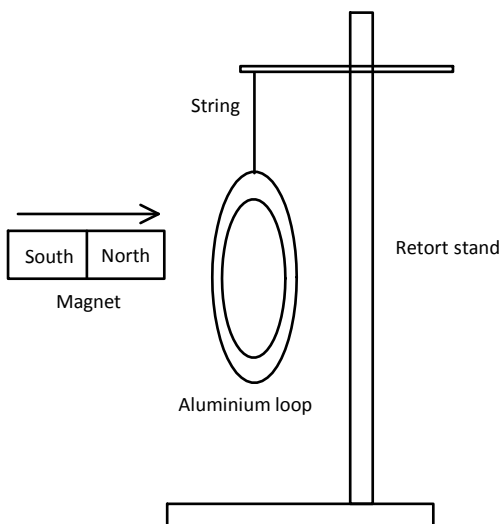
The existence of the current on the galvanometer indicates that the changing magnetic field is creating an emf as stated in Faraday's Law. The faster the magnet moves, the greater the current registered on the galvanometer.

#### Remember

Faraday's law of electromagnetic induction states that when there is a change in the magnetic flux linking a coil, an emf is induced in that coil. The strength of the emf is proportional to the rate of change of the flux linking the coil.

### To demonstrate Lenz's Law

#### Apparatus



#### Method

A force exists on a current carrying conductor in a magnetic field. It is described by the formula:

$$F = BIl$$

Where  $F$  = force,  $B$  = magnetic flux density,  $I$  = current,  $l$  = length of conductor

A similar force exists on a charge,  $q$ , moving through a magnetic field at velocity,  $v$ .

We can say that the current in this case is the quantity of charge passing any point per second ( $I = \frac{q}{t}$ ), and the effective length of the charge in the magnetic field is given by  $l = vt$ .

Substituting into:  $F = BIl$

$$\text{Gives: } F = B \frac{q}{t} vt$$

$$F = qvB$$

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