

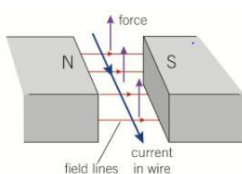
The Motor Effect

1 Fleming's Left Hand rule:

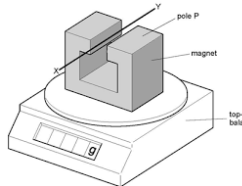
First Finger = Field
Second Finger = Current
Thumb = Motion of Wire



2 The force is perpendicular to the field lines and to the current in the wire

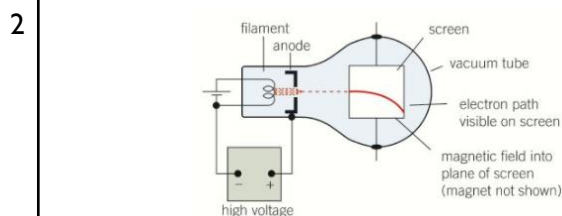


3 A top pan balance can be used to find the force on a current carrying wire. Vary the current, flux density or length of wire to change the force



Moving Charges in a Magnetic Field

1 Charged particles moving in a magnetic field will experience a force which can deflect them



3 Cyclotrons work using this principle

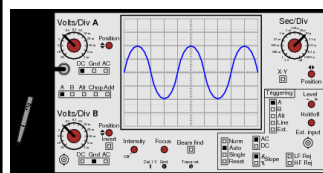
Electromagnetic induction

1 Faraday's Law The induced EMF is equal to the rate of change of flux linkage

2 Lenz's Law The direction of the induced current is always such as to oppose the change that caused it

Alternating currents

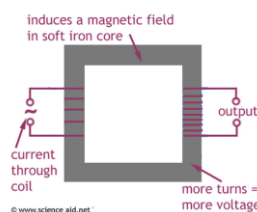
1 An oscilloscope can be used to measure the time-intervals and frequencies of AC waveforms



2 Converting between peak-to-peak values and rms values

$$I_{\text{rms}} = \frac{I_0}{\sqrt{2}}; V_{\text{rms}} = \frac{V_0}{\sqrt{2}}$$

3 Transformers rely on AC input to produce AC output



4 Step-up and step-down transformers

$$\frac{N_s}{N_p} = \frac{V_s}{V_p}$$

5 Transformers lose energy due to heating effects of eddy currents. This can be reduced by using (1) low resistance windings and (2) a laminated core

Definitions

1	Magnetic flux density	The magnetic flux is the number of lines of force passing through a unit area of material, B. The unit is the tesla (T).
2	Magnetic flux	Defined as $\Phi = BA$ where B is at right angles to A
3	Magnetic Flux linkage	Defined as $N\Phi$ where N is number of turns of wire cutting the flux

Key equations

1	Force on a current carrying wire	$F = BIl$
2	Force on a moving particle at right angles to the field	$F = BQv$
3	Flux linkage	$N\Phi = BAN\cos\theta$
4	Magnitude of induced EMF	$\varepsilon = N \frac{\Delta\Phi}{\Delta t}$
5	EMF induced in a rotating coil	$\varepsilon = BAN\omega\sin\omega t$
6	Transformer efficiency	$= \frac{I_s V_s}{I_p V_p}$