

## PH5 Notes

When you connect a resistor to the circuit, the capacitor starts to discharge.

$$Q = Q_0 e^{-t/RC}$$

Q = Charge (C)

$Q_0$  = Charge at  $t=0$  (C)

$t$  = Time (s)

R = Resistance ( $\Omega$ )

$$I = I_0 e^{-t/RC}$$

I = Current (A)

$I_0$  = Current at  $t=0$  (A)

$t$  = Time (s)

R = Resistance ( $\Omega$ )

$$V = V_0 e^{-t/RC}$$

V = Potential difference (V)

$V_0$  = Potential difference at  $t=0$  (V)

$t$  = Time (s)

R = Resistance ( $\Omega$ )

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## PH5 Notes

$$F = Eq$$

F = Force (N)  
E = Electric field strength (NC<sup>-1</sup>)  
q = Charge (C)

Which can derive  
the equation...

$$a = \frac{Vq}{md}$$

a = Acceleration (ms<sup>-2</sup>)  
V = Potential difference (V)  
q = Charge (C)  
m = Mass (kg)  
d = Distance between the  
cathode and anode (m)

You can calculate the energy that a particle gains:

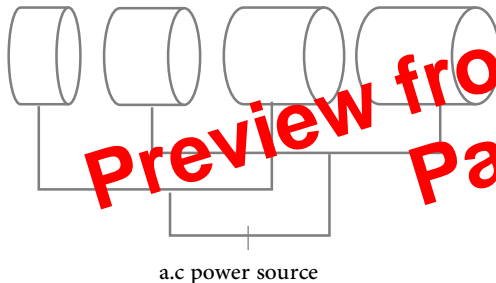
$$W = qV_E$$

W = Energy gained (eV)  
q = Charge (C)  
V<sub>E</sub> = Potential difference (V)

eV = Electron volt  
1eV = 1.6 x 10<sup>-19</sup> J

Linear accelerator (Linac)

The acceleration is provided by an electric field.

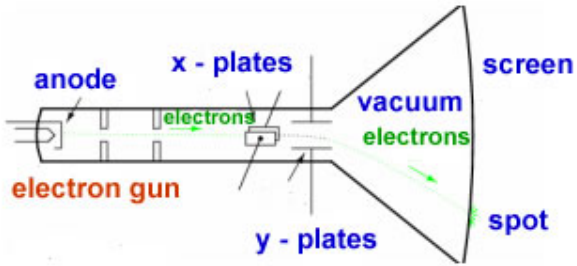


The particles accelerate in the gaps  
between the tubes.

The tubes get longer so that as the particles  
accelerate, the time spent in each tube  
remains the same.

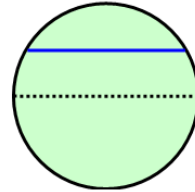
The potential difference is synchronised so that the charged particle is inside  
a tube as the potential difference changes direction.

Cathode Ray Oscilloscope

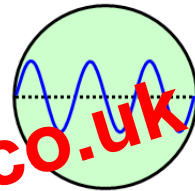


It can be used to measure a.c. and d.c. voltages and currents, and frequencies.

A d.c. current makes the dot on the monitor move to the top/bottom of the screen.



An a.c. current makes the dot move up and down repeatedly in a sinusoidal pattern.



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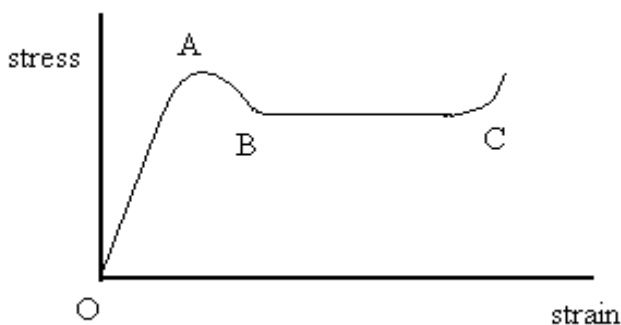
The energy loss due to elastic hysteresis in rubber can be useful (e.g. in shock absorbers.) However, it can also be a nuisance (e.g. the rolling resistance of car tyres).

You can reduce the elastic hysteresis by vulcanisation. This is the introduction of cross-linkages.

### Polythene

The polythene molecules are partly folded into crystals called lamellae. The strands of lamellae are held together by Van der Waals forces.

Stress varies with strain for polythene when it's stretched:



OA = Elastic region.

AB = A neck forms.

BC = The strands of lamellae unfold, so the width of the neck is constant.

C = The stronger covalent bonds take the strain.

### Composite Materials

Composite Materials are developed to take advantage of the mechanical properties of individual materials from which they are made.

Examples:

- Vehicle tyres
  - o Rubber reinforced with woven cords.
- Reinforced concrete
  - o Steel rods imbedded in concrete (this allows for much larger loads to be carried.)
- Fibre reinforced polymers (e.g. glass or carbon)
  - o Stiff fibres of carbon/glass are embedded in a tough matrix (background material.)
- Wood based composites
  - o Plywood – A 'sandwich' of several layers of thin wood.
  - o Chipboard – Chips or fibres of wood embedded in a matrix of glue.