Unit 1,2 Momentum and Circular motion

Centripetal Force

Force/acceleration now centripetal

Horizontal velocity no longer constant

Conservation of Momentum

Sum of momenta before (collision) = sum of momenta after

Collision in a closed system.

Remember:

Angular velocity = ω

Linear Speed $v=r\omega$

Acceleration:$a=r\omega\ \omega$

Collision

Fixed target

There is momentum before the collision so there must be momentum after the collision.

So particle(s) created must have some kinetic energy

So not all KE converted to mass.

Colliding beams

(If particles have the same mass and speed), total initial momentum is zero,momentum after collision will be zero.

If one stationary particle is created,

All of the kinetic energy of the particle is converted to mass.

Explosion:

Under explosion, the momentum is still the same as the momentum before collision,

So in order to conserve momentum, the products must be travelling different directions

Unit 5 Capacitance

Charging process:

Capacitor charges up

Negative charge on one plate and positive charge on the other

As capacitor charges current decreases

No current through resistor

Time Constant

RC

The equation is found by

$$Q = Q_0 e^{\frac{-t}{RC}}$$

Put e^-1 and find Q for which the Q is at 36.79% of its original amount.

Unit 4,6 Electric Fields and Magnetic Fields

Uniform electric field:

Space/area/region where a force acts on a charged particle.

The force is the same at all points.

Electric fields: E=F/Q

Can be used to accelerate/deflect particles

Direction of force indicates (sign of) charge.

a = EQ/m

Magnetic fields: F=BIL and B=u0NI/L and B=u0I/2(pi)r

Produce circular motion Or provides a centripetal force Or causes spirals/arc

Direction of force indicates (sign of) charge.

Momentum/speed/mass found from radius by r = p/BQ Or Bqv = mv^2/r

The radius of curve gets less because particle slows down.

Electromagnetic Induction:

There is a magnetic field in iron core.

This field/flux is changing due to the AC magnetic field,

B field passes through the rotor,

Magnetic field lines are cut,

The changing magnetic flux/field leads to an induced emf,

Since the current is in a completed circuit.

The amount of EMF induced can be found by Faraday's law and Lenz's Law.

Statement of Lenz's law in terms of induced e.m.f. or current .

The (induced) current in the coil produces a magnetic field to oppose motion

So there is a force on the magnet in the opposite direction to its motion

As work = force × distance, work is done as the magnet moves.

Particle Movement in b-field

With a greater radius of curvature, use r=p/BQ and left-hand Rule to deduce the direction and curvature.

Rotation of Electromagnet:

Rotor experiences a force and F = BIL.

Due to the current in the rotor being in a magnetic field

Or rotor becomes a magnet.

Ways to increase power output:

Increase frequency of current

Increase magnitude of current

Add more turns to either coil

Magnetic Field in the current:

Current in a wire produces a magnetic field

Identifies direction of B field around either wire

Each wire is in the magnetic field of the other wire

A current-carrying wire in a magnetic field experiences a force

By Fleming's left hand rule.

Neutral Matters:

Does not leave a track

Charge conservation

Amount of emf induced

Use of $\Phi = BA$, Converts cm to m Or mT to T

$\mathcal{E} = Blv$ and $\varepsilon = \Delta\Phi/\Delta t$.

And $\Delta\Phi$ is the magnetic flux linkage.

Cyclotron:

Electric field/ p.d. accelerates particles by giving particles energy

Constant time period

Polarity of dees switches every half cycle .

Magnetic field/force at right angles to particles path

Maintains circular motion (whilst in dees)

Radius of circle increases as particles get faster.

Linear Accelerator:

particles accelerate when in the gaps

p.d. / polarity / supply reverses while particles are in the tube

p.d./ polarity / supply switches at constant time interval

p.d./supply has a constant frequency

(Drift) tubes get longer so particles are in tubes for the same time

Unit 7,8 Particle Physics

Electron guns:

Disc is heated by a current, resulting in thermionic emission.

Availability of antimatter:

Availability of antimatter is poor

Difficulty of storing antimatter

Deflection of Alpha particles in Gold Nucleus

Observation: Most alpha went straight through

Some deflected

Very few came straight back.

Conclusion: Atom mainly empty (space)

Positive Charge and mass is concentrated in the center

Particles-Antiparticles

Charge conserved

Strangeness Conserved

Lepton Number Conserved

Baryons are made of 3 quarks (or 3 anti-quarks)

Mesons are made of a quark and an anti-quark

Alpha Particle Deflection

Observation - most of the alpha particles were undeflected Or most of the alphas went straight through,

from this they could conclude –

that most did not get near enough to any matter to be affected

Observation - a few particles were deflected (by small angles)

from this they could conclude –

only a few particles came close enough to charge to be affected

Observation - a very small proportion of alpha particles were deflected through more than 90°

from this they could conclude that the nucleus must have mass much greater than the alpha particle mass in order to cause this deflection