

Edexcel Physics A-Level

Topic 8.1 - Nuclear Physics

Flashcards

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What is nucleon number?



What is nucleon number?

The sum of the number of protons and neutrons in the nucleus.



What is atomic number?



What is atomic number?

The total number of protons in the nucleus.



Outline Rutherford's alpha scattering experiment.



Outline Rutherford's alpha scattering experiment.

High speed alpha particles were fired at a very thin sheet of gold foil. The deflections of the particles were measured and conclusions were drawn.



What was observed in the Alpha scattering experiment?



What was observed in the Alpha scattering experiment?

- Most of the alpha particles passed straight through the gold atoms
 - Some of them were deflected
- A few of them were deflect backwards



What is thermionic emission?



What is thermionic emission?

Thermionic emission is the release of electrons due to heating.



Explain why electrons are released from a heated filament.



Explain why electrons are released from a heated filament.

As the filament heats up, free electrons inside the metal gain kinetic energy. When the surface electrons gain sufficient energy, they are released from the surface.



What will happen to a beam of electrons if it is passed through a potential difference?



What will happen to a beam of electrons if it is passed through a potential difference?

The beam of electrons will be accelerated since work is done by the potential difference.



How do you calculate the energy transferred to an electron, when it is accelerated across a potential difference?



How do you calculate the energy transferred to an electron, when it is accelerated across a potential difference?

Energy = Charge x Potential Difference

Energy = eV



What happens when a beam of electrons is directed into a magnetic field?



What happens when a beam of electrons is directed into a magnetic field?

The electron beam will be deflected, since magnetic fields apply forces on moving charges.



What is the magnitude of the force experienced by a moving electron in a magnetic field?



What is the magnitude of the force experienced by a moving electron in a magnetic field?

Force = Magnetic Flux Density x Charge
x Velocity

$$F = Bev$$



If the electrons are moving perpendicular to the field lines, which direction will the magnetic force act?



If the electrons are moving perpendicular to the field lines, which direction will the magnetic force act?

The force will act perpendicular to both the electron and field directions.



Describe the shape of the path of a beam of electrons passing through a magnetic field.



Describe the shape of the path of a beam of electrons passing through a magnetic field.

The beam will produce a circular path since the magnetic force always acts perpendicular to the electrons' motion. This means it acts as a centripetal force and produces a circular path.



What is a cyclotron?



What is a cyclotron?

A cyclotron is a particle accelerator that uses magnetic fields to accelerate particles in circular paths. This allows higher speeds to be reached, without the limitation of the accelerator's length.



Describe the basic composition of a cyclotron.



Describe the basic composition of a cyclotron.

Cyclotrons consist of two D-shaped paths which are separated by a small gap. An alternating potential difference is applied across the gap.



How does a cyclotron work?



How does a cyclotron work?

An electron beam is passed into the cyclotron, where it is deflected into a circular path by a perpendicular magnetic field. When the beam reaches the gap, it is accelerated by a potential difference. This increases the speed of the beam, causing the radius of the path to increase. This process repeats every half circle.



State the equation used to calculate the circular radius of an electron beam deflected in a magnetic field.



State the equation used to calculate the circular radius of an electron beam deflected in a magnetic field.

$$\text{Radius} = \frac{mv}{BQ}$$



What two equations must you combine to derive the radius equation?



What two equations must you combine to derive the radius equation?

1. Centripetal Force = mv^2/r

2. Magnetic Force = BQv

Centripetal Force = Magnetic Force



State the mass-energy equation.



State the mass-energy equation.

$$E = mc^2$$



What is 1 MeV in joules?



What is 1 MeV in joules?

$$(1.6 \times 10^{-19}) \times 10^6 = 1.6 \times 10^{-13} \text{ J}$$

