OCR (B) Physics GCSE

Topic 5.1 - What is radioactivity?

Flashcards

Describe the structure of a nucleus

Describe the structure of a nucleus

The nucleus is positively charged and is made of protons (positive) and neutrons (neutral).

What are the relative charges of protons, electrons and neutrons?

What are the relative charges of protons, electrons and neutrons?

Protons: +1

Electrons: -1

Neutrons: 0

What are the relative masses of protons, electrons and neutrons?

What are the relative masses of protons, electrons and neutrons?

Protons: 1

Electrons: 0 (0.0005)

Neutrons: 1

Give an estimate for the radius of an atom

Give an estimate for the radius of an atom

1×10^{-10}m

Describe the arrangement of electrons in an atom

Describe the arrangement of electrons in an atom

Electrons are arranged at different **energy levels**, different distances from the nucleus.

How can electrons arrangement change?

How can electron arrangement change?

If an atom absorbs EM radiation, electrons can move to higher energy levels or leave the atoms entirely.

Describe Dalton's atomic model

Describe Dalton's atomic model

Everything is made of tiny spheres (atoms) which **could not be divided** into anything smaller.

(1800)

Describe JJ Thompson's atomic model

Describe JJ Thompson's atomic model

The Plum Pudding Model: the overall charge of an atom is neutral, so it consists of a positive sphere ("pudding") with embedded negative electrons.

(1897)

Describe Rutherford's experiment

Describe Rutherford's experiment

- Alpha particles (charge +2) were fired at a thin sheet of gold foil.
- Most particles went straight through.
- Some particles were deflected by small angles (< 90º).
- A few particles were deflected by large angles (> 90º).

What are the conclusions of Rutherford's experiment?

What are the conclusions of Rutherford's experiment?

- Most of an atom is empty space.
- The nucleus has a positive charge.
- Most of the mass is concentrated in the nucleus.

Describe Rutherford's atomic model

Describe Rutherford's atomic model

There is a positive nucleus at the centre of an atom, with negative electrons existing in a "cloud"/region around the nucleus.

(1913)

Describe Bohr's atomic model

Describe Bohr's atomic model

Bohr's model was very similar to the Rutherford model, but he described electrons as existing in fixed **orbitals**/shells/energy levels around the nucleus.

What is an isotope?

What is an isotope?

Atoms of the same element, with the same number of protons, but a different number of neutrons so therefore different masses.

What do all atoms of the same element share?

What do all atoms of the same element share?

The same number of protons (atomic number).

When is an atom neutral?

When is an atom neutral?

When proton number = electron number.

When does radioactive decay occur?

When does radioactive decay occur?

When an atomic nucleus is unstable; it gives off radiation to become more stable.

Define activity

Define activity

The rate of decay of a source of unstable nuclei; the number of decays per second.

What is activity measured in?

What is activity measured in?

Becquerels, Bq

Define count rate

Define count rate

The number of decays per second.

How can count rate be measured?

How can count rate be measured?

Using a Geiger-Muller Tube.

Describe α radiation

Describe α radiation

- 1 particle is 2 protons, 2 neutrons (same as a helium nucleus).
- Highly ionising.
- Weakly penetrating (blocked by ~5cm of air).

Give the equation for an α particle

Give the equation for a α particle

$$\alpha \; {}^{4}_{2}$$

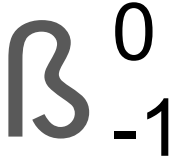
Describe ß radiation

Describe ß- radiation

- 1 particle is a single electron.
- Medium ionising effect.
- Medium penetration (blocked by ~50cm of air or a sheet of metal).

Give the equation for a ß particle

Give the equation for a ß particle



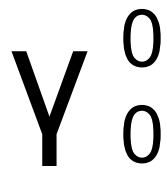
Describe γ radiation

Describe γ radiation

- Weakly ionising.
- Highly penetrating (blocked by several cm of lead).
- Electromagnetic radiation (no particles).

Give the equation for γ radiation

Give the equation for γ radiation



γ radiation is an EM wave.

Define half life

Define half life

Half life is the time taken for the number of radioactive nuclei to halve, or the time taken for the count rate/activity to halve.

Why can the decay of a single nucleus not be predicted?

Why can the decay of a single nucleus not be predicted?

Radioactive decay is a random process.

How is net decline calculated? (Higher)

How is net decline calculated? (Higher)

Net decline = initial number - number after *n* half lives

Or

Net decline = initial number - (initial number x $(\frac{1}{2})^n$)