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TOPIC 5: RADIOACTIVE MATERIALS: NUCLEAR ENERGY

Fusion In the sun (or other stars)

Total mass of reactants > mass of product

Some mass is converted
and released as energy

When two small nuclei
fuse together to form a
heavier nucleus

Not yet used on Earth to produce
energy, as it always uses more
energy than it gives out

Fission

Splitting of an
unstable nucleus into
smaller nuclei

Usually started by a nucleus
absorbing a neutron

Energy is also released as the
kinetic energy of the products

Produces 2 small nuclei,
neutrons and gamma
radiation

Chain reaction

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TOPIC 5: RADIOACTIVE MATERIALS: ATOMS & RADIOACTIVITY

Atomic Models

Plum Pudding/
Thompson

Positive sphere
embedded electrons

Bohr

Electrons in
fixed orbitals

Nucleus

Contains
positively charged protons (+1)
and neutral neutrons (0)

Matter is composed
of atoms

Dalton

Electrons: 0.0005

Neutrons: 1

Protons: 1

Relative masses:

The radius of an atom
is $\sim 1 \times 10^{-10} \text{m}$

Electrons (-1) are arranged
in energy levels around the
nucleus

Electrons can be promoted or
demoted by absorbing/emitting EM
radiation

Rutherford

Positive nucleus,
electron clouds

Rutherford's Experiment

Some deflected by
small angles

Most particles went
straight through

A few deflected by large
angles by positive nucleus

Alpha particles (charge +2) fired at a
thin sheet of gold foil

Isotopes

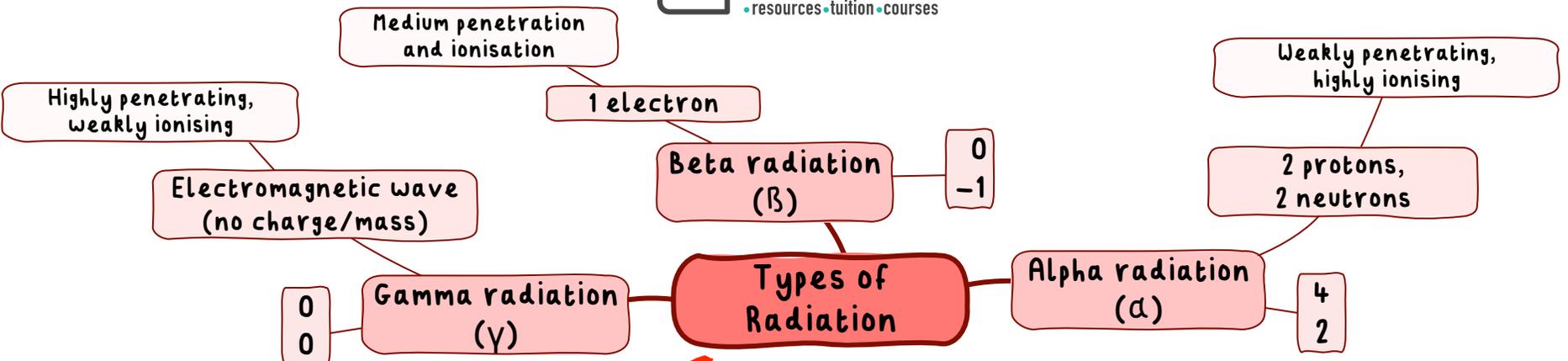
Different neutron
numbers but the same
atomic numbers

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Types of Radiation



Radioactivity (random process)

When a nucleus gives off radiation to become more stable

Activity

The number of decays per second

Activity/count rate can be measured using a Geiger-Muller Tube

Half life is the time taken for the count rate to halve

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

Conclusions:
Most of an atom is empty space
The positively charged nucleus occupies a very small volume

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