WJEC A-Level Physics

3.6 Nuclear Energy

Flashcards

What does the graph of N against Z show?

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It shows the relationship between proton number and neutron number. The graph shows a stability curve which starts as N=Z until a N value of 20. After that the graph curves upward and becomes steeper.

Where on the curve does B- decay occur and why?

Where on the curve does B- decay occur and why?

Above the stability line, because the nuclei found there contains too many neutrons. Therefore when beta minus decay occurs the neutron turns into a proton and it becomes more stable.

What type of decay occurs below the stability line and why?

What type of decay occurs below the stability line and why?

Beta plus decay occurs since the isotopes found below the line have too many protons. When beta plus decay occurs a proton turns into a neutron, making the nuclei more stable.

How do the heavier nuclei often decay?

How do the heavier nuclei often decay?

Through alpha decay. This is because alpha decay emits a helium nucleus (2 protons and 2 neutrons) therefore causing the nuclei to become less heavy and more stable.

What is the relationship between nuclear radius (R) and nucleon number (A)?

What is the relationship between nuclear radius (R) and nucleon number (A)?

$$R = r_0 A^{1/3}$$

Therefore nuclear radius is directly proportional to the cube root of the nucleon number.

True or false? The density of a nucleus is independent of its radius.

True or false? The density of a nucleus is independent of its radius.

True.

As $V = 4/3\pi r_0^3 A$.

Therefore Density = $m/(4/3\pi r_0^3 A)$.

$m = Au$

so density = $Au/(4/3\pi r_0^3 A)$. Cancel out the A's

Density = $u/(4/3\pi r_0^3 A.)$

What equation is used to convert mass to its energy equivalent?

What equation is used to convert mass to its energy equivalent?

$$E = mc^2$$

What is the mass defect?

What is the mass defect?

The difference between the total mass of all the nucleons separately compared to the total mass of the nucleus.

Why is there a mass defect?

Why is there a mass defect?

Energy is needed to bring the constituent parts of a nucleus together, therefore the mass equivalent of the energy is lost and the total mass decreases.

What is binding energy? Draw a graph to show this.

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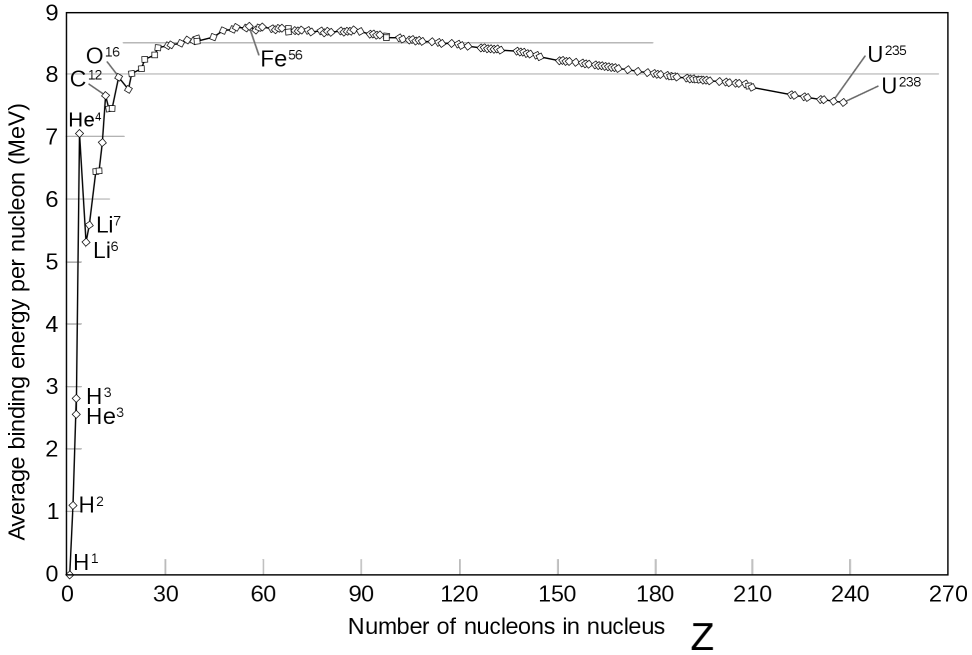
The energy required to separate a nucleus into its constituent parts.



What is nuclear fission?

What is nuclear fission?

- An unstable nucleus splits into 2 smaller nuclei.
  - Often occurs with larger nuclei.
- The binding energy per nucleon increases when fission occurs therefore the overall process releases energy.

What is fusion?

What is fusion?

When two small nuclei fuse together to create a larger nuclei. The new nucleus has a larger binding energy per nucleon than the old nuclei therefore energy is released in the process.

Why is it difficult to make fusion occur on earth?

Why is it difficult to make fusion occur on earth?

There is a large repulsion between the two positively charged nuclei, therefore a lot of energy is required to overcome the repulsion and fuse them together.

It is hard to get a material that can withstand the heat whilst being cost effective.

How is fission used in nuclear reactors?

How is fission used in nuclear reactors?

Rods of uranium-235 absorb neutrons and become unstable and then split into two daughter nuclei. It also releases 2/3 more neutrons. These then go on to be reabsorbed by another uranium-235.

What is the critical mass?

What is the critical mass?

The minimum mass of fuel needed for a chain reaction to occur.