

Topic C.3AB Nuclear Fusion & Fission

Past Exam Questions (Paper 3)

1. [3 marks]

Nuclear reactions transform one nuclide into another. Fission, splitting a large nucleus into two smaller nuclei, releases vast amounts of energy.

(i) Explain why fusion, combining two smaller nuclei into a larger nucleus, releases vast amounts of energy. Use section 36 of the data booklet.

.....

.....

.....

.....

(ii) Outline **one** advantage of fusion as a source of energy.

.....

.....

.....

.....

2a. [1 mark]

Carbon is produced by fusion reactions in stars.

Outline how the spectra of light from stars can be used to detect the presence of carbon.

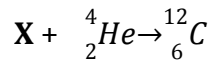
.....

.....

.....

2b. [1 mark]

The main fusion reaction responsible for the production of carbon is:



Deduce the identity of **X**.

.....

.....

.....

2c. [1 mark]

Outline why this reaction results in a release of energy.

.....

.....

.....

3a. [1 mark]

The sun is the main source of energy used on earth.

One fusion reaction occurring in the sun is the fusion of deuterium, ${}^2_1\text{H}$, with tritium, ${}^3_1\text{H}$, to form helium, ${}^4_2\text{He}$. State a nuclear equation for this reaction.

.....

.....

.....

3b. [2 marks]

Explain why this fusion reaction releases energy by using section 36 of the data booklet.

.....

.....

.....

.....

.....

.....

3c. [1 mark]

State the technique used to show that the sun is mainly composed of hydrogen and helium.

.....

.....

.....

4. [2 marks]

The Sun's energy is produced by the fusion of hydrogen nuclei.

Explain fusion reactions with reference to binding energy.

.....

.....

.....

.....

.....

.....

5. [2 marks]

Explain fusion reactions with reference to binding energy.

.....

.....

.....

.....

.....

.....

6a. [1 mark]

Red supergiant stars contain carbon-12 formed by the fusion of helium-4 nuclei with beryllium-8 nuclei.

Mass of a helium-4 nucleus = 4.002602 amu

Mass of a beryllium-8 nucleus = 8.005305 amu

Mass of a carbon-12 nucleus = 12.000000 amu

State the nuclear equation for the fusion reaction.

.....

.....

.....

6b. [2 marks]

Explain why fusion is an exothermic process.

.....

.....

.....
