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:	
$\mathbf{X} + {}^{4}_{2}He \rightarrow {}^{12}_{6}C$	
Deduce the identity of X .	
2c. [1 mark]	
Outline why this reaction results in a release of energy.	
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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, ${}^{2}_{1}H$, with tritium, ${}^{3}_{1}$	Н
to form helium, ${}_{2}^{4}He$. 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.

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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]
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6b. [2 marks] Explain why fusion is an exothermic process.