

17 In France, scientists from many countries are working together to build the International Thermonuclear Experimental Reactor (ITER).

(a) On the ITER website it states:

“Fusion is the energy source of the Sun and stars. In the core of these stellar bodies, hydrogen nuclei fuse into helium nuclei and release tremendous amounts of energy.”

Explain why energy is released when hydrogen nuclei fuse to form helium nuclei.

(2)

(b) It is hoped that the ITER will be the first fusion device on Earth to maintain nuclear fusion for long periods of time.

To achieve fusion in the ITER, a hot plasma is used.

The plasma must

- be at an extremely high temperature
- have sufficient density for fusion.

Explain why each of these two conditions must be met.

(4)



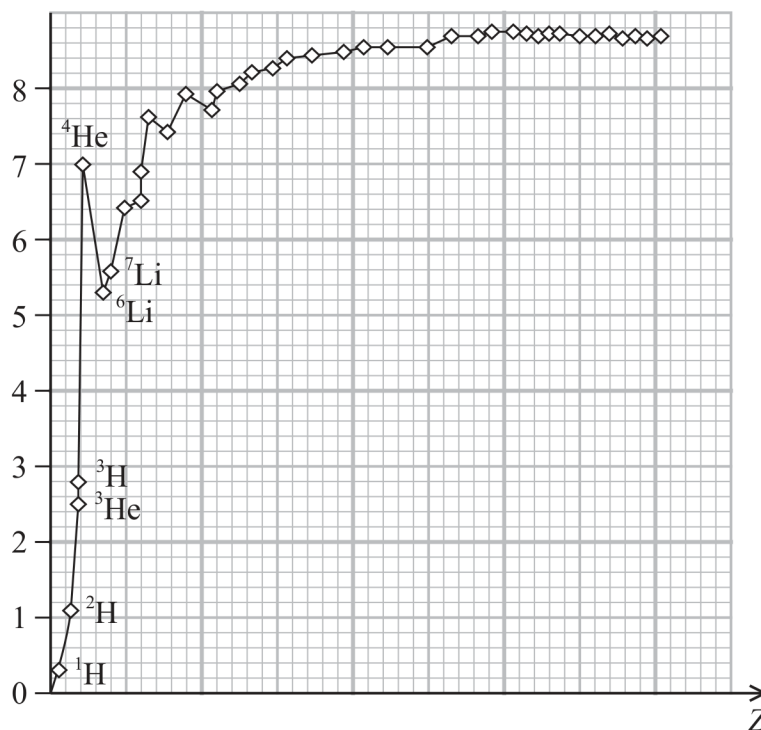
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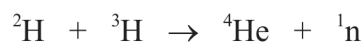
(c) The graph shows the variation of binding energy per nucleon with proton number Z .

Binding energy
per nucleon/MeV



In one possible fusion reaction, a nucleus of ^2H fuses with a nucleus of ^3H .

A nucleus of ^4He and a free neutron are produced as shown in the following nuclear equation.



Determine the energy, in MeV, released when a nucleus of ^2H fuses with a nucleus of ^3H .

(3)

Energy released = MeV

(Total for Question 17 = 9 marks)