

Nuclear fission

1. (a) Nuclear power stations use the energy released by *nuclear fission* to generate electricity.

(i) Explain what is meant by *nuclear fission*.

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(2)

(ii) How does nuclear fission lead to a chain reaction?

You may give your answer as a labelled diagram.

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(1)

(b) Although nuclear fuels are relatively cheap the total cost of generating electricity using nuclear fuels is expensive. Why?

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(1)

(c) The table compares the energy released from 1 kg of coal and 1 kg of uranium.

| | |
|---------|------------|
| Coal | 29 MJ |
| Uranium | 580 000 MJ |

1 MJ = 1 000 000 joules

State **one** benefit to the environment of using a concentrated fuel like uranium to generate electricity rather than using the energy from coal.

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.....

(1)

(Total 5 marks)

2. The first commercial nuclear power station in the world was built at Calder Hall in Cumbria.
- (a) The fuel used at the Calder Hall power station is uranium. Natural uranium consists mainly of two isotopes: uranium-235 (${}_{92}^{235}\text{U}$) and uranium-238 (${}_{92}^{238}\text{U}$). The nucleus of a uranium-235 atom is different to that of a uranium-238 atom.

(i) Where is the nucleus in an atom?

..... (1)

(ii) Name the **two** types of particle found in the nucleus.

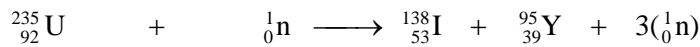
..... and (2)

(iii) How is the nucleus of a uranium-238 atom different to the nucleus of a uranium-235 atom?

.....

 (2)

(b) In the nuclear reactor fission of uranium atoms takes place in reactions such as the one shown below.



The nuclear reactions are carefully controlled in the power station so that a chain reaction takes place.

Explain, as fully as you can:

(i) how fission of uranium atoms takes place in a nuclear reactor;

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(ii) how this leads to a chain reaction;

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(iii) why it can be used to generate electricity.

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(4)
 (Total 9 marks)