

APOLLO

# Fission

## HL

Physics

First assessment 2025

8 questions | questions

- 38.** A suitable material for use as a moderator in a nuclear reactor is...
- A. cadmium.
  - B. concrete.
  - C. uranium-238.
  - D. water.

**39.** In a simple model of a nuclear reactor, four neutrons are emitted per fission on average.

The average number of neutrons absorbed by the control rods is  $N_c$  per fission.

The average number of neutrons that are lost through the walls of the reactor is  $N_1$  per fission.

Any remaining neutrons induce further fissions.

What are possible values for  $N_c$  and  $N_1$  for the reactor to maintain a steady reaction?

|    | $N_c$ | $N_1$ |
|----|-------|-------|
| A. | 1     | 1     |
| B. | 1     | 3     |
| C. | 2     | 1     |
| D. | 2     | 2     |

- 39.** The moderator in a nuclear power station...
- A. increases the proportion of U-235 in the fuel source.
  - B. transfers internal energy from the reactor to the turbines.
  - C. allows operators to regulate the rate of power production.
  - D. decreases the kinetic energy of neutrons in the reactor.

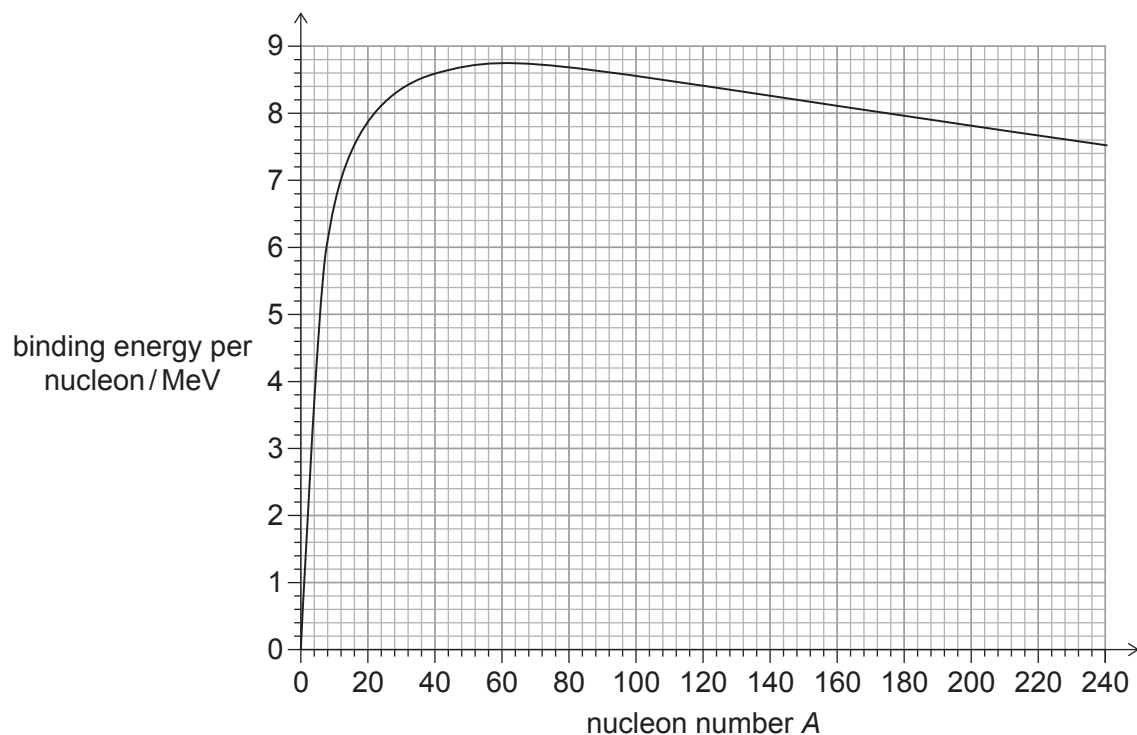
- 37.** Which component is responsible for slowing down neutrons in a nuclear reactor to increase the likelihood of nuclear fission?
- A. Moderator
  - B. Control rods
  - C. Fuel rods
  - D. Heat exchanger

- 38.** A nucleus of uranium-235 ( $^{235}_{92}\text{U}$ ) absorbs a neutron and decays into two nuclides, xenon-140 ( $^{140}_{54}\text{Xe}$ ) and strontium-94 ( $^{94}_{38}\text{Sr}$ ).

How many neutrons are released in this reaction?

- A. 1
- B. 2
- C. 3
- D. 4

37. A graph of the variation with nucleon number  $A$  of the binding energy per nucleon is shown.



What is the approximate total energy, in MeV, needed to completely separate the nucleons of a  $^{180}_{72}\text{Hf}$  nucleus?

- A. 580
- B. 620
- C. 1440
- D. 2020

- 38.** Which two components of a nuclear power station are primarily responsible for ensuring that a controlled chain reaction is maintained?
- A. Control rods and heat exchangers
  - B. Moderators and shielding
  - C. Shielding and heat exchangers
  - D. Moderators and control rods

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**Turn over**  
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**36.** Three statements about a nuclear fission reactor are:

- I. The heat exchanger transfers energy from the fuel rods to the moderator.
- II. The control rods must be good absorbers of neutrons.
- III. The moderator must slow neutrons down.

Which statements about the reactor are correct?

- A. I and II only
- B. I and III only
- C. II and III only
- D. I, II and III