

Exercise walk-through

7.2

Fission and fusion

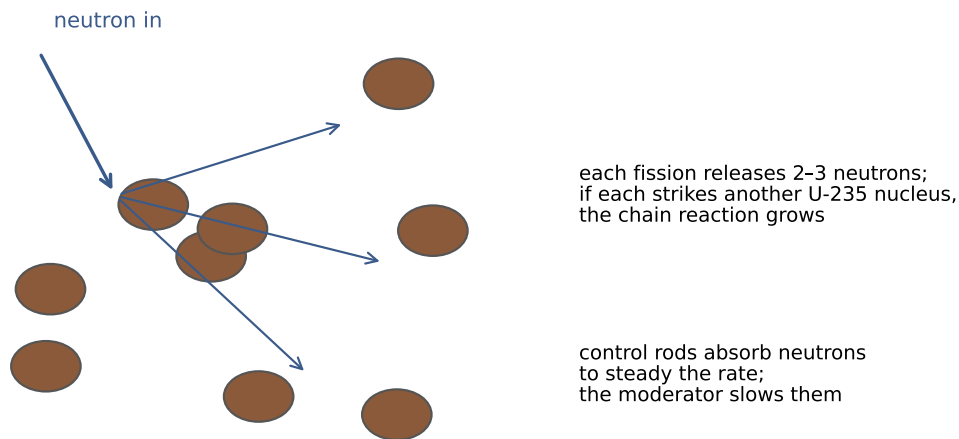
Pearson Edexcel · International GCSE · Physics

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The method

Method — The chain, managed

One $\text{U-235} + \text{n} \rightarrow \text{two daughter nuclei} + 2\text{--}3 \text{ neutrons} + \text{kinetic energy}$. Moderator slows neutrons; control rods absorb them; shielding protects.



Method — Fusion: joining nuclei

Small nuclei fuse to a larger one with a loss of mass and release of energy – the Sun's power. Proton repulsion demands extreme temperature and pressure.

Exercises 2.1·2.3

2.1 State what bombards U-235 to cause fission. [1]

2.2 Name the three products of a U-235 fission besides energy. [3]

2.3 State the role of the control rods. [1]

Exercises 2.1·2.3

2.1 State what bombards U-235 to cause fission. [1]

2.1 A (slow) neutron.

2.2 Name the three products of a U-235 fission besides energy. [3]

2.2 Two radioactive daughter nuclei and 2–3 neutrons.

2.3 State the role of the control rods. [1]

2.3 Absorb neutrons to control the fission rate.

Exercises 2.4·3.1

2.4 State the role of the moderator.

[1]

2.5 What provides the Sun's energy?

[1]

3.1 Describe how a chain reaction builds in a mass of U-235, and how control rods keep it steady.

[3]

Exercises 2.4·3.1

2.4 State the role of the moderator. [1]

2.4 Slow the neutrons so they split U-235 efficiently.

2.5 What provides the Sun's energy? [1]

2.5 Nuclear fusion of hydrogen (into helium).

3.1 Describe how a chain reaction builds in a mass of U-235, and how control rods keep it steady. [3]

3.1 A fission releases 2–3 neutrons; each can strike another U-235 nucleus, causing further fissions whose neutrons continue the growing chain; control rods lowered into the reactor absorb neutrons, holding one fission per neutron – a steady rate.

Exercises 3.2·3.3

3.2 Explain the difference between nuclear fission and nuclear fusion, naming where each is used. [3]

3.3 Explain why fusion reactors need much higher temperatures than fission reactors produce. [3]

Exercises 3.2-3.3

3.2 Explain the difference between nuclear fission and nuclear fusion, naming where each is used. [3]

3.2 Fission splits a large nucleus (U-235) into smaller nuclei, releasing energy – used in nuclear power stations; fusion joins small nuclei into a larger one, releasing energy – powering the Sun (and experimental reactors).

3.3 Explain why fusion reactors need much higher temperatures than fission reactors produce. [3]

3.3 Both nuclei to be fused are positively charged; like charges repel electrostatically, so the nuclei must collide at enormous speed to approach closely enough to fuse; enormous speeds require extremely high temperatures and pressures.