

Q1.

Question number	Answer	Additional guidance	Mark
	P - control rods (1)	boron steel rods	<b>(2)</b>
	Q - graphite/moderator (1)	heavy water	

Q2.

	Answer	Additional guidance	Mark
(i)	<p>an explanation linking:</p> <p>(control rods) absorb <u>neutrons</u> (1)</p> <p>(so) fewer (neutrons) available for chain reaction (1)</p>	<p>ignore slow down the nuclear chain reaction</p> <p>accept (control rods) block <u>neutrons</u></p> <p>accept <u>neutrons</u> can't pass through (control rods)</p> <p>fewer fission(s) (reactions)</p>	<b>(2)</b> AO1

Q3.

Question Number	Answer	Acceptable answers	Mark
<b>(b)</b>	<p>An explanation linking</p> <p>Absorb (more) neutrons (1)</p> <p>(to) reduce the number of fission reactions (1)</p>	<p>ignore slow down neutrons</p> <p>slow down (the rate of) the reaction/fission</p>	<b>(2)</b>

Q4.

Question number	Answer	Additional guidance	Mark
	<p>An explanation that combines understanding (1 mark) and reasoning/justification - understanding (2 marks):</p> <ul style="list-style-type: none"><li>• slows down neutrons (1)</li><li>• increase chance of collision / fission (1)</li><li>• maintain the reaction rate (1)</li></ul>	<p>to allow capture by nucleus</p> <p>increase the reaction rate</p>	<b>(3)</b>

Q5.

Question number	Answer	Additional guidance	Mark
	<p>An explanation that combines identification - knowledge (1 mark) and reasoning/justification - knowledge (2 marks):</p> <ul style="list-style-type: none"><li>• reaction will slow down (1)</li><li>• because there are fewer fissions (1)</li><li>• because fission more likely with slow neutrons (1)</li></ul>	<p>allow</p> <p>reactor shuts down/eq</p> <p>fission requires slow neutrons</p> <p>thermal neutrons for slow neutrons</p>	<b>(3)</b>

Q6.

Question Number	Answer	Mark
*	<p>Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme.</p> <p>The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant.</p> <p style="text-align: center;"><b>AO1</b></p> <ul style="list-style-type: none"><li>• neutrons released in a chain reaction</li><li>• slow(er) neutrons needed for fission</li><li>• (some) neutrons are too fast</li><li>• control rods can be moved in and out</li><li>• control rods control speed of the reaction</li></ul> <p style="text-align: center;"><b>AO2</b></p> <ul style="list-style-type: none"><li>• graphite core is the moderator</li><li>• graphite core slows down the neutrons</li><li>• moveable rods absorb neutrons</li><li>• moveable rods make more or fewer neutrons available for fission</li></ul>	<p><b>(6)</b></p> <p>AO 1 1</p> <p>AO 2 1</p>

Level	Mark	Descriptor
	0	No awardable content
Level 1	1-2	<ul style="list-style-type: none"> <li>An explanation that demonstrates elements of physics understanding, some of which is inaccurate. Understanding of scientific ideas lacks detail. (AO1)</li> <li>The explanation attempts to link and apply knowledge and understanding of scientific ideas, flawed or simplistic connections made between elements in the context of the question. (AO2)</li> </ul>
Level 2	3-4	<ul style="list-style-type: none"> <li>An explanation that demonstrates physics understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas is not fully detailed and/or developed. (AO1)</li> <li>The explanation is mostly supported through linkage and application of knowledge and understanding of scientific ideas, some logical connections made between elements in the context of the question. (AO2)</li> </ul>
Level 3	5-6	<ul style="list-style-type: none"> <li>An explanation that demonstrates accurate and relevant physics understanding throughout. Understanding of the scientific ideas is detailed and fully developed. (AO1)</li> <li>The explanation is supported throughout by linkage and application of knowledge and understanding of scientific ideas, logical connections made between elements in the context of the question. (AO2)</li> </ul>