

Name of the Student: _____

Max. Marks : 18 Marks

Time : 18 Minutes

Mark Schemes

Q1.

Question Number	Answer	Mark
	an answer containing both of the following numbers in the correct places (1) $\begin{array}{c} 99 \\ \hline 43 \end{array} \text{Tc}$	(1) AO 2 1

Q2.

	Answer	Additional guidance	Mark
	substitution (1) $\text{number of atoms} = \frac{4.0 \times 10^{-7}}{0.15 (\times 10^{-9})}$ evaluation (1) 2 700	$\frac{4.0 \times 10^{-7}}{1.5 (\times 10^{-10})}$ $\frac{0.000\ 000\ 4}{0.000\ 000\ 000\ 15}$ accept any value that rounds to 2 700 award full marks for correct answer without working	(2) AO2

Q3.

Question number	Answer	Additional guidance	Mark
	recognition of there being 4 half lives involved (1) so fraction of 1/16 involved (1) evaluation (1) 2.4 (kBq)	 allow 2 marks for 4.8 (kBq) (used three instead of 4 half lives) allow 1 mark for any other $(1/2)^n$ being involved i.e. for answers that round to 19.3 (kBq), 9.63 (kBq), 1.2(kBq) award full marks for the correct answer without working	(3)

Q5.

	Answer	Additional guidance	Mark
(i)	reading from graph (1) (at 5 degrees:) number between 10^6 and 10^7 AND (at 100 degrees:) 10^2 evaluation (1) $\frac{\text{number between } 10^6 \text{ and } 10^7}{10^2}$ OR between $10^4:1$ and $10^5:1$ between 10 000:1 and 100 000:1 OR between 10^4 and 10^5 between 10 000 and 100 000	(e.g. $10^{6.5}$) (e.g. $10^{4.5}:1$ or $10^7:10^2$) allow any correct ratio not in its simplest form (e.g. $10^{4.5}$) award full marks for correct answer without working inverted ratio scores 1 mark maximum	(2) AO2

	Answer	Additional guidance	Mark
(ii)	an explanation including any four from: Observations most (alpha particles) pass (straight) through the foil (with little deflection) (1) some (alpha particles) are {scattered / deflected} through {small angles / less than 90 degrees} (1) (very) few (alpha particles) are {scattered / deflected} through {large angles / greater than 90 degrees} (1) Conclusions atoms are mainly empty space (1) there must be a nucleus / something inside the atom (1) (nucleus / something) must be {small / heavy / dense / concentrated / charged / positive} (1)	ignore electrons ignore refracted allow repelled allow rebound / reflect / back scattering / bounce back ignore electrons	(4) A01,A03

Q6.

	Answer	Additional guidance	Mark
(i)	an explanation linking: (control rods) absorb <u>neutrons</u> (1) (so) fewer (neutrons) available for chain reaction (1)	ignore slow down the nuclear chain reaction accept (control rods) block <u>neutrons</u> accept <u>neutrons</u> can't pass through (control rods) fewer fission(s) (reactions)	(2) AO1
	Answer	Additional guidance	Mark
(ii)	$\frac{4(.0 \times 10^3)(\times 100)}{3(.0 \times 10^7)}$ (1) $1.3 \times 10^{-2} (\%)$ (1)	0.013 (%) allow 0.01 (%) power of ten error scores 1 mark maximum award full marks for the correct answer without working	(2) AO2

	Answer	Additional guidance	Mark
(iii)	A description to include: (from) kinetic energy (of fission fragments) (1) (transferred to) thermal energy (of coolant) (1)	accept references to energy stores accept energy in nuclear store accept nuclear energy / gamma radiation energy / binding energy / mass (to) thermal store (in coolant) accept heat for thermal if no other marks awarded allow steam transfers thermal energy/heat from reactor to kinetic energy of turbine for 2 marks	(2) AO1