Q	Marking instructions	AO	Marks	Typical solution
5(a)	Substitutes t = 15.9 hours and $N = \frac{N_0}{2}$ in the model to find k **OE** **PI** by correct value of k	3.4	M1	$\frac{N_0}{2} = N_0 e^{-15.9k}$ $k = 0.0436$ $0.1 = e^{-0.0436t}$ $t = 52.8$ hours t = 2.2 days
	Obtains correct k **AWFW** [0.043, 0.044] or $-\frac{ln(0.5)}{15.9}$	1.1b	A1	
	Substitutes their value of k and $N = 0.1N_0$ in the model to find t **OE**	3.4	M1	
	Solves their equation correctly to find their t **AWFW** [52.3, 53.6] if correct k used	1.1a	M1	
	Obtains correct t in days **AWRT** 2.2 days Accept [2 days 4 hours, 2 days 6 hours] or 3 days Condone 2 days if 2.2 days seen	3.2a	A1	
5(b)	Substitutes t = 24x7 or 168 and their value of k in the model. Condone omission of N or N_0 or use of N_0 = 1 or 100 **PI** by [0.000616, 0.00073] or correct answer	3.4	M1	$N = N_0 e^{-0.0436\times168}$ $= N_0 \times 0.000658..$ 0.066%
	Obtains correct percentage **AWFW** [0.0616, 0.073] **ISW**	3.2a	A1	
5(c)	Gives a sensible reason relating continuous model for discrete data **OE**	3.2b	E1	The model is continuous but the number of atoms is discrete

5(d)	Explains that the number of atoms will eventually become small or explains that the model will eventually predict less than one atom but never zero atoms **OE**	3.5a	E1	As t gets large the number of atoms predicted by the model will become small so the model will no longer be accurate.
	Total		**9**	