Q	Marking instructions	AO	Marks	Typical solution
8(a)	Substitutes $t = 0$ into the model **PI** by 20	3.4	M1	$\theta = 20\left(11 - 10e^0\right)$ $= 20$ Room temperature $= 20°C$
	Obtains 20°C Must have units	3.2a	A1	
	Subtotal		2	

Q	Marking instructions	AO	Marks	Typical solution
8(b)	Replaces e^{-kt} with 0 or substitutes any positive value for kt **PI** by 220	3.4	M1	For large values of t, $e^{-kt} \to 0$ $T = 20\left(11 - 10 \times 0\right)$ Hence $T = 220$
	Obtains 220	3.4	A1	
	Subtotal		2	

Q	Marking instructions	AO	Marks	Typical solution
8(c)(i)	Forms the equation $86 = 20\left(11 - 10e^{-k}\right)$ **PI** by correct answer	3.4	M1	$86 = 20\left(11 - 10e^{-k}\right)$ $k = 0.4$
	Obtains **AWFW** [0.4, 0.4005] or $-\ln 0.67$ **OE**	3.3	A1	
	Subtotal		2	

Q	Marking instructions	AO	Marks	Typical solution
8(c)(ii)	Uses their T from part **8(b)** and their k from part **8(c)(i)** correctly to form the equation $T - 1 = 20\left(11 - 10e^{-kt}\right)$ **PI** by correct answer Condone use of inequality sign	3.4	M1	$220 - 1 = 20\left(11 - 10e^{-0.4t}\right)$ $t = 13.2$ minutes
	Obtains **AWFW** [13.2, 13.25] mins or **AWFW** [13m 12s, 13m 15s] or 13 mins Condone missing units or $t > 13.2$ or $t \geq 13.2$ **ISW**	1.1b	A1	
	Subtotal		2	

	Question 8 Total		8	