Question	Scheme	Marks	AOs
8 (a)	Temperature = 83°C	B1	3.4
		(1)	
(b)	$18+65e^{-\frac{t}{8}}=35 \Rightarrow 65e^{-\frac{t}{8}}=17$	M1	1.1b
	$t=-8\ln\left(\frac{17}{65}\right)$ | $\ln 65-\frac{t}{8}=\ln 17 \Rightarrow t=...$	dM1	1.1b
	$t=10.7$	A1	1.1b
		(3)	
(c)	States a suitable reason • As $t\to\infty, \theta\to 18$ from above. • The minimum temperature is 18°C	B1	2.4
		(1)	
(d)	$A+B=94$ or $A+Be^{-1}=50$	M1	3.4
	$A+B=94$ and $A+Be^{-1}=50$	A1	1.1b
	Full method to find at least a value for A	dM1	2.1
	Deduces $\mu=\frac{50e-94}{e-1}$ or accept $\mu=$ awrt 24.4	A1	2.2a
		(4)	
			(9 marks)

Notes

(a)

B1: Uses the model to state that the temperature $=83°C$ Requires units as well

(b)

M1: Uses the information and proceeds to $Pe^{\pm\frac{t}{8}}=Q$ condoning slips

dM1: A full method using correct log laws and a knowledge that e^x and ln$x$ are inverse functions. This cannot be scored from unsolvable equations, e.g $P>0, Q<0$. Condone one error in their solution.

A1: $t=$ awrt 10.7

(c)

B1: States a suitable reason with minimal conclusion

- As $t\to\infty, \theta\to 18$ from above.
- The minimum temperature is 18°C (so it cannot drop to 15°C)
- Substitutes $\theta=15$ (or a value between 15 and 18) into $18+65e^{-\frac{t}{8}}=15$ (may be impied by $15-18=-3$ or similar) and makes a statement that $e^{-\frac{t}{8}}$ cannot be less than zero or else that $\ln(-ve)$ is undefined and hence $\theta\neq 15$. All calculations must be correct
- (According to the model) the room temperature is 18°C (so cannot fall below this)

(d)

M1: Attempts to use $(0,94)$ or $(8,50)$ in order to form at least one equation in A and B

Allow this to be scored with an equation containing e^0

A1: Correct equations $A+B=94$ and $A+Be^{-1}=50$ or equivalent. $e^0=1$ must have been processed. Condone $A+B=94$ and $A+0.37B=50$ where $e^{-1}=$ awrt 0.37

dM1: Dependent upon having two equations in A and B formed from the information given. It is a full and correct method leading to a value of A. Allow this to be solved from a calculator.

Note $B=69.6..$ or $\dfrac{44}{1-e^{-1}} \Rightarrow A=94-"B"$

A1: Deduces that $\mu=\dfrac{50e-94}{e-1}$ or accept $\mu=$ awrt 24.4 . Condone $y=\ldots$