Question	Scheme	Marks	AOs
12 (a)	$N = aT^b \Rightarrow \log_{10} N = \log_{10} a + \log_{10} T^b$	M1	2.1
	$\Rightarrow \log_{10} N = \log_{10} a + b\log_{10} T$ so $m = b$ **and** $c = \log_{10} a$	A1	1.1b
		(2)	
(b)	Uses the graph to find either *a* or *b* $a = 10^{\text{intercept}}$ **or** b = gradient	M1	3.1b
	Uses the graph to find both *a* and *b* $a = 10^{\text{intercept}}$ **and** b = gradient	M1	1.1b
	Uses $T = 3$ in $N = aT^b$ with their *a* and *b*	M1	3.1b
	Number of microbes ≈ 800	A1	1.1b
		(4)	
(c)	$N = 1000000 \Rightarrow \log_{10} N = 6$	M1	3.4
	We cannot 'extrapolate' the graph and assume that the model still holds	A1	3.5b
		(2)	
(d)	States that '*a*' is the number of microbes 1 day after the start of the experiment	B1	3.2a
		(1)	
			(9 marks)

Question 12 continued

Notes:

(a)

M1: Takes logs of both sides and shows the addition law

M1: Uses the power law, writes $\log_{10} N = \log_{10} a + b\log_{10} T$ and states $m = b$ **and** $c = \log_{10} a$

(b)

M1: Uses the graph to find either a or b $a = 10^{\text{intercept}}$ **or** b = gradient. This would be implied by the sight of $b = 2.3$ **or** $a = 10^{1.8} \approx 63$

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M1: Uses $T = 3 \Rightarrow N = aT^b$ with their a and b. This is implied by an attempt at $63 \times 3^{2.3}$

A1: Accept a number of microbes that are approximately 800. Allow 800 ± 150 following correct work.

There is an alternative to this using a graphical approach.

M1: Finds the value of $\log_{10} T$ from T =3. Accept as $T = 3 \Rightarrow \log_{10} T \approx 0.48$

M1: Then using the line of best fit finds the value of $\log_{10} N$ from their "0.48"

Accept $\log_{10} N \approx 2.9$

M1: Finds the value of N from their value of $\log_{10} N$ $\log_{10} N \approx 2.9 \Rightarrow N = 10^{'2.9'}$

A1: Accept a number of microbes that are approximately 800. Allow 800 ± 150 following correct work

(c)

M1 For using N = 1000000 and stating that $\log_{10} N = 6$

A1: Statement to the effect that "we only have information for values of $\log N$ between 1.8 and 4.5 so we cannot be certain that the relationship still holds". "We cannot extrapolate with any certainty, we could only interpolate"

There is an alternative approach that uses the formula.

M1: Use N = 1000000 in their $N = 63 \times T^{2.3} \Rightarrow \log_{10} T = \dfrac{\log_{10}\left(\dfrac{1000000}{63}\right)}{2.3} \approx 1.83$.

A1: The reason would be similar to the main scheme as we only have $\log_{10} T$ values from 0 to 1.2. We cannot ‘extrapolate’ the graph and assume that the model still holds

(d)

B1: Allow a numerical explanation $T = 1 \Rightarrow N = a1^b \Rightarrow N = a$ giving a is the value of N at T =1