Q	Marking Instructions	AO	Marks	Typical Solution
10(a)	Substitutes $t = 0$ to obtain $\theta = A$ Or States when t = 0, $10^{-kt} = 1$ **and** Infers correctly that A is the initial temperature of the water	2.2b	R1	$t = 0$ gives $\theta = A$ A is the starting temperature of the water
10(b)	Uses logarithms correctly to achieve given answer Must see clear evidence of use AG $\log_{10} A \times \log_{10} 10^{-kt}$ scores B0	1.1b	B1	$\log_{10} \theta = \log_{10} A + \log_{10} 10^{-kt}$ $= \log_{10} A - kt$
10(c)	Substitutes correct t and θ values to form at least one correct equation	3.3	M1	$t = 10, \theta = 30, t = 20, \theta = 12$ $\log_{10} 30 = \log_{10} A - 10k$ $\log_{10} 12 = \log_{10} A - 20k$ $k = \frac{1}{10} \log_{10} 2.5 = 0.0398$ $A = 75$
	Substitutes correct t and θ values to form two correct equations	3.1b	A1	
	Solves the equations to find exact k ACF or AWFW 0.039 to 0.04	1.1a	M1	
	Solves to find A AWRT 75	1.1b	A1	
10(d)	Substitutes 'their' calculated values of k , A and $t = 45$ into the given equation or Solves $75 \times 10^{-0.039 \times t} = 1$	3.4	M1	$75 \times 10^{-0.039 \times 45}$ $= 1.2$ $1.2 > 1$ Model does not support Zena's statement
	Obtains correct answer for θ AWFW 1.18 to 1.32 Or Obtains $t = 47.1$ AWFW 46.8 to 48.1	1.1b	A1	
	Compares AWFW 1.18 to 1.32 with 1 and states that the model does not support Zena's statement or Compares AWFW 46.8 to 48.1 with 45 and states that the model does not support Zena's statement	3.2b	R1	
10(e)	States a valid problem with the **model.** For example: Change in outside temperature Model implies water never cools	3.5b	E1	After 45 minutes the outside temperature may have changed

	down to 0°C. Other factors may affect rate of cooling for example air currents She has not taken enough measurements to accurately determine the model parameters Water behaves differently as its temperature approaches 0°C We do not know what happens after t = 20 **Do not** accept any reference to rates of change unless fully qualified			
	Total		**10**	