Question Number	Scheme	Marks	AOs
4 (a)	$t=4, V=50 \Rightarrow 50=a+2b$ **or** $t=9, V=20 \Rightarrow 20=a+3b$	M1	3.1b
	Attempts both and solves to find values for a **and** b	dM1	1.1b
	$V=110-30\sqrt{t}$	A1	3.3
		(3)	
(b)	220 litres	B1ft	3.4
		(1)	
(c)	Sets their $110-30\sqrt{t}=0 \Rightarrow t=...$	M1	3.4
	$\{0 \leqslant\}\ t \leqslant \dfrac{121}{9}$	A1ft	3.5b
		(2)	
			(6 marks)

Notes:

(a)

M1: Forms at least one equation using $t=4, V=50$ or $t=9, V=20$ the correct way round in the given model, e.g., $50=a+b\sqrt{4}$

dM1: Uses both pieces of information the correct way round and solves their equations to find values for a **and** b. Dependent on the previous method mark.

Condone a slip in substitution when creating the equations, e.g., failing to square root the 9 or 4, or miscopying 20 as 30, and do not be concerned about their processing to solve the simultaneous equations.

A1: cao $V=110-30\sqrt{t}$ o.e. in any form e.g. $V=110-30t^{\frac{1}{2}}$ or $V+30\sqrt{t}=110$

Condone e.g. $V=110+-30\sqrt{t}$

If just a = 110 and b = –30 seen in part (a) this mark may be awarded for a complete model seen in part (b) or part (c).

(b)

B1ft: 220 litres including units but follow through on twice their value for a provided it is positive.

May come from other models e.g. $V=a+bt$ for part (b).

(c) **Their model must be of the correct form for this part.**

M1: Realises that the model breaks down when V = 0 so solves their $110-30\sqrt{t}=0 \Rightarrow t=...$

Do not be concerned about their processing to solve the equation for this mark.

May be implied by e.g. t < awrt 13.4 or by their $t \leqslant$ … following through on their value to 3sf.

A1ft: Finds the limitation to the model $\{0 \leqslant\} t \leqslant \frac{121}{9}$ There is no requirement to see the lower limit.

Condone solutions such as $t \leqslant 13.\dot{4}$ and $t < \frac{121}{9}$ or an equivalent statement in words, e.g. "the model is only valid for values of t up to "$\frac{121}{9}$" or "$13.\dot{4}$ is the last possible value…".

Must be exact, so not e.g. $t \leqslant 13.4$ regardless of whether the exact critical value has previously been stated.

Follow through on their a and b so look for $t \leqslant \frac{a^2}{b^2}$ or $t < \frac{a^2}{b^2}$ but a and b must be numerical.

Ignore any other spurious incorrect statements such as t cannot be 0, provided they do not clearly affect the upper limit, and ignore any incorrect units.