Question number	Scheme	Marks
3	Let l be the length. $\dfrac{\mathrm{d}l}{\mathrm{d}t}=0.005$	
	$l=10x \Rightarrow \dfrac{\mathrm{d}l}{\mathrm{d}x}=10$ or $\dfrac{\mathrm{d}l}{\mathrm{d}t}=10\dfrac{\mathrm{d}x}{\mathrm{d}t}=0.005 \Rightarrow \dfrac{\mathrm{d}x}{\mathrm{d}t}=0.0005$	B1
	$r=\dfrac{x}{2}, \quad V=\pi\left(\dfrac{x}{2}\right)^2\times 10x \Rightarrow V=\dfrac{5\pi x^3}{2}$	B1
	$\dfrac{\mathrm{d}V}{\mathrm{d}x}=\dfrac{15\pi x^2}{2}$	M1
	$\dfrac{\mathrm{d}V}{\mathrm{d}t}=\dfrac{\mathrm{d}V}{\mathrm{d}x}\times\dfrac{\mathrm{d}x}{\mathrm{d}l}\times\dfrac{\mathrm{d}l}{\mathrm{d}t}$ or $\dfrac{\mathrm{d}V}{\mathrm{d}t}=\dfrac{\mathrm{d}V}{\mathrm{d}x}\times\dfrac{\mathrm{d}x}{\mathrm{d}t}$	M1
	$\dfrac{\mathrm{d}V}{\mathrm{d}t}=\dfrac{15\pi\times 3^2}{2}\times\dfrac{1}{10}\times 0.005$ or $\dfrac{\mathrm{d}V}{\mathrm{d}t}=\dfrac{15\pi\times 3^2}{2}\times 0.0005$	dM1
	$=0.106028...$	
	$\dfrac{\mathrm{d}V}{\mathrm{d}t}\approx 0.11\ (\mathrm{cm}^3/\mathrm{s})$	A1 [6]
Alternative		
	$x=\dfrac{l}{10}$ or $r=\dfrac{l}{20}$ stated or used	B1
	$V=\pi\left(\dfrac{l}{20}\right)^2\times l=\dfrac{\pi l^3}{400}$	B1
	$\dfrac{\mathrm{d}V}{\mathrm{d}l}=\dfrac{3\pi l^2}{400}$	M1
	$\dfrac{\mathrm{d}V}{\mathrm{d}t}=\dfrac{\mathrm{d}V}{\mathrm{d}l}\times\dfrac{\mathrm{d}l}{\mathrm{d}t}$	M1
	$\dfrac{\mathrm{d}V}{\mathrm{d}t}=\dfrac{3\pi\times 30^2}{400}\times 0.005=0.106028...$	dM1
	$\dfrac{\mathrm{d}V}{\mathrm{d}t}\approx 0.11 \quad (\mathrm{cm}^3/\mathrm{s})$	A1 [6]
		Total 6 marks

Apart from x, which is defined in the question, different variables may be used providing that they are consistent throughout the working. Score the best mark using either alternative but not a mixture of both.		
	B1	$\frac{dl}{dx}=10$ or $\frac{dx}{dt}=0.0005$
	B1	Correct expression for the volume of the cylinder. Simplification not needed. Brackets for $\left(\frac{x}{2}\right)^2$ are required unless implied by subsequent working.
	M1	Attempt to differentiate to find $\frac{dV}{dx}$. You need to see a multiple of x^2 from differentiating x^3. ft their V if it is a multiple of x^3. Mark the differentiation and ignore any error in the label, $\frac{dV}{dx}$, for this mark only.
	M1	State, or use correctly, the chain rule $\frac{dV}{dt}=\frac{dV}{dx}\times\frac{dx}{dl}\times\frac{dl}{dt}$ or $\frac{dV}{dt}=\frac{dV}{dx}\times\frac{dx}{dt}$
	dM1	Substitute to find a numerical expression for $\frac{dV}{dt}$ dep on both M marks. ft their $\frac{dV}{dx},\frac{dl}{dx},\frac{dx}{dt}$ if clearly stated.
	A1	$\frac{dV}{dt}\approx 0.11$ **given to 2SF**

Alternative		
	B1	$x=\frac{l}{10}$ or $r=\frac{l}{20}$ stated or used
	B1	Correct expression for the volume of the cylinder. Simplification not needed. Brackets for $\left(\frac{l}{20}\right)^2$ are required unless implied by subsequent working.
	M1	Attempt to differentiate to find $\frac{dV}{dl}$. You need to see a multiple of l^2 from differentiating l^3. ft their V if it is a multiple of l^3. Mark the differentiation and ignore any error in the label, $\frac{dV}{dl}$, for this mark only.
	M1	State, or use correctly, the chain rule $\frac{dV}{dt}=\frac{dV}{dl}\times\frac{dl}{dt}$
	dM1	Substitute to find a numerical expression for $\frac{dV}{dt}$ dep on both M marks. ft their $\frac{dV}{dl}$ if clearly stated.
	A1	$\frac{dV}{dt}\approx 0.11$ **given to 2SF**