Question number	Scheme	Marks
6	$\left[\dfrac{\mathrm{d}V}{\mathrm{d}t} = 3\ \left(\mathrm{cm}^3/\mathrm{s}\right)\right]$ $V = \dfrac{4}{3}\pi r^3 \quad \dfrac{\mathrm{d}V}{\mathrm{d}r} = 4\pi r^2, \quad A = 4\pi r^2 \quad \dfrac{\mathrm{d}A}{\mathrm{d}r} = 8\pi r$ $\dfrac{\mathrm{d}A}{\mathrm{d}t} = \dfrac{\mathrm{d}A}{\mathrm{d}r} \times \dfrac{\mathrm{d}r}{\mathrm{d}V} \times \dfrac{\mathrm{d}V}{\mathrm{d}t}$ oe $\dfrac{\mathrm{d}A}{\mathrm{d}t} = [8\pi \times 10] \times \left[\dfrac{1}{4\pi \times 10^2}\right] \times 3 = 0.6\ (\mathrm{cm}^2/s)$	M1A1,A1 (M1 for any one) M1 dM1A1 [6]
		Total 6 marks

Mark	Notes
M1	For using the **correct** formula for volume of a sphere or for surface area of a sphere and attempt to differentiate their expression. [See General Guidance for definition of attempt to differentiate]
A1	For one correct $\dfrac{\mathrm{d}V}{\mathrm{d}r} = 4\pi r^2$ or $\dfrac{\mathrm{d}A}{\mathrm{d}r} = 8\pi r$
A1	For both correct $\dfrac{\mathrm{d}V}{\mathrm{d}r} = 4\pi r^2$ and $\dfrac{\mathrm{d}A}{\mathrm{d}r} = 8\pi r$
M1	For applying a **correct** Chain rule using their $\dfrac{\mathrm{d}V}{\mathrm{d}r}$, their $\dfrac{\mathrm{d}A}{\mathrm{d}r}$ and $\dfrac{\mathrm{d}V}{\mathrm{d}t} = 3$ to obtain $\dfrac{\mathrm{d}A}{\mathrm{d}t} = \dfrac{\mathrm{d}A}{\mathrm{d}r} \times \dfrac{\mathrm{d}r}{\mathrm{d}V} \times \dfrac{\mathrm{d}V}{\mathrm{d}t} = '\ 8\pi r' \times '\dfrac{1}{4\pi r^2}' \times 3$ May be seen in two stages.
dM1	For substitution of $r = 10$ into their expression for $\dfrac{\mathrm{d}A}{\mathrm{d}t}$ to obtain $\dfrac{\mathrm{d}A}{\mathrm{d}t} = '\ 8\pi \times 10' \times '\dfrac{1}{4\pi \times 10^2}' \times 3$
A1	$\dfrac{\mathrm{d}A}{\mathrm{d}t} = 0.6\ (\mathrm{cm}^2\ /\ \mathrm{s})$