Question	Scheme	Marks	AOs
3	$x^2+y^2=r^2$	B1	1.2
	$\{V\}=\pi\int_{-r}^{r} r^2-x^2\ \mathrm{d}x$ or $\{V\}=2\pi\int_{0}^{r} r^2-x^2\ \mathrm{d}x$	B1	2.1
	Integrates to the form $\alpha x \pm \beta x^3$ $\left[\text{note: the correct integration gives } r^2x-\frac{1}{3}x^3\right]$	M1	1.1b
	Substitutes limits of – r and r and subtracts the correct way round $\left(r^2(r)-\frac{1}{3}(r)^3\right)-\left(r^2(-r)-\frac{1}{3}(-r)^3\right)$ or Substitutes limits of 0 and r and subtracts the correct way round with twice the volume. Note the limit of 0 can be implied if gives and answer of 0 $\left(r^2(r)-\frac{1}{3}(r)^3\right)-(0)$	dM1	1.1b
	$V=\frac{4}{3}\pi r^3$ * cso	A1*	1.1b
		(5)	

(5 marks)

Notes:

B1: Correct equation of the circle, may be implied by correct integral

B1: Correct expression for the volume, including limits, dx may be implied and if using limits r and 0 the 2 could appear later with reasoning

M1: Integrates to the form $\alpha x \pm \beta x^3$. Do not award if $r^2 \to \lambda r^3$

dM1: Dependent on previous method mark. Correct use of limits – r and r or limits of 0 and r with twice the volume.

A1*: $V=\frac{4}{3}\pi r^3$ * cso

Note: rotation about the y-axis all marks are available, however for the final accuracy mark must refer to symmetry