Question Number	Scheme	Marks
3.	Vol of cylinder $=8\pi r^2 h$ Vol cut away $=\frac{1}{3}\pi r^2 h$ Cylinder part cut away conical shell container mass M $(\pm)\frac{1}{24}M$ $\frac{1}{12}M$ $\frac{25}{24}M$ dist from O h $\frac{7}{4}h$ $5h$ $\bar{x}$ $Mh-\frac{7}{96}Mh+\frac{5}{12}Mh=\frac{25}{24}M\bar{x}$ $\bar{x}=\frac{129}{100}h$ or $1.29h$	M1A1 B1 M1A1 A1 **[6]**

M1	Attempt at mass ratios. Must have 4 masses. M may be consistently omitted. Condone omission of 1/3 in volume of cone. Must be using the given masses, not volumes.
A1	Correct mass ratios. Sign not needed for cut away part.
B1	Correct distances (from a consistent point – see below)
M1	Attempt at moments equation. Condone missing minus. Accept as part of a vector equation.
A1	Correct equation.
A1	$\bar{x}=\frac{129}{100}h$ or $1.29h$

ALT distances

	Cylinder	Cut away	Shell
Vertex	0	$\frac{3}{4}h$	$4h$
Top of cylinder	$(-)h$	$(-)\frac{1}{4}h$	$3h$
Top of cone	$6h$	$\frac{21}{4}h$	$2h$

Note: If completing in 2 stages, centre of mass with cut-away cylinder without shell is $\frac{89}{92}h$.

Marks can only be awarded when they give a complete method, including the conical shell.

Special Case: If they first find the CoM of cut-away cylinder, then use M for its mass, award max M0A0 B1 M1A1 A0. Their equation must be $M\times\frac{89}{92}h+\frac{M}{12}\times 5h=\frac{13M}{12}\bar{x}$