Question	Answer	Mark	Comments
1	**Alternative method 1: working in terms of π**		
	π (×) 4^2 (×) 10 or 160π or [502, 503]	M1	oe accept 3 or better for π accept 480 or 496
	$\frac{2}{3}$ (×) π (×) 6^3 or 144π or [452, 453]	M1	oe accept 3 or better for π accept 0.66 or 0.67 or better for $\frac{2}{3}$ accept 432 or 446(.4)
	160π and 144π or [502, 503] and [452, 453]	A1	oe values accept 480 and 432 or 496 and 446(.4)
	160π and 144π and cylinder or [502, 503] and [452, 453] and cylinder or cylinder is 16π greater	A1ft	ft correct decision for their 160π and their 144π with M1M1 scored accept 480 and 432 and cylinder or 496 and 446(.4) and cylinder
	Alternative method 2: working without π		
	4^2 (×) 10 or 160	M1	oe
	$\frac{2}{3}$ (×) 6^3 or 144	M1	oe accept 0.66 or 0.67 or better for $\frac{2}{3}$
	160 and 144	A1	oe values
	160 and 144 and cylinder	A1ft	ft correct decision for their 160 and their 144 with M1M1 scored
	Additional Guidance for this question is on the next page		

	Additional Guidance	
	Better than 3 for π could be 3.1, 3.14, 3.142 or $\frac{22}{7}$	
	160π with incorrect method for hemisphere	M1M0A0A0
	144π with incorrect method for cylinder	M0M1A0A0
	160π and 144π with incorrect decision or no decision	M1M1A1A0
	160 and 144 with incorrect or no decision	M1M1A1A0
1	Accept values given as fractions for the first A mark, but for the second A mark, they must have a common denominator. eg 160π and $\frac{432\pi}{3}$ and cylinder eg $\frac{480}{3}$ and $\frac{432}{3}$ and cylinder	 M1M1A1A0 M1M1A1A1
	Working with π for one value but not the other can only score M1 eg 160π and 144 (with or without a decision)	 M1 only
	Do not allow M1 for a correct formula as part of an incorrect formula eg $\frac{1}{3} \times \pi \times 4^2 \times 10$	 M0

	Valid criticism	B1	eg the scale factor should be 4 or surface area is 248 cm^2
	Additional Guidance		
	$sf = 2^2$		B1
	62×4		B1
2(a)	62×2^2		B1
	The area is 248 (ignore units)		B1
	Should be $2 \times 10 \times 6 + 2 \times 10 \times 4 + 2 \times 6 \times 4$		B1
	Condone It should be 4		B1
	4		B0
	He should have multiplied all lengths by 2		B0
	It should be $10 \times 4 \times 6$		B0

2(b)	**Alternative method 1**		
	$\sqrt[3]{\frac{125}{8}}$ or $\frac{5}{2}$ or $\sqrt[3]{\frac{8}{125}}$ or $\frac{2}{5}$	M1	oe eg $\sqrt[3]{15.625}$ or 2.5 or $\sqrt[3]{0.064}$ or 0.4
	$5 \times \sqrt[3]{\frac{125}{8}}$ or $5 \div \sqrt[3]{\frac{8}{125}}$	M1dep	oe
	12.5 or $12\frac{1}{2}$ or $\frac{25}{2}$	A1	
	Alternative method 2		
	$5 \times 3 \times 2 \times \frac{125}{8}$ or 468.75	M1	oe eg $5 \times 3 \times 2 \times 15.625$ or $30 \times \frac{125}{8}$
	$x \times \frac{3x}{5} \times \frac{2x}{5}$ = their 468.75	M1dep	oe eg $\frac{6}{25}x^3$ = their 468.75
	12.5 or $12\frac{1}{2}$ or $\frac{25}{2}$	A1	
	Additional Guidance		
	$\sqrt{\frac{125}{8}}$ or $\sqrt{\frac{8}{125}}$		M0M0A0
	$x \times \frac{x}{\frac{5}{3}} \times \frac{x}{\frac{5}{2}}$ = their 468.75		M1M1
	Allow 1.66 or 1.67 for $\frac{5}{3}$ eg $x \times \frac{x}{1.66} \times \frac{x}{2.5}$ = their 468.75		M1M1

Q	Answer	Mark	Comments
3	**Alternative method 1** Working out time to fill the ball		
	$4 \div 3 \times 15^3 \times \pi$ or $[4488, 4500]\pi$ or [14 092, 14 139]	M1	oe allow 1.33 or better
	their [14 092, 14 139] – 5000 or [9092, 9139] or their [14 092, 14 139] ÷ 160 or [88, 88.37]	M1dep	oe
	(their [14 092, 14 139] – 5000) ÷ 160 or [56, 57.12]	M1dep	oe eg their [9092, 9139] ÷ 160 or their [88, 88.37] – 5000 ÷ 160
	[56, 57.12] and Yes	A1	
	Alternative method 2 Comparing volume needed with volume that could be filled		
	$4 \div 3 \times 15^3 \times \pi$ or $[4488, 4500]\pi$ or [14 092, 14 139]	M1	oe allow 1.33 or better
	their [14 092, 14 139] – 5000 or [9092, 9139]	M1dep	
	[58, 60] × 160 or [9280, 9600]	M1	oe
	[9092, 9139] and [9280, 9600] and Yes	A1	

3 cont	**Alternative method 3** Volume of ball compared with volume that could be filled + 5000		
	$4 \div 3 \times 15^3 \times \pi$ or [4488, 4500]π or [14 092, 14 139]	M1	oe allow 1.33 or better
	[58, 60] × 160 or [9280, 9600]	M1	oe
	their [9280, 9600] + 5000 or [14 280, 14 600]	M1dep	dep on 2nd M1
	[14 092, 14 139] and [14 280, 14 600] and Yes	A1	
	Additional Guidance		
	Accept $\frac{4}{3}\pi 15^3$ without multiplication signs		
	Condone use of 1.3 for up to M3 if 1.3 shown		
	Up to M3 may be awarded for correct work, with no or incorrect answer, even if this is seen amongst multiple attempts		
	Using an incorrect power eg 15^2, $15\pi^3$, $(15\pi)^3$ or omitting π unless recovered		1st M0
	NB 56.(59…) or 56.6 or 57 coming from 5000 ÷ 88.35…		M1M1M0
	Yes can be implied eg Alt 1 $57 < 60$		M3A1

Q	Answer	Mark	Comments
4	**Alternative method 1**		
	$4 \times 26 \times 15$ or 1560	M1	
	$\pi \times (26 \div 2)^2 \times 15 (\div 2)$ or $\pi \times 13^2 \times 15 (\div 2)$ or $2535\pi (\div 2)$ or $\pi \times (26 \div 2)^2 \div 2 (\times 15)$ or $\pi \times 13^2 \div 2 (\times 15)$ or $\frac{169\pi}{2} (\times 15)$ or $84.5\pi (\times 15)$ or [265.3, 265.5] (× 15) or [7959.9, 7965] (÷ 2)	M1	oe accept [3.14, 3.142] for π
	$\frac{2535\pi}{2}$ or 1267.5π or [3979.95, 3982.5]	M1dep	dep on previous mark
	[5539, 5543]	A1	
	Alternative method 2		
	4×26 or 104	M1	
	$\pi \times (26 \div 2)^2 \div 2$ or $\pi \times 13^2 \div 2$ or $\frac{169\pi}{2}$ or [265.3, 265.5]	M1	accept [3.14, 3.142] for π
	(their 104 + their $\frac{169\pi}{2}$) × 15 or [369.3, 369.5] × 15	M1dep	dep on M1M1
	[5539, 5543]	A1	

Q	Answer	Mark	Comments
5(a)	$\frac{1}{3} \times \pi \times 24^2 \times 117$ or $\frac{2}{3} \times \pi \times 24^3$	M1	oe eg $\frac{1}{3}\pi \times 576 \times 117$ or $\frac{2}{3}\pi \times 13824$
	22464π or [70536, 70582] or 9216π or [28938, 28957]	A1	may be seen in a sum implied by final A1
	$\frac{1}{3} \times \pi \times 24^2 \times 117 + \frac{2}{3} \times \pi \times 24^3$ or $22464\pi + 9216\pi$ or [70536, 70582] + [28938, 28957]	M1dep	oe
	31680π or [99474, 99539]	A1	
	Additional Guidance		
	π may be seen as any value in the interval [3.14, 3.142]		
	Do not allow any misreads of formulae unless recovered eg $\pi \times 24^2 \times 117$ and $\frac{2}{3} \times \pi \times 24^2$		M0
	Allow dots for multiplication		
	For A marks allow eg $22464 \times \pi$ or $\pi \times 31680$		
	31680π followed by incorrect evaluation attempt		M1A1M1A1
	31680π followed by further work		M1A1M1A0
	31680 only		M0A0M0A0
	$\frac{1}{3} \times \pi \times 24^2 \times 117 = 4725$ $\frac{2}{3} \times \pi \times 24^3 = 28952$ $4725 + 28952$ (even though 4725 is wrong the method for $\frac{1}{3} \times \pi \times 24^2 \times 117$ is seen)		M1A1 M1

Q	Answer	Mark	Comments
6(a)	3×500 or 1500	M1	actual radius of circle in metres
	(their $1500)^2 \times \pi \times 17$ or $38\,250\,000\pi$	M1dep	
	[120 000 000, 120 200 000] or $[1.2 \times 10^8, 1.202 \times 10^8]$	A1	accept in words eg 120 million SC1 [480, 481] or [0.048, 0.0481]
	Additional Guidance		
	Do not award A mark if incorrect further work is seen		

Q	Answer	Mark	Comments
6(b)	It could be less than or greater than Virat's estimate (3rd box ticked) and statement that area is larger but depth is smaller	B2	B1 It is less than Virat's estimate (1st box ticked) and statement that depth is smaller or It is greater than Virat's estimate (2nd box ticked) and statement that area is larger or It could be less than or greater than Virat's estimate (3rd box ticked) and statement that depth is smaller or It could be less than or greater than Virat's estimate (3rd box ticked) and statement that area is larger
	Additional Guidance		
	For B2 their statement must refer to larger area and smaller depth		
	For B1 their statement must correctly refer to larger area or smaller depth for their box ticked		
	Examples of statements implying actual depth is smaller: height is less depth is lower it is shallower Virat's estimate of the depth is bigger		
	Examples of statements implying actual area is larger: the width is bigger cross section is bigger shape is greater Virat's estimate of the area is smaller		
	The reservoir could be bigger or smaller		B0
	The reservoir is larger		B0
	We do not know the depth		B0

Q	Answer	Mark	Comments
7	**Alternative method 1 – expressions in x**		
	$4\pi x^2 \div 2$ or $2\pi x^2$ or πx^2 or $\pi(3x)^2$ or $9\pi x^2$ or $2 \times \pi(3x)^2$ or $18\pi x^2$ or $2\pi x(3x)$ or $6\pi x^2$	M1	oe area of curved face of hemisphere oe area of flat face of hemisphere oe area of one flat face of cylinder oe area of both flat faces of cylinder oe area of curved face of cylinder
	$4\pi x^2 \div 2 + \pi x^2$ or $3\pi x^2$ or $\pi(3x)^2 + \pi(3x)^2 + 2\pi x(3x)$ or $9\pi x^2 + 9\pi x^2 + 6\pi x^2$ or $24\pi x^2$	M1dep	oe total surface area of the hemisphere oe total surface area of the cylinder
	$3\pi x^2$ and $24\pi x^2$ and 1 : 8	A1	either order
	Alternative method 2 – substituting a value for x		
	Substitutes a value for x and works out the area of at least one of area of curved face of hemisphere area of flat face of hemisphere area of one flat face of cylinder area of both flat faces of cylinder area of curved face of cylinder	M1	eg using $x = 5$, at least one of 50π 25π 225π 450π 150π
	Substitutes a value for x and works out an expression for the total surface area of the hemisphere or the cylinder	M1dep	eg using $x = 5$ total surface area of hemisphere = $25\pi + 50\pi$ or 75π or total surface area of cylinder = $225\pi + 225\pi + 150\pi$ or 600π
	Both correct total surface areas for their value of x and 1 : 8	A1	either order

	Additional Guidance	
7 cont	1 : 8 or 8 : 1 without correct working or values	M0M0A0
	Condone π missing consistently for all marks	
	Allow 'correct' and consistent values of π throughout (eg 3, 3.14, $\frac{22}{7}$)	
	Condone use of r for x throughout	
	Do not allow $3\pi x^2$ from $3x \times \pi \times x$ oe	

Q	Answer	Mark	Comments
8	**Alternative method 1** Compares 70% of volume of hemisphere with volume of water		
	$\frac{4}{3} \times \pi \times 12^3$ or 2304π or [7216, 7239.2] or $\frac{2}{3} \times \pi \times 12^3$ or 1152π or [3581, 3638]	M1	oe eg $\frac{4}{3}\pi \times 1728$ allow without any multiplication signs eg $\frac{4}{3}\pi 12^3$
	0.7 × their 1152π or 806.4π or [2506, 2547]	M1dep	oe 0.7 × their [3581, 3638] or $\frac{4032}{5}\pi$ must be using volume of hemisphere
	325 × 8 or 2600	M1	oe
	[2506, 2547] and 2600 and Yes	A1	oe
	Alternative method 2 Works out volume of water as proportion of volume of hemisphere		
	$\frac{4}{3} \times \pi \times 12^3$ or 2304π or [7216, 7239.2] or $\frac{2}{3} \times \pi \times 12^3$ or 1152π or [3581, 3638]	M1	oe eg $\frac{4}{3}\pi \times 1728$ allow without any multiplication signs eg $\frac{4}{3}\pi 12^3$
	325 × 8 or 2600	M1	oe
	their 2600 ÷ their 1152π or [0.71, 0.73]	M1dep	oe eg their 2600 ÷ their [3581, 3638] or 72% dep on M2 must be using volume of hemisphere
	[71, 73](%) and Yes	A1	oe eg 0.72 and 0.7 and Yes

8 cont	**Alternative method 3** Works out time to fill 70% of volume of hemisphere		
	$\frac{4}{3} \times \pi \times 12^3$ or 2304π or [7216, 7239.2] or $\frac{2}{3} \times \pi \times 12^3$ or 1152π or [3581, 3638]	M1	oe eg $\frac{4}{3}\pi \times 1728$ allow without any multiplication signs eg $\frac{4}{3}\pi 12^3$
	$0.7 \times$ their 1152π or 806.4π or [2506, 2547] or their $1152\pi \div 325$ or [11, 11.2]	M1dep	oe $0.7 \times$ their [3581, 3638] or $\frac{4032}{5}\pi$ or their [3581, 3638] ÷ 325 must be using volume of hemisphere
	$0.7 \times$ their $1152\pi \div 325$ or $0.7 \times$ their [3581, 3638] ÷ 325 or [7.7, 7.84]	M1dep	oe their [2506, 2547] ÷ 325 or $0.7 \times$ their [11, 11.2]
	[7.7, 7.84] and Yes	A1	oe

	Additional Guidance	
8 cont	Up to M3 may be awarded for correct work with no answer or incorrect answer, even if this is seen amongst multiple attempts	
	Allow 1.33(…) for $\frac{4}{3}$	
	Allow 0.66(…) or 0.67 for $\frac{2}{3}$	
	π may be seen as [3.14, 3.142] eg Alt 1 $\frac{2}{3} \times 3.14 \times 12^3$	M1
	If a number (or calculation) in terms of π is seen but π is subsequently omitted, treat as a miscopy for M marks eg Alt 1 1152π $0.7 \times 1152 = 806.4$ $325 \times 8 = 2600$ Yes	 M1 M1dep M1A0
	Yes cannot be implied by inequalities	
	Alts 1 and 2 $325\,\text{cm}^3 \times 8$ seen is M1 even if evaluated incorrectly $325^3 \times 8$ seen is M0 unless recovered to 2600	
	Do not allow misreads of the given formula unless recovered eg1 using 12^2 instead of 12^3 eg2 using $\frac{3}{4}$ instead of $\frac{4}{3}$	
	For $0.7 \times$ their 1152π, do not accept $70\% \times$ their 1152π unless recovered	

Q	Answer	Mark	Comments
9	No ticked and correct reason or correct evaluation of the surface areas for any numerical or algebraic values or correct ratio of the surface areas	B2	eg 2 faces are hidden B1 No ticked
	Additional Guidance		
	Ignore irrelevant reasons or evaluations alongside a correct reason or evaluation, unless contradictory		
	"No" may be implied by a correct reason		
	Accept reasoning that uses A as a cube		
	No ticked and A has 6, B has 10 (condone sides for faces) A has 3, B has 5 A has 6 sides, on B each cube only has 5 Ratio is 3:5 (accept equivalent ratios) The bottom and the top are missing (or covered) When they are put together you lose two faces You wouldn't count two sides (condone sides for faces) Some of the faces are covered You cannot see one side because they are stacked together One face covered Part of the area of A is covered where it joins B Both touching sides		 B2 B2 B2 B2 B2 B2 B2 B2 B2 B2 B2 B2
	Yes ticked or Cannot tell ticked		B0

Q	Answer	Mark	Comments
10	72 (–) 6 or 66 or 63 (–) 6 or 57 or 45 (+) 21 or 66 or 36 (+) 21 or 57 or 56 (+) 10 or 66 or 49 (+) 8 or 57	M1	large rectangle subtract missing rectangle, implied by volumes of 864 and 72 splits side elevation vertically, implied by volumes of 540 and 252 splits side elevation horizontally, implied by volumes of 672 and 120 oe may be on diagram
	792 or 165	A1	
	Maximum 792 and Minimum 165	A1	

Q	Answer	Mark	Comments
11(a)	11 5 4 or 10 7 3 or 10 6 4 or 9 8 3 or 9 7 4 or 9 6 5 or 8 7 5	B2	any order B1 answer of three positive numbers in any order with sum 20 eg 17 2 1 or $9\frac{1}{2}$ $8\frac{1}{2}$ 2 or 10 5 5 or $6\frac{2}{3}$ $6\frac{2}{3}$ $6\frac{2}{3}$ or correct equation in w, x and y eg $4w + 4x + 4y = 80$ or $w + x + y = 20$
	Additional Guidance		
	Ignore attempts to work out the volume or surface area eg 10 5 5 volume calculated as 500	B1	
	Negative numbers and/or zero used	B0	
	$wxy > 200$ or $wxy = 200$	B0	
	Allow $6.\dot{6}$ for $6\frac{2}{3}$		

Q	Answer	Mark	Comments
11(b)	$54a^2$	B1	

Q	Answer	Mark	Comment
12	$\frac{1}{3} \times 9^2 \times 30 \times \pi$ or 810π or [2543, 2545.1]	M1	oe
	$\frac{2}{3} \times 6^3 \times \pi$ or 144π or [452.1, 452.5]	M1	
	$30 \times \frac{6}{9}$ or 20 or $\left(\frac{6}{9}\right)^3$	M1	oe implied by 240π or [753.6, 754.1]
	$\frac{1}{3} \times 9^2 \times 30 \times \pi - \frac{1}{3} \times 6^2 \times$ their $20 \times \pi$ or $\frac{1}{3} \times 9^2 \times 30 \times \pi - \frac{1}{3} \times 9^2 \times 30 \times \left(\frac{6}{9}\right)^3 \times \pi$ or $810\pi - 240\pi$ or their [2543, 2545.1] – their [753.6, 754.1] or 570π or [1788.9, 1791.5]	M1dep	dep on 1st and 3rd M1
	426π or [1336, 1339.4]	A1	
	Additional Guidance		
	All values may be seen on diagrams		

Q	Answer	Mark	Comments
13a	Correct statement	B1	eg she used the height instead of the slant height or she used the vertical height or she used 12 (instead of 13)
	Additional Guidance		
	Check diagram		
	For 'vertical' accept anything that implies she has used the wrong height		
	Condone 'length' to mean 'height' or 'slant height'		
	12 or 13 circled on the diagram must be accompanied by a supporting statement		
	Indicates '12' in the calculation	B1	
	She should have done $\pi \times 5 \times 13$	B1	
	It should be 65π	B1	
	She used the wrong height / the (value of) l is wrong	B1	
	She hasn't used the slant height (she used the (vertical) height)	B1	
	She hasn't used the 13	B1	
	She hasn't used the 13 and should be $5 \times 12 \times 13 \times \pi$	B0	
	The multiplication used the wrong number(s)	B0	
	She hasn't used a value for π	B0	
	An incorrect statement with a correct statement eg she used 13 instead of 12 and didn't square the radius	B0	

Q	Answer	Mark	Comments
13b	$\pi \times 5 \times 5$ or 25π or $3 \times 5 \times 5$	M1	oe accept [3.14, 3.142] or $\frac{22}{7}$ for π
	75	A1	
	Additional Guidance		
	$\pi 25$	M1	

Q	Answer	Mark	Comments
13c	'More than' indicated or implied by statement and valid reason	B1	eg valid reasons 3.14 is greater (than 3) Beth's number is bigger (than Adam's) (the correct answer is) 78.5 (with their answer to (b) less than 78.5)
	Additional Guidance		
	If calculations are used, the outcomes must be correct		
	Accept 78 or 79 for 78.5 unless from incorrect working		
	'Less than' indicated	B0	
	Do not penalise use of the same incorrect formula in (b) and (c) eg $3 \times 10 = 30$ in (b) and $3.14 \times 10 = 31.4$ in (c) with 'More than' ticked	B1	
	Ignore a non-contradictory reason with a correct reason eg 3.14 is bigger than 3 and nearer the true value of pi	B1	
	Acceptable reasons		
	Adam has rounded (pi) down / Adam only used 3	B1	
	There is an extra 0.14 to multiply by	B1	
	Her number has decimal places	B1	
	Her number is to more significant figures	B1	
	Non-acceptable reasons		
	3.14 will give a bigger answer / 3.14 is more accurate	B0	

Q	Answer	Mark	Comments
14	**Alternative method 1: works out a scale factor**		
	$\frac{1}{2} \times 3(L) \times 4(L) \times 12(L)$ or $72(L^3)$ where L is any variable or any positive value	M1	oe volume eg $(L=2)$ $\frac{1}{2} \times 6 \times 8 \times 24$ or 576
	$1125 \div$ their 72 or $\frac{125}{8}$ or 15.625	M1dep	oe eg $1125 \times 2 \div (3 \times 4 \times 12)$ eg $(L=2)$ $1125 \div$ their 576 or $\frac{125}{64}$
	$\sqrt[3]{\text{their } \frac{125}{8}}$ or $\frac{5}{2}$ or 2.5	M1dep	oe eg $(L=2)$ $\sqrt[3]{\text{their } \frac{125}{64}}$ or $\frac{5}{4}$ or 1.25
	$2 \times 3 \times$ their $2.5 + 2 \times 4 \times$ their 2.5 $+ 2 \times 5 \times$ their 2.5 $+ 3 \times 12 \times$ their 2.5	M1dep	oe eg $(L=2)$ $2 \times 6 \times$ their $1.25 + 2 \times 8 \times$ their 1.25 $+ 2 \times 10 \times$ their 1.25 $+ 3 \times 24 \times$ their 1.25
	150	A1	SC4 [119, 119.1]

14 cont	**Alternative method 2: works out a value of a, b, c or d**		
	Correct expression for volume in terms of a or b eg $\frac{1}{2} \times a \times \frac{4a}{3} \times \frac{12a}{3}$ or $\frac{8a^3}{3}$ or $\frac{1}{2} \times \frac{3b}{4} \times b \times \frac{12b}{4}$ or $\frac{9b^3}{8}$	M1	oe in terms of c or d eg $\frac{1}{2} \times \frac{3c}{5} \times \frac{4c}{5} \times \frac{12c}{5}$ or $\frac{72c^3}{125}$ or $\frac{1}{2} \times \frac{3d}{12} \times \frac{4d}{12} \times d$ or $\frac{d^3}{24}$ may be implied by an equation eg $a \times \frac{4a}{3} \times \frac{12a}{3} = 1125 \times 2$
	$a^3 = 1125 \div$ their $\frac{8}{3}$ or $a^3 = \frac{3375}{8}$ or $b^3 = 1125 \div$ their $\frac{9}{8}$ or $b^3 = 1000$	M1dep	oe eg $c^3 = 1125 \div$ their $\frac{72}{125}$ or $c^3 = \frac{15\,625}{8}$ or $d^3 = 1125 \div$ their $\frac{1}{24}$ or $d^3 = 27\,000$
	$a = \sqrt[3]{\text{their } \frac{3375}{8}}$ or $a = 7.5$ or $b = \sqrt[3]{1000}$ or $b = 10$	M1dep	oe eg $c = \sqrt[3]{\text{their } \frac{15\,625}{8}}$ or $c = 12.5$ or $d = \sqrt[3]{27\,000}$ or $d = 30$
	$2 \times$ their $a + 2 \times \frac{4}{3} \times$ their a $+ 2 \times \frac{5}{3} \times$ their $a + 3 \times \frac{12}{3} \times$ their a or $2 \times \frac{3}{4} \times$ their $b + 2 \times$ their b $+ 2 \times \frac{5}{4} \times$ their $b + 3 \times 3 \times$ their b	M1dep	oe correct method using their c or their d
	150	A1	SC4 [119, 119.1]
	Additional Guidance		
	Up to M3 may be awarded for correct work with no answer or incorrect answer, even if this is seen amongst multiple attempts		

Q	Answer	Mark	Comments
15(a)	**Alternative method 1**		
	$\frac{4}{3}\pi r^3 = \pi r^2 h$	M1	
	$\frac{4}{3}r = h$ or $4r = 3h$	M1dep	oe equation with π and r^2 cancelled
	3 : 4 with M2 awarded	A1	oe ratio eg $\frac{3}{4}$: 1 or 1 : $\frac{4}{3}$ accept 1.33 or better for $\frac{4}{3}$
	Alternative method 2		
	$\frac{4}{3}\pi r^3 = \pi r^2 h$ or substitution of the same value of r into $\frac{4}{3}\pi r^3$ and $\pi r^2 h$	M1	the substitution must be shown
	Substitution of the same value of r into $\frac{4}{3}\pi r^3$ and $\pi r^2 h$ and correct value of h for their value of r	A1	the substitution must be shown their h should be exactly $\frac{4}{3}\times$ their r eg $r = 2$ and $h = \frac{8}{3}$ (oe fraction) do not allow rounded values
	3 : 4 with M1A1 awarded	A1	oe ratio eg $\frac{3}{4}$: 1 or 1 : $\frac{4}{3}$ accept 1.33 or better for $\frac{4}{3}$
	Additional Guidance		
	Accept h : r = 4 : 3 for final mark with M2 or M1A1 awarded		

Q	Answer	Mark	Comments
15(b)	$(\pi)(3r)^2(2h)$ or $3^2 \times 2$	M1	oe ft their formula for a cylinder from part (a) in the form $k\pi r^2 h$ with k as a positive constant
	18	A1	
	Additional Guidance		
	Answer 18 from choosing values for r and h eg $\pi \times 3^2 \times 4 = 36\pi$ and $\pi \times 9^2 \times 8 = 648\pi$ and $648\pi \div 36\pi = 18$	M1A1	
	Answer 18 from rounding a decimal	M0A0	