Q	Answer	Mark	Comments
1(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
1(b)	**Alternative method 1** Uses volume scale factor		
	$24 \div 2$ or 12	M1	oe eg $12 \times 2 = 24$
	(their 12)^3	M1dep	oe eg $24^3 \div 2^3$ or $13824 \div 8$
	1728	A1	condone 1 : 1728 or 1728 : 1 SC2 $\frac{1}{1728}$
	Alternative method 2 Compares volumes of cornets (ie compares total volumes)		
	$24 \div 2$ or 12	M1	oe eg $12 \times 2 = 24$ may be implied eg (height of cone) 9.75 or (volume of cone) 13π or (volume of cone) [40.8, 40.85] or (total volume) $\frac{55}{3}\pi$ or [57.4, 57.7]
	their (a) $\div$ $(\frac{1}{3}\pi \times 2^2 \times \frac{117}{\text{their } 12} + \frac{2}{3}\pi \times 2^3)$	M1dep	oe eg their (a) $\div$ [57.4, 57.7]
	1728	A1	condone 1 : 1728 or 1728 : 1 SC2 $\frac{1}{1728}$

1(b) cont	**Alternative method 3** Compares volumes of cones		
	$24 \div 2$ or 12	M1	oe eg $12 \times 2 = 24$ may be implied eg (height of cone) 9.75 or (volume of cone) 13π or (volume of cone) [40.8, 40.85] or (total volume) $\frac{55}{3}\pi$ or [57.4, 57.7]
	their volume of cone from (a) $\div (\frac{1}{3}\pi \times 2^2 \times \frac{117}{\text{their } 12})$	M1dep	oe eg their volume of cone from (a) $\div$ [40.8, 40.85]
	1728	A1	condone 1 : 1728 or 1728 : 1 SC2 $\frac{1}{1728}$
	Alternative method 4 Compares volumes of hemispheres		
	their volume of hemisphere from (a) $\div (\frac{2}{3}\pi \times 2^3)$	M2	oe eg their volume of hemisphere from (a) $\div$ [16.7, 16.8]
	1728	A1	condone 1 : 1728 or 1728 : 1 SC2 $\frac{1}{1728}$

	Additional Guidance	
1(b) cont	π may be seen as any value in the interval [3.14, 3.142]	
	Answer $\times 1728$ or $1728\times$	M1M1A1
	Answer 12	M1M0A0
	Answer 12^3 with 1728 seen	M1M1A1
	Answer 12^3 without 1728 seen	M1M1A0
	Alts 2, 3 and 4 Allow if an incorrect volume formula from (a) is used in (b) eg Alt 4 (a) $\frac{1}{2} \times \frac{2}{3} \times \pi \times 24^3 = 4608\pi$ (b) $\frac{1}{2} \times \frac{2}{3} \times \pi \times 2^3 = \frac{8}{3}\pi$ $4608\pi \div \frac{8}{3}\pi$ 1728	 M2 A1
	Alts 2 and 3 Allow $\frac{55}{3}$ rounded to 1dp or better eg allow 18.3	
	Alt 4 Allow $\frac{16}{3}$ rounded to 1dp or better eg allow 5.3	
	Alts 2 and 3 2nd M1 – allow consistent omission of π	
	Alt 4 M2 – allow consistent omission of π	
	Alts 2, 3 and 4 Answer 1728 is M1M1A1 unless it comes from rounding or truncating eg1 Alt 2 $99\,525.655 \div 57.595 = 1728$ eg2 Alt 2 $99\,525.655 \div 57.595 = 1728.03$ Answer 1728	 M1M1A1 M1M1A0

Q	Answer	Mark	Comment
2(a)	$-\frac{1}{2}$	B1	may be seen on diagram