01. 0580_m24_ms_42 Q: 4

Question	Answer	Marks	Partial Marks
(a)(i)	432	**2**	**M1** for 12 × 12 × 9 ÷ 3 oe

Question	Answer	Marks	Partial Marks
(a)(ii)	404 or 403.5 to 403.7	**5**	**M4** for $12^2 + 4 \times \frac{1}{2} \times 12 \times \sqrt{6^2 + 9^2}$ oe or **M3** for $\frac{1}{2} \times 12 \times \sqrt{6^2 + 9^2}$ oe or **M2** for explicit method to find height of triangular face e.g. $\sqrt{6^2 + 9^2}$ oe or **M1** for implicit method to find height of triangular face or for $6^2 + 9^2$ oe seen or **B1** for slant height of triangle FC $\sqrt{153}$ or $3\sqrt{17}$ or 12.4 or 12.36 to 12.37 soi
(b)	4.4[0] or 4.398 to 4.399... nfww	**4**	**M3** for $\sqrt{\frac{304}{(2+3) \times \pi}}$ oe or **M2** for $\frac{4\pi r^2}{2} + \pi r \times 3r = 304$ oe or **M1** for $\frac{4\pi r^2}{2}$ oe seen or $\pi r \times 3r$ oe seen

02. 0580_m24_ms_42 Q: 12

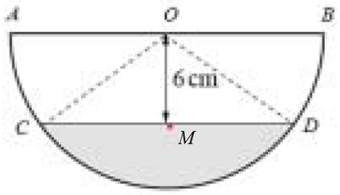
Question	Answer	Marks	Partial Marks
(a)	88.9 or 88.92 to 88.93...	4	**M3** for $2\times12+\frac{360-50}{360}\times2\times\pi\times12$ oe or **M2** for $\frac{(360-50)}{360}\times2\times\pi\times12$ oe isw or **M1** for $\frac{50}{360}\times2\times\pi\times12$ oe isw
(b)	9.01 or 9.009 to 9.010…	3	**M2** for $\frac{(360-50)}{360}\times\pi\times12^2\times h=3510$ or **M1** for $\frac{k}{360}\times\pi\times12^2\times h$ oe seen with k = 50 or 360 – 50

03. 0580_s24_ms_41 Q: 7

Question	Answer	Marks	Partial Marks
(a)(i)	10 100	3	**M2** for $30\times70+2\times30\times40+2\times40\times70$ or **M1** for 30 × 40 or 30 × 70 or 40 × 70
(a)(ii)	16	3	**M2** for 2 fit width, 2 fit height and 4 fit length soi or **M1** for 70, 30 or 40 ÷ 15 or 20
(b)(i)	$\frac{1}{3}\pi r^2\times3r$ = *their* (750 ÷ 8.9) oe	M2	**M1** for using 750 and 8.9 correctly in $v=m/d$ oe or 750 ÷ 8.9
	$r^3=\frac{\textit{their}(750\div8.9)}{\pi}$ oe	M1dep	
	r = 2.993…	A1	

Question	Answer	Marks	Partial Marks
(b)(ii)	117 or 116.9 to 117.2	**5**	**M4** for $\pi \times 2.99^2 + \pi \times 2.99 \times \sqrt{2.99^2 + (3 \times 2.99)^2}$ oe or **M3** for $\pi \times 2.99 \times \sqrt{2.99^2 + (3 \times 2.99)^2}$ or **M2** for $\sqrt{2.99^2 + (3 \times 2.99)^2}$ or **M1** for $2.99^2 + (3 \times 2.99)^2$ or for $\pi \times 2.99^2$

04. 0580_s24_ms_42 Q: 4

Question	Answer	Marks	Partial Marks
(a)(i)	22 620 cao	3	**B2** for 7200π or 22 608 to 22 629 or **M1** for $\frac{1}{2}\times\pi\times12^2$[×figs 1] oe
(a)(ii)	8840 or 8850 or 8836 to 8850. 	5	**M1** for cos $COM = \frac{6}{12}$ oe or sin $AOC = \frac{6}{12}$ oe **M1** for $\left(\frac{their\,COD}{360}\times\pi\times12^2\right)$ oe **M1** for $\left(\frac{1}{2}\times12^2\times\sin(their\,COD)\right)$ oe **M1dep** for (*their* area of sector *COD*–*their* area of triangle *COD*) ×100 **dep** on at least M1M1 oe
(b)	647 or 646.8	3	**M2** for $2.2 = \frac{m}{42\times35\times0.2}$ oe or **M1** for [vol of stone =] 42×35×0.2 oe If 0 scored **SC1** for answer figs 647 or figs 6468
(c)	46.1 or 46.12 to 46.14	4	**M3** for tan = $\frac{15}{\sqrt{8^2+12^2}}$ oe or **M2** for $8^2 + 12^2$ oe or $8^2 + 12^2 + 15^2$ oe or **M1** for identifying the angle *GAC*

05. 0580_s24_ms_42 Q: 5

Question	Answer	Marks	Partial Marks
(a)	$125x^9$ final answer	2	**B1** for answer $125x^k$ or mx^9 or for correct answer seen then spoilt

Question	Answer	Marks	Partial Marks
(b)	6^{n-2} oe final answer	**2**	**B1** for answer of form 6^k oe or answer of the form $\left(\frac{1}{6}\right)^{-k}$ oe or for correct answer seen
(c)	$3x^3 + 2x^2 - 37x + 12$ final answer	**3**	**B2** for correct expansion of three brackets unsimplified or for simplified four-term expression of correct form with 3 terms correct or **B1** for correct expansion of two brackets with at least 3 terms out of 4 correct
(d)(i)	eliminates the fraction correctly eg $(3x + 5)(x - 2) + 7 = x(x - 2)$	**M1**	
	$3x^2 + 5x - 6x - 10 + 7 = x^2 - 2x$ oe	**B2**	**B1** for $3x^2 + 5x - 6x - 10$ [+ 7] oe seen with at least 3 terms correct
	leading to $2x^2 + x - 3 = 0$	**A1**	**dep** on M1 B2 with no errors or omissions
(d)(ii)	$(2x+3)(x-1)$	**M2**	or **M1** for $(2x + a)(x + b)$ where $ab = -3$ or $2b + a =$ [+]1 or for partial factors $2x(x - 1) + 3(x - 1)$ or $x(2x + 3) - [1](2x + 3)$
	-1.5 oe and $+1$	**B1**	
(e)	[TSA cylinder =] $2\pi x^2 + 2\pi x \times 3x$	**M1**	
	[TSA hemisphere=] $\pi(5y)^2 + \frac{4\pi(5y)^2}{2}$	**M1**	
	Leading to $2\pi x^2 + 6\pi x^2 = 50\pi y^2 + 25\pi y^2$ oe	**M1**	dep **M1M1**
	$x^2 = \frac{75y^2}{8}$	**A1**	dep on **M1M1M1**

06. 0580_s24_ms_42 Q: 9

Question	Answer	Marks	Partial Marks
(a)	[a =] 9 [b =] 14	**3**	**B2** for a =9 OR **M2** for $\frac{60}{360}\times 2\times\pi\times 17+\frac{60}{360}\times 2\times\pi\times 10+7+7$ oe or **M1** for $\frac{60}{360}\times 2\times\pi\times 17$ oe **or** $\frac{60}{360}\times 2\times\pi\times 10$ oe If 0 scored **SC1** for b =14
(b)(i)	60° at centre or interior angle = 120°	**B1**	
	[6×]$\frac{1}{2}\times d^2\times\sin 60$ oe	**M1**	
	[d^2 =]$\frac{127.3}{6\times\frac{1}{2}\times\sin 60}$	**M1**	
	6.99[9…] to 7.00[…]	**A1**	Dep on M1M1
(b)(ii)(a)	1273	**1**	
(b)(ii)(b)	675 or 674.5 to 674.6	**2**	**M1** for 2 ×127.3 oe or 6 × 7 × 10 oe

07. 0580_s24_ms_43 Q: 4

Question	Answer	Marks	Partial Marks
(a)	$\frac{1}{2}(r+5)(r+2)\sin 30=(r+1)^2$	**M2**	**M1** for $\frac{1}{2}(r+5)(r+2)\sin 30$ oe
	$r^2+5r+2r+10$ or $r^2+r+r+1$ soi	**B1**	
	Leading to $3r^2+r-6=0$ with no errors or omissions	**A1**	Dependent on both expansions seen

Question	Answer	Marks	Partial Marks
(b)	$\frac{-1\pm\sqrt{1^2-4(3)(-6)}}{2(3)}$ Or $-\frac{1}{6}\pm\sqrt{2+\left(\frac{1}{6}\right)^2}$ oe or $\frac{1}{3}\left(-\frac{1}{2}\pm\sqrt{18+\left(\frac{1}{2}\right)^2}\right)$ oe	**B2**	**B1** for $\sqrt{1^2-4(3)(-6)}$ or for $\frac{-1+\sqrt{p}}{2(3)}$ or $\frac{-1-\sqrt{p}}{2(3)}$ or $\left(r+\frac{1}{6}\right)^2$ or $\left(3r+\frac{1}{2}\right)^2$
	–1.59 and 1.26	**B1**	
(c)	9.028 to 9.040	**2**	**M1** for (*their* root (greater than –1) + 1) × 4

08. 0580_s24_ms_43 Q: 8

Question	Answer	Marks	Partial Marks
(a)(i)	37.3 or 37.26 to 37.27	**5**	**M2** for $\pi\times0.35\times\sqrt{0.35^2+1.5^2}$ oe or **M1** for $0.35^2+1.5^2$ or better **M1** for $\pi\times0.35^2$ **M1** for $2\times\pi\times0.35\times16$
(a)(ii)	6.35 or 6.349 to 6.351	**3**	**M1** for $\pi\times0.35^2\times16$ **M1** for $\frac{1}{3}\times\pi\times0.35^2\times1.5$
(a)(iii)	22.2 or 22.3 or 22.24 to 22.26	**3**	**M2** for $17.5\times3.5\times1.4-10\times$ *their* **(a)(ii)** or **M1** for $17.5\times3.5\times1.4$

Question	Answer	Marks	Partial Marks
(b)	154 or 154.3 to 154.4	**3**	**M2** for $450 \times \left(\sqrt{\frac{98}{200}}\right)^3$ oe or **M1** for $\left(\sqrt{\frac{98}{200}}\right)^3$ or $\left(\sqrt{\frac{200}{98}}\right)^3$ oe or for $\left(\frac{450}{V}\right)^2 = \left(\frac{200}{98}\right)^3$ oe

09. 0580_m23_ms_42 Q: 3

Question	Answer	Marks	Partial Marks
(a)	$[h =] \frac{\frac{1}{2}\times\frac{4}{3}\times\pi\times3^3}{\pi\times12^2}$ oe leading to 0.125 or $3 - \frac{\pi\times12^2\times3 - \frac{1}{2}\times\frac{4}{3}\times\pi\times3^3}{\pi\times12^2}$ oe leading to 0.125	**M3**	**M2** for $\pi\times12^2\times h = \frac{1}{2}\times\frac{4}{3}\times\pi\times3^3$ oe or for $\pi\times12^2\times3 = \pi\times12^2\times x + \frac{2}{3}\times\pi\times3^3$ oe or for $\frac{\frac{1}{2}\times\frac{4}{3}\times\pi\times3^3}{\pi\times12^2\times3} = \frac{h}{3}$ oe or **M1** for $\pi\times12^2\times h$ or $\frac{1}{2}\times\frac{4}{3}\times\pi\times3^3$ oe or $\pi\times12^2\times3$

Question	Answer	Marks	Partial Marks
(b)	4.8[0] or 4.795 to 4.796	**3**	**M2** for $\pi\times12^2\times(3-0.125) = \pi\times R^2\times18$ oe or $\pi\times12^2\times3 - \frac{2}{3}\times\pi\times3^3 = \pi\times R^2\times18$ or **B1** for $3 - 0.125$ or for 414π oe
(c)	10.5 or 10.47 to 10.49	**3**	**M2** for $\frac{\frac{4}{3}\times\pi\times3^3 - 30\times1.5^3}{\frac{4}{3}\times\pi\times3^3}$ or $\frac{30\times1.5^3}{\frac{4}{3}\times\pi\times3^3}\times100$ oe or **M1** for $\frac{4}{3}\times\pi\times3^3 - 30\times1.5^3$ or $\frac{30\times1.5^3}{\frac{4}{3}\times\pi\times3^3}$ oe

10. 0580_m23_ms_42 Q: 8

Question	Answer	Marks	Partial Marks
(a)	54	**2**	**M1** for $\frac{1}{2}\times12\times9$

Question	Answer	Marks	Partial Marks
(b)	$2x^2+13x-85\,[=0]$	B3	**M1** for $\frac{1}{2}(2x+3)(x+5)\ [=50]$ oe **B1** for $2x^2+10x+3x+15$
	$\frac{-13\pm\sqrt{13^2-4(2)(-85)}}{2(2)}$ oe or $-\frac{13}{4}\pm\sqrt{\frac{85}{2}+\left(\frac{13}{4}\right)^2}$ oe	M2	**M1** for $\sqrt{13^2-4\times2\times-85}$ oe or for $\frac{-13+\text{or}-\sqrt{p}}{2(2)}$ oe or for $[2]\left(x+\frac{13}{4}\right)^2$
	4.03 cao	B1	

11. 0580_s23_ms_42 Q: 5

Question	Answer	Marks	Partial Marks
(a)(i)	251 or 251.3 to 251.4	2	**M1** for $\frac{1}{3}\times\pi\times4^2\times15$ oe
(a)(ii)	79.5 or 79.51…	5	**M3** for $\pi\times4\times\sqrt{4^2+15^2}$ oe or **M2** for $\sqrt{15^2+4^2}$ oe or **M1** for $[l^2=]\ 4^2+15^2$ oe or $\pi\times4\times$ *their* l **M1** for $\frac{\textit{their}\text{ curved surface area}}{\textit{their}\text{ curved surface area}+\pi\times4^2}[\times100]$ oe
(b)(i)	13 min 20 sec	3	**B2** for 800 or $\frac{40}{3}$ oe seen or **M1** for figs 3 ÷ figs 375 or figs 3 ÷ 22 500
(b)(ii)	0.472 or 0.4715 to 0.4716…	3	**M2** for $\pi\times0.45^2\times h=0.3$ or $\pi\times45^2\times h=300\,000$ oe or **M1** for $\pi\times\text{figs}45^2\times h=\text{figs}3$ oe

12. 0580_s23_ms_43 Q: 8

Question	Answer	Marks	Partial Marks
(a)	$4x + 3(x + 27) = 194.75$ or $4x + 3x + 81 = 194.75$	**M1**	
	16.25 cao	**B2**	**M1** for $7x = k$ where $k < 194.75$ or **B1** for answer 16.3
(b)	$x^2 - 20x - 69 [= 0]$ oe or $y^2 + 116y - 861 [= 0]$ oe	**M2**	**M1** for $x^2 + 4(-8 - 5x) = 37$ oe or for $37 - 4y = \left(\frac{-8 - y}{5}\right)^2$ oe or for $x^2 + 4y = 37$ and $20x + 4y = -32$ subtracted with no more than one error

Question	Answer	Marks	Partial Marks
	$(x + 3)(x - 23) [= 0]$ oe or $(y - 7)(y + 123) [= 0]$ oe	**M1**	correct method to solve *their* quadratic e.g. $x = \frac{-(-20) \pm \sqrt{(-20)^2 - 4 \times 1 \times (-69)}}{2 \times 1}$ or $x - 10 = \pm 13$ or $x - 10 = \pm\sqrt{169}$
	$x = -3 \quad y = 7$ $x = 23 \quad y = -123$ final answer	**B2**	**B1** for one correct pair or two correct x values or two correct y values
(c)	$2\pi x \times 6x + 2\pi x^2$ or $2\pi x(6x + x)$	**M2**	or **M1** for $2\pi x \times 6x$ or $2\pi x^2$
	Their $(2\pi x \times 6x + 2\pi x^2) = 4\pi r^2$	**M1**	Dep on at least on M1 earned *Their* LHS must be an area in terms of x only
	At least one further stage of working leading to $r^2 = \frac{7}{2}x^2$	**A1**	with no error seen

13. 0580_w23_ms_41 Q: 8

Question	Answer	Marks	Partial Marks
(a)(i)	$\frac{2}{3}\pi(3.6)^3 + \frac{2}{3}\pi(5.4)^3 + \pi(3.6)^2 \times 6.5$	**M3**	**M1** for either $\frac{2}{3}\pi(3.6)^3$ or $\frac{2}{3}\pi(5.4)^3$ **M1** for $\pi(3.6)^2 \times 6.5$
	692.1 to 692.2…	**A1**	
(a)(ii)	33.6 or 33.60 to 33.62	**4**	**M3** for $\left(\frac{0.6}{3.6}\right)^3 \times 692 \times 10.49$ oe or **M2** for $\left(\frac{0.6}{3.6}\right)^3 \times 692$ oe or **M1** for $\left(\frac{0.6}{3.6}\right)^3$ or $\left(\frac{3.6}{0.6}\right)^3$ oe If 0 scored, **SC1** for *their* volume × 10.49
(b)(i)	12π final answer	**2**	**M1** for $\frac{216}{360} \times 2\pi \times 10$ oe After **0** scored SC1 for final answer 8π or 12π + 20
(b)(ii)	302 or 301.5 to 301.6…	**4**	**M1** for $2\pi r =$ *their* **(b)(i)** oe or for $\frac{216}{360} \times \pi \times 10^2 = \pi \times r \times 10$ oe and **M1** for $[h =] \sqrt{10^2 - \text{their}6^2}$ oe and **M1** for $[V =] \frac{1}{3}\pi(\text{their}6)^2 \times (\text{their}8)$

14. 0580_w23_ms_42 Q: 4

Question	Answer	Marks	Partial Marks
(a)	72 or 72.0 cao nfww	3	**M2** for $\frac{x}{360}\times 2\times\pi\times 7.5=2\times\pi\times 1.5$ oe or **M1** for $\frac{x}{360}\times 2\times\pi\times 7.5$ or for $2\times\pi\times 1.5$ oe OR **M2** for $\frac{x}{360}\times\pi\times 7.5^2=\pi\times 1.5\times 7.5$ oe or **M1** for $\frac{x}{360}\times\pi\times 7.5^2$ or for $\pi\times 1.5\times 7.5$ oe
(b)(i)	$2\times\sqrt{17^2-8^2}$ or $\sqrt{34^2-16^2}$ oe	M2	**M1** for $17^2=8^2+d^2$ or $34^2 = 16^2 + k^2$
(b)(ii)	29.3 or 29.30 to 29.31	4	**M3** for $([\pi]\times 8^2\times 30)\div\frac{4}{3}\times[\pi]\times 17^3$ [$\times$ 100] oe OR **M1** for $\pi\times 8^2\times 30$ oe **M1** for $\frac{4}{3}\times\pi\times 17^3$ oe

Question	Answer	Marks	Partial Marks
(c)	12.7 or 12.73 to 12.74	3	**B2** for 2.26 or 2.261 to 2.262…. soi or **M2** for $\left(20^2\times 15-\frac{4}{3}\times\pi\times 6^3\right)\div 20^2$ oe or for $15-\left(\frac{4}{3}\times\pi\times 6^3\div 20^2\right)$ oe or **M1** for $20^2\times 15-\frac{4}{3}\times\pi\times 6^3$ oe or $20^2\times D=\frac{4}{3}\times\pi\times 6^3$ oe If 0 scored, **SC1** for answer 11[.0] or 10.97 to 10.98

15. 0580_w23_ms_43 Q: 8

Question	Answer	Marks	Partial Marks
(a)(i)	$\sin[BOC] = \frac{2}{6}$ or better oe	**M1**	
	19.47…	**A1**	
(a)(ii)	64.6 or 64.55 to 64.58	**3**	**M2** for $\frac{360-135-19.5}{360} \times \pi \times 6^2$ oe or **M1** for $\frac{k}{360} \times \pi \times 6^2$ oe

Question	Answer	Marks	Partial Marks
(a)(iii)	16.1 or 16 10 to 16.13	**5**	**M2** for $2 \times \sqrt{6^2 - 2^2}$ oe or $2 \times 6 \cos 19.5$ oe or **M1** for $OC^2 + 2^2 = 6^2$ oe or $6 \cos 19.5$ or better AND **M2** for $\sqrt{6^2 + \textit{their } OD^2 - 2 \times 6 \times \textit{their } OD \times \cos 135}$ OR **M1** for $6^2 + \textit{their } OD^2 - 2 \times 6 \times \textit{their } OD \times \cos 135$ **A1** for 259 to 260
(a)(iv)	94.2 or 94.3 or 94.15 to 94.27… nfww	**4**	**M1** for ½ × 6 × *their OD* × sin 135 oe **M1** for ½ × 6 × 2 × sin(90 – 19.5) oe or for ½ × *their OC* × 2 **M1dep** for *their* **(a)(ii)** + *their* two triangle areas
(b)	1000 cao	**3**	**M2** for $160 \times \left(\frac{20}{8}\right)^2$ or $160 \div \left(\frac{8}{20}\right)^2$ oe or **M1** for $\left(\frac{20}{8}\right)^2$ or $\left(\frac{8}{20}\right)^2$ oe OR **M2** for $\frac{\text{sector angle}}{360} \times \pi 20^2$ or **M1** for $\frac{160}{\pi 8^2} \times 360$ oe or better OR **M2** for $\frac{\text{percentage}}{100} \times \pi 20^2$ oe or better or **M1** for $\frac{160}{\pi 8^2}$ [× 100] oe or better

16. 0580_m22_ms_42 Q: 9

Question	Answer	Marks	Partial Marks
(a)	54[.0] or 53.99 to 54.03...	6	**M2** for [h =] $95.4 \times 3 \div (\pi \times 2.4^2)$ oe or **M1** for $95.4 = \frac{1}{3} \times \pi \times 2.4^2 \times h$ **M2** for [slant ht , l =] $\sqrt{(their\ h)^2 + 2.4^2}$ or **M1** for $(their\ h)^2 + 2.4^2$ **M1** for $\frac{x}{360} \times 2 \times \pi \times their\ l = 2 \times \pi \times 2.4$ oe or $\frac{x}{360} \times \pi \times (their\ l)^2 = \pi \times 2.4 \times their\ l$

Question	Answer	Marks	Partial Marks
(b)	14500 or 14470 to 14480	4	**M3** for $200 \times 60 \times 24 \times \pi \times 4^2$ [÷1000] or $2 \times 60 \times 24 \times \pi \times 0.04^2$ [×1000] or **M2** for $200 \times \pi \times 4^2$ or for $2 \times \pi \times 0.04^2$ or **M1** for $\pi \times 4^2$ oe or $\pi \times 0.04^2$ seen oe isw or 1000 cm^3 = 1 litre soi or 1 m^3 = 1000 litres soi or for 24×60 seen oe

17. 0580_w22_ms_41 Q: 1

Question	Answer	Marks	Partial Marks
(a)(i)	1580 or 1583 to 1584	2	**M1** for $\pi \times 6^2 \times 14$
(a)(ii)	452 or 452.3 to 452.4...	2	**M1** for $\left[\frac{1}{2}\right] \times \frac{4}{3} \times \pi \times 6^3$
(b)(i)	7.85 ÷ 1000 [= 0.00785]	M1	
(b)(ii)	16[.0] or 15.95 to 15.99	2	**FT** {*their* **(a)(i)** + *their* **(a)(ii)**} × 0.00785 evaluated to 3 sig fig or better **M1** for (*their* **(a)(i)** + *their* **(a)(ii)**) × 0.00785
(c)(i)	16.2 or 16.21 to 16.23	3	**M2** for $\frac{2000 - 50 \times \frac{4}{3} \times \pi \times 2^3}{2000}$ [×100] or for $\frac{50 \times \frac{4}{3} \times \pi \times 2^3}{2000} \times 100$ or **M1** for $\frac{50 \times \frac{4}{3} \times \pi \times 2^3}{2000}$
(c)(ii)	6.87 or 6.870 to 6.872	1	FT $\sqrt[3]{2000 - their\left(50 \times \frac{4}{3} \times \pi \times 2^3\right)}$ evaluated to 3sf or better
(d)	$\frac{2}{3}$ oe	4	**M1** for $[\pi](3R)^2 + [\pi]3R \times 9R$ oe **M1** for $2[\pi]x^2 + 2[\pi]x \times 7x$ oe **M1** for *their* area of cone = *their* area of cylinder seen

18. 0580_w22_ms_42 Q: 10

Question	Answer	Marks	Partial Marks
(a)	42.05 final answer	2	**M1** for 11.4 + 0.05 oe or 14.8 + 0.05 oe or 15.7 + 0.05 oe
(b)	319 or 318.5 to 318.6	2	**M1** for $\frac{150}{360} \times \pi \times 15.6^2$ oe
(c)	$\frac{360-x}{360} \times 2\pi r + 2r = 3\left(\frac{x}{360} \times 2\pi r + 2r\right)$ oe	M2	**M1** for $\frac{x}{360} \times 2\pi r$ oe seen or $\frac{360-x}{360} \times 2\pi r$ oe seen
	$\frac{4x}{360} \times 2\pi[r] = 2\pi[r] - 4[r]$ oe	M1	i.e. M mark for isolating and collecting terms in x
	Leading to $\frac{90(\pi-2)}{\pi}$	A1	With no errors or omissions

19. 0580_w22_ms_43 Q: 5

Question	Answer	Marks	Partial Marks
(a)	$\left(\frac{(36+50)\times 40}{2}\right)\times 120$ oe or $\left(\frac{(0.36+0.5)\times 0.4}{2}\right)\times 1.2$ oe	M2	M1 for $\frac{(36+50)\times 40}{2}$ oe or $\frac{(0.36+0.5)\times 0.4}{2}$ oe
	206400 ÷ 1000 = 206.4 or 0.2064 × 1000 = 206.4 nfww	A1	Must see an explicit conversion
(b)	5 [minutes] 44 seconds	3	B2 for 344 [seconds] oe 5.73…[mins] or M1 for figs206.4 ÷ figs 6 oe
(c)(i)	28[.0] or 27.96 to 27.97	3	M2 for $[r^2=]\ \frac{\text{figs } 2064}{(figs84)\pi}$ or M1 for $\pi r^2 \times figs84 = \text{figs } 2064$
(c)(ii)	140 cao	2	M1 for $0.6h = 84$ oe ALT method M1 for $\pi\times(their\ \textbf{(c)(i)})^2\times h = figs206400\div 0.6$ oe
(d)	128 or 127.7 to 127.8	4	B3 for $40^2+120^2+18^2$ oe OR B1 for horizontal length 18 soi M1 for any correct attempt at 2-dimensional Pythagoras' 18^2+120^2, 120^2+40^2, 18^2+40^2

20. 0580_m21_ms_42 Q: 8

	Answer	Mark	Partial Marks
(a)(i)	$\frac{53}{360}\times\pi\times9.5^2$	**M1**	
	41.74 to 41.75	**A1**	
(a)(ii)	5.9[0] or 5.899 to 5.903..	**4**	**M3** for $\left[OA^2=\right]\ \frac{\frac{1}{3}\times41.7}{\frac{1}{2}\sin53}$ oe **M2** for $\frac{1}{2}\times OA^2\times\sin53=\frac{1}{3}\times41.7$ oe **M1** for $\frac{1}{2}\times OA\times OB\times\sin53=\frac{1}{3}\times41.7$ seen or better
(b)	396 or 397 or 396.4 to 396.6	**6**	**M2** for $\left[r=\right]\left(\frac{60}{360}\times2\times\pi\times24\right)\div2\pi$ oe or better or **M1** for $2\pi r=\frac{60}{360}\times2\times\pi\times24$ oe **M2** for $\sqrt{24^2-a^2}$ or **M1** for $h^2+a^2=24^2$ **M1** for $\frac{1}{3}\pi\times their\ r^2\times their\ h$

21. 0580_s21_ms_41 Q: 3

	Answer	Mark	Partial Marks
(a)	2.64 or 2.638…	**4**	**M3** for $[R^2=]\frac{\pi\times2.4^2+\pi\times2.4\times6.3}{\pi+2\pi}$ oe or **M2** for $\pi\times2.4^2+\pi\times2.4\times6.3=\pi R^2+\frac{1}{2}\times4\pi R^2$ or **M1** for $[\pi\times2.4^2]+\pi\times2.4\times6.3$ oe or $[\pi R^2]+\frac{1}{2}\times4\pi R^2$ oe

	Answer	Mark	Partial Marks
(b)	953 or 952.6 to 952.8	**4**	**M3** for $\frac{1}{3}\times\pi\times7.6^2\times16\times\left(1-\left(\frac{16-12}{16}\right)^3\right)$ or $\frac{1}{3}\times\pi\times7.6^2\times16-\frac{1}{3}\times\pi\times1.9^2\times(16-12)$ OR **B1** for top radius = 1.9 or $\left(\frac{16-12}{16}\right)^3$ oe **M2** for $\frac{1}{3}\times\pi\times7.6^2\times16-\frac{1}{3}\times\pi\times(their1.9)^2\times(16-12)$ or $\frac{1}{3}\times\pi\times7.6^2\times16\times\left(1-their\left(\frac{16-12}{16}\right)^3\right)$ or **M1** for $\frac{1}{3}\times\pi\times7.6^2\times16$ or for $\frac{1}{3}\times\pi\times(their1.9)^2\times(16-12)$

22. 0580_s21_ms_43 Q: 8

	Answer	Mark	Partial Marks
(a)(i)	1200	**1**	
(a)(ii)(a)	800	**3**	**M2** for [2 ×] (20 × 12 + 20 × 5 + 12 × 5) or **M1** for 20 × 12 or 20 × 5 or 12 × 5
(a)(ii)(b)	0.19	**1**	**FT** 152 ÷ *their* 800
(b)	$\frac{3x}{2}$ or $1.5x$	**3**	**B2** for $r^3 = \frac{27x^3[\pi]}{8[\pi]}$ or better or **M1** for $\frac{4}{3}\pi r^3 = \pi x^2 \times \frac{9x}{2}$
(c)	13.6 or 13.59 to 13.61	**7**	If chord is *AB* and *O* is centre of the cross section **M2** for $2 \times \cos^{-1}\left(\frac{20-5}{20}\right)$ oe or **M1** for $\cos = \frac{20-5}{20}$ oe **M1** for $\frac{theirAOB}{360} \times \pi \times 20^2$ or $\frac{1}{2}(20)^2\left(\frac{82.8\pi}{180}\right)$ **M1** for $\frac{1}{2} \times 20^2 \times \sin(their\ AOB)$ oe **M1** for *their* area × 150 **M1** for *their* volume ÷ 1000

23. 0580_m20_ms_42 Q: 3

	Answer	Mark	Partial Marks
(a)	187	**2**	**M1** for $220 \times \left(1 - \frac{15}{100}\right)$ oe or **B1** for 33 seen
(b)	19.8	**3**	**M2** for $29.7 \times \sqrt[3]{\frac{0.4}{1.35}}$ oe or **M1** for $\sqrt[3]{\frac{0.4}{1.35}}$ or $\sqrt[3]{\frac{1.35}{0.4}}$ oe seen or for $\frac{29.7^3}{x^3} = \frac{1.35}{0.4}$ oe
(c)	12.4 or 12.44…	**3**	**M1** for $90 \times 75 \times h = 7 \times$ figs 12 **B1** for 1000 cm^3 = 1 litre soi

24. 0580_m20_ms_42 Q: 4

	Answer	Mark	Partial Marks
(a)	32.9 or 32.91 to 32.92…	**2**	**M1** for $\pi \times 1.65 \times 4.7 + \pi \times 1.65^2$
(b)	69.4 or 69.44 to 69.45	**2**	**M1** for cos = $1.65 \div 4.7$ oe
(c)(i)	12.5 or 12.54 to 12.55	**4**	**M3** for $\frac{1}{3} \times \pi \times 1.65^2 \times \sqrt{4.7^2 - 1.65^2}$ oe or **M2** for $\sqrt{4.7^2 - 1.65^2}$ oe or for $4.7 \times \sin(\textit{their}$ **(b)**$)$ oe or **M1** for $1.65^2 + h^2 = 4.7^2$ oe or for $\frac{h}{4.7} = \sin(\textit{their}$ **(b)**$)$ oe
(c)(ii)	41 nfww	**4**	**B3** for 41.7… to 41.9 or **M2** for $\frac{4}{3} \times \pi \times 5^3 \div$ *their* 12.5 or **M1** for $\frac{4}{3} \times \pi \times 5^3$ After **M2** scored, **M1** for truncating *their* decimal number of cones seen to an integer answer

25. 0580_p20_ms_40 Q: 5

	Answer	Mark	Partial Marks
(a)(i)	$[y =] \frac{1}{2}(80 - 2x)$ oe	M1	for $40 - x$ is enough
	$A =$ *their* $\frac{1}{2}(80 - 2x) \times x$ oe	M1	for $\frac{1}{2}(80 - x)$ or $40 - 2x$ for *their* $\frac{1}{2}(80 - 2x)$
	$A = 40x - x^2$ and $x^2 - 40x + A = 0$	A1	for no errors or omissions
(a)(ii)	$(x - 30)(x - 10)$	B2	**B1** for $x(x - 30) - 10(x - 30)$ [= 0] or $x(x - 10) - 30(x - 10)$ [= 0] or **SC1** for $(x + a)(x + b)$ where $ab = 300$ or $a + b = -40$
	30, 10	B1	
(a)(iii)	$\sqrt{(-40)^2 - 4(1)(200)}$ or better	B1	Or for $(x - 20)^2$
	$p = --40$ and $r = 2(1)$	B1	Must see $\frac{p + \sqrt{q}}{r}$ or $\frac{p - \sqrt{q}}{r}$ or both or for $20 \pm \sqrt{200}$
	5.86 34.14	B2	If B0, **SC1** for 5.9 or 5.857 to 5.858 **and** 34.1 or 34.14… or 5.86 **and** 34.14 seen in working or –5.86 **and** –34.14 as final answers
(b)(i)	$\frac{200}{x} - \frac{200}{x + 10}$	M2	Or **M1** for $\frac{200}{x}$ or $\frac{200}{x + 10}$ soi
	$\frac{200(x + 10) - 200x}{x(x + 10)} = \frac{2000}{x(x + 10)}$	A1	No errors or omissions
(b)(ii)	16 (min) 40 (s)	3	**B2** for $0.2\dot{7}$ or 0.278 or 0.2777 to 0.2778 or $\frac{5}{18}$ [h] oe or $16.\dot{6}$ or 16.7 or 16.66 to 16.67 or $\frac{50}{3}$ [min] or **M1** for $2000 \div 80(80 + 10)$ or $\frac{200}{80} - \frac{200}{90}$

26. 0580_p20_ms_40 Q: 10

	Answer	Mark	Partial Marks
(a)	14 137 to 14 137.2 or 14 139	2	**M1** for $\frac{4}{3} \times \pi \times 15^3$
(b)(i)	104 000 or 103 600 to 103 700	3	**M2** for $\pi \times 25^2 \times 60 - 14\,140$ or **M1** for $\pi \times 25^2 \times 60$ **FT** $\pi \times 37\,500 = 117\,809$. … allow *their* answer as long as it rounds to 14 140
(b)(ii)	52.8 or 52.75 to 52.81…	2	**M1** for *their* **(b)(i)** $\div (\pi \times 25^2)$ or $14\,140 \div (\pi \times 25^2)$ **FT** $\pi \times 25^2 = 1963$… (allow use of *their* answer as long as it rounds to 14 140) or 7.198 to 7.201…
(c)	$\sqrt{(5x)^2 + (12x)^2}$	M1	
	[slant height =] $13x$	A1	
	$\pi(5x)^2$ or $\pi(5x)(13x)$	M1	Accept $25\pi x^2$
	$\pi(5x)^2 + \pi(5x)(13x) = 4\pi r^2$	M1	
	$r^2 = \frac{90\pi}{4\pi}x^2 = \frac{45}{2}x^2$	A1	With all steps shown and no errors seen

27. 0580_s20_ms_41 Q: 9

	Answer	Mark	Partial Marks
(a)	39[.0] or 39.03 to 39.04…	3	**M2** for $\frac{165}{360}\times 2\times\pi\times 8+16$ or **M1** for $\frac{165}{360}\times 2\times\pi\times 8$
(b)	2.71 or 2.708…	4	**M3** for $\sqrt{\frac{\frac{165}{360}[\times\pi]\times 8^2}{4[\times\pi]}}$ oe or **M2** for $r^2=\frac{\frac{165}{360}[\times\pi]\times 8^2}{4[\times\pi]}$ oe or **M1** for $\frac{165}{360}\times\pi\times 8^2$ oe seen

	Answer	Mark	Partial Marks
(c)(i)	3.67 or 3.666 to 3.667	2	**M1** for $\frac{165}{360}\times 2[\times\pi]\times 8=2[\times\pi]\times r$ or better or for $\frac{165}{360}[\times\pi]\times 8^2=[\pi\times]r\times 8$ or better
(c)(ii)	100 or 100.0 to 100.1… final answer	4	**M3** for $\frac{1}{3}\pi\times their(c)(i)^2\times\sqrt{8^2-their\,\text{radius}^2}$ or **M2** for $\sqrt{8^2-their\,\text{radius}^2}$ or **M1** for $(their\ (c)(i))^2+h^2=8^2$

28. 0580_s20_ms_42 Q: 8

	Answer	Mark	Partial Marks
(a)(i)	36	**2**	**M1** for $\left(\frac{8}{12}\right)^2$ or $\left(\frac{12}{8}\right)^2$ oe
(a)(ii)	30	**3**	**M2** for $320 \div 16 \times \frac{12}{8}$ oe or **M1** for $320 \div 16$
(b)	3.375 cao	**3**	**M2** for $\frac{\frac{4}{3}\pi \times 4.5^3}{\pi \times 6^2}$ or better or **M1** for $\pi \times 6^2 \times h = \frac{4}{3} \times \pi \times 4.5^3$
(c)	3.63 or 3.627 to 3.628	**3**	**M2** for $\frac{20^3}{40 \times \frac{4}{3}\pi}$ or **M1** for $40 \times \frac{4}{3} \times \pi \times r^3 = 20^3$
(d)	$\frac{3x}{2}$ or $1.5x$ or $1\frac{1}{2}x$	**3**	**B2** for $4R^2 = 9x^2$ oe or better or **M1** for $4\pi R^2 = 2\pi x^2 + \pi \times 2x \times \frac{7x}{2}$

29. 0580_m19_ms_42 Q: 6

	Answer	Mark	Partial Marks
(a)	5.83 or 5.832 to 5.833	**5**	**B2** for sector angle = 210 soi or **M1** for [$\cos DOE =] \frac{0.25}{0.5}$ oe **M2** for $\frac{their 210}{360} \times 2 \times \pi \times 0.5 + 2 \times 1.5 + 2 \times 0.5$ oe or **M1** for $\frac{their 210}{360} \times 2 \times \pi \times 0.5$ oe isw
(b)	1.21 or 1.208…	**3**	**M2** for $\frac{their 210}{360} \times \pi \times 0.5 \times 0.5 + 1.5 \times 0.5$ oe or **M1** for $\frac{their 210}{360} \times \pi \times 0.5 \times 0.5$ oe isw
(c)(i)	4[.00...]	**3**	**M2** for $0.5 \times \sqrt{\frac{77.44}{their \textbf{(b)}}}$ oe or **M1** for $\sqrt{\frac{77.44}{their \textbf{(b)}}}$ or $\sqrt{\frac{their \textbf{(b)}}{77.44}}$ or for $\frac{their \textbf{(b)}}{77.44} = \frac{0.5^2}{r^2}$ oe
(c)(ii)	2.20704	**3**	**M2** for 77.44 × 1.5 × 19 ÷ 1000 oe or **M1** for figs 2207[04] or figs 221 seen or [vol =] 77.44 × 1.5

30. 0580_s19_ms_41 Q: 3

	Answer	Mark	Partial Marks
(a)	530	4	**B3** for $[DE] = 130$ m and $[DC] = 80$ m or **B2** for $[DE] = 130$ m or $[DC] = 80$ m or **M1** for $50^2 + 120^2$ or $170^2 - 150^2$
(b)	52.9 or 52.89…	4	**M2** for $\frac{100^2 + 150^2 - 120^2}{2 \times 100 \times 150}$ or **M1** for $120^2 = 100^2 + 150^2 - 2 \times 100 \times 150\cos(\ldots)$ **A1** for 0.603 or 0.6033…or $\frac{181}{300}$
(c)(i)	28.1 or 28.07…	2	**M1** for $\cos = \frac{15}{17}$ oe
(c)(ii)	331.9 or 331.9…	2	**FT** 360 – *their* **(c)(i)** **M1** for 360 – *their* **(c)(i)** oe
(d)	1.5[0] or 1.498… nfww	4	**M1** for $\frac{1}{2} \times 50 \times 120$ oe **M1** for $\frac{1}{2} \times 100 \times 150 \sin(\textit{their}\textbf{(b)})$ oe **M1** for $\frac{1}{2} \times 150 \times \textit{their}CD$ oe or $\frac{1}{2} \times 150 \times 170 \times \sin \textit{their}\textbf{(c)(i)}$ If 0 scored, **SC1** for dividing *their* area by 10 000

31. 0580_s19_ms_41 Q: 5

	Answer	Mark	Partial Marks
(a)	4.73 or 4.730 to 4.731...	3	**M2** for $3 \times 1.2 + \pi \times 0.6^2$ oe or **M1** for $\pi \times 0.6^2$ or $\frac{1}{2} \times \pi \times 0.6^2$ or 3×1.2
(b)	946 or 946.0 to 946.2...	3	**M2** for *their* **(a)** $\times 0.2 \times 1000$ oe or **M1** for *their* **(a)** $\times 0.2$ or 20 implied by figs 946[0] to 9462
(c)	1.28 or 1.29 or 1.284 to 1.290	3	**M2** for $\frac{(1007 - \textit{their}(\mathbf{b})) \div 1000}{\textit{their}(\mathbf{a})} \times 100$ oe or for $\frac{1007 - \textit{their}(\mathbf{b})}{\textit{their}(\mathbf{b})} \times 20$ oe or **M1** for figs $\frac{1007 - \textit{their}(\mathbf{b})}{\textit{their}(\mathbf{a})}$ or figs $\frac{1007}{\textit{their}(\mathbf{a})}$ or for $\frac{1007 - \textit{their}(\mathbf{b})}{\textit{their}(\mathbf{b})}$ or $\frac{1007}{\textit{their}(\mathbf{b})} \times 20$ oe

32. 0580_s19_ms_41 Q: 10

	Answer	Mark	Partial Marks
(a)	10	1	
(b)	6.2[0] or 6.203 to 6.204	3	**M2** for $[x^3 =]\ 1000 \div \frac{4}{3}\pi$ oe or better or **M1** for $\frac{4}{3}\pi x^3 = 1000$
(c)	7.82 or 7.815 to 7.816	4	**B3** for $[x^3 =] 1000 \div \frac{1}{3}\pi \div 2$ oe or better or **M1** for $\left(x\sqrt{5}\right)^2 - x^2$ soi by $4x^2$ or $2x$ **M1dep** for $\frac{1}{3}\pi \times x^2 \times \textit{their}h[=1000]$

	Answer	Mark	Partial Marks
(d)	$6\frac{2}{3}$ or 6.67 or 6.666 to 6.667	4	**B3** for $[x^3 =]1000 \div \frac{27}{8}$ oe or $\frac{3x}{2} = 10$ or better or **M2** for $\frac{1}{2} \times x \times \frac{x}{2} \times \frac{27x}{2} = 1000$ oe or **M1** for $\frac{1}{2} \times x \times \frac{x}{2}$ If 0 scored, **SC2** for answer 5.29 or 5.291..

33. 0580_s19_ms_42 Q: 10

	Answer	Mark	Partial Marks
(a)(i)	18[.0] or 17.99 to 18.00…	3	**M2** for $\sqrt[3]{\frac{24430 \times 3}{4\pi}}$ oe or **M1** for $\frac{4}{3}\pi r^3 = 24430$
(a)(ii)	447 or 446.8 to 446.9...	3	**M2** for $\pi \times 50^2 \times 60 - 24430$ oe or **M1** for $\pi \times 50^2 \times 60$ oe

	Answer	Mark	Partial Marks
(b)	4 [hours] 30 [mins] nfww	4	**B3** for 16200 or 4.5 or 270 or **M2** for $\frac{\text{figs } 18 \times \text{figs } 15 \times \text{figs } 12}{\text{figs } 2}$ oe or **M1** for figs 18 × figs 15 × figs 12 oe
(c)	12.5 or 12.50…	3	**M2** for $17 \times \sqrt{\frac{159.5}{295}}$ oe or **M1** for $\sqrt{\frac{159.5}{295}}$ or $\sqrt{\frac{295}{159.5}}$ seen or for $\frac{159.5}{295} = \frac{x^2}{17^2}$ oe

34. 0580_s19_ms_43 Q: 4

	Answer	Mark	Partial Marks
(a)(i)	$\frac{1}{2}\times\frac{4}{3}\times\pi\times5.6^3$	**M1**	
	367.8... to 367.9	**A1**	
(a)(ii)	3.06 or 3.060 to 3.061...	**4**	**M1** for 0.8×368 [= 294.4] **M2** for [r^2 =] $\frac{\textit{their}\ 294.4}{10\pi}$ oe or **M1** for $\pi r^2\times10=$ *their* 294.4 oe
(b)(i)	44[.0] or 43.98 to 43.99 nfww	**5**	**B2** for [slant height =] $\frac{25}{4}$ oe or **M1** for [l^2 =] $6^2+1.75^2$ oe **M2** for $\pi\times1.75\times\textit{their}\ l+\pi\times1.75^2$ or **M1** for $\pi\times1.75\times\textit{their}\ l$ or $\pi\times1.75^2$
(b)(ii)(a)	SF = $\frac{1}{4}$ oe soi	**B1**	
	$\frac{1}{3}\pi\times1.75^2\times6-\frac{1}{3}\pi\times\textit{their}\ 0.4375^2\times1.5$ **OR** $\frac{1}{3}\pi\times1.75^2\times6\times\left(1-\left(\frac{1}{4}\right)^3\right)$ oe	**M2**	**M1** for $\frac{1}{3}\pi\times1.75^2\times6$ or $\frac{1}{3}\pi\times\textit{their}\ 0.4375^2\times1.5$ **OR** **M1** for $1-\left(\frac{1}{4}\right)^3$ oe
	18.94 or 18.939 to18.944…	**A1**	
(b)(ii)(b)	95 final answer	**3**	**B2** for 94.5 or 94.69 to 94.722 OR **M2** for $18.9\times10^3\div200$ oe or **M1** for 18.9×10^3 or $200\div10^3$ or figs 189..÷ 200 or 18.9.. ÷ figs 2

35. 0580_w19_ms_43 Q: 6

	Answer	Mark	Partial Marks
(a)(i)	Angle ABC=52 nfww	**B1**	ALTERNATIVE [Reflex] angle AOC = 256
	Opposite angles in cyclic quad oe Angles in opposite segments	**B1**	Angle at centre=2 × angle at circumference/arc
	[Angle AOC=104] Angle at centre=2 × angle at circumference/arc nfww	**B1**	Angles around a point
(a)(ii)	22 nfww	**2**	**B1** for angle OAC = 38 or angle CAD = 24
(a)(iii)	28	**1**	
(a)(iv)	36.6 or 36.62 to 36.63 nfww	**3**	**B2** for 7.4 or 17.42 to 17.43 or **M2** for $9.6\times 2+\frac{104}{360}\times 2\times\pi\times 9.6$ or **M1** for $\frac{104}{360}\times 2\times\pi\times 9.6$
(b)(i)	81	**3**	**M2** for $\frac{A}{36}=\left(\sqrt[3]{\frac{2187}{648}}\right)$ oe or better or for $A\times\frac{648}{36}\times\sqrt[3]{\frac{2187}{648}}=2187$ oe or better or **M1** for $\frac{A^3}{36^3}=\frac{2187^2}{648^2}$ oe or $\sqrt[3]{\frac{2187}{648}}$ or $\sqrt[3]{\frac{648}{2187}}$
(b)(ii)	8.05 or 8.051 to 8.052…	**3**	**M2** for $\left[r^3=\right]\frac{2187\times 3}{4\times\pi}$ oe or **M1** for $\frac{4\pi r^3}{3}=2187$ **SC2** for $\frac{648\times 3}{4\times\pi}$ or **SC1** for $\frac{4\pi r^3}{3}=648$

36. 0580_m18_ms_42 Q: 2

	Answer	Mark	Partial Marks
(a)	128	2	**M1** for $4\times\frac{1}{2}\times 8\times 8$ oe
(b)(i)	18.3 or 18.26 to 18.29…	3	**M2** for $\frac{1}{4}(\pi\times 8^2 - \textit{their}\,128)$ oe or **M1** for $\pi\times 8^2 - \textit{their}\,128$ oe or for $\frac{1}{4}\times\pi\times 8^2$ oe OR **SC2dep** for answer 4.56 to 4.57...
(b)(ii)	23.9 or 23.87 to 23.882	4	**M3** for $\frac{90}{360}\times 2\times\pi\times 8+\sqrt{8^2+8^2}$ oe OR **M1** for $\frac{90}{360}\times 2\times\pi\times 8$ oe **M1** for $\sqrt{128}$ oe OR **SC3dep** for answer 11.9 or 11.93 to 11.94…

37 . 0580_m18_ms_42 Q: 5

	Answer	Mark	Partial Marks
(a)(i)	1930 or 1940 or 1933.4 to 1935.3	5	**B1** for interior angle 120 soi or angle at centre 60 soi or for correct use of Pythagoras' with 7 and 3.5 or with 14 and 7 **M3** for $6\times\frac{1}{2}\times 7^2\times\sin 60\times 15.2$ oe or complete other methods or **M2** for $6\times\frac{1}{2}\times 7^2\times\sin 60$ oe OR **M1** for $\frac{1}{2}\times 7^2\times\sin 60$ oe or other partial area of hexagon **M1dep** for *their* area × 15.2 evaluated

	Answer	Mark	Partial Marks
(a)(ii)	893 or 892.8 to 893.0…	3	**M2** for $6 \times 7 \times 15.2 + 2 \times 6 \times \frac{1}{2} \times 7^2 \times \sin 60$ oe or for $6 \times 7 \times 15.2 + 2 \times$ *their* area of hexagon from **(a)** oe or **M1** for $[6 \times]\ 7 \times 15.2$ oe or $2 \times$ *their* area of hexagon from **(a)** oe
(b)	2.71 or 2.709 to 2.710	3	**M2** for $\sqrt[3]{500 \div \left(6 \times \frac{4}{3}\pi\right)}$ oe or **M1** for $500 = 6 \times \frac{4}{3}\pi r^3$ oe If 0 scored, **SC1** for answer 4.92 or 4.923 to 4.924

38. 0580_s18_ms_41 Q: 6

	Answer	Mark	Partial Marks
(a)	4.79 or 4.788 to 4.789	3	**M2** for $\sqrt[3]{\frac{230 \times 3}{2 \times \pi}}$ oe or **M1** for $230 = \frac{2}{3} \times \pi \times r^3$ oe If 0 scored **SC1** for answer 3.8[0…]
(b)(i)	8.7[0] or 8.702 to 8.704	3	**M2** for $(300 - 230) \div (1.6^2 \pi)$ or **M1** for $\pi \times 1.6^2 \times h$
(b)(ii)	6.4	3	**M2** for $1.6 \times \sqrt[3]{\frac{19200}{300}}$ oe or **M1** for sf $\sqrt[3]{\frac{19200}{300}}$ or $\sqrt[3]{\frac{300}{19200}}$ oe or for $\left(\frac{1.6}{r}\right)^3 = \frac{300}{19200}$

39. 0580_s18_ms_43 Q: 7

	Answer	Mark	Partial Marks
(a)	204 or 203.5 to 203.6… nfww	4	**M2** for $\pi \times 1.5^2 \times 8 \times 60 \times 60$ or **M1** for $\pi \times 1.5^2$ **M1** for dividing *their* volume by 1000 If 0 scored **SC1** for an answer figs 204 or figs 2035 to 2036 without working
(b)(i)	$\pi \times 6 \times 12 + \pi \times 6^2 = 108\pi$	**M2**	**M1** for $\pi \times 6 \times 12$

	Answer	Mark	Partial Marks
(b)(ii)	[x =] 5.2[0] or 5.196… [y =] 6	4	**B2** or **M1** for $4\pi x^2 = 108\pi$ seen **B2** or **M1** for $\frac{1}{2}(4\pi y^2) + \pi y^2$ or better seen

40. 0580_w18_ms_41 Q: 10

	Answer	Mark	Partial Marks
(a)	132.26 to 132.28 or 132.3	5	**B1** for angle ABO or angle $CBO = 90$ soi **M1** for $\tan[XOB] = \frac{15}{8}$ oe **M1** for $\tan[BOY] = \frac{22.4}{8}$ oe **A1** for [BOY =]70.3… or [XOB =] 61.9….
(b)	18.4 or 18.5 or 18.43 to 18.48	2	**M1** for $\frac{\textit{their (a)}}{360} \times 2 \times \pi \times 8$ oe
(c)	75.7 to 75.9	4	**M1** for $\frac{1}{2}(15 + 22.4) \times 8$ oe **M2** for $\frac{\textit{their (a)}}{360} \times \pi \times 8^2$ oe or **M1** for one sector either $\frac{inv\tan\left(\frac{15}{8}\right)}{360} \times \pi \times 8^2$ oe or $\frac{inv\tan\left(\frac{22.4}{8}\right)}{360} \times \pi \times 8^2$ oe

41. 0580_w18_ms_42 Q: 10

	Answer	Mark	Partial Marks
(a)(i)	75000 × 60 × 20 oe	**M1**	Allow × 1200 for × 60 × 20
(a)(ii)	16.4 or 16.36 …	**3**	**M2** for $\frac{9\times10^7\times100}{1000\times55\times10^4}$ oe or **B2** for answer 0.164 or 0.1636 … or **B1** for answer figs 164 or 1636 … or **M1** for figs 9 ÷ figs 55
(a)(iii)	28.3 or 28.27 to 28.28	**3**	**M2** for $\frac{76}{360}\times2\pi\times8.5+2\times8.5$ oe or **M1** for $\frac{76}{360}\times2\pi\times8.5$ oe

	Answer	Mark	Partial Marks
(b)(i)	3770 or 3769 to 3770. …	**2**	**M1** for $\frac{1}{3}\times\pi\times10^2\times36$
(b)(ii)	3.68 or 3.683 to 3.684 …	**4**	**M3** for $[r^3=]\ \frac{1}{2}\times$ *their* **(b)(i)** $\times\frac{3}{4\pi\times9}$ oe or **M2** for $\frac{4\pi r^3}{3}+\frac{4\pi(2r)^3}{3}=\frac{1}{2}\times$ *their* **(b)(i)** or for $\frac{4\pi r^3}{3}=\frac{1}{1+8}\times\frac{1}{2}\times$ *their* **(b)(i)** or **M1** for $\frac{4\pi r^3}{3}+\frac{4\pi(2r)^3}{3}$ or $\frac{1}{2}\times\frac{\pi\times10^2\times36}{3}$ or $\frac{1}{2}$ *their* **(b)(i)** seen or ratio of vols = $1:2^3$ oe seen

42. 0580_w18_ms_43 Q: 3

	Answer	Mark	Partial Marks
(a)(i)	427 or 427.2 to 427.3…	**2**	**M1** for $\pi \times 8 \times 17$
(a)(ii)	1010 or 1005….	**4**	**M2** for $\sqrt{17^2 - 8^2}$ oe or **M1** for $h^2 + 8^2 = 17^2$ oe **M1** for $\frac{1}{3} \times \pi \times 8^2 \times \textit{their } h$ oe
(a)(iii)	804 or 804.2 to 804.4 or 808	**1**	**FT** *their* **(ii)** × 0.8
(a)(iv)	396 or 395.6 to 395.8 or 392	**1**	**FT** 1200 – *their* **(iii)**
(b)(i)	$\frac{1}{54}$	**4**	**B3** for $\frac{\frac{4}{3}\pi r^3}{72\pi r^3}$ or better or **M2** for $\frac{\frac{4}{3} \times \pi \times r^3}{\pi \times (3r)^2 \times 8r}$ or $72 \times \pi \times r^3$ or **M1** for $\pi \times (3r)^2 \times 8r$ If 0 scored, **SC2** for answer of $\frac{1}{18}$
(b)(ii)	972π final answer	**4**	**B2** for $r = \frac{9}{2}$ oe or **M1** for $4\pi r^2 = 81\pi$ or better **M1** for $2 \times \pi \times (3 \times \textit{their } r) \times (8 \times \textit{their } r)$ isw

43. 0580_s17_ms_41 Q: 5

	ANSWER	MARK	PARTIAL MARKS
(a)(i)	50890 or 50893 to 50900.4	**2**	**M1** for $\pi \times 18^2 \times 50$

	ANSWER	MARK	PARTIAL MARKS
(a)(ii)	20.5 or 20.52 to 20.534	**3**	**B2** for answer 29.5 or 29.46 to 29.48 OR **M2** for $(50900-30000)\div(\pi\times18^2)$ oe or **M1** for (figs 50.9 –figs 30) ÷ ($\pi\times$ figs18^2) or **M1** for $(50900-30000)=(\pi\times18^2)h$ oe OR **alternative method** **M2** for $50-\frac{30000}{\pi\times18^2}$ oe **M1** for figs $30=\pi\times$ figs $18^2\times(50-h)$ oe or for $\frac{\text{figs }30}{\pi\times\text{figs}18^2}$ oe OR **alternative method** **M2** for $\frac{(50.9-30)}{50.9}\times50$ oe or **M1** for $\frac{(50.9-30)}{50.9}$ or $\frac{30}{50.9}\times50$ oe or **M1** for $\frac{(\text{figs }50.9-\text{figs }30)}{\text{figs }50.9}\times50$ oe
(a)(iii)	334 nfww	**4**	**M2** for figs $30\div\frac{2}{3}\pi\times3.5^3$ oe or **M1** for $\frac{1}{2}\times\frac{4}{3}\pi\times3.5^3$ oe and **B1** for 30 000
(b)(i)	3.28[6..] or 3.29	**3**	**M2** for [$r^2=$] $\frac{95\times3}{8.4\pi}$ oe or **M1** for $\frac{1}{3}\pi\times r^2\times8.4$ [$=95$]
(b)(ii)	93.1 to 93.6	**4**	**M3** for $\pi\times3.3\times\sqrt{3.3^2+8.4^2}$ or **M2** for $\sqrt{3.3^2+8.4^2}$ or **M1** for $3.3^2+8.4^2$

44. 0580_s17_ms_42 Q: 5

	ANSWER	MARK	PARTIAL MARKS
(a)(i)	94.2 or 94.3 or 94.24 to 94.26	**2**	**M1** for $\pi \times 3 \times 10$
(a)(ii)	9.54 or 9.539…	**3**	**M2** for $\sqrt{10^2 - 3^2}$ or **M1** for $h^2 + 3^2 = 10^2$ oe
(a)(iii)	89.9 or 89.90 to 89.92…	**2**	**M1** for $\frac{1}{3} \times \pi \times 3^2 \times$ *their* **(a)(ii)**
(b)	108 or 107.9 to 108.1 nfww	**4**	**M3** for $\frac{\pi \times 3 \times 10}{\pi \times 10^2} \times 360$ oe or $\frac{\textit{their}\ \textbf{(a)(i)}}{\pi \times 10^2} \times 360$ oe or $\frac{2 \times \pi \times 3}{2 \times \pi \times 10} \times 360$ oe or **M2** for $\frac{x}{360} \times \pi \times 10^2 = \textit{their}$**(a)(i)** oe or $\frac{x}{360} \times 2 \times \pi \times 10 = 2 \times 3 \times \pi$ oe or **M1** for $\frac{x}{360} \times \pi \times 10^2$ seen or $\frac{x}{360} \times 2 \times \pi \times 10$ seen
(c)	46.6 to 46.8	**4**	**M3** for $\frac{\textit{their}\ \textbf{(b)}}{360} \times \pi \times 10^2 - \frac{1}{2} \times 10 \times 10 \times \sin(\textit{their}\ \textbf{(b)})$ oe or **M1** for $\frac{\textit{their}\ \textbf{(b)}}{360} \times \pi \times 10^2$ or *their* **(a)(i)** soi and **M1** for $\frac{1}{2} \times 10 \times 10 \times \sin(\textit{their}\ \textbf{(b)})$ soi

45. 0580_s17_ms_43 Q: 4

	ANSWER	MARK	PARTIAL MARKS
(a)(i)	17.5 or 17.46....nfww	**6**	**B3** for triangle height 3.46[4...] or $\sqrt{12}$ oe or **M2** for $\sqrt{4^2-2^2}$ or **M1** for $h^2+2^2=4^2$ **and M2** for $2\times 7+\frac{1}{2}\times 2\times$*their h* oe or **M1** for $\frac{1}{2}\times 2\times$*their h*
(a)(ii)	140 or 139.6 to 139.7...	**1FT**	**FT** *their* **(a)** × 8
(b)(i)	2.62 or 2.618…	**3**	**M2** for $[r^2=]\ \frac{280}{13\pi}$ oe or **M1** for $280=\pi\times r^2\times 13$
(b)(ii)	10.2 or 10.20… or $10\frac{10}{49}$	**3**	**M2** for $\frac{280}{14^3}$ [×100] oe or **B1** for 2744 or 14^3 seen

46. 0580_w17_ms_41 Q: 8

	ANSWER	MARK	PARTIAL MARKS
(a)	$\pi\times\frac{5}{2}\times l+\frac{4}{2}\times\pi\times\left(\frac{5}{2}\right)^2=\frac{115\pi}{4}$ oe or $\frac{115\pi}{4}-\frac{4}{2}\times\pi\times\left(\frac{5}{2}\right)^2=\pi\times\frac{5}{2}\times l$ oe	**M2**	**M1** for $\pi\times\frac{5}{2}\times l$ or $\frac{4}{2}\times\pi\times\left(\frac{5}{2}\right)^2$
	$\frac{5\pi l}{2}=\frac{65\pi}{4}$ oe or $[l=]\left(\frac{115\pi}{4}-2\times\pi\times 2.5^2\right)\div 2.5\pi$ oe	**B1**	nfww oe both terms must be written in terms of π nfww or correct complete method for *l* with decimals
	$[l=]\ \frac{65\pi\times 2}{4\times 5\pi}$ or $\frac{65\pi}{10\pi}$ oe = 6.5	**A1**	Correct calculation with no errors and **B1** earned
(b)	6	**3**	**M2** for $\sqrt{6.5^2-2.5^2}$ or **M1** for $h^2+2.5^2=6.5^2$ If zero scored, **SC2dep** for answer 4.15[3]…

	ANSWER	MARK	PARTIAL MARKS
(c)	72[.0…] or 71.99… nfww	**4**	**M3** for $\frac{\pi}{3} \times \left(\frac{5}{2}\right)^2 \times$ *their* 6 $+ \frac{1}{2} \times \frac{4\pi}{3} \times \left(\frac{5}{2}\right)^3$ oe or **M1** for $\frac{\pi}{3} \times \left(\frac{5}{2}\right)^2 \times$ *their* 6 oe and **M1** for $\frac{1}{2} \times \frac{4\pi}{3} \times \left(\frac{5}{2}\right)^3$ oe If zero scored, **SC3dep** for $\frac{\pi}{3} \times (5)^2 \times$ *their* 4.15 $+ \frac{1}{2} \times \frac{4\pi}{3} \times (5)^3$ oe or **SC1dep** for $\frac{\pi}{3} \times (5)^2 \times$ *their* 4.15 oe **SC1dep** for $\frac{1}{2} \times \frac{4\pi}{3} \times (5)^3$ oe
(d)	53.7 or 53.65 to 53.67	**3**	**M1** for figs (*their* **(c)**) × 19.3 × 38.62 or better **M1** for ÷ 1000 soi

47. 0580_w17_ms_42 Q: 2

	ANSWER	MARK	PARTIAL MARKS
(a)(i)	1070 or 1072. ..	3	**M1** for $\pi \times 8^2 \times 2 \times 8$ **M1** for $\frac{4}{3} \times \pi \times 8^3$ or **M2** for $\frac{2}{3}\pi r^3$ or **M1** for $\pi r^2 2r - \frac{4}{3}\pi r^3$
(a)(ii)	2.58 or 2.580 to 2.581	3	**B2** for $r^3 = \frac{36 \times 3}{2\pi}$ or better or **M1** for $\pi \times r^2 \times 2 \times r - \frac{4}{3} \times \pi \times r^3 = 36$ oe
(b)(i)	4.24 or 4.241 to 4.242	4	**M3** for $(\pi \times 5^2 + \pi \times 5 \times \sqrt{5^2 + 12^2})$ or **M2** for $\pi \times 5 \times \sqrt{5^2 + 12^2}$ or **M1** for $5^2 + 12^2$ or $\pi \times 5^2$
(b)(ii)	64 cao final answer	3	**M2** for $\frac{[k\pi] \times 5^2 \times 12}{[k\pi] \times 1.25^2 \times 3}$ or **M1** for $\frac{1}{3} \times \pi \times 5^2 \times 12$ or $\frac{1}{3} \times \pi \times 1.25^2 \times 3$ OR **M2** for 4^3 or $\left(\frac{1}{4}\right)^3$ seen or **M1** for factor 4 or $\frac{1}{4}$ soi

48. 0580_w17_ms_42 Q: 10

	ANSWER	MARK	PARTIAL MARKS
(a)	5.68 or 5.684 to 5.685	5	**M2** for $2x\sqrt{x^2 + x^2}$ oe or $2 \times \sqrt{2} \times x^2$ or **M1** for $x\sqrt{2}$ or $\sqrt{x^2 + x^2}$ oe soi **M1** for $\frac{270}{360} \times \pi \times x^2$ oe **M1** for $0.5\ x^2$ oe
(b)	4.4[0] or 4.398 to 4.401	2	**dep** on a correct value for k in **(a)** **M1** for $\left[x^2\right] = \frac{110}{\textit{their } k}$