

Solid Geometry - Paper 4 – Mark Scheme

Question 1

7 (a)	4.53 or 4.526 – 4.530....	3	SC2 for figs 453 or 4526 – 4530 If SC0, M1 for $\pi \times (\text{figs } 31)^2 \times 15$
(b)	3.62 to 3.624 ft	2ft	M1 for their (a) \times figs 8 oe
(c) (i)	$360 - 2 \times 90 - 60$ oe	2	E2 The 90's and the 60 must be clearly justified. Accept in diagram. SC1 for 60 or two 90's soi in correct positions oe e.g $360 \div 3$ scores 0
(ii)	0.649 (0.6492 to 0.6493)	2	M1 for $\pi \times$ figs $62 \div 3$
(iii)	7.53 (7.527 or 7.528....)	3	M1 for their (ii) $\times 3$ M1 (indep) for $18 \times$ figs 31 This M is spoiled by extra lengths.
(iv)	112.9 to 113 ft	1ft	ft their (iii) $\times 15$

Question 2

6 (a)	$\frac{4}{3}\pi \times 2.4^3$ 57.87 – 57.92 to at least 4 figures	M1 A1	Must see method
(b) (i)	14.4, 9.6, 4.8	1, 1, 1	Any order
(ii)	664 (663.5 – 663.6) ft	1ft	
(iii)	315 or 316 or 317 (315.2 – 316.8) ft	1ft	ft their (b)(ii) – $6 \times$ '57.9' (only if positive)
(iv)	507 (506.8 – 506.9) ft	2ft	M1 for $(14.4 \times 9.6 + 14.4 \times 4.8 + 9.6 \times 4.8) \times 2$ or their 3 lengths.
(c) (i)	Height seen or implied as 6×4.8 or better $\pi \times 2.4^2 \times$ their height 521 (520.8 – 521.3) www 3	M1 M1 A1	Indep
(ii)	174 or 173 (173.2 – 174.1) ft	1ft	ft their (c)(i) – $6 \times$ '57.9' only if positive
(iii)	470 – 471 cao www 3	3	M1 for $2 \times \pi \times 2.4^2$ (36.17 to 36.2), and M1 indep for $\pi \times 4.8 \times$ their height from (c)(i)

Question 3

<p>8 (a)</p>	<p>40 ÷ 10 and 12 ÷ 6 (or 12 ÷ 3) and 6 ÷ 3 (or 6 ÷ 6) oe 4 × 2 × 2 = 16 reducing (seen) to 16</p>	<p>E2</p>	<p>M1 Allow drawing for M1 but must see reaching 16 for E2 Reaching 16 without any errors or omissions SC1 for $\frac{40 \times 12 \times 6}{\text{their (b)}}$ even if = 16 or 4 × 2 × 2 = 16 or 4 × 4 × 1 = 16 without other working</p>
<p>(b)</p>	<p>180</p>	<p>1</p>	
<p>(c) (i)</p>	<p>23 640 (allow 23 600)</p>	<p>2</p>	<p>M1 for their 180 × 8 × 16 + 600</p>
<p>(ii)</p>	<p>23.64 (or 23.6) ft</p>	<p>1ft</p>	<p>ft their (i) ÷ 1000</p>
<p>(d) (i)</p>	<p>216</p>	<p>2</p>	<p>M1 for (10 × 6 + 10 × 3 + 6 × 3) × 2 oe</p>
<p>(ii)</p>	<p>8.64</p>	<p>3</p>	<p>M1 for their (i) × 16 × 25 M1(indep) for ÷ 100² Figs 864 imply M1 only</p>
<p>(e)</p>	<p>75.3 (75.26 to 75.33....)</p>	<p>3</p>	<p>M1 for $\frac{4}{3}\pi \times 0.5^3$ (0.5235..) Implied also by 104.7.... then M1 (dep) for their (b) – 200 × their $\frac{4}{3}\pi \times 0.5^3$ must be giving positive answer</p>
<p>(f)</p>	<p>0.842 (0.8419 – 0.8421)</p>	<p>3</p>	<p>M1 for $(\frac{4}{3}\pi r^3) = 50 \div 20$ then M1 for $\frac{50 \div 20}{\frac{4}{3}\pi}$ (0.5966 to 0.5972) After 0 scored SC1 for $\sqrt[3]{\frac{50}{\frac{4}{3}\pi}}$ (implied by 2.29)</p>

Question 4

4	(a) $1.5^2 + 2^2$ ($l =$) 2.5 $\pi \times 1.5 \times$ their 2.5 $2 \times \pi \times 1.5 \times 4$ Addition of their areas for cone and cylinder 49.45 to 49.5	M1 A1 M1 M1 M1 A1	soi by 6.25 May be on diagram Their 2.5 \neq 2 soi by 11.77 to 11.8 or 3.75π soi by 37.68 to 37.715 or 12π soi by 15.75π This M mark is lost if any circles are added www 6
	(b) (i) $\pi \times 1.5^2 \times 4$ $\frac{1}{3} \pi \times 1.5^2 \times 2$ Addition of their volumes 32.9(7) to 32.99... (ii) 84(0) to 84.1 www	M1 M1 M1 E1 3	soi by 28.26 to 28.3 or 9π soi by 4.71 to 4.72 or 1.5π 10.5π implies M3 M1 for $\frac{1}{2} \pi \times 0.5^2$ soi by 0.392 to 0.393 or $\pi/8$ and M1 for their $33 \div (\frac{1}{2} \pi \times 0.5^2)$ soi by $264/\pi$ or SC1 for 42 to 42.1 as answer
	(c) (i) 33000 (ii) 18min 20s cao	1 2	M1 for their $33000 \div 1800$ soi by 18.3(3...) or correct in mins and secs for their 33000

Question 5

4	(a) (i) 218 (217.7 to 218) (ii) 501 (500.7 to 501.4) (iii) 99	2 1ft 2ft	M1 for $1/3\pi \times 4^2 \times 13$ ft their (a) $\times 2.3$ ft $50\,000 \div$ their (a)(ii) and truncated to whole number M1 for $50\,000 \div$ their (a)(ii) oe or answers 99.8 or 100
	(b) their (a)(i) $\times \left(\frac{32.5}{13}\right)^3$ oe 3400 or 3410 (3401 to 3407)	M2 A1	or $1/3\pi \times 10^2 \times 32.5$ or M1 for $(32.5 \div 13)^3 (=15.625)$ seen or $(13 \div 32.5)^3 (=0.064)$ seen www3
	(c) ($r^2 =$) $550 \div 12\pi$ 3.82 (3.818 to 3.821)	M2 A1	(14.58 to 14.6) or M1 for $12\pi r^2 = 550$ or better www3

Question 6

8	(a) (i) 396 (395.6 – 396)	4	M1 for $\frac{2}{3} \times \pi \times 3^3$ and M1 (independent) for $\pi \times 3^2 \times 12$,
	(ii) 3.13 (3.125 – 3.128....) ft	2ft	M1 (dependent on M2) for adding 126 π implies M3 ft their (i) $\times 7.9 \div 1000$.
	(iii) 144 (144 – 144.4) ft	2ft	M1 for $\times 7.9$ soi by figs 313 or 3125 – 3128... ft $15 \times 6 \times 6$ – their (a)(i) M1 for $6 \times 6 \times 15$ oe
	(b) (i) 311 (310.8 – 311.1)	5	M1 for $2 \times \pi \times 3^2$ and M1 (independent) for $\pi \times 6 \times 12$ and M1 for $\pi \times 3^2$, M1 (dependent on M3) for adding. (99π implies M4)
(ii) 3.50 (3.496 to 3.50) ft	2ft	ft their (b)(i) $\times 0.01125$ M1 for their (b)(i) $\div 8$ and \times figs 9 implied by figs 3496 to 350	

Question 7

6 (a)	23.6 (23.60...)	2	M1 for $14^2 + 19^2$
(b)	2300 or 2303 to 2304 cao	4	M3 for $2 \times \frac{1}{2} \times 14 \times 19 + 14 \times 36 + 19 \times 36 +$ their $BC \times 36$ M2 for 4 of these added M1 for $\frac{1}{2} \times 14 \times 19$
(c)	4788 or 4790 cao	2	M1 their triangle area $\times 36$
(d)	43(.0) or 43.04 to 43.05 cao	2	M1 for $(\text{their (a)})^2 + 36^2$ or $36^2 + 19^2 + 14^2$
(e)	18.9° to 19.02° cao	3	M2 for $\text{inv sin} \left(\frac{14}{\text{their } CE} \right)$ or $\text{inv tan} \left(\frac{14}{\sqrt{19^2 + 36^2}} \right)$ or $\text{inv cos} \left(\frac{\sqrt{19^2 + 36^2}}{\text{their } CE} \right)$ or complete longer methods (M1 for clearly identifying angle CEA)

Question 8

7 (a)	87.5 (87.45 to 87.52) www 4	4	M1 for $\frac{1}{2} \times 2.5 \times 9.5$ soi by 11.875 or 71.25 and M2 for $\frac{1}{2} \times 2.5^2 \times \sin 60 \times 6$ oe (16.23 to 16.24) or M1 for $\frac{1}{2} \times 2.5^2 \times \sin 60$ (2.706..) or 1 trapezium (8.1189..)
(b)	107.9 to 108.0.....www3	3	Must see at least 4 figures M2 for $\frac{55}{360} \times \pi \times 15^2$ or M1 for $\frac{55}{360}$ seen
(c) (i)	2.29 (2.291 to 2.293) www 2	2	M1 for $108 = 15\pi r$ oe allow 107.9 to 108.0... for their 108
(c) (ii)	14.8 (14.82 to 14.83) cao www 3	3	M2 for $\sqrt{15^2 - \text{their } 2.29^2}$ (M1 for $h^2 + \text{their } 2.29^2 = 15^2$)
(d)	70.9 to 71.5 cao www 3	3	M2 for $\frac{\pi}{3}$ (their $2.29^2 \times \text{their } 14.8 - \text{their } 1.145^2$ $\times \text{their } 7.4$) (not 15 or 7.5) or $\frac{7}{8} \times \frac{\pi}{3} \times \text{their } 2.29^2 \times \text{their } 14.8$ or M1 for 1/8 oe e.g. $\frac{7.5^3}{15^3}$ or 7/8 or ($\frac{1}{2}$ their R and $\frac{1}{2}$ their h) seen

Question 9

4	<p>(a) (i) $2.7 \times \frac{20}{12}$ oe = 4.5</p> <p>(ii) $\frac{1}{3}\pi \times 4.5^2 \times 20 - \frac{1}{3}\pi \times 2.7^2 \times 12$ or $(1 - (3/5)^3) \times \frac{1}{3}\pi \times 4.5^2 \times 20$ oe 332.3 to 332.6 or 332 or 333</p> <p>(b) (i) $8^2 + (4.5 - 2.7)^2$ oe sq root 8.2</p> <p>(ii) 185 or 186 or 185.5 or 185.45 to 185.51</p>	<p>E2</p> <p>M3</p> <p>A1</p> <p>M1</p> <p>M1</p> <p>E1</p> <p>5</p>	<p>M1 for (SF =) 20/12 or 12/20 (but not from 2.7/4.5 or 4.5/2.7)</p> <p>M1 for $\frac{1}{3}\pi \times 4.5^2 \times 20$ (424 ... or 135π) and M1 for $\frac{1}{3}\pi \times 2.7^2 \times 12$ (91.6..or 29.16π)</p> <p>e.g. Alt: $20^2 + 4.5^2$ and $12^2 + 2.7^2$</p> <p>Dep on 1st M1 Alt: 20.5 – 12.3 Other complete correct methods are M2</p> <p>No errors seen</p> <p>M4 for $\pi \times 4.5 \times 20.5 - \pi \times 2.7 \times 12.3$ or other complete correct method or M3 for $\pi \times 4.5 \times 20.5$ or $\pi \times 2.7 \times 12.3$ (290 or 92.25π) (104.3...or 33.21π) or B2 for (slant height of large cone =) 20.5 or (slant height of removed cone =) 12.3 or M1 for $\sqrt{4.5^2 + 20^2}$ or $\sqrt{2.7^2 + 12^2}$ or 12/8 \times 8.2 oe or 20/8 \times 8.2 oe</p>
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Question 10

4	<p>(a) (i) 28 cao</p> <p>(ii) 420</p> <p>(b) $(r^3 =) \frac{3 \times 1080}{4\pi}$ oe</p> <p>$(r =) \sqrt[3]{\frac{3 \times 1080}{4\pi}}$ oe</p> <p>6.36 or 6.37 www</p> <p>(c) (i) 24</p> <p>(ii) 232 (231.6 to 232.2)</p>	<p>2 M1 for $\frac{350 \times 16}{200}$ oe or $350 \div 12.5$ oe or 1.75×16 oe</p> <p>2ft ft for <i>their</i> 28×15</p> <p>M1 for <i>their</i> $28 \times \frac{240}{16}$ or $\frac{350 \times 240}{200}$ oe or 1.75×240 oe</p> <p>M1 Correct rearrangement soi by 257 to 258</p> <p>M1dep Dependent on previous M1</p> <p>A1 6.364 to 6.366</p> <p>B1</p> <p>3 M1 for $\pi \times 2.5^2 \times 1.8$ (soi by 35.3 to 35.4) or area = $20 \times 30 - \text{their } 24 \times \pi \times 2.5^2$ (soi by 128.7 to 129) and M1dep for $1080 - (\pi \times 2.5^2 \times 1.8) \times \text{their } 24$ or <i>their</i> area $\times 1.8$</p>
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Question 11

6	<p>(a) (i) 141 (141.3 to 141.4)</p> <p>(ii) 8.93 (8.93...)</p> <p>(b) (i) 2.98 or 2.976 to 2.977</p> <p>(ii) Answer rounds to 15.7</p> <p>(c) 535 or 536 (534.9 to 535.8)</p>	<p>2 M1 for $\pi \times 4.5 \times 10$</p> <p>3 M2 for $\sqrt{10^2 - 4.5^2}$ or M1 for $h^2 + 4.5^2 = 10^2$ implied by 79.75</p> <p>2ft ft their (a)(ii) $\div 3$ www correct to 3sf or better M1 for their (a)(ii) $\div 3$</p> <p>2ft ft their (a)(i) $\div 9$ correct to 3 sf or better or $\pi \times 1.5 \times \sqrt{\text{their } 2.98^2 + 1.5^2}$ M1 for their (a)(i) $\div 9$ or $\pi \times 1.5 \times 10 \div 3$ oe or $\pi \times 1.5 \times \sqrt{\text{their } 2.98^2 + 1.5^2}$</p> <p>5 M1 for area of one circle $\pi \times 1.5^2$ or $\pi \times 4.5^2$ (7.0685 or 63.617) and M1 for their (a)(i) – their (b)(ii) (large cone SA – small cone SA) (141 – 15.7) (= 125.3 to 125.7) and M1 for $12 \times \pi \times 9$ (curved area of cylinder) (339.292...) and M1 for correct collection of 4 areas</p>
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Question 12

1	(a) 1 min 36 s www	3	M1 for $1.2 \times 0.8 \times 0.5 (= 0.48)$ A1 1.6 or 96 If A0 , B1 for correctly converting to min and sec Dep on M1
	(b) 0.954 to 0.956 www	3	M2 for $\frac{\text{their } 0.48}{\pi \times 0.4^2}$ or M1 for $\pi \times 0.4^2 \times d = '0.48'$
	(c) 8.09 to 8.10 www	4	M1 for $\pi \times 0.4^2 (0.503)$ condone $\times 2$ and M1 for $\pi \times 0.8 \times 1.2 (3.02)$ M1 for their area $\times 2.3$ (dep M1 M1)

Question 13

6	(a) (i) 13 or 13.0 www	3	M1 for $3^2 + 4^2$ oe Equiv if find <i>AC</i> first and M1 for $\sqrt{12^2 + \text{their } (3^2 + 4^2)}$
	(ii) 13.32 to 13.35 or 13.3	2	M1 for $\sin = \frac{3}{\text{their } AP}$ or $\tan = \frac{3}{\text{their } AC}$ oe
	(b) (i) 36.86 to 36.87 or 36.9	2	M1 for $\tan (PBC) = \frac{3}{4}$ oe
	(ii) 2.770 to 2.774 or 2.77	3	M2 for $\frac{4 \sin \text{their } (b)(i)}{\sin 120}$ or M1 for correct implicit eqn

Question 14

10 (a)	2030 or 2040 or 2034 to 2036. (...)	2	$(V =) \frac{1}{3} \times \pi \times 9^2 \times 24$ Accept 648π for 2 marks if final answer
	(b) (upper radius =) 3 (vol cut off =) $\frac{1}{3} \times \pi \times \text{their } 3^2 \times 8$ their (a) – their 75.39 1958 to 1964.(...)	B1 M1 M1 dep E1	accept $9 \times \frac{8}{24}$ oe (= 75.36 to 75.41) their <i>r</i> must be less than 9 [alternate method M1 for ratio sides 1:3 M1 ratio vols 1 : 27 M1 their (a) $\times 26 \div 27$] 624π implies B1 M2 or M3 must see a figure after decimal point if 1960
(c)	1960 = $5 \times \pi \times r^2 \times 15$ soi $r^2 = 1960 \div \pi \div 15 \div 5$ $\sqrt{\text{their } 8.318}$ 2.88 to 2.89	M1 M1 M1 E1	implied by 8.318... dep on M1 M1 SC2 for $5 \times \pi \times 2.9^2 \times 15 = 1980$ to 1982

Question 15

5	(a) (i) 980 (979.6 to 980.3....) www 4	4	<p>M3 for $(\pi \times 8^2 \times 6) - \left(2 \times \frac{4}{3} \times \pi \times 3^3\right)$</p> <p>Or M1 for $\pi \times 8^2 \times 6$</p> <p>and M1 for $\left[2 \times \frac{4}{3}\right] \times \pi \times 3^3$</p>	
	(ii) 0.98[0] (0.9796 to 0.9803...)			1ft ft their (i) $\div 1000$ but not in terms of π
	(b) 1.2[0] (1.195 to 1.196)			2ft ft their (a)(i) $\times 1.22 \div 1000$ or their (a)(ii) $\times 1.22$ SC1ft for figs 12[0] or 1195 to 1196 Apply ft to SC
(c)	4.88 or 4.87 (4.871 to 4.878..) www 2	2ft	ft their (a)(i) $\div \pi 8^2$ provided their (a)(i) is not 384π or 1206... M1 for their (a)(i) $\div \pi 8^2$	

Question 16

5	(a) 55.6 to 55.61 www	3	<p>M2 for $\sqrt{46^2 + 24^2 + 20^2}$ oe $\left[\sqrt{3092}\right]$ or M1 for $46^2 + 24^2$ oe [soi by 2692 or art 51.9] or $46^2 + 20^2$ oe [soi by 2516 or art 50.2] or $24^2 + 20^2$ oe [soi by 976 or art 31.2]</p>		
	(b) 90.6 or 90.57 to 90.58			3	M2 for $\frac{20000}{(20 \times 24 \times 46)} \times 100$ oe or M1 for $20 \times 24 \times 46$ [22080]
	(c) 25.19 to 25.21, 30.23 to 30.246 or 30.2, 57.95 to 57.97 or 58[.0]			3	M2 for $20 \times \sqrt[3]{2}$ or $24 \times \sqrt[3]{2}$ or $46 \times \sqrt[3]{2}$ M1 for $\sqrt[3]{2}$ oe seen [1.259 to 1.261]
	(d) 16.8 to 16.842			3	M2 for $\sqrt[3]{\frac{20000}{4/3\pi}}$ oe or answer figs 168 to 16842 or M1 for $\sqrt[3]{\frac{20000}{4/3\pi}}$ [4770 – 4780] seen

Question 17

<p>8</p> <p>(a) $2x + 7$ final answer $x + 9$ final answer</p> <p>(b) $2(2x + 3)(x + 5)$ at any stage $2x^2 + 3x + 10x + 15$ or better $4x^2 + 26x + 30$</p> <p>(c) (i) $4x^2 + 26x - 45 [= 0]$ soi $\frac{-26 \pm \sqrt{(26)^2 - 4(4)(-45)}}{2(4)}$ $-7.92, 1.42$ final answers</p> <p>(ii) $6.42 [0\dots]$</p>	<p>2 B1 for each, accept in either order After 0 scored allow SC1 mark for both correct but unsimplified</p> <p>M1 The $\times 2$ could be embedded within one of the brackets e.g. $(4x + 6)(x + 5)$</p> <p>B1 Expands brackets correctly</p> <p>E1 No errors seen and two previous stages shown</p> <p>B1</p> <p>B1 ft fit their $4x^2 + 26x \pm k [k \neq 0]$ oe</p> <p>B1 ft In square root B1 ft for $(26)^2 - 4(4)(-45)$ or better (1396)</p> <p>If in form $\frac{p + \sqrt{q}}{r}$ or ; $\frac{p - \sqrt{q}}{r}$</p> <p>B1 ft for -26 and $2(4)$ or better</p> <p>B1 B1 If B0, SC1 for -7.9 and 1.4 or both answers $-7.920\dots, 1.420\dots$ or for $-7.92, 1.42$ seen</p> <p>1 ft fit their greatest positive root If their $x \leq 2$ then ft $x + 5$ If their $x > 2$ then ft $2x + 3$</p>
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Question 18

<p>3</p> <p>(a) $7.407\dots$ or 7.41</p> <p>(b) 9</p> <p>(c) (i) 6.36 to 6.37 www</p> <p>(ii) 508 to 510</p> <p>(d) $\sqrt{2}$ or $1.41 [1.414\dots]$ www</p>	<p>1</p> <p>2 M1 for $1080 \div (12 \times 10)$ oe</p> <p>3 M2 for $\sqrt[3]{\frac{1080}{\frac{4}{3}\pi}}$ oe or M1 for $\frac{1080}{\frac{4}{3}\pi}$ oe [257.7 to 258.7] Accept 4.18 to 4.19 for $4/3\pi$</p> <p>2 M1 for $4 \times \pi \times (\text{their (c)(i)})^2$</p> <p>2 Allow over 1 or $\sqrt{2} : 1$ etc M1 for $(R / r)^2 = 2$ oe or $[R^2 =] (2 \times \text{their (c)(ii)}) / 4\pi$ or $[R^2 =] 2 \times (\text{their (c)(i)})^2$</p>
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Question 19

<p>9 (a)</p>	<p>371 or 371.1...</p>	<p>4</p>	<p>M3 for $(6 \times 4 \times 12) + (2 \times 6 \times 0.5 \times 4 \times 4 \times \sin 60)$ oe or M2 for area of 1 or 2 hexagons or M1 for area of one relevant triangle or trapezium or rectangle within hexagon If 0 scored SC1 for 288 shown</p>
<p>(b) (i)</p>	<p>1740 or 1743.6 to 1744.2</p>	<p>4</p>	<p>M3 for $\frac{12000}{4} \div (\pi \times 0.74^2)$ oe or SC2 for figs 174[3..] or 174[4..] or B1 for $\pi \times 0.74^2$ seen [1.72..] or B1 for 12000 / 4 soi by 3000</p>
<p>(ii)</p>	<p>87 cao www 5</p>	<p>5</p>	<p>B4 for 87.39 to 87.43 or M3 for $[r=] \sqrt{\frac{\text{figs } 12}{\pi \times \text{figs } 5}}$ oe or M2 for $[r^2 =] = \frac{\text{figs } 12}{\pi \text{ figs } 5}$ oe or M1 for $\text{figs } 12 = \pi r^2 \times \text{figs } 5$</p>

Question 20

<p>4 (a)</p>	<p>3080</p>	<p>2</p>	<p>M1 for $\frac{1}{2} \times 7 \times 22 \times 40$</p>
<p>(b)</p>	<p>46.2 or 46.18 to 46.2 www</p>	<p>4</p>	<p>M3 for $\sqrt{7^2 + 22^2 + 40^2}$ or M2 for $7^2 + 22^2 + 40^2$ soi by 2133 or M1 for correct Pythagoras on one face</p>
<p>(c)</p>	<p>8.7 or 8.7 to 8.72 www</p>	<p>3</p>	<p>M2 for $\sin^{-1} \frac{7}{\text{their}(b)}$ oe or M1 for $\sin = \frac{7}{\text{their}(b)}$ oe</p>
<p>(d)</p>	<p>217</p>	<p>3</p>	<p>M1 for $\frac{4}{3} \times \pi \times 1.5^3$ soi by 14.1 to 14.14 and M1 dep for <i>their</i> (a) \div <i>their</i> 14.14 soi by 218. Dependent on M1 earned</p>
<p>(e) (i)</p>	<p>25.13875 final answer</p>	<p>2</p>	<p>B1 for 4.55 and 11.05 seen or 25.13875 seen and then spoiled</p>
<p>(ii)</p>	<p>25.14</p>	<p>1FT</p>	<p>Strict FT <i>their</i> (e)(i) correct to 4s.f. if rounding is possible</p>

Question 21

3	(a) (i) 204 or 204.2 to 204.23	2	M1 for $\pi \times 5 \times 13$ implied by answer in range 204.1 to 204.3
	(ii) 12 cao	3	M2 for $\sqrt{13^2 - 5^2}$ or states 5, 12, 13 triangle or M1 for $13^2 = 5^2 + h^2$ or better
	(iii) 314 or 314.1 to 314.2	2	M1 for $\frac{1}{3} \times \pi \times 5^2 \times \text{their (a) (ii)}$ implied by answer in range 314 to 314.3
	(iv) 3.14×10^{-4} or 3.141 to 3.142×10^{-4}	2FT	FT <i>their (a) (iii)</i> $\div 100^3$ correctly evaluated and given in standard form to 3 sig figs or better or M1 FT for <i>their (a) (iii)</i> $\div 100^3$ or SC1 for conversion of <i>their</i> m^3 into standard form only if negative power
	(b) 138 or 138.3 to 138.5	4	M3 for $\frac{10\pi}{26\pi} \times 360$ oe or $\frac{\pi \times 5 \times 13 \text{ or their (a)(i)}}{\pi \times 13^2} \times 360$ oe or M2 for a correct fraction without $\times 360$ or M1 for $\pi \times 2 \times 13$ oe [81.6 to 81.8] seen or $\pi \times 13^2$ oe [530.6 to 531.2] seen

Question 22

4	(a) (i) $90 \div (42/360 \times \pi \times 8^2)$ o.e. 3.836 to 3.837	M3	M2 for $42/360 \times \pi \times 8^2 \times h = 90$ or M1 for $42/360 \times \pi \times 8^2$
	(ii) 131 or 130.75 to 130.9 nfw	A1	
		5	M2 for $42/360 \times \pi \times 2 \times 8 \times 3.84$ oe [22.48 to 22.53] or M1 for $42/360 \times \pi \times 2 \times 8$ oe soi [5.86 to 5.87] and M1 for $2 \times (8 \times 3.84)$ [61.37 to 61.44] and M1 for $2 \times (42/360 \times \pi \times 8^2)$ [46.88 to 47]
	(b) 2.42 or 2.416 to 2.419	3	M2 for $3.84 \times \sqrt[3]{\frac{22.5}{90}}$ oe or $h = \sqrt[3]{\frac{3.84^3 \times 22.5}{90}}$ or M1 for $\sqrt[3]{\frac{22.5}{90}}$ oe or $\sqrt[3]{\frac{90}{22.5}}$ oe seen or $\frac{3.84^3}{h^3} = \frac{90}{22.5}$ oe

Question 23

3	(a) $9 - 2x, 7 - 2x$ oe	2	B1 for each, accept in any order
	(b) $x(9 - 2x)(7 - 2x)$ $4x^3 - 32x^2 + 63x$	M1FT A1	Correct expansion and simplification with no errors

Question 24

6	(a)	329.7 to 330	3	M2 for $\frac{1}{2}\pi(12^2 + 8.75^2 - 3.25^2)$ oe or M1 for $\frac{1}{2}\pi 12^2$ or $\frac{1}{2}\pi 8.75^2$ or $\frac{1}{2}\pi 3.25^2$ SC2 for answer 1318 to 1320
	(b)	2970 or 2967 to 2969.[...]	4	M3 for $\frac{1}{2}\pi(24 + 17.5 + 6.5) \times 35 + \text{their (a)}$ or M2 for $\frac{1}{2}\pi(24 + 17.5 + 6.5) \times 35$ or M1 for $\frac{1}{2}\pi \times 24$ or $\frac{1}{2}\pi \times 17.5$ or $\frac{1}{2}\pi \times 6.5$ SC3 for 3955 to 3960 dep on SC2 in (a)
	(c)	11.5 or 11.6 or 11.53 to 11.55	3FT	M1 for <i>their (a)</i> $\times 35$ A1 for 11500 or 11530 to 11550
	(d) (i)	$\frac{r}{h} = \frac{20}{40}$ or $\frac{r}{20} = \frac{h}{40}$	1	Accept $20 : 40 = r : h$ leading to $40r = 20h$ [$r = h/2$] $\frac{20}{40} = \frac{1}{2}$ and $\frac{r}{h} = \frac{1}{2}$
	(ii)	35.3 or 35.31 to 35.34	3	M2 for $\sqrt[3]{\frac{\text{their } 11545 \times 12}{\pi}}$ oe or $2 \times \text{their } r$ or M1 for $\text{their } 11545 = \frac{1}{3} \times \pi \times \left(\frac{h}{2}\right)^2 \times h$ oe or $\text{their } 11545 = \frac{1}{3} \times \pi \times r^2 \times 2r$ oe

Question 25

3	(a)	62705	2	M1 for $75246 \div 6$ soi by 12541 or 75246×5
	(b)	10.9 or 10.88...	3	M2 for $\frac{(150675 - 135890)}{135890} \times 100$ oe or M1 for correct fraction soi by 0.1088... or $\frac{150675}{135890} \times 100$ soi by 110.88...

(c)	127 000	3	M2 for $135\,890 \div 1.07$ oe or M1 for 135 890 associated with 107%
(d) (i)	59 112 to 59 113 or 59 100 or 59 110 or 59 119 to 59 120 or 59 100 nfww	3	M2 for $\pi \times 21 \times (30^2 - 2^2)$ oe Or M1 for $\pi \times 21 \times 30^2$ or $\pi \times 21 \times 2^2$
(ii)	(a) 0.0125 (b) 7580 or 7582 or 7581 or 7583 nfww	1 4	M1 for $21 \times 29.7 \times \text{their } 0.0125$ [=7.796 or 7.8[0]] and M1 for <i>their (d)(i)</i> $\div (21 \times 29.7 \times \text{their } 0.0125)$ A1 for 7580 to 7583.2 (non integer) If 0 then SC1 for <i>their (d)(i)</i> $\div (21 \times 29.7 \times 0.125)$

Question 26

5	(a) (i) 2412 to 2413.... (ii) 2.41[0] (b) 1 min 24 s	B2 B1 4	Must be at least 4 figures shown M1 for $\pi \times 8^2 \times 12$ oe B3 for 83.76 to 83.8[0] or 84 or 1.396 to 1.397 or 1.4 or 1 min 23.76 to 1 min 23.8 seen or M2 for $\frac{1}{3}\pi \times 4^2 \times 10 \div 2$ [$80/3\pi$] or M1 for $\frac{1}{3}\pi \times 4^2 \times 10$ [$160/3\pi$ or 167.5 to 167.6]
	(c) 14	3	M1 for $\frac{2410}{\frac{1}{3}\pi \times 4^2 \times 10}$ or $\frac{2410}{\text{their cone vol from part (b)}}$ A1 for 14.3 to 14.4....

Question 27

10	(a)	[r =] 2.30[9...]	3	<p>B2 for [r =] 2.31</p> <p>or M2 for $4 \tan 30$</p> <p>or M1 for $\frac{r}{4} = \tan 30$</p>
	(b)	333 or 332.5 to 332.6	4	<p>M3 for $0.5 \times 8 \times 8 \times \sin 60 \times 12$ oe</p> <p>or M2 for $0.5 \times 8 \times 8 \times \sin 60$ oe</p> <p>or M1 for <i>their</i> triangle area $\times 12$ shown dep on '$\frac{1}{2}$' used within <i>their</i> area of triangle method</p>
	(c) (i)	30	3	<p>M2 for $12 \div 0.4$ or $120 \div 4$</p> <p>or SC1 for figs 3</p>
	(ii)	6.65 or 6.647 to 6.648[...]	2	<p>M1 for $\pi \times 2.3^2 \times 0.4$</p> <p>or SC1 for $\pi \times 2.3^2 \times 4$ soi by 66.5 or 66.47 to 66.48[...]</p>
	(iii)	40[.0] or 40.1 or 40.0 to 40.2 nfw	3	<p>M2 for $100 - \frac{\text{their}(c)(i) \times \text{their}(c)(ii)}{\text{their}(b)} \times 100$</p> <p>or $\frac{\text{their}(b) - \text{their}(c)(i) \times \text{their}(c)(ii)}{\text{their}(b)} \times 100$</p>
				<p>or M1 for $\frac{\text{their}(c)(i) \times \text{their}(c)(ii)}{\text{their}(b)} \times 100$</p> <p>or $\frac{\text{their}(b) - \text{their}(c)(i) \times \text{their}(c)(ii)}{\text{their}(b)}$</p>

Question 28

<p>7 (a) (i) $120 \times 55 \times 75 [= 495000]$ $\div 1000 [= 495]$ or $495[1] \times 1000 = 495000[\text{ml}]$</p> <p>(b) (i) 11</p> <p>(ii) 37.5 or 37.50 to 37.51</p>	<p>M1</p> <p>M1</p> <p>2</p> <p>3</p>	<p>M1 for $495000 \div 750 [= 660]$ oe [660] After 0 scored, SC1 for answer figs 11</p> <p>M2 for $\sqrt{\frac{\text{figs}495}{112\pi}}$ oe or M1 for $[112r^2 =] \frac{\text{figs}495}{\pi}$ or $[\pi r^2 =] \frac{\text{figs}495}{112}$ or better</p>
<p>(c) 15</p> <p>(d) 24.4[4..] to 24.45</p>	<p>4</p> <p>3</p>	<p>B3 for answer 60 or M3 for $75 - \sqrt{145^2 - (55^2 + 120^2)}$ oe M2 for $\sqrt{145^2 - (55^2 + 120^2)}$ oe or M1 for $\sqrt{55^2 + 120^2}$</p> <p>M2 for $\cos^{-1}(\sqrt{55^2 + 120^2} / 145)$ oe, e.g. or $\sin^{-1}(75 - \text{their (c)})/145$ or $\tan^{-1}((75 - \text{their (c)})/\sqrt{55^2 + 120^2})$ or M1 for $\cos = \sqrt{55^2 + 120^2} / 145$ oe or $\sin = (75 - \text{their (c)})/145$ or $\tan = (75 - \text{their (c)})/\sqrt{55^2 + 120^2}$</p>

Question 29

<p>4 (a) (i) 9π final answer</p> <p>(ii) (a) 4.5[0] or 4.497 to 4.504...</p> <p>(b) 11.1 or 11.12[...]</p>		<p>2</p>	<p>M1 for $\frac{135}{360} \times 2 \times \pi \times 12$ oe</p>
<p>(b) (i) 75 nfw</p>		<p>2FT</p> <p>3FT</p>	<p>FT <i>their</i> $9 \div 2$</p> <p>M1 for $2\pi r = \textit{their } 9\pi$ or $12\pi r = \frac{135}{360}\pi 12^2$ oe</p> <p>FT their $\sqrt{12^2 - \textit{their } 4.5^2}$ to 3 sf or better (<i>their</i> $4.5 < 12$)</p> <p>M2 for $\sqrt{12^2 - \textit{their } 4.5^2}$ (<i>their</i> $4.5 < 12$)</p> <p>or</p> <p>M1 for $12^2 = h^2 + \textit{their } 4.5^2$ oe (<i>their</i> $4.5 < 12$)</p>
<p>(ii) 2730 or 2730.0 to 2730.4 nfw</p>		<p>3</p>	<p>M2 for $l = \frac{35}{7} \times 15$ or $x = \frac{35}{7} \times 8$ oe or for 40 seen nfw</p> <p>or correct trig or Pythagoras' method leading to value rounding to 40.0</p> <p>M1 for $\frac{l}{15} = \frac{35}{7}$ oe or $\frac{x}{8} = \frac{35}{7}$ oe</p> <p>or $\frac{l-35}{8} = \frac{35}{7}$ oe or $\frac{l-35}{l} = \frac{8}{15}$ oe</p>
<p>(c) (i) $16r^3$</p> <p>(ii) 8 : 27 oe</p>		<p>3</p> <p>2</p> <p>1</p>	<p>M2 dep for $\pi \times 15 \times \textit{their } 75 - \pi \times 8 \times (\textit{their } 75 - 35) [+ \pi \times 8^2]$ dep <i>their</i> $75 > 35$</p> <p>or 805π [2527.7 to 2530] nfw</p> <p>or 869π [2728.6 to 2731.2] nfw</p> <p>or</p> <p>M1 for $\pi \times 15 \times \textit{their } 75$ or 1125π [3532.5 to 3535.8] nfw seen</p> <p>or $\pi \times 8 \times (\textit{their } 75 - 35)$ or 320π [1004.8 to 1005.8] nfw seen</p> <p>or $\pi \times 8^2$ or 64π [200.9 to 201.2] nfw seen</p> <p>M1 for $[M=] k \times r^3$ or $1458 = k \times 4.5^3$ oe</p> <p>or $\frac{M}{1458} = \frac{r^3}{4.5^3}$ oe</p> <p>After M0, SC1 for 16 seen</p> <p>1 Must be numeric, e.g. 128:432</p>

Question 30

8	(a)	28.3 or 28.29...	2	M1 for $180\,000 \div (\pi \times 45^2)$
	(b) (i)	360 000	3	M2 for $\frac{1}{2}(70+50) \times 40 \times 150$ oe or M1 for $\frac{1}{2}(70+50) \times 40$ oe or <i>their</i> area of $ABCD \times 150$ dependent on <i>their</i> area being two dimensional
	(ii)	360	1FT	FT <i>their</i> (b)(i) $\div 1000$
	(c)	3 h 20 min	3	M2 for $180\,000 \div 15 \div 60$ (implied by 200) or M1 for $180\,000 \div 15$ (implied by 12000) or correct conversion of <i>their</i> seconds into h and min
	(d) (i)	$\frac{h}{40} = \frac{\frac{1}{2}(x-50)}{10}$ oe $h = 2(x-50)$	M1	i.e. a correct statement from similar figures which must contain h , x and numbers
	(ii)	$\frac{1}{2}(x+50) 2(x-50)$	A1	Answer established with at least one more step and no errors or omissions
	(iii)	60.8 or 60.82 to 60.83	M1	
	(iv)	21.7 or 21.65 to 21.66	2	M1 for $(x^2 - 2500) \times 150 = 180\,000$ or better
			1FT	FT for $2(\textit{their} \text{ (d)(iii)} - 50)$ evaluated only if $x > 50$

Question 31

<p>3 (a)</p>	<p>43 200</p>	<p>3</p>	<p>M2 for $0.5 \times (35 + 25) \times 12 \times 120$ oe or M1 for $0.5 \times (35 + 25) \times 12$ oe</p>
<p>(b) (i)</p>	<p>$0.5 \times (25 + 30) \times 6 \times 120 [= 19\,800]$</p>	<p>M2</p>	<p>Dep on a valid method for obtaining the width of 30 cm B1 for $0.5 \times (25 + 35)$ oe</p>
<p>(ii)</p>	<p>45.8 or 45.83...</p>	<p>1FT</p>	<p>FT for $\frac{19\,800}{\text{their (a)}} \times 100$</p>
<p>(c)</p>	<p>1 hr 39 min</p>	<p>4</p>	<p>B3 for 1.65 [h] or 99 mins or $\frac{33}{20}$ or M2 for $\frac{19\,800}{12 \times 1000}$ oe or M1 for $\frac{19\,800}{12}$ or $\frac{19\,800}{1000}$ or 12×1000 If zero scored then SC1 for figs 165 and B1 for converting their time (in hours) into hours and minutes</p>
<p>(d)</p>	<p>12.8 or 12.80 to 12.81</p>	<p>3</p>	<p>M2 for $\sqrt[3]{\frac{19\,800}{3\pi}}$ or M1 for $\pi r^2 3r = 19\,800$</p>
<p>(e)</p>	<p>21[.0]</p>	<p>2</p>	<p>M1 for $\frac{19\,800}{1000} + 1.2$</p>

Question 32

<p>8 (a) (i)</p>	<p>47.7 or 47.74 to 47.75</p>	<p>3</p>	<p>M1 for [arc =] $68 - 2 \times 24$ or $24 + 24 + \frac{x}{360} \times 2\pi \times 24 = 68$ M1 for [x =] <i>their</i> arc $\times 360 \div (2 \times \pi \times 24)$</p>
<p>(ii)</p>	<p>252 or 252.3 to 252.4....</p>	<p>6</p>	<p>M1 for $r = \frac{20}{2\pi}$ or $\left(\frac{\text{their}47.7}{360} \times 2 \times \pi \times 24\right) \div (2\pi)$ A1 for $r = 3.18$ or 3.182 to 3.183... or $\frac{10}{\pi}$ M1 for $h^2 = 24^2 - \text{their } r^2$ A1 for $h = 23.8$ or 23.78... to 23.79 M1dep on M1 earned for $V = \frac{1}{3} \pi \times \text{their } h \times \text{their } r^2$</p>
<p>(b)</p>	<p>139 or 139.3 to 139.4... nfw</p>	<p>5</p>	<p>M4 for $8^2 + \frac{1}{4} \pi \times 8^2 + \frac{1}{2} \pi \times \left(\frac{8}{2}\right)^2$ or M1 for $\frac{1}{4} \pi \times 8^2$ and M1 for $\frac{1}{2} \pi \times \left(\frac{8}{2}\right)^2$ and M1 for 8^2 added to at least one term with π</p>

Question 33

<p>10 (a)</p>	<p>5.2[0] or 5.196...</p>	<p>3</p>	<p>M2 for [$h^2 =$] $6^2 - 3^2$ or better or M1 for $h^2 + 3^2 = 6^2$ or B1 for PR (or PQ or QR) = 6</p>
<p>(b) (i) (ii)</p>	<p>7.2[0] or 7.196... 62.4 or 62.35...</p>	<p>1FT 5</p>	<p>FT <i>their (a)</i> + 2 M4 for $12 \times 6 \times \frac{1}{2} \tan 60$ oe or M3 for $6 \times \frac{1}{2} \tan 60$ oe or M2 for realising that $\frac{1}{2}$ base = $1 \times \tan 60$ oe or B1 for angle 30 or 60 in correct position on diagram or in a calculation If 0 scored, SC1 for volume = an area $\times 12$ seen</p>

Question 34

4	(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 $\pi \times 25^2 \times 60 - 14140$ or M1 for $\pi \times 25^2 \times 60$
	(ii)	52.8 or 52.75 to 52.81...	2	M1 for <i>their</i> (b)(i) $\div (\pi \times 25^2)$ or $14\,140 \div (\pi \times 25^2)$
	(c) (i)	15.8 or 15.81.....	3	M2 for $[r^2 =] \frac{14140}{\frac{1}{3} \times \pi \times 54}$ or M1 for $\frac{1}{3} \times \pi \times r^2 \times 54 = 14\,140$ oe
	(ii)	3580 or 3576 to 3581 nfw	4	M1 for $(\textit{their} (c)(i))^2 + 54^2$ M1 for $\pi \times (\textit{their} (c)(i)) \times \sqrt{\{(\textit{their} (c)(i))^2 + 54^2\}}$ M1 for $\pi \times (\textit{their} (c)(i))^2$

Question 35

6	(a)	3	1	
	(b) (i)	9900	3	M2 for $2(60 \times 35) + 2(60 \times 30) + 2(30 \times 35)$ oe or M1 for one correct rectangle
	(ii)	0.99 oe	1FT	FT <i>their</i> (b)(i) $\div 10\,000$
	(c) (i)	75.7 or 75.66 to 75.67	4	M3 for $\sqrt{60^2 + 30^2 + 35^2}$ oe could be in stages or M2 for $60^2 + 30^2 + 35^2$ oe or M1 for $60^2 + 30^2$ or $60^2 + 35^2$ or $35^2 + 30^2$ oe
	(ii)	23.4 or 23.3 or 23.34 to 23.36...	3	M2 for $\sin^{-1}(30 \div \sqrt{60^2 + 35^2 + 30^2})$ oe or for $\sin^{-1}(30 \div \textit{their} (c)(i))$ or M1 for $\sin = 30 \div \sqrt{60^2 + 35^2 + 30^2}$ oe or for $\sin = 30 \div \textit{their} (c)(i)$
	(d) (i)	$30 \times 35 \times 60 [= 63\,000]$	1	With no errors seen
	(ii)	22.4 or 22.38 to 22.391	3	M2 for $\sqrt{\frac{63\,000}{40\pi}}$ oe or M1 for $40\pi r^2 = 63\,000$ oe

Question 36

<p>9 (a)</p> <p>(b)</p>	<p>270 or 270.17 to 270.22</p> <p>518 or 517.6 to 517.8 nfw</p>	<p>3</p> <p>M2 for $\frac{360-145}{360} \times \pi 12^2$ oe or B1 for 215 seen or M1 for $\frac{\theta}{360} \times \pi 12^2$ used</p> <p>6</p> <p>B4 for vertical height = 9.62 to 9.63 or B3 for radius = 7.166 to 7.17 or B2 for length of sector = 45.[0] or 45.02 to 45.04 or M1 for $\frac{360-145}{360} \times 2 \times \pi \times 12$ oe or for $\sqrt{12^2 - \text{their radius}^2}$ and M1 indep for $\frac{1}{3} \pi \times \text{their radius}^2 \times \text{their } h$ ($h \neq 12$ or $r \neq 12$)</p>
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Question 37

5(a)(i)	50890 or 50893 to 50900.4	2	M1 for $\pi \times 18^2 \times 50$
5(a)(ii)	20.5 or 20.52 to 20.534	3	<p>B2 for answer 29.5 or 29.46 to 29.48 OR M2 for $(50900 - 30000) \div (\pi \times 18^2)$ oe</p> <p>or M1 for $(\text{figs } 50.9 - \text{figs } 30) \div (\pi \times \text{figs } 18^2)$ or M1 for $(50900 - 30000) = (\pi \times 18^2)h$ oe</p> <p>OR <u>alternative method</u> M2 for $50 - \frac{30000}{\pi \times 18^2}$ oe</p> <p>M1 for $\text{figs } 30 = \pi \times \text{figs } 18^2 \times (50 - h)$ oe or for $\frac{\text{figs } 30}{\pi \times \text{figs } 18^2}$ oe</p> <p>OR <u>alternative method</u> M2 for $\frac{(50.9 - 30)}{50.9} \times 50$ oe or M1 for $\frac{(50.9 - 30)}{50.9}$ or $\frac{30}{50.9} \times 50$ oe or M1 for $\frac{(\text{figs } 50.9 - \text{figs } 30)}{\text{figs } 50.9} \times 50$ oe</p>
5(a)(iii)	334 nfw	4	<p>M2 for $\text{figs } 30 \div \frac{2}{3} \pi \times 3.5^3$ oe or M1 for $\frac{1}{2} \times \frac{4}{3} \pi \times 3.5^3$ oe</p> <p>and B1 for 30 000</p>
5(b)(i)	3.28[6..] or 3.29	3	<p>M2 for $[r^2 =] \frac{95 \times 3}{8.4\pi}$ oe or M1 for $\frac{1}{3} \pi \times r^2 \times 8.4 [= 95]$</p>
5(b)(ii)	93.1 to 93.6	4	<p>M3 for $\pi \times 3.3 \times \sqrt{3.3^2 + 8.4^2}$ or M2 for $\sqrt{3.3^2 + 8.4^2}$ or M1 for $3.3^2 + 8.4^2$</p>

Question 38

8(a)	$\pi \times \frac{5}{2} \times l + \frac{4}{2} \times \pi \times \left(\frac{5}{2}\right)^2 = \frac{115\pi}{4} \text{ oe}$ $\text{or } \frac{115\pi}{4} - \frac{4}{2} \times \pi \times \left(\frac{5}{2}\right)^2 = \pi \times \frac{5}{2} \times l \text{ oe}$	M2	M1 for $\pi \times \frac{5}{2} \times l$ or $\frac{4}{2} \times \pi \times \left(\frac{5}{2}\right)^2$
	$\frac{5\pi l}{2} = \frac{65\pi}{4} \text{ oe}$ $\text{or } [l =] \left(\frac{115\pi}{4} - 2 \times \pi \times 2.5^2 \right) \div 2.5\pi \text{ oe}$	B1	nfw oe both terms must be written in terms of π nfw or correct complete method for l with decimals
	$[l =] \frac{65\pi \times 2}{4 \times 5\pi} \text{ or } \frac{65\pi}{10\pi} \text{ oe} = 6.5$	A1	Correct calculation with no errors and B1 earned
8(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]...
8(c)	72[.0...] or 71.99... nfw	4	M3 for $\frac{\pi}{3} \times \left(\frac{5}{2}\right)^2 \times \text{their } 6 + \frac{1}{2} \times \frac{4\pi}{3} \times \left(\frac{5}{2}\right)^3$ oe or M1 for $\frac{\pi}{3} \times \left(\frac{5}{2}\right)^2 \times \text{their } 6$ 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 $\frac{\pi}{3} \times (5)^2 \times \text{their } 4.15 + \frac{1}{2} \times \frac{4\pi}{3} \times (5)^3$ oe or SC1dep for $\frac{\pi}{3} \times (5)^2 \times \text{their } 4.15$ oe SC1dep for $\frac{1}{2} \times \frac{4\pi}{3} \times (5)^3$ oe
8(d)	53.7 or 53.65 to 53.67	3	M1 for figs (<i>their (c)</i>) $\times 19.3 \times 38.62$ or better M1 for $\div 1000$ soi

Question 39

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

Question 40

8(a)(ii)	30	3	<p>M2 for $320 \div 16 \times \frac{12}{8}$ oe</p> <p>or M1 for $320 \div 16$</p>
8(b)	3.375 cao	3	<p>M2 for $\frac{4}{3} \pi \times 4.5^3$ or better</p> <p>or M1 for $\pi \times 6^2 \times h = \frac{4}{3} \times \pi \times 4.5^3$</p>
8(c)	3.63 or 3.627 to 3.628	3	<p>M2 for $\frac{20^3}{40 \times \frac{4}{3} \pi}$</p> <p>or M1 for $40 \times \frac{4}{3} \times \pi \times r^3 = 20^3$</p>
8(d)	$\frac{3x}{2}$ or $1.5x$ or $1\frac{1}{2}x$	3	<p>B2 for $4R^2 = 9x^2$ oe or better</p> <p>or M1 for $4\pi R^2 = 2\pi x^2 + \pi \times 2x \times \frac{7x}{2}$</p>