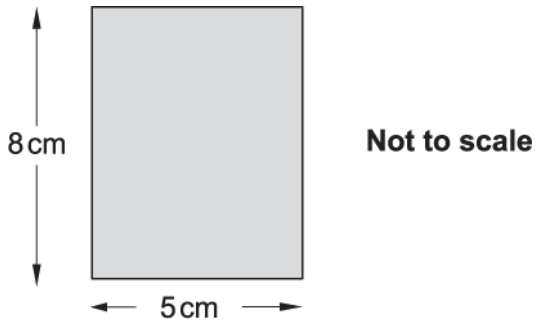
1(a). Jo makes a pendant from a rectangular piece of silver.

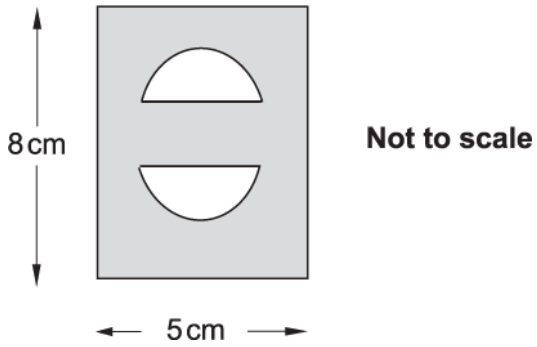


Not to scale

Work out the area of this rectangle.

_____ cm^2 **[1]**

(b). To complete the pendant, Jo cuts two semicircles of radius 1 cm from the rectangle, as shown below.



Not to scale

Show that the shaded area is 36.9 cm^2 correct to three significant figures.

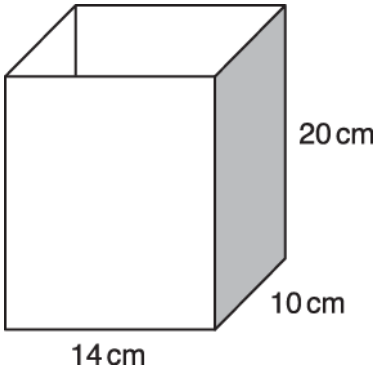
[4]

(c). The silver Jo uses is 2 mm thick.

Find the volume of silver in the pendant.
Give your answer in cm^3.

_____ cm^3 **[3]**

2. Zoe needs a container that can hold at least 2.5 litres of water.
This container is a cuboid.



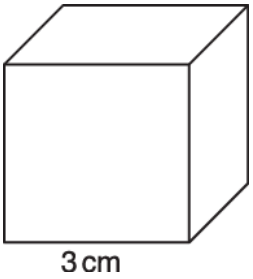
1000 cm^3 = 1 litre

Could this container hold the amount of water that Zoe wants?
Show working to support your answer.

---

[4]

3. Here is a cube.



Aleisha tries to work out the volume of this cube.

Here is her working.

$$3 \times 3 \times 3 = 9 \text{ cm}^2$$

She has made two errors.

What are her errors?

1

2

---

[2]

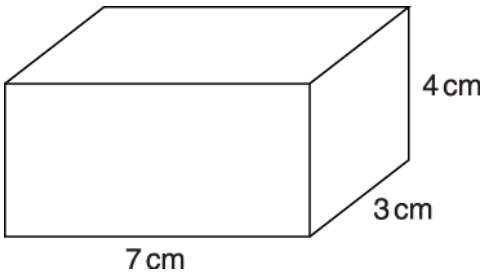
4. A cuboid with a square base has a height of 8 cm.
The volume of the cuboid is 200 cm^3.

Calculate the length of one side of the square base.

_____ cm

[3]

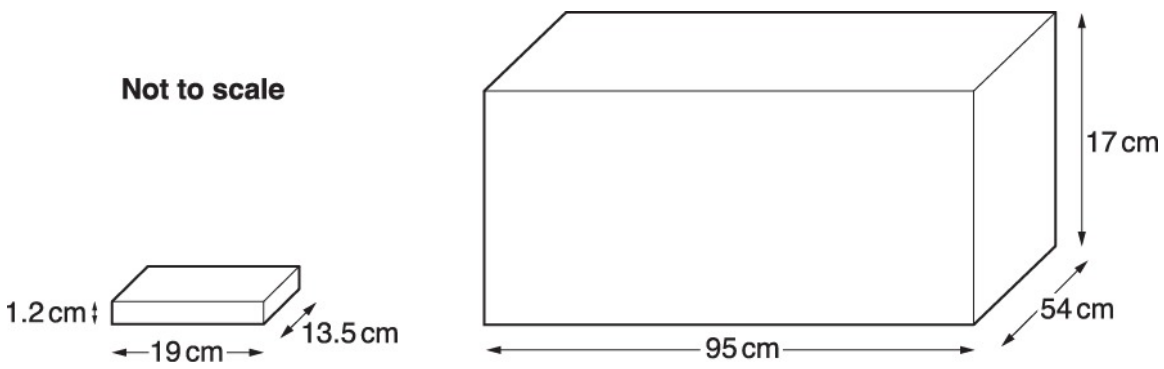
5. Here is a cuboid.



Calculate the volume of the cuboid.

_____ cm^3 **[2]**

6. *



Trevor is packing his DVD cases into a storage box.

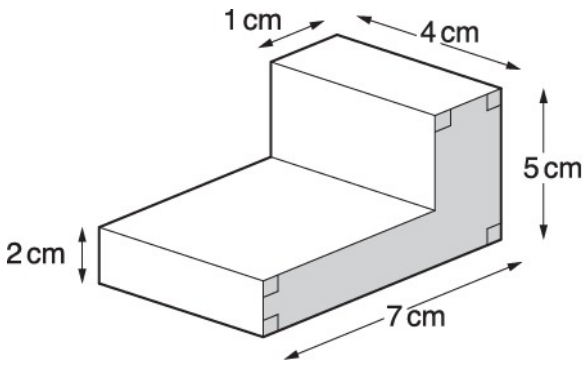
Each DVD case is a cuboid measuring 19 cm by 13.5 cm by 1.2 cm.

The storage box is a cuboid measuring 95 cm by 54 cm by 17 cm.

Work out the maximum number of DVDs that Trevor can pack in the storage box.

_____ [5]

7(a). This solid shape is a prism.



Not to scale

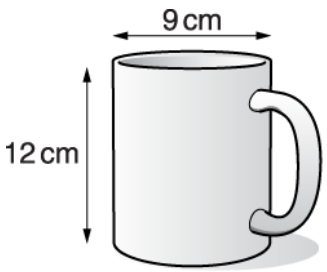
Show that the area of the shaded face of the solid is 17 cm^2.

[2]

(b). Work out the total surface area of the solid.

_____ cm^2**[3]**

8. * Jo has 22 litres of hot chocolate to pour into mugs.
The mugs are cylinders with an internal diameter of 9 cm and an internal height of 12 cm.
Each mug is filled to 1 cm from the top.

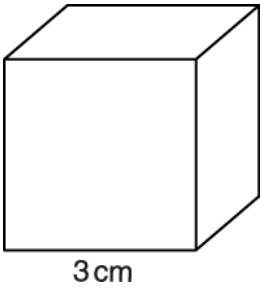


How many mugs can Jo fill?

_____ [5]

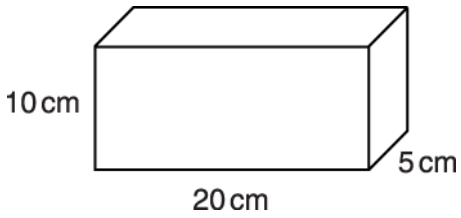
9. In this cube each side has length 3 cm.

What is the volume of the cube?



_____ cm^3 **[2]**

10. The diagram shows a box in the shape of a cuboid.

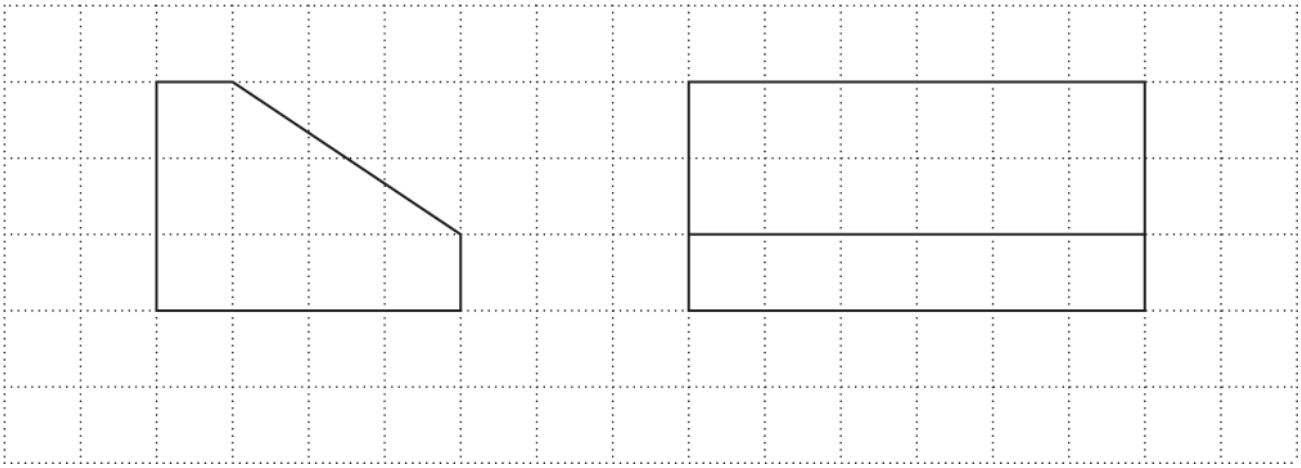


Nikki has some of these boxes.
Nikki packs her boxes into a crate in the shape of a cuboid.
The crate has length 2 m, height 50 cm and width 40 cm.

Work out how many of her boxes Nikki can pack into the crate.

_____ [4]

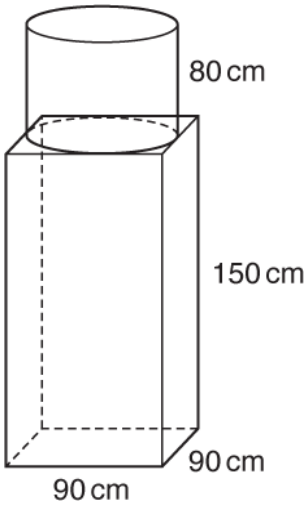
11. The front and side elevations of a prism, with a pentagon as its cross section, are drawn on this one-centimetre square grid.



Calculate the volume of the prism.

_____ cm^3 **[3]**

12.



A sculpture is formed from a cylinder resting on top of a cuboid.
The cylinder has radius 45 cm and height 80 cm.
The cuboid measures 90 cm by 90 cm by 150 cm.

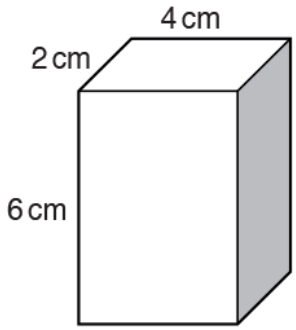
The sculpture is made of granite.
The granite has a density of 2.7 g/cm^3.

Calculate the total mass of the sculpture in tonnes.

_____ tonnes **[5]**

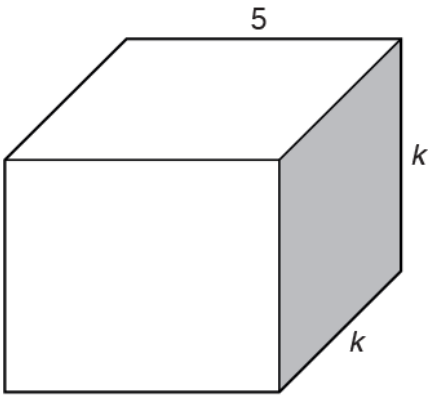
13(a) Calculate the volume of this cuboid.

.



---------- cm^3 **[2]**

(b). In this cuboid all lengths are in centimetres.



The cuboid has a volume of 320 cm^3.

Find the value of *k*.

k = ---------- **[3]**

END OF QUESTION PAPER

Question			Answer/Indicative content	Marks	Part marks and guidance	
1	a		40	1		
	b		Correct reasoning leading to 36.9	4	**M2** for $\pi \times 1^2$ Or **M1** for $\frac{1}{2} \pi \times 1^2$ And **M1** for *their* '40' $-\pi \times 1^2$	
	c		7.38 or better	3	**M1** for 2 mm = 0.2 cm **soi** **M1** for 36.9 × *their* '0.2' **oe**	
			Total	**8**		
2			Yes because 2800 > 2500 or yes because 2.8 > 2.5	4	**B1** for 2.5 litres = 2500 [cm^3] soi or *their* 2800 [cm^3] = *their* 2.8 litres soi **and** **B2** for 2800 or **M1** for 14 × 10 × 20	Must come from attempt at volume Examiner's Comments Many candidates found the volume successfully, some encountered problems with their multiplication and some in error calculated the surface area. The most common problem was not stating an explicit conversion between litres and centimetres cubed and candidates need to take care to give enough detail in their answer to support their conclusion.
			Total	**4**		

Question			Answer/Indicative content	Marks	Part marks and guidance	
3			answer should be 27 or explains clearly the error in the calculation oe units should be cm^3 oe	2 2		See appendix 1 <u>Exemplar responses</u> They have added, [when it is multiply] (1, 0) They have done 3 × 3 (1, 0) The calculation is wrong (0, 0) It should be 27 (1, 0) It would be cubed not squared (0, 1) The units should be cubed not squared (0, 1) She used a squared sign instead of a cubed (0, 1) The power should be cubed as there are 3 measurements (0, 1) The units are wrong (0, 0) 3 × 3 × 3 does not equal 9 (1, 0) cm × cm × cm not equal to cm^2 (0, 1) It is 27 cm^3 (1, 1) 3 × 3 is 9 she forgot to times by the other 3 (1, 0) She put cm^2 which should not be there (0, 0) you do 3 times 3 first and then multiply the answer to this by 3 (0, 0) <u>Examiner's Comments</u> Many described the errors clearly and the best answers gave the correct volume and units. Some were vague and simply said that the calculation was wrong or the units were wrong which was insufficient.
			Total	2		

Question			Answer/Indicative content	Marks	Part marks and guidance	
4			5	3	**M2** for $\sqrt{\frac{200}{8}}$ or **M1** for 200 ÷ 8 oe	soi by 25 Examiner's Comments This question did discriminate between candidates. Many were able to obtain the value 25 in their working from 200 ÷ 8 and gained partial credit for this. A common error was then to give 12.5 as the answer. Those that read the question carefully and recognised that the cuboid had a square base often used a checking strategy before the final answer and 5 × 5 × 8 = 200 was seen in working before giving the correct answer of 5.
			Total	3		
5			84	2	**M1** for 7 × 3 × 4 Examiner's Comments Very well answered with only a few finding surface area rather than the volume of the cuboid.	
			Total	2		

Question			Answer/Indicative content	Marks	Part marks and guidance	
6			* Fully correct answer of 280 showing the divisions of 95 ÷ 19, 54 ÷ 13.5 and 17 ÷ 1.2 and 5 [×] 4 [×] 14. (For divisions throughout accept 19 × 5 = 95, 13.5 × 4 = 54 and 1.2 × 14 = 16.8 or better)	5	No need for a proof that this is the maximum by trying other combinations	
			Gives answer 280 from limited correct working OR Correct method with division steps shown but with incorrect / no rounding e.g. 5 × 4 × 15 = 300 or 5 × 4 × 85/6 oe = 283 to 284	4-3	Uses false volume method and shows working i.e. 95 × 54 × 17 = 87210 then 19 × 13.5 × 1.2 = 307.8 then divides to get 283 to 284 OR gives answer 280 from no working or 3 correct divisions shown but then wrong method	
			2 correct divisions soi OR 95 × 54 × 17 soi [87210] **and** 19 × 13.5 × 1.2 soi [307.8]	2-1	95 × 54 × 17 soi [87210] **or** 19 × 13.5 × 1.2 soi [307.8] OR 1 correct division soi	

Question			Answer/Indicative content	Marks	Part marks and guidance	
			No worthy work	0	Examiner's Comments The QWC question proved to be more accessible to some candidates than in previous years as more candidates gained marks. Working was usually concise and accurate but there were many who used the false volume approach, dividing the volume of the storage box by the volume of the DVD for which partial credit was given. The correct method resulting from the placing of the cases in the box was also considered by a large number of candidates who scored full marks on the question. Some who did the correct divisions of dimensions went on to add their values rather than multiplying. Others merely added all the dimensions in each case and others found the areas of faces.	
			Total	5		

Question			Answer/Indicative content	Marks	Part marks and guidance	
7	a		7×2 + 3×1 soi OR 6×2 + 5×1 soi OR 7×5 – 3×6 soi	2	M1 for any one of 7×2, 3×1, 6×2, 5×1, 7×5, 3×6 soi Examiner's Comments Many candidates correctly split the shape into two rectangles and went on to show the areas added to 17. A small number incorrectly used the fact that adding some of the lengths could also total 17 (7+5+4+1).	
	b		130	3	M2 for 17; 17; 4×1; 4×2; 4×3; 4×5; 4×6; 4×7 oe soi with at most one incorrect, one extra or one missing Or M1 for any five of these sides soi Examiner's Comments There were many good attempts. Often one or more sides were missing or incorrect in the total. A very small number of candidates multiplied all the lengths together or added them.	M2 for 17×2; 5×4×2; 7×4×2 Or M1 for any two of these
			Total	5		

Question			Answer/Indicative content	Marks	Part marks and guidance	
8			* Correct answer of 31 with all correct working seen.	5		
			Correct working with answer of 31.4[…] or 31 with 3 of the following $4.5^2 \times \pi$ implied by 63.617[…] to 63.63 63.617[…] to 63.63 × 11 implied by 699.789[…] to 700 22 × 1000 implied by 22000 22000 ÷ *their* 699.789[…] to 700	4-3	3 of : $4.5^2 \times \pi$ implied by 63.617[…] to 63.63 *Their* 63.617[…] to 63.63 × 11 implied by 699.789[…] to 700 22 × 1000 implied by 22000 22000 ÷ *their* 699.789[…] to 700 31 or 31.4 as answer or Answer of 28[.8] with all working shown from use of 12 not 11	
			2 of : $4.5^2 \times \pi$ implied by 63.617[…] to 63.63 *Their* 63.617[…] to 63.63 × 11 implied by 699.789[…] to 700 22 × 1000 implied by 22000 22000 ÷ *their* 699.789[…] to 700 31 or 31.4 as answer	2 - 1	1 of : $4.5^2 \times \div$ implied by 63.617[…] to 63.63 *Their* 63.617[…] to 63.63 × 11 implied by 699.789[…] to 700 22 × 1000 implied by 22000 22000 ÷ *their* 699.789[…] to 700 31 or 31.4 as answer	

Question			Answer/Indicative content	Marks	Part marks and guidance	
			No relevant working	0	**Examiner's Comments** This was the question assessing the Quality of Written Communication. A few candidates demonstrated some clear, logical methods leading to the correct answer, although some appeared not to realise it was necessary to show working. Additionally, some candidates failed to realise they needed to use π, while others used the diameter rather than the radius; a small number of candidates assumed the cup held 250ml. Several candidates were able to gain a mark for the volume conversion, although a significant number used 2200 rather than 22 000.	
			Total	**5**		
9			27	2	**M1** for 3^3 or 3 × 3 × 3 or 3 × 9 **oe** **Examiner's Comments** The technique for finding the volume of a cube was understood by about half the candidates, a few had difficulty calculating 3 × 3 × 3 and consequently only obtained the method mark. Some found the total length of all the edges on the cube, or attempted to find the total surface area.	do not accept 3 × 3 × 3 ÷ 2 for **M1**
			Total	**2**		

Question			Answer/Indicative content	Marks	Part marks and guidance	
10			400 **nfww**	4	**M1** for 10 × 20 × 5 **soi** by 1000 **M1** for 200 × 50 × 40 **soi** by 400000 **M1** for attempt at division of *their* '200 × 50 × 40' ÷ *their* '10 × 20 × 5' or **M3** for 10 × 5 × 8 or **M2** for 10 and 5 and 8 or **M1** for 10 or 5 or 8 clearly linked to 200(2m) or 50 or 40 **Examiner's Comments** Some candidates were able to select a suitable method and gain all 4 marks. Others had selected a correct method but were let down by poor arithmetic and the conversion between metric units. Some candidates had found for example the number of boxes which could be fitted in each dimension as 10, 5 and 8 but then added them to give 23 rather than multiplying them.	accept equivalent numbers being divided must be volumes and division must be seen Check diagram for numbers Accept alternative orientations of the small cuboids
			Total	4		

Question			Answer/Indicative content	Marks	Part marks and guidance		
11			54	3	**B1** for 9 [cm^2] **And** **M1** for *their* 9 × 6 or for a volume calculation where 6 is identified as the length	seen as area Eg $b \times l \times w$ = 4 × 6 × 3 May be seen on diagram	
			Total	3			

Question			Answer/Indicative content	Marks	Part marks and guidance		
12			4.653 to 4.655 or 4.65 or 4.7 or 5	5	**Volume of cuboid** **M1** for 90 × 90 × 150 soi 1 215 000 **Volume of cylinder** **M1** for π × 45^2 × 80 soi 508 680 to 509 004 **Total volume** **M1** for *their* 1215 *000* + *their* 508 938.1 soi 1 723 680 to 1 723 938.1 **Find mass using density** **M1** for any of *their* volumes × 2.7	Answers of 4.7 or 5 require supporting working Answers from values of π π = 508 938.0099 3.142 = 509 004 3.14 = 508 680 *Their* volumes must be seen to come from the product of three relevant lengths Dependent on a calculated volume for cuboid, cylinder or total If total consists of one volume and one non-volume but is × 2.7, final **M1** scored **Examiner's Comment** Considering its difficulty, a pleasing number of candidates scored marks

Question			Answer/Indicative content	Marks	Part marks and guidance	
					on this question. Many candidates found the volume of the cuboid and a reasonable number found the volume of the cylinder and added the two. There was clear indecision about whether to multiply or divide by 2.7. Also pleasingly, few candidates found surface areas, although there was some uncertainty about the formula for the cylinder. Solutions were too often poorly structured however and bits of working sometimes covered the available space on the page. Weaker candidates combined the given numbers in creative ways, but not ways that could be awarded marks.	
			Total	5		

Question			Answer/Indicative content	Marks	Part marks and guidance	
13	a		48	2	M1 for $6 \times 2 \times 4$ | May be in stages	
	b		8	3	M2 $\sqrt{\frac{320}{5}}$ for or M1 $\frac{320}{5}$ for soi 64 or $5k^2 = 320$ Examiner's Comments Many candidates scored 2 marks for part (a). However, a significant number of candidates showed misunderstanding or poor numerical skills. Some obscure wrong methods were seen such as $6^2 + 2^2 + 4^2$, possibly from an attempt to calculate surface area. In part (b) some candidates went straight to a correct answer showing little working. Others wrote a trial, or a number of trials, attempting to produce 320. Occasionally these lead to the correct result. Many scored M1 for dividing 320 by 5 to reach 64. They were often unsure how to proceed and often gave 32 as an answer.	
			Total	5		