

WA6MMGTH2

Three-dimensional space and structures

Core + Challenge

Volume of Rectangular Prisms — Marking Key

I can find the volume of rectangular prisms by counting cubes in layers and by using $\text{length} \times \text{width} \times \text{height}$.

For tutors and parents. Award method marks for correct working even if the final answer is wrong.

Marks summary

A Warm up: 16 B Practise: 21 C Think it through: 10 D Challenge: 9 **Total: 56**

Gold shading in this key shows what the child should have shaded or drawn. Accept any correct arrangement unless the question fixes it.

A

Warm up *answers*

/ 16 marks

Q	Answer	Model answer / notes	Marks
1	12	2 layers of $3 \times 2 = 6$: $2 \times 6 = 12$.	1
2	8	1 layer of $4 \times 2 = 8$: $1 \times 8 = 8$.	1
3	18	2 layers of $3 \times 3 = 9$: $2 \times 9 = 18$.	1
4	20	2 layers of $5 \times 2 = 10$: $2 \times 10 = 20$.	1
5	cm^3	Small objects: cm^3 . Large objects (rooms, pools, containers): m^3 .	1
6	m^3	Small objects: cm^3 . Large objects (rooms, pools, containers): m^3 .	1
7	cm^3	Small objects: cm^3 . Large objects (rooms, pools, containers): m^3 .	1
8	m^3	Small objects: cm^3 . Large objects (rooms, pools, containers): m^3 .	1
9	36 cubes	One layer = $4 \times 3 = 12$. $3 \times 12 = 36$.	1
10	40 cubes	One layer = $5 \times 2 = 10$. $4 \times 10 = 40$.	1
11	27 cubes	One layer = $3 \times 3 = 9$. $3 \times 9 = 27$.	1
12	24 cubes	One layer = $6 \times 2 = 12$. $2 \times 12 = 24$.	1
13	40 cm^3	$5 \times 4 \times 2 = 40 \text{ cm}^3$.	1
14	54 cm^3	$6 \times 3 \times 3 = 54 \text{ cm}^3$.	1
15	100 cm^3	$10 \times 2 \times 5 = 100 \text{ cm}^3$.	1
16	12 m^3	$3 \times 2 \times 2 = 12 \text{ m}^3$.	1

B Practise *answers and working*

/ 21 marks

Q	Answer	Working / sample response	Marks																				
1	12 cubes	Count in columns from the front: $3 + 2 + 1 = 6$ cubes in the front half. It is 2 cubes deep, so $2 \times 6 = 12$ cubes. <i>1 mark: counts the front (6).</i> <i>1 mark: doubles for the depth.</i> <i>1 mark: 12 with an explanation.</i>	3																				
2	7	A full prism has $4 \times 3 \times 2 = 24$ cubes. She has 12 in the bottom layer and 5 on top: 17. $24 - 17 = 7$ more. <i>1 mark: 24 or 17.</i> <i>1 mark: 7.</i>	2																				
3	See table	<table border="1"> <thead> <tr> <th>Length</th><th>Width</th><th>Height</th><th>Volume</th></tr> </thead> <tbody> <tr> <td>5 cm</td><td>3 cm</td><td>2 cm</td><td>30 cm³</td></tr> <tr> <td>4 cm</td><td>4 cm</td><td>3 cm</td><td>48 cm³</td></tr> <tr> <td>6 cm</td><td>3 cm</td><td>5 cm</td><td>90 cm³</td></tr> <tr> <td>5 cm</td><td>2 cm</td><td>10 cm</td><td>100 cm³</td></tr> </tbody> </table> $V = 5 \times 3 \times 2 = 30 \text{ cm}^3$. Missing sides: $48 \div (4 \times 4) = 3 \text{ cm}$, $90 \div (6 \times 5) = 3 \text{ cm}$, $100 \div (2 \times 10) = 5 \text{ cm}$. <i>3 marks: all four. 2 marks: three. 1 mark: two.</i>	Length	Width	Height	Volume	5 cm	3 cm	2 cm	30 cm ³	4 cm	4 cm	3 cm	48 cm ³	6 cm	3 cm	5 cm	90 cm ³	5 cm	2 cm	10 cm	100 cm ³	3
Length	Width	Height	Volume																				
5 cm	3 cm	2 cm	30 cm ³																				
4 cm	4 cm	3 cm	48 cm ³																				
6 cm	3 cm	5 cm	90 cm ³																				
5 cm	2 cm	10 cm	100 cm ³																				
4	12 m ³ , \$540	Volume = $4 \times 3 \times 1 = 12 \text{ m}^3$. Cost = $12 \times \\$45 = \\$540$. <i>1 mark: 12 m³.</i> <i>1 mark: \$540.</i>	2																				
5	3 cm	Length $\times$ width = $5 \times 4 = 20 \text{ cm}^2$ (one layer is 20 cubes). Height = $60 \div 20 = 3 \text{ cm}$. <i>1 mark: $5 \times 4 = 20$.</i> <i>1 mark: 3 cm.</i>	2																				
6	a) 30 000 cm ³ b) 30 L	a) $50 \times 30 \times 20 = 30\,000 \text{ cm}^3$. b) $30\,000 \text{ cm}^3 = 30\,000 \text{ mL}$. $1000 \text{ mL} = 1 \text{ L}$, so $30\,000 \text{ mL} = 30 \text{ L}$. <i>1 mark: 30 000 cm³.</i> <i>1 mark: 30 000 mL.</i> <i>1 mark: 30 L.</i>	3																				
7	6	Along the length: $6 \div 2 = 3$. Along the width: $4 \div 2 = 2$. Up: $2 \div 2 = 1$. $3 \times 2 \times 1 = 6$ cubes. (Check: $48 \text{ cm}^3 \div 8 \text{ cm}^3 = 6$.) <i>1 mark: 3, 2 and 1 (or $48 \div 8$).</i> <i>1 mark: 6.</i>	2																				

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Q	Answer	Working / sample response	Marks
8	e.g. $3 \times 2 \times 2$	 Any three whole numbers that multiply to 12, e.g. $3 \times 2 \times 2$, $4 \times 3 \times 1$, $6 \times 2 \times 1$, $12 \times 1 \times 1$. Check the drawing has that many cubes. <i>1 mark: dimensions multiply to 12.</i> <i>1 mark: drawing matches.</i>	2
9	B, by 4 cm^3	A: $6 \times 5 \times 2 = 60 \text{ cm}^3$. B: $4 \times 4 \times 4 = 64 \text{ cm}^3$. B holds 4 cm^3 more. <i>1 mark: both volumes.</i> <i>1 mark: B by 4 cm^3.</i>	2

C

Think it through *sample answers and criteria*

/ 10 marks

Q	Answer	Working / sample response	Marks
1	No, 18 cubes	Ava only counted the cubes on the outside faces she could see. There are 4 hidden cubes in the bottom layer. $3 \times 3 \times 2 = 18$ cubes. <i>1 mark: explains hidden cubes are missed.</i> <i>1 mark: 18.</i>	2
2	False	Old volume: $1 \times 2 \times 3 = 6 \text{ cm}^3$. New box $2 \text{ cm} \times 4 \text{ cm} \times 6 \text{ cm} = 48 \text{ cm}^3$. 48 is 8 times 6, not double. <i>1 mark: False.</i> <i>1 mark: both volumes (6 and 48) or explains $\times 8$.</i>	2
3	Sometimes	Always Sometimes Never True: $5 \times 2 \times 2 = 20 \text{ cm}^3$ is more than $2 \times 2 \times 2 = 8 \text{ cm}^3$. False: $5 \times 1 \times 1 = 5 \text{ cm}^3$ is less than $2 \times 2 \times 2 = 8 \text{ cm}^3$, even though it is longer. <i>1 mark: Sometimes.</i> <i>1 mark: one example each way.</i>	2
4	$5 \text{ cm} \times 2 \text{ cm} \times 5 \text{ cm}$	$2 \times 3 \times 8$, $4 \times 3 \times 4$ and $6 \times 2 \times 4$ all have a volume of 48 cm^3. $5 \times 2 \times 5 = 50 \text{ cm}^3$. <i>1 mark: $5 \times 2 \times 5$.</i> <i>1 mark: shows the volumes (48, 48, 48, 50).</i>	2
5	Rows make a layer; layers make the prism	Length tells how many cubes in one row. Width tells how many rows make one layer, so one layer has length $\times$ width cubes. Height tells how many layers, so the total is length $\times$ width $\times$ height. <i>1 mark: length $\times$ width = cubes in one layer.</i> <i>1 mark: $\times$ height for the number of layers.</i>	2

D

Challenge *solutions and criteria*

/ 9 marks

Q	Answer	Working / sample response	Marks
1	6 boxes; $2 \times 3 \times 4$ is closest to a cube	$1 \times 1 \times 24, 1 \times 2 \times 12, 1 \times 3 \times 8, 1 \times 4 \times 6, 2 \times 2 \times 6, 2 \times 3 \times 4$. Work in order: smallest side 1, then 2 (no box with smallest side 3 works, as $3 \times 3 \times 3 = 27$ is too big). $2 \times 3 \times 4$ has the sides closest together, so it is most like a cube. <i>2 marks: all six (1 mark for four or five).</i> <i>1 mark: $2 \times 3 \times 4$.</i>	3
2	3 faces: 8, 2: 12, 1: 6, 0: 1	3 faces: the 8 corner cubes. 2 faces: the middle cube of each of the 12 edges. 1 face: the centre of each of the 6 faces. No faces: the 1 cube in the very middle. Check: $8 + 12 + 6 + 1 = 27$. <i>1 mark: 8 and 12.</i> <i>1 mark: 6 and 1.</i> <i>1 mark: checks the total is 27 (or all four correct).</i>	3
3	a) 4 cm b) 20 boxes	a) Base area = $80 \div 5 = 16 \text{ cm}^2$. A square with area 16 cm^2 has sides of 4 cm. b) Along the length $20 \div 4 = 5$, across the width $8 \div 4 = 2$, and $10 \div 5 = 2$ layers. $5 \times 2 \times 2 = 20$ boxes. (Check: $1600 \text{ cm}^3 \div 80 \text{ cm}^3 = 20$.) <i>1 mark: 4 cm.</i> <i>1 mark: 5, 2 and 2.</i> <i>1 mark: 20 boxes.</i>	3