

C5.5 Compound shapes and parts of shapes

Name: _____ Class: _____ Date: _____

Total: 20 marks

KEY WORDS compound shape • area • volume • circle • radius

Objective

Use compound shapes and parts of shapes to solve Core IGCSE Mathematics problems.

You must be able to:

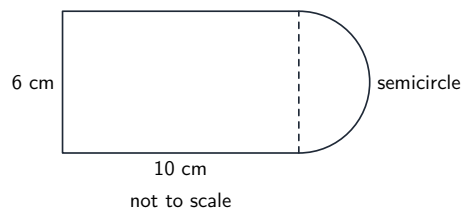
- Split or subtract regions to find a compound area
- Count only exposed boundaries and surfaces
- Combine volumes without counting shared faces as outside area

1 Key knowledge and worked examples

■ Key knowledge: Compound shapes and parts of shapes

Split a compound region into familiar shapes and add their areas, or subtract a missing region from a larger one. Perimeter uses only the outside boundary, not internal joins. Add volumes of nonoverlapping solids; subtract a cavity's volume. For exposed surface area, remove the faces hidden at joins and include any exposed cavity walls. Keep exact π until rounding.

■ Worked example: Compound shapes and parts of shapes



A 10×6 cm rectangle has a semicircle attached along its 6 cm side, so $r = 3$ cm.

- Area: $A = lw + \frac{1}{2}\pi r^2 = 60 + 4.5\pi \text{ cm}^2$.
- Boundary: two 10 cm sides, one 6 cm side and a semicircular arc.
- $P = 2l + w + \pi r = 26 + 3\pi$ cm; the joined diameter is not counted.
- Half a sphere of radius 3 cm has $V = \frac{1}{2}(4\pi r^3/3) = 18\pi \text{ cm}^3$.

- A circular hole of radius 2 cm in a square of side 6 cm leaves $A = s^2 - \pi r^2 = 36 - 4\pi \text{ cm}^2$.
- Two cubes of edge 2 cm joined face to face have 12 faces before joining but two are hidden. Exposed area is $S = (12 - 2)e^2 = 10(2)^2 = 40 \text{ cm}^2$; volume is $V = 2e^3 = 16 \text{ cm}^3$.

■ Method check

At a join, volumes add but touching faces disappear from the outside surface. Count each exposed face rather than adding two complete surface areas.

2 Practice

2.1 A 9×7 cm rectangle has a 3×2 cm corner cut out. Find the remaining area. [2]

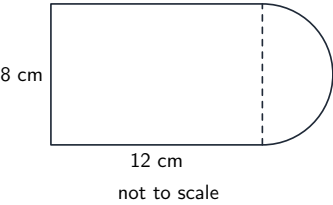
2.2 A circle of radius 2 cm is cut from a square of side 6 cm. Find the remaining area in terms of π . [2]

2.3 Two cuboids of volumes 36 and 54 cm^3 are joined without overlap. Find the total volume. [2]

2.4 Find the volume of half a sphere of radius 6 cm in terms of π . [2]

3 Exam-style questions

3.1 Apply the compound shapes and parts of shapes methods below. Show working and include units where appropriate.

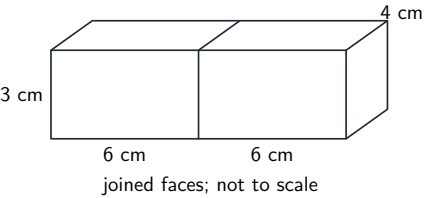


(a) A 12×8 cm rectangle has a semicircle attached along an 8 cm side. Find the total area in terms of π . [2]

(b) Find the outside perimeter in terms of π . [2]

(c) Two cubes of edge 3 cm are joined face to face. Find their combined exposed surface area. [2]

3.2 Two cuboids each measure 6 cm by 4 cm by 3 cm. They join along their 4 cm by 3 cm faces to make one longer cuboid.



(a) Find the combined volume and state the dimensions of the new cuboid. [3]

(b) Find the exposed surface area by removing the joined faces from the two original surface areas. Check with the dimensions of the new cuboid. [3]

Solutions

Award method and answer marks as indicated; accept equivalent correct methods.

2.1

- $A = 9(7) - 3(2) = \mathbf{57 \text{ cm}^2}$.

2.2

- $A = s^2 - \pi r^2 = 36 - 4\pi \text{ cm}^2$; the full answer is $(36 - 4\pi) \text{ cm}^2$.

2.3

- $V = V_1 + V_2 = 36 + 54 = \mathbf{90 \text{ cm}^3}$.

2.4

- $V = (1/2)(4\pi r^3/3) = (1/2)(4\pi(6)^3/3) = \mathbf{144\pi \text{ cm}^3}$.

3.1

(a)

- $r = 8/2 = 4$; $A = 12(8) + \frac{1}{2}\pi(4)^2 = \mathbf{96 + 8\pi \text{ cm}^2}$.

(b)

- $P = 2(12) + 8 + \pi(4) = \mathbf{32 + 4\pi \text{ cm}}$.

(c)

- Two of the 12 faces are hidden: $S = (12 - 2)3^2 = \mathbf{90 \text{ cm}^2}$.

3.2

(a)

- Each volume is $V = lwh = 6(4)(3) = 72 \text{ cm}^3$.
- Combined $V_T = 2(72) = \mathbf{144 \text{ cm}^3}$.
- New dimensions are $\mathbf{12 \times 4 \times 3 \text{ cm}}$.

(b)

- Each surface is $S = 2(6 \times 4 + 6 \times 3 + 4 \times 3) = 108 \text{ cm}^2$.
- Exposed $S_T = 2(108) - 2(4 \times 3) = \mathbf{192 \text{ cm}^2}$.
- Check $S_T = 2(12 \times 4 + 12 \times 3 + 4 \times 3) = 192 \text{ cm}^2$.