Unit 2 · Solid Objects

HARDER PRACTICE QUESTIONS · ANSWER KEY

Full marks 33

Give the marks for the points in the marking scheme; an answer in other words that says the same is right.

1 Two cubes in one model

ANSWER A · 4

i. A cube has 12 edges and 8 vertices: **12 straws and 8 balls**.
ii. $2 \times 12 =$ **24 straws** and $2 \times 8 =$ **16 balls**.
iii. Count in layers across the model. There are 3 squares (the two ends and the shared one in the middle), each with 4 straws: $3 \times 4 = 12$. Then 4 long lines join them, each 2 straws long: $4 \times 2 = 8$. That is $12 + 8 =$ **20 straws**. Each of the 3 squares has 4 corners: $3 \times 4 =$ **12 balls**.
iv. $24 - 20 =$ **4 straws** and $16 - 12 =$ **4 balls**: the shared square's 4 edges and 4 corners.

MARKING SCHEME

✓ 12 straws and 8 balls.
✓ 24 straws and 16 balls.
✓ 20 straws and 12 balls.
✓ 4 straws and 4 balls saved.

2 One piece of wire

ANSWER A · 3

i. A cuboid has 4 edges of each length: $4 \times 12 + 4 \times 8 + 4 \times 4 = 48 + 32 + 16 =$ **96 cm**.
ii. A cube has 12 equal edges: $96 \div 12 =$ **8 cm**. Check: $12 \times 8 = 96$. ✓

MARKING SCHEME

✓ 4 edges each of 12 cm, 8 cm and 4 cm.
✓ 96 cm.
✓ 8 cm, from $96 \div 12$.

3 Spot the error

ANSWER U · 3

She has counted each vertex more than once. At every vertex of a cuboid, **3 faces** meet, so each vertex is in her 24 three times.
The right number is $24 \div 3 =$ **8 vertices**: 4 on the top and 4 on the bottom.

MARKING SCHEME

✓ Each vertex is counted more than once.
✓ 3 faces meet at each vertex.
✓ $24 \div 3 = 8$ vertices.

4 The hidden faces of a die

ANSWER A · 3

i. Bottom $7 - 5 =$ **2**, back $7 - 3 =$ **4**, left $7 - 1 =$ **6**.
ii. $2 + 4 + 6 =$ **12**.
iii. All six faces: $1 + 2 + 3 + 4 + 5 + 6 = 21$. She sees $5 + 3 + 1 = 9$. So $21 - 9 =$ **12** are hidden. ✓

MARKING SCHEME

✓ 2, 4 and 6.
✓ 12 hidden.
✓ $21 - 9 = 12$.

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5 Painted and pulled apart

ANSWER HA · 3

i. The middle cube touches a cube on its left and on its right. Those 2 faces were hidden, so **4** of its faces are red.
ii. An end cube touches only one cube, so **5** of its faces are red.
iii. Red faces: $4 + 5 + 5 = 14$. Not red: $18 - 14 = \mathbf{4}$, the two faces at each of the 2 joins.

MARKING SCHEME

✓ 4 red faces on the middle cube.
✓ 5 red faces on each end cube.
✓ 4 faces not red.

6 Lines and angles in a box

ANSWER A · 4

i. A **right angle**: each face is a rectangle (or a square).
ii. 6 faces with 4 corners each: $6 \times 4 = \mathbf{24}$ right angles.
iii. **3** edges. The edges go in only three directions, and 4 edges go in each, so 3 others go the same way as yours.
iv. At each end of your edge, **2** other edges meet it, both at a right angle: $2 + 2 = \mathbf{4}$.

MARKING SCHEME

✓ A right angle.
✓ 24 right angles.
✓ 3 parallel edges.
✓ 4 edges at a right angle.

7 A box from a net

ANSWER A · 3

i. **6** rectangles, one for each face.
ii. **2** of 15 cm by 8 cm (top and bottom), **2** of 15 cm by 2 cm (front and back) and **2** of 8 cm by 2 cm (the two ends).
iii. **5 faces.** The edges and vertices stay the same, **12 edges and 8 vertices**: the top still has 4 edges round it and 4 corners, even with nothing on it.

MARKING SCHEME

✓ 6 rectangles.
✓ Three sizes, two of each.
✓ 5 faces, 12 edges, 8 vertices.

8 Is it possible?

ANSWER HA · 4

i. **No.** A cuboid's edges come in groups of 4 equal edges: 4 lengths, 4 breadths and 4 heights. So at most 3 different lengths.
ii. **No.** If 4 faces are squares, the box is as long as it is broad, and as broad as it is high. Then all three are equal, it is a cube, and all **6** faces are squares.
iii. **No.** Every cube is a cuboid: a cuboid whose faces are all equal squares.
iv. **Yes.** A ball (a sphere) has a curved surface with no edge and no vertex.

MARKING SCHEME

✓ i. No, the edges come in groups of 4 equal ones.
✓ ii. No, 4 squares make it a cube with 6.
✓ iii. No, every cube is a cuboid.
✓ iv. Yes, a ball.

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9 Make your own

ANSWER HA · 3

i. $12 = 12 \times 1 \times 1 = 6 \times 2 \times 1 = 4 \times 3 \times 1 = 3 \times 2 \times 2$. So **12 by 1 by 1**, **6 by 2 by 1**, **4 by 3 by 1** and **3 by 2 by 2** (turning a cuboid over doesn't make a new one).

ii. **12 by 1 by 1** (its two ends are 1 by 1 squares) and **3 by 2 by 2** (its two ends are 2 by 2 squares). The other two have no square face.

MARKING SCHEME

✓ Two of the four cuboids.

✓ All four cuboids.

✓ 12 by 1 by 1 and 3 by 2 by 2 have exactly 2 square faces.

10 Think

ANSWER HA · 3

i. $10 \times 3 = 30$ straw ends. Each straw has 2 ends: $30 \div 2 =$ **15 straws**.

ii. **No.** $7 \times 3 = 21$ straw ends. Every straw has 2 ends, so the number of ends must be even. 21 is odd, so it can't be done.

MARKING SCHEME

✓ 30 straw ends.

✓ 15 straws.

✓ No: 21 ends is odd, but the ends come in twos.

Marks by level	Knowledge	Understanding	Application	Higher ability	Total
Marks	0	3	17	13	**33**

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