4.8 3D Block Counting: Test Pack

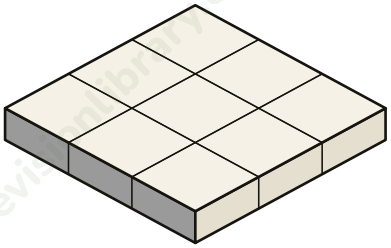
GL ASSESSMENT GL-EP.N10 · Calculators not allowed · about 60 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

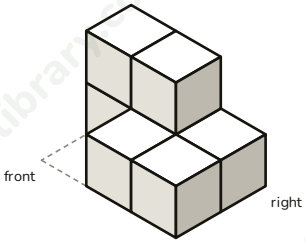
Answer ALL questions. Show all your working.

1 The solid is lifted, dipped completely in paint so that every outward-facing surface (including the underside) is coloured, then rebuilt in exactly the same arrangement. How many individual unit cubes have exactly 2 painted faces?



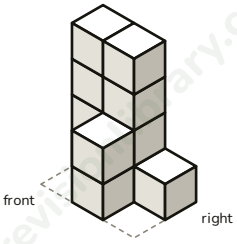
A	B	C	D	E
1	2	3	4	5

2 Rule: every cube sits on the table or on another cube (nothing floats), every stack of cubes can be seen from above in the picture (no stack is hidden behind another), and a cube you cannot see is always one that is needed to hold up the cubes you can. How many individual unit cubes are touching the table (the surface the solid stands on)?



A	B	C	D	E
7	3	4	5	6

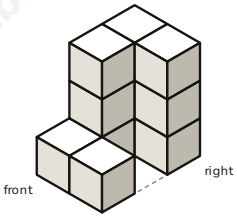
3 Rule: every cube sits on the table or on another cube (nothing floats), every stack of cubes can be seen from above in the picture (no stack is hidden behind another), and a cube you cannot see is always one that is needed to hold up the cubes you can. This solid stands inside an invisible box measuring 3 x 2 x 4 unit cubes (so a completely full box would need 24 cubes in total). How many extra unit cubes would need to be added to fill the box completely, with no gaps?

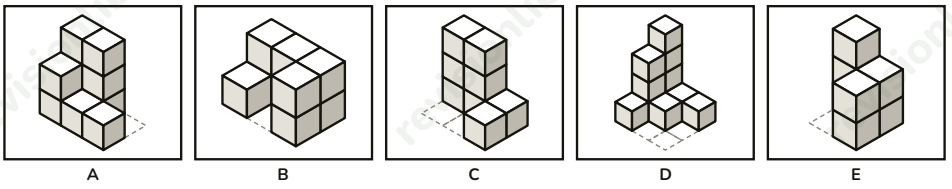


A	B	C	D	E
11	12	24	14	13

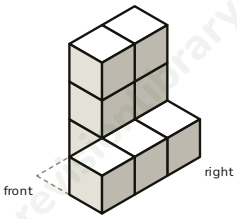
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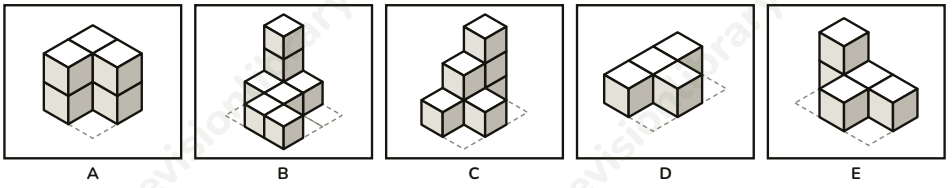
4 Rule: every cube sits on the table or on another cube (nothing floats), every stack of cubes can be seen from above in the picture (no stack is hidden behind another), and a cube you cannot see is always one that is needed to hold up the cubes you can. Which option, A to E, shows a solid made from exactly 2 fewer cubes than the solid shown?



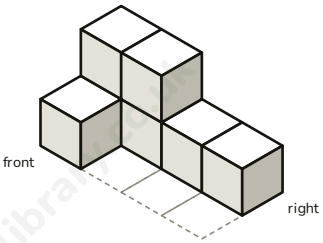


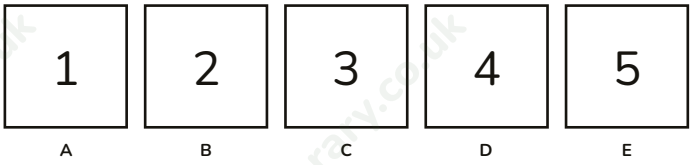
5 Rule: every cube sits on the table or on another cube (nothing floats), every stack of cubes can be seen from above in the picture (no stack is hidden behind another), and a cube you cannot see is always one that is needed to hold up the cubes you can. Which option, A to E, shows a solid made from exactly 3 fewer cubes than the solid shown?



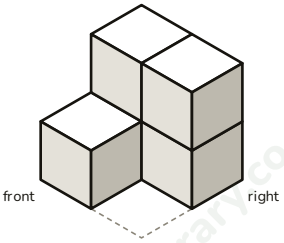


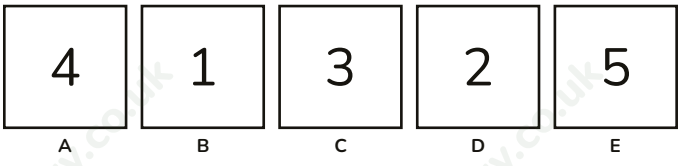
6 How many individual unit cubes are touching the table (the surface the solid stands on)?



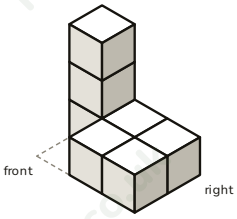


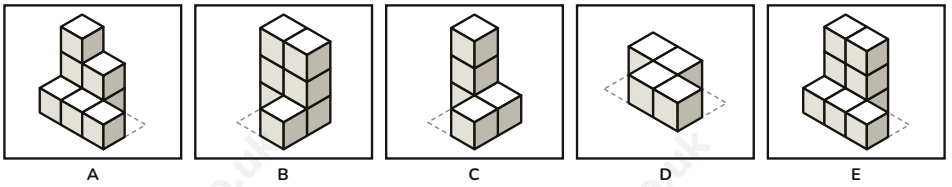
7 Rule: every cube sits on the table or on another cube (nothing floats), every stack of cubes can be seen from above in the picture (no stack is hidden behind another), and a cube you cannot see is always one that is needed to hold up the cubes you can. How many individual unit cubes are touching the table (the surface the solid stands on)?





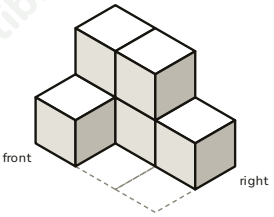
8 Rule: every cube sits on the table or on another cube (nothing floats), every stack of cubes can be seen from above in the picture (no stack is hidden behind another), and a cube you cannot see is always one that is needed to hold up the cubes you can. Which option, A to E, shows a solid made from the same number of cubes as the solid shown?

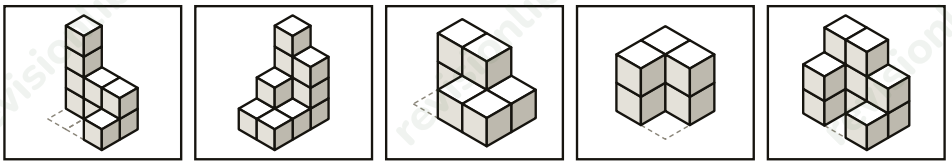




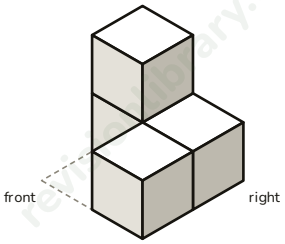
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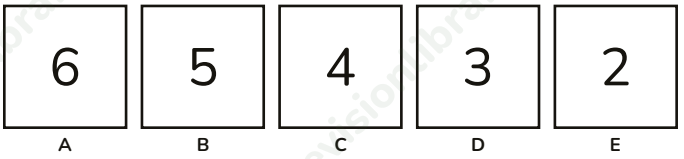
9 Rule: every cube sits on the table or on another cube (nothing floats), every stack of cubes can be seen from above in the picture (no stack is hidden behind another), and a cube you cannot see is always one that is needed to hold up the cubes you can. Which option, A to E, shows a solid made from exactly 3 more cubes than the solid shown?



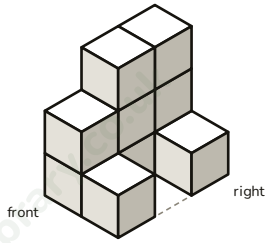


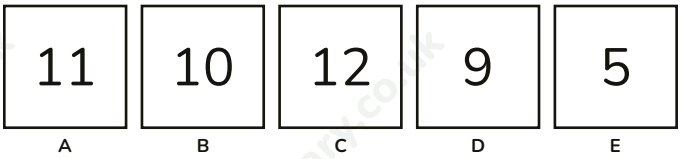
10 Rule: every cube sits on the table or on another cube (nothing floats), every stack of cubes can be seen from above in the picture (no stack is hidden behind another), and a cube you cannot see is always one that is needed to hold up the cubes you can. How many unit cubes make up this solid altogether?



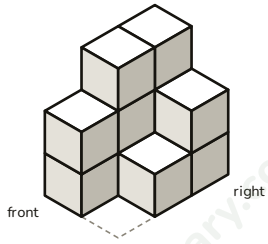


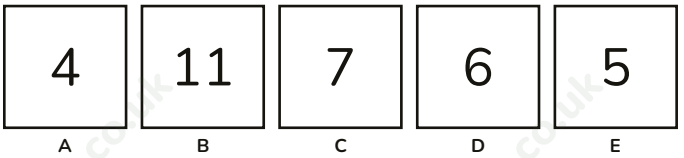
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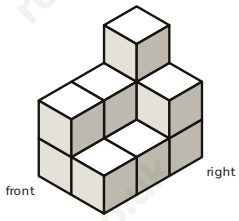


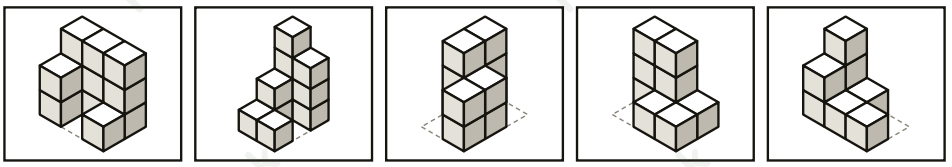
12 Rule: every cube sits on the table or on another cube (nothing floats), every stack of cubes can be seen from above in the picture (no stack is hidden behind another), and a cube you cannot see is always one that is needed to hold up the cubes you can. How many individual unit cubes are touching the table (the surface the solid stands on)?





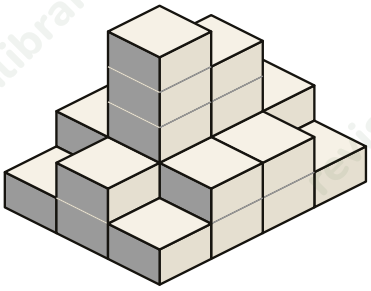
13 Rule: every cube sits on the table or on another cube (nothing floats), every stack of cubes can be seen from above in the picture (no stack is hidden behind another), and a cube you cannot see is always one that is needed to hold up the cubes you can. Which option, A to E, shows a solid made from exactly 1 fewer cube than the solid shown?

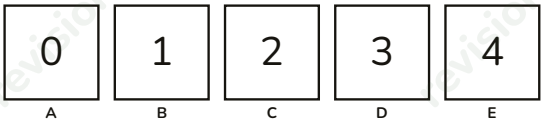




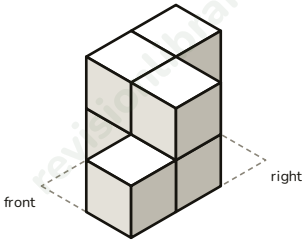
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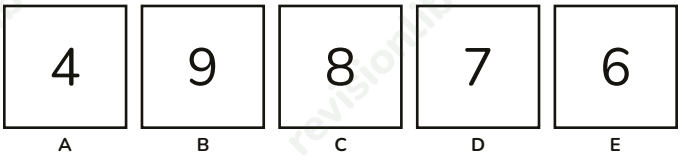
14 A unit cube counts as completely hidden if it has no visible left, right, front, back or top face - the underside resting on the table does not count. How many unit cubes in this solid are completely hidden from view?



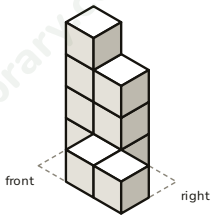


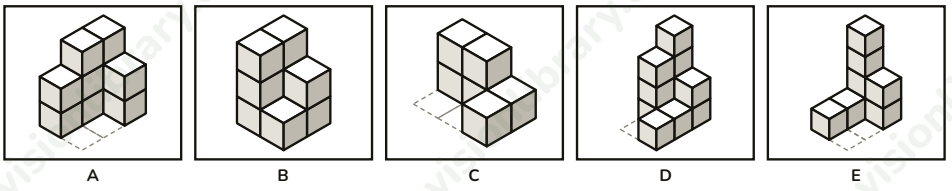
15 Rule: every cube sits on the table or on another cube (nothing floats), every stack of cubes can be seen from above in the picture (no stack is hidden behind another), and a cube you cannot see is always one that is needed to hold up the cubes you can. How many unit cubes make up this solid altogether?



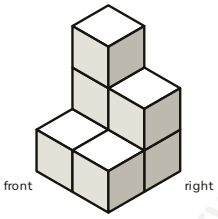


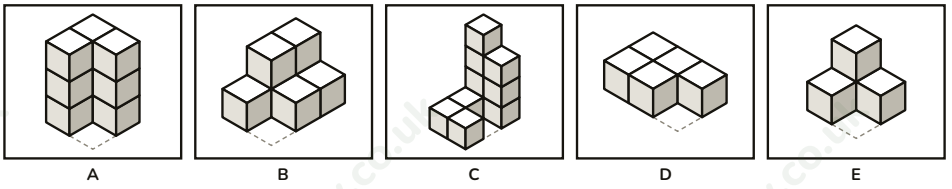
16 Rule: every cube sits on the table or on another cube (nothing floats), every stack of cubes can be seen from above in the picture (no stack is hidden behind another), and a cube you cannot see is always one that is needed to hold up the cubes you can. Which option, A to E, shows a solid made from the same number of cubes as the solid shown?



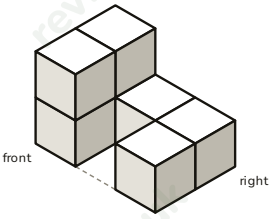


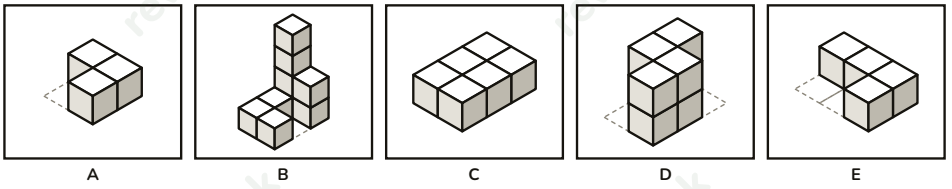
17





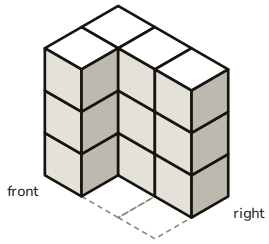
18 Rule: every cube sits on the table or on another cube (nothing floats), every stack of cubes can be seen from above in the picture (no stack is hidden behind another), and a cube you cannot see is always one that is needed to hold up the cubes you can. Which option, A to E, shows a solid made from exactly 1 fewer cube than the solid shown?





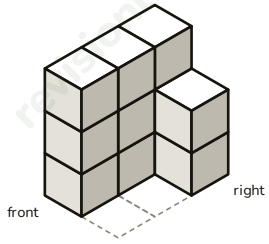
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19 Rule: every cube sits on the table or on another cube (nothing floats), every stack of cubes can be seen from above in the picture (no stack is hidden behind another), and a cube you cannot see is always one that is needed to hold up the cubes you can. How many cubes would have to be removed from this solid so that only a single layer (every stack one cube high) is left?



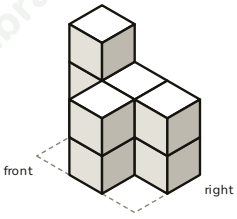
A	B	C	D	E
12	7	4	9	8

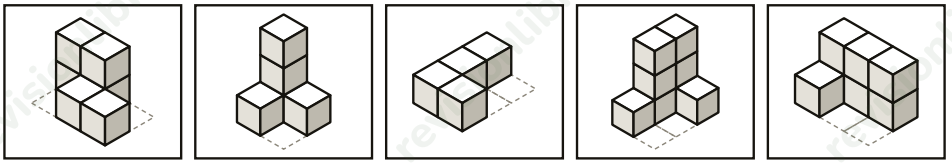
20 Rule: every cube sits on the table or on another cube (nothing floats), every stack of cubes can be seen from above in the picture (no stack is hidden behind another), and a cube you cannot see is always one that is needed to hold up the cubes you can. This solid stands inside an invisible box measuring 2 x 3 x 3 unit cubes (so a completely full box would need 18 cubes in total). How many extra unit cubes would need to be added to fill the box completely, with no gaps?



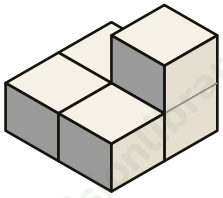
A	B	C	D	E
7	11	18	6	8

21 Rule: every cube sits on the table or on another cube (nothing floats), every stack of cubes can be seen from above in the picture (no stack is hidden behind another), and a cube you cannot see is always one that is needed to hold up the cubes you can. Which option, A to E, shows a solid made from exactly 3 fewer cubes than the solid shown?





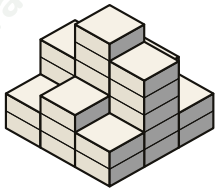
22 The solid is lifted and every outward-facing surface, including the underside, is painted red. How many unit squares (faces) are painted red in total?



A	B	C	D	E
20	21	22	23	24

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23 This solid has a tall centre column. Answer both parts about the same solid.



(a) How many unit cubes make up this solid altogether?

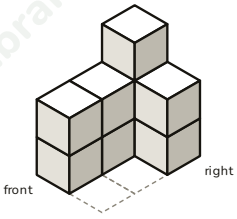
- A) 27
- B) 28
- C) 29
- D) 30
- E) 31

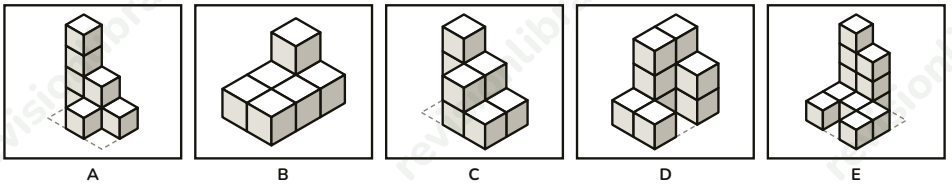
(b) A unit cube counts as completely hidden if it has no visible left, right, front, back or top face - the underside resting on the table does not count. How many unit cubes in this solid are completely hidden from view?

- A) 1
- B) 2
- C) 3
- D) 4
- E) 5

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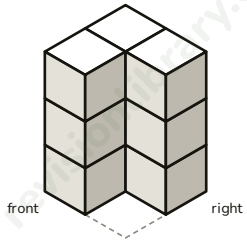
24 Rule: every cube sits on the table or on another cube (nothing floats), every stack of cubes can be seen from above in the picture (no stack is hidden behind another), and a cube you cannot see is always one that is needed to hold up the cubes you can. Which option, A to E, shows a solid made from the same number of cubes as the solid shown?

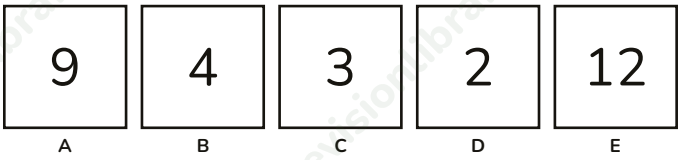




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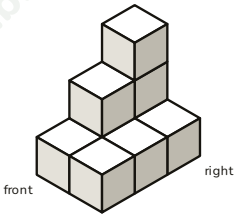
25 Rule: every cube sits on the table or on another cube (nothing floats), every stack of cubes can be seen from above in the picture (no stack is hidden behind another), and a cube you cannot see is always one that is needed to hold up the cubes you can. This solid stands inside an invisible box measuring 2 x 2 x 3 unit cubes (so a completely full box would need 12 cubes in total). How many extra unit cubes would need to be added to fill the box completely, with no gaps?

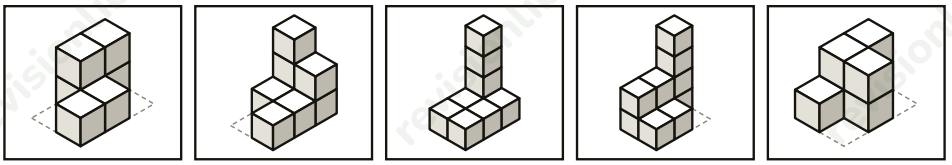




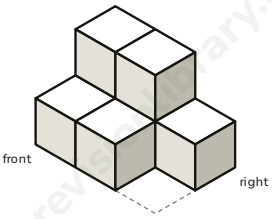
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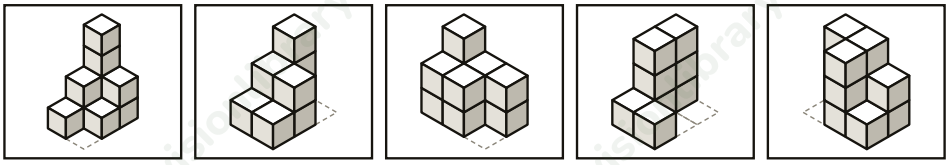
26 Rule: every cube sits on the table or on another cube (nothing floats), every stack of cubes can be seen from above in the picture (no stack is hidden behind another), and a cube you cannot see is always one that is needed to hold up the cubes you can. Which option, A to E, shows a solid made from exactly 1 fewer cube than the solid shown?



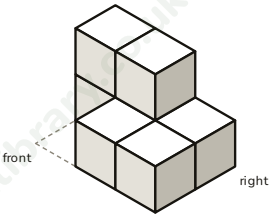


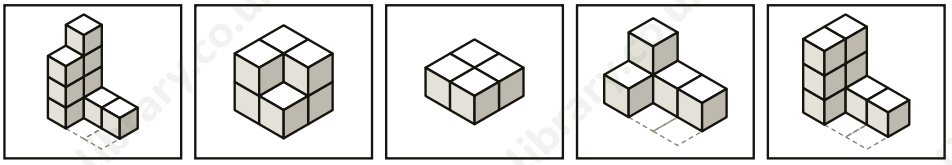
27 Rule: every cube sits on the table or on another cube (nothing floats), every stack of cubes can be seen from above in the picture (no stack is hidden behind another), and a cube you cannot see is always one that is needed to hold up the cubes you can. Which option, A to E, shows a solid made from exactly 2 more cubes than the solid shown?



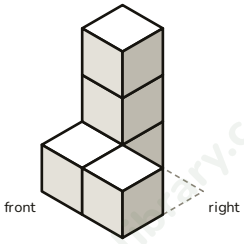


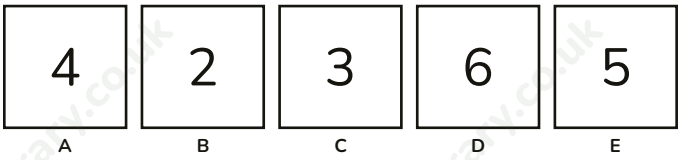
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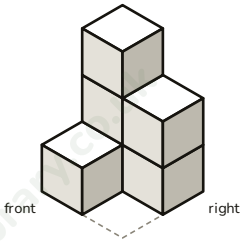


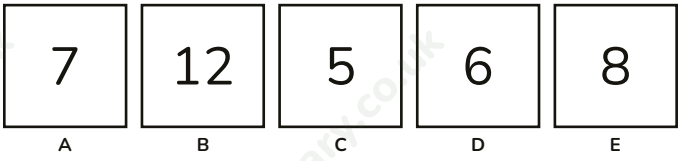
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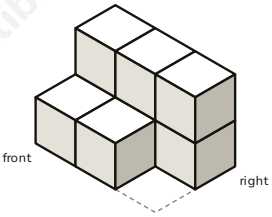
30 Rule: every cube sits on the table or on another cube (nothing floats), every stack of cubes can be seen from above in the picture (no stack is hidden behind another), and a cube you cannot see is always one that is needed to hold up the cubes you can. This solid stands inside an invisible box measuring 2 x 2 x 3 unit cubes (so a completely full box would need 12 cubes in total). How many extra unit cubes would need to be added to fill the box completely, with no gaps?

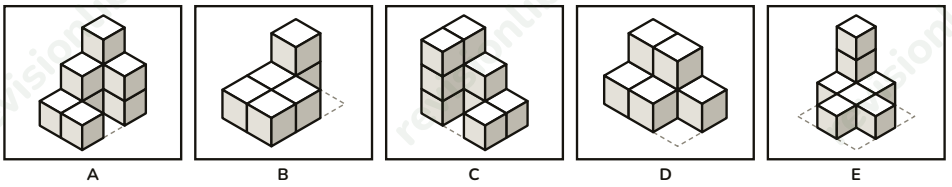




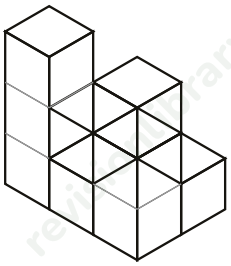
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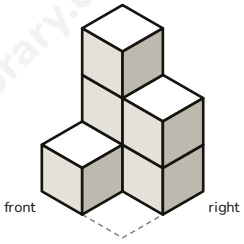


32 This solid stands inside an invisible box measuring 3 x 2 x 3 unit cubes (so a completely full box would need 18 cubes in total). How many extra unit cubes would need to be added to fill the box completely, with no gaps?



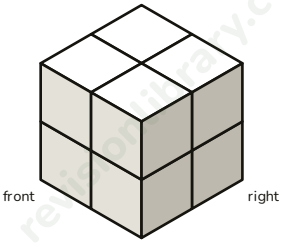
A	B	C	D	E
2	5	6	7	8

33 Rule: every cube sits on the table or on another cube (nothing floats), every stack of cubes can be seen from above in the picture (no stack is hidden behind another), and a cube you cannot see is always one that is needed to hold up the cubes you can. How many cubes would have to be removed from this solid so that only a single layer (every stack one cube high) is left?



A	B	C	D	E
2	5	6	4	3

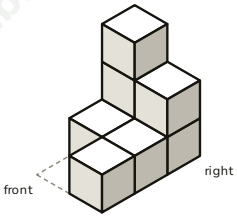
34 Rule: every cube sits on the table or on another cube (nothing floats), every stack of cubes can be seen from above in the picture (no stack is hidden behind another), and a cube you cannot see is always one that is needed to hold up the cubes you can. A unit cube counts as completely hidden if none of its faces (top, front or right) can be seen in the picture. The underside resting on the table does not count. How many unit cubes in this solid are completely hidden from view?

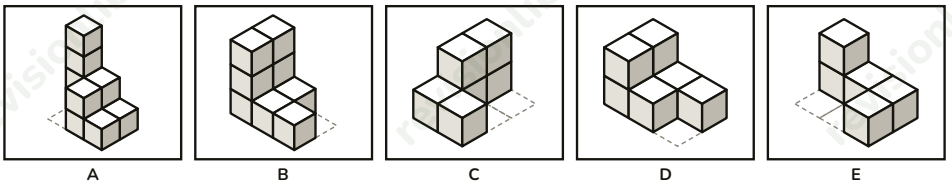


A	B	C	D	E
1	8	7	2	3

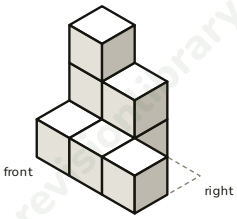
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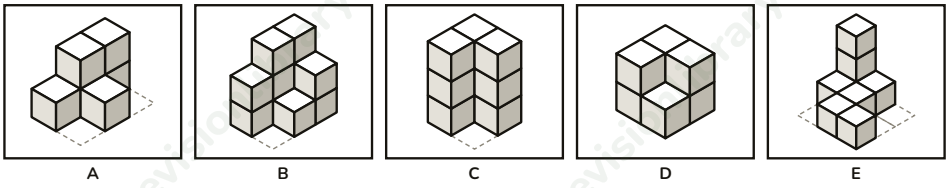
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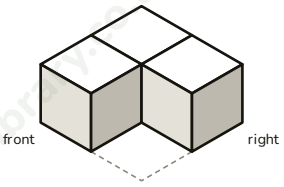


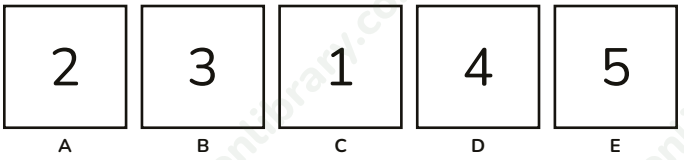
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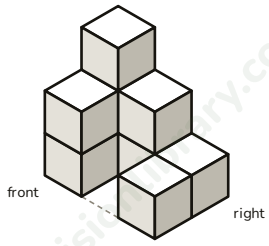


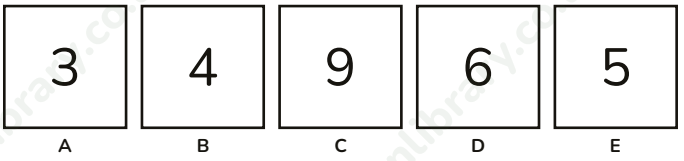
37 Rule: every cube sits on the table or on another cube (nothing floats), every stack of cubes can be seen from above in the picture (no stack is hidden behind another), and a cube you cannot see is always one that is needed to hold up the cubes you can. How many individual unit cubes are touching the table (the surface the solid stands on)?





38 Rule: every cube sits on the table or on another cube (nothing floats), every stack of cubes can be seen from above in the picture (no stack is hidden behind another), and a cube you cannot see is always one that is needed to hold up the cubes you can. How many cubes would have to be removed from this solid so that only a single layer (every stack one cube high) is left?





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Mark scheme · 4.8 3D Block Counting: Test Pack

Question 1

Correct option identified (1 oe) - only the single centre cube (B2) has all four side faces covered by neighbours, leaving just its top and bottom painted **B1**

Answer: 1

Question 2

Correct option identified (5): A cube touches the table in every grid square that is built on: 5 squares. **B1**

Answer: D) 5

Question 3

Correct option identified (13): The full box needs 24 cubes and the solid has 11, so 24 - 11 = 13. **B1**

Answer: E) 13

Question 4

Correct option identified: the stem solid has 11 cubes so the answer needs 9; the options have 10, 9, 8, 11, 7 cubes. **B1**

Answer: B) a solid built from unit cubes standing on a flat table, isometric view from the front-right-top. Base grid: 3 columns (A, B, C) by 2 rows (row 1 nearest the viewer). Stack heights - Row 1: A = 1, B = 0, C = 2; Row 2: A = 2, B = 2, C = 2. A height of 0 means that grid square is bare table.

Question 5

Correct option identified: the stem solid has 9 cubes so the answer needs 6; the options have 6, 8, 7, 4, 5 cubes. **B1**

Answer: A) a solid built from unit cubes standing on a flat table, isometric view from the front-right-top. Base grid: 2 columns (A, B) by 2 rows (row 1 nearest the viewer). Stack heights - Row 1: A = 2, B = 0; Row 2: A = 2, B = 2. A height of 0 means that grid square is bare table.

Question 6

Correct option identified (5 oe) - five of the eight grid squares are occupied (A1, A2, B2, C2, D2) **B1**

Answer: 5

Question 7

Correct option identified (3): A cube touches the table in every grid square that is built on: 3 squares. **B1**

Answer: C) 3

Question 8

Correct option identified: the stem solid has 7 cubes so the answer needs 7; the options have 8, 7, 5, 4, 9 cubes. **B1**

Answer: B) a solid built from unit cubes standing on a flat table, isometric view from the front-right-top. Base grid: 2 columns (A, B) by 2 rows (row 1 nearest the viewer). Stack heights - Row 1: A = 0, B = 1; Row 2: A = 3, B = 3. A height of 0 means that grid square is bare table.

Question 9

Correct option identified: the stem solid has 6 cubes so the answer needs 9; the options have 9, 12, 7, 6, 11 cubes. **B1**

Answer: A) a solid built from unit cubes standing on a flat table, isometric view from the front-right-top. Base grid: 3 columns (A, B, C) by 2 rows (row 1 nearest the viewer). Stack heights - Row 1: A = 0, B = 0, C = 1; Row 2: A = 4, B = 2, C = 2. A height of 0 means that grid square is bare table.

Question 10

Correct option identified (4): Count each stack: the heights add up to 4, including the cubes you cannot see. **B1**

Answer: C) 4

Question 11

Correct option identified (10): Count each stack: the heights add up to 10, including the cubes you cannot see. **B1**

Answer: B) 10

Question 12

Correct option identified (5): A cube touches the table in every grid square that is built on: 5 squares. **B1**

Answer: E) 5

Question 13

Correct option identified: the stem solid has 11 cubes so the answer needs 10; the options have 12, 11, 10, 9, 8 cubes. **B1**

Answer: C) a solid built from unit cubes standing on a flat table, isometric view from the front-right-top. Base grid: 2 columns (A, B) by 3 rows (row 1 nearest the viewer). Stack heights - Row 1: A = 0, B = 2; Row 2: A = 3, B = 2; Row 3: A = 3, B = 0. A height of 0 means that grid square is bare table.

Question 14

Correct option identified (4 oe) - the bottom two levels of both interior stacks (B2 and C2) are hidden, giving 2 + 2 = 4 **B1**

Answer: 4

Question 15

Correct option identified (7): Count each stack: the heights add up to 7, including the cubes you cannot see. **B1**

Answer: D) 7

Question 16

Correct option identified: the stem solid has 9 cubes so the answer needs 9; the options have 10, 9, 6, 11, 8 cubes. **B1**

Answer: B) a solid built from unit cubes standing on a flat table, isometric view from the front-right-top. Base grid: 2 columns (A, B) by 2 rows (row 1 nearest the viewer). Stack heights - Row 1: A = 3, B = 1; Row 2: A = 3, B = 2. A height of 0 means that grid square is bare table.

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Question 17

Correct option identified: the stem solid has 7 cubes so the answer needs 7; the options have 9, 7, 10, 5, 4 cubes. **B1**

Answer: B) a solid built from unit cubes standing on a flat table, isometric view from the front-right-top. Base grid: 2 columns (A, B) by 3 rows (row 1 nearest the viewer). Stack heights - Row 1: A = 1, B = 0; Row 2: A = 2, B = 1; Row 3: A = 2, B = 1. A height of 0 means that grid square is bare table.

Question 18

Correct option identified: the stem solid has 7 cubes so the answer needs 6; the options have 3, 9, 6, 8, 4 cubes. **B1**

Answer: C) a solid built from unit cubes standing on a flat table, isometric view from the front-right-top. Base grid: 2 columns (A, B) by 3 rows (row 1 nearest the viewer). Stack heights - Row 1: A = 1, B = 1; Row 2: A = 1, B = 1; Row 3: A = 1, B = 1. A height of 0 means that grid square is bare table.

Question 19

Correct option identified (8): Each of the 4 stacks keeps 1 cube: 12 - 4 = 8 to remove. **B1**

Answer: E) 8

Question 20

Correct option identified (7): The full box needs 18 cubes and the solid has 11, so 18 - 11 = 7. **B1**

Answer: A) 7

Question 21

Correct option identified: the stem solid has 9 cubes so the answer needs 6; the options have 6, 5, 4, 8, 7 cubes. **B1**

Answer: A) a solid built from unit cubes standing on a flat table, isometric view from the front-right-top. Base grid: 3 columns (A, B, C) by 2 rows (row 1 nearest the viewer). Stack heights - Row 1: A = 0, B = 1, C = 1; Row 2: A = 2, B = 2, C = 0. A height of 0 means that grid square is bare table.

Question 22

Correct option identified (20 oe) - adding the exposed faces of all five cubes gives 4 + 4 + 4 + 3 + 5 = 20 **B1**

Answer: 20

Question 23

(a) Correct option identified (29 oe) - the three row totals 7, 15 and 7 sum to 29 **B1**

(a) Answer: 29

(b) Correct option identified (3 oe) - the bottom three cubes of the centre (B2) stack are each surrounded on all four sides and covered from above **B1**

(b) Answer: 3

Question 24

Correct option identified: the stem solid has 9 cubes so the answer needs 9; the options have 8, 7, 9, 10, 12 cubes. **B1**

Answer: C) a solid built from unit cubes standing on a flat table, isometric view from the front-right-top. Base grid: 3 columns (A, B, C) by 2 rows (row 1 nearest the viewer). Stack heights - Row 1: A = 0, B = 2, C = 1; Row 2: A = 3, B = 2, C = 1. A height of 0 means that grid square is bare table.

Question 25

Correct option identified (3): The full box needs 12 cubes and the solid has 9, so 12 - 9 = 3. **B1**

Answer: C) 3

Question 26

Correct option identified: the stem solid has 9 cubes so the answer needs 8; the options have 6, 8, 9, 10, 7 cubes. **B1**

Answer: B) a solid built from unit cubes standing on a flat table, isometric view from the front-right-top. Base grid: 2 columns (A, B) by 3 rows (row 1 nearest the viewer). Stack heights - Row 1: A = 0, B = 1; Row 2: A = 1, B = 1; Row 3: A = 3, B = 2. A height of 0 means that grid square is bare table.

Question 27

Correct option identified: the stem solid has 7 cubes so the answer needs 9; the options have 10, 9, 11, 8, 12 cubes. **B1**

Answer: B) a solid built from unit cubes standing on a flat table, isometric view from the front-right-top. Base grid: 2 columns (A, B) by 3 rows (row 1 nearest the viewer). Stack heights - Row 1: A = 1, B = 1; Row 2: A = 2, B = 2; Row 3: A = 3, B = 0. A height of 0 means that grid square is bare table.

Question 28

Correct option identified: the stem solid has 7 cubes so the answer needs 7; the options have 9, 7, 4, 5, 8 cubes. **B1**

Answer: B) a solid built from unit cubes standing on a flat table, isometric view from the front-right-top. Base grid: 2 columns (A, B) by 2 rows (row 1 nearest the viewer). Stack heights - Row 1: A = 2, B = 1; Row 2: A = 2, B = 2. A height of 0 means that grid square is bare table.

Question 29

Correct option identified (3): A cube touches the table in every grid square that is built on: 3 squares. **B1**

Answer: C) 3

Question 30

Correct option identified (6): The full box needs 12 cubes and the solid has 6, so 12 - 6 = 6. **B1**

Answer: D) 6

Question 31

Correct option identified: the stem solid has 8 cubes so the answer needs 9; the options have 9, 6, 10, 7, 8 cubes. **B1**

Answer: A) a solid built from unit cubes standing on a flat table, isometric view from the front-right-top. Base grid: 2 columns (A, B) by 3 rows (row 1 nearest the viewer). Stack heights - Row 1: A = 1, B = 1; Row 2: A = 2, B = 0; Row 3: A = 3, B = 2. A height of 0 means that grid square is bare table.

Question 32

Correct option identified (8 oe) - the solid uses 10 cubes, so 18 minus 10 leaves 8 cubes needed to complete the box **B1**

Answer: 8

Question 33

Correct option identified (3): Each of the 3 stacks keeps 1 cube: 6 - 3 = 3 to remove. **B1**

Answer: E) 3

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Question 34

Correct option identified (1): 1 of the 8 cubes has no face showing. **B1**

Answer: A) 1

Question 35

Correct option identified: the stem solid has 8 cubes so the answer needs 7; the options have 10, 9, 6, 7, 5 cubes. **B1**

Answer: D) a solid built from unit cubes standing on a flat table, isometric view from the front-right-top. Base grid: 3 columns (A, B, C) by 2 rows (row 1 nearest the viewer). Stack heights - Row 1: A = 2, B = 1, C = 0; Row 2: A = 2, B = 1, C = 1. A height of 0 means that grid square is bare table.

Question 36

Correct option identified: the stem solid has 8 cubes so the answer needs 8; the options have 6, 11, 9, 7, 8 cubes. **B1**

Answer: E) a solid built from unit cubes standing on a flat table, isometric view from the front-right-top. Base grid: 3 columns (A, B, C) by 3 rows (row 1 nearest the viewer). Stack heights - Row 1: A = 0, B = 1, C = 1; Row 2: A = 1, B = 1, C = 0; Row 3: A = 3, B = 1, C = 0. A height of 0 means that grid square is bare table.

Question 37

Correct option identified (3): A cube touches the table in every grid square that is built on: 3 squares. **B1**

Answer: B) 3

Question 38

Correct option identified (4): Each of the 5 stacks keeps 1 cube: 9 - 5 = 4 to remove. **B1**

Answer: B) 4

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