4.8 3D Block Counting: 30-minute Pack

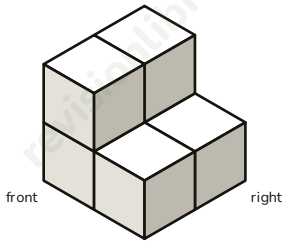
GL ASSESSMENT GL-EP.N10 · Calculators not allowed · about 30 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

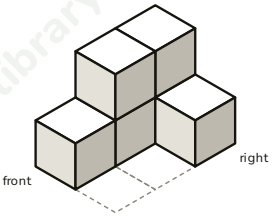
Answer ALL questions. Show all your working.

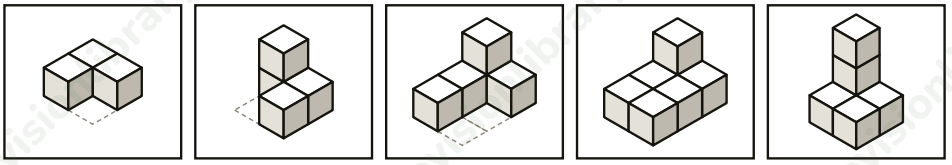
1 Rule: every cube sits on the table or on another cube (nothing floats), every stack of cubes can be seen from above in the picture (no stack is hidden behind another), and a cube you cannot see is always one that is needed to hold up the cubes you can. This solid stands inside an invisible box measuring 2 x 2 x 2 unit cubes (so a completely full box would need 8 cubes in total). How many extra unit cubes would need to be added to fill the box completely, with no gaps?



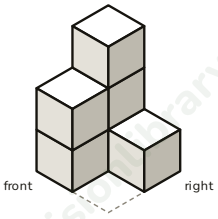
A	B	C	D	E
1	3	2	8	6

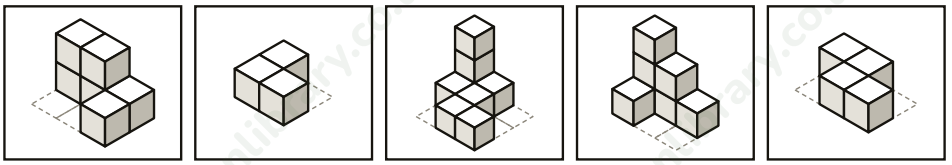
2 Rule: every cube sits on the table or on another cube (nothing floats), every stack of cubes can be seen from above in the picture (no stack is hidden behind another), and a cube you cannot see is always one that is needed to hold up the cubes you can. Which option, A to E, shows a solid made from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





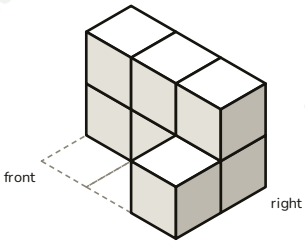
3 Rule: every cube sits on the table or on another cube (nothing floats), every stack of cubes can be seen from above in the picture (no stack is hidden behind another), and a cube you cannot see is always one that is needed to hold up the cubes you can. Which option, A to E, shows a solid made from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





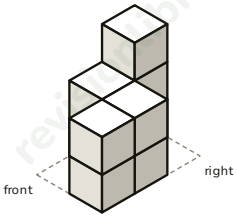
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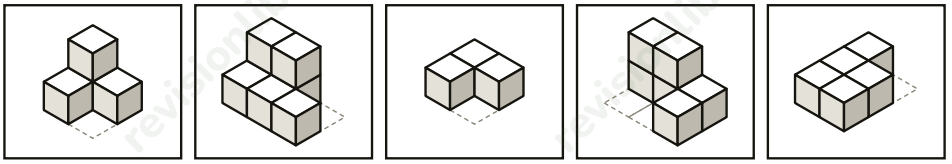
4 Rule: every cube sits on the table or on another cube (nothing floats), every stack of cubes can be seen from above in the picture (no stack is hidden behind another), and a cube you cannot see is always one that is needed to hold up the cubes you can. How many cubes would have to be removed from this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



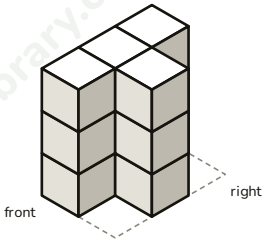
A	B	C	D	E
7	2	4	5	3

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?



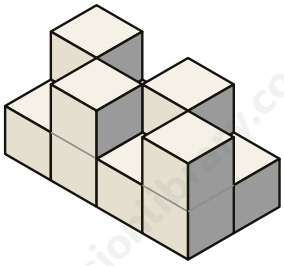


6 Rule: every cube sits on the table or on another cube (nothing floats), every stack of cubes can be seen from above in the picture (no stack is hidden behind another), and a cube you cannot see is always one that is needed to hold up the cubes you can. How many individual unit cubes are touching the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



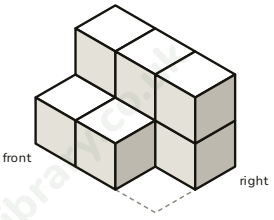
A	B	C	D	E
3	6	5	12	4

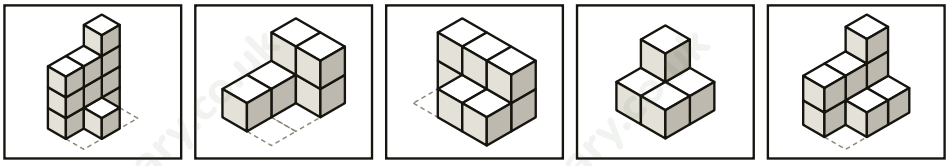
7 How many unit cubes make up this solid altogether?



A	B	C	D	E
9	10	11	12	13

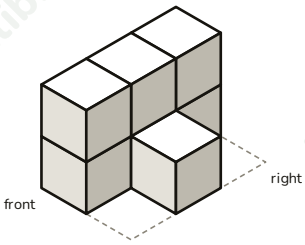
8 Rule: every cube sits on the table or on another cube (nothing floats), every stack of cubes can be seen from above in the picture (no stack is hidden behind another), and a cube you cannot see is always one that is needed to hold up the cubes you can. Which option, A to E, shows a solid made from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





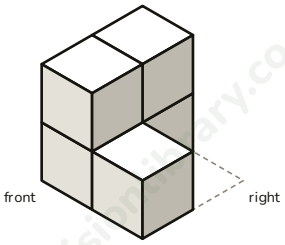
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9 Rule: every cube sits on the table or on another cube (nothing floats), every stack of cubes can be seen from above in the picture (no stack is hidden behind another), and a cube you cannot see is always one that is needed to hold up the cubes you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



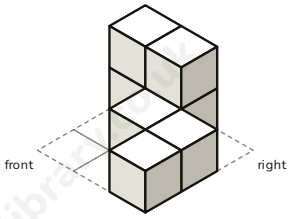
A	B	C	D	E
7	4	6	3	5

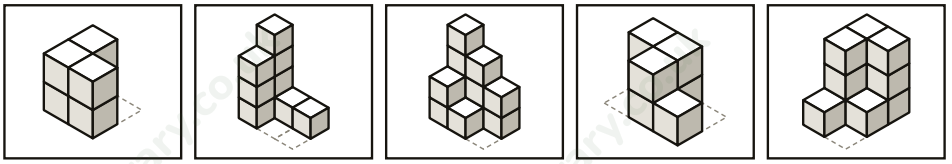
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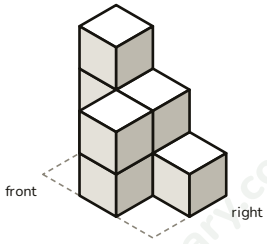
A	B	C	D	E
1	4	3	5	2

11 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?



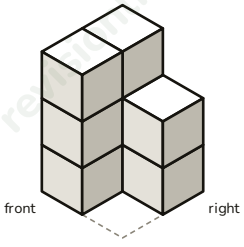


12 Rule: every cube sits on the table or on another cube (nothing floats), every stack of cubes can be seen from above in the picture (no stack is hidden behind another), and a cube you cannot see is always one that is needed to hold up the cubes you can. How many unit cubes make up this solid altogether?



A	B	C	D	E
9	4	7	10	8

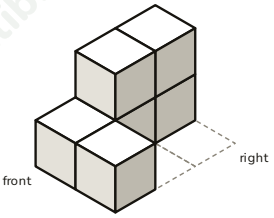
13

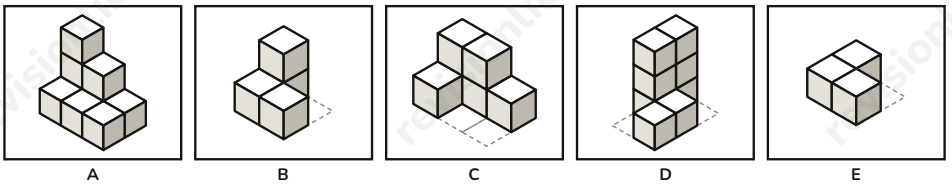


A	B	C	D	E
7	3	9	8	6

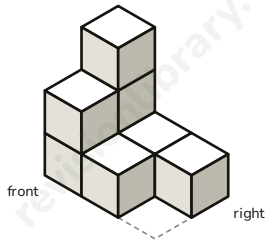
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14 Rule: every cube sits on the table or on another cube (nothing floats), every stack of cubes can be seen from above in the picture (no stack is hidden behind another), and a cube you cannot see is always one that is needed to hold up the cubes you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



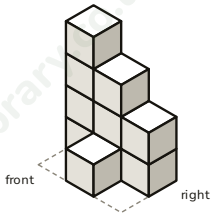


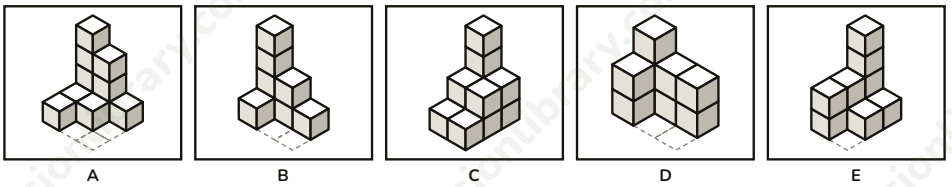
15 Rule: every cube sits on the table or on another cube (nothing floats), every stack of cubes can be seen from above in the picture (no stack is hidden behind another), and a cube you cannot see is always one that is needed to hold up the cubes you can. How many unit cubes make up this solid altogether?



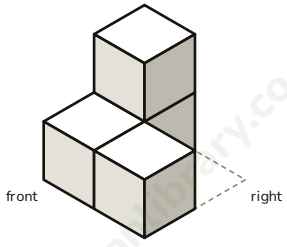
A	B	C	D	E
8	7	5	10	9

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?



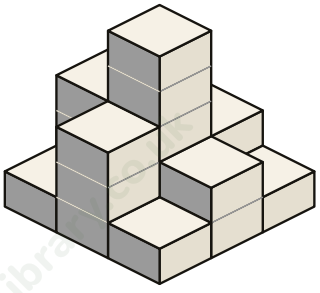


17 Rule: every cube sits on the table or on another cube (nothing floats), every stack of cubes can be seen from above in the picture (no stack is hidden behind another), and a cube you cannot see is always one that is needed to hold up the cubes you can. How many individual unit cubes are touching the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



A	B	C	D	E
5	3	2	4	1

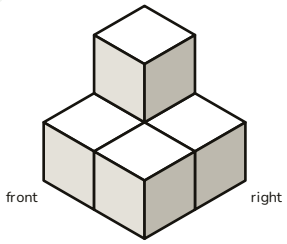
18 A unit cube counts as completely hidden if it has no visible left, right, front, back or top face - the underside resting on the table does not count. How many unit cubes in this solid are completely hidden from view?



A	B	C	D	E
0	1	2	3	4

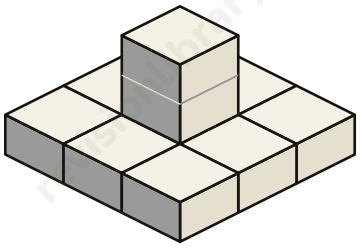
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19 Rule: every cube sits on the table or on another cube (nothing floats), every stack of cubes can be seen from above in the picture (no stack is hidden behind another), and a cube you cannot see is always one that is needed to hold up the cubes you can. This solid stands inside an invisible box measuring 2 x 2 x 2 unit cubes (so a completely full box would need 8 cubes in total). How many extra unit cubes would need to be added to fill the box completely, with no gaps?



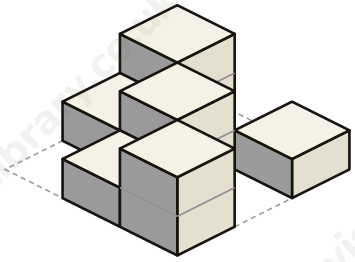
A	B	C	D	E
3	5	2	4	8

20 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 4 painted faces?



A	B	C	D	E
3	4	5	6	7

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



A	B	C	D	E
6	7	8	9	10

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Mark scheme · 4.8 3D Block Counting: 30-minute Pack

Question 1

Correct option identified (2): The full box needs 8 cubes and the solid has 6, so 8 - 6 = 2. **B1**

Answer: C) 2

Question 2

Correct option identified: the stem solid has 6 cubes so the answer needs 4; the options have 3, 4, 5, 7, 6 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 = 2, B = 1. A height of 0 means that grid square is bare table.

Question 3

Correct option identified: the stem solid has 6 cubes so the answer needs 6; the options have 6, 3, 8, 7, 4 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 = 2, B = 2, C = 1. A height of 0 means that grid square is bare table.

Question 4

Correct option identified (3): Each of the 4 stacks keeps 1 cube: 7 - 4 = 3 to remove. **B1**

Answer: E) 3

Question 5

Correct option identified: the stem solid has 9 cubes so the answer needs 6; the options have 4, 7, 3, 6, 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 = 0, B = 0, C = 1; Row 2: A = 2, B = 2, C = 1. A height of 0 means that grid square is bare table.

Question 6

Correct option identified (4): A cube touches the table in every grid square that is built on: 4 squares. **B1**

Answer: E) 4

Question 7

Correct option identified (12 oe) - each row of stack heights sums to 6, and 6 + 6 = 12 **B1**

Answer: 12

Question 8

Correct option identified: the stem solid has 8 cubes so the answer needs 8; the options have 11, 6, 8, 5, 9 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 = 1, C = 1; Row 2: A = 2, B = 2, C = 2. A height of 0 means that grid square is bare table.

Question 9

Correct option identified (4): A cube touches the table in every grid square that is built on: 4 squares. **B1**

Answer: B) 4

Question 10

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

Answer: C) 3

Question 11

Correct option identified: the stem solid has 7 cubes so the answer needs 9; the options have 6, 9, 12, 7, 11 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 = 3, B = 0, C = 0; Row 2: A = 4, B = 1, C = 1. A height of 0 means that grid square is bare table.

Question 12

Correct option identified (8): Count each stack: the heights add up to 8, including the cubes you cannot see. **B1**

Answer: E) 8

Question 13

Correct option identified (8): Count each stack: the heights add up to 8, including the cubes you cannot see. **B1**

Answer: D) 8

Question 14

Correct option identified: the stem solid has 6 cubes so the answer needs 6; the options have 9, 4, 6, 8, 3 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 = 1, B = 0, C = 0; Row 2: A = 2, B = 2, C = 1. A height of 0 means that grid square is bare table.

Question 15

Correct option identified (8): Count each stack: the heights add up to 8, including the cubes you cannot see. **B1**

Answer: A) 8

Question 16

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

Answer: E) 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 = 2, B = 0; Row 2: A = 2, B = 1; Row 3: A = 4, B = 1. A height of 0 means that grid square is bare table.

Question 17

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

Answer: B) 3

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Question 18

Correct option identified (2 oe) - the shortest neighbour of the centre stack limits full cover to only the bottom two levels **B1**

Answer: 2

Question 19

Correct option identified (3): The full box needs 8 cubes and the solid has 5, so 8 - 5 = 3. **B1**

Answer: A) 3

Question 20

Correct option identified (5 oe) - the four corner cubes of the flat layer plus the middle cube of the centre tower each end up with exactly 4 painted faces **B1**

Answer: 5

Question 21

Correct option identified (6 oe) - six of the nine grid squares are occupied (A1, C1, A2, B2, B3, C3) **B1**

Answer: 6

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