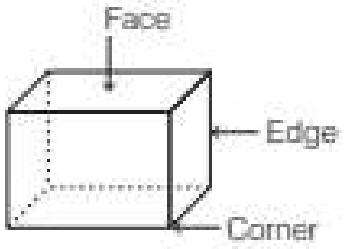
CHAPTER 15

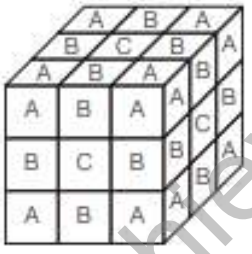
Cube and Dice

Cube- A cube is a three dimensional solid object bounded by six square faces



A cube has 6 faces, 8 corners and 12 edges.

If a larger cube is cut into smaller cubes of equal volume so that each edge is divided into n parts, then



- Number of smaller cubes $= (n)^3$

  where, $n = \dfrac{\text{Edge of larger cube}}{\text{Edge of smaller cube}}$

- Number of corner cubes (exist at each corner) = A = 8

- Number of middle cubes (exist at middle of each edge)

  $= B = 12 (2 – n)$

- Number of central cubes (exist at centre of each face)

  $= C = 6(n - 2)^2$

- Number of nucleus cube/Inner Central Cube (hidden and exist at centre of large cube)

  $= D = (n - 2)^3$

Note: When a large cube is painted with some colour and then divided into smaller cubes of equal size, then after separation, number of smaller cubes so obtained are as follows,

Number of smaller cubes with 3 sides painted = Number of corner cubes

Number of smaller cubes with 2 sides painted = Number of middle cubes

Number of smaller cubes with 1 side painted = Number of central cubes

Number of cubes with no side painted = Number of nucleus or Inner central cubes.

Example 1: How many smaller cubes of 1 cm side can be formed with a solid cube of 3 cm side ?

(a) 3 (b) 6 (c) 9 (d) 27

Sol. (d) Required number of smaller cubes

$$= \frac{\text{Volume of bigger cube}}{\text{Volume of smaller cube}} = \frac{(3)^3}{(1)^3} = (3)^3 = 27$$

Example 2: A cube is colored red on all its faces. It is then cut into 64 smaller cubes of equal size. The smaller cubes so obtained are separated. How many cubes have no faces colored?

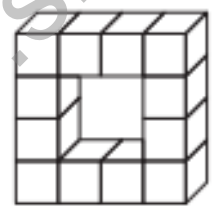
(a) 24 (b) 16 (c) 8 (d) 10

Sol. (c) Number of smaller cubes $= n^3 = 64 \Rightarrow n = \sqrt[3]{64} = 4$

Now, cubes with no painted surface are inner central cubes or nucleus cubes.

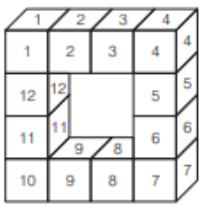
$\therefore$ Number of nucleus cubes $= (n-2)^3 = (4-2)^3 = 8$

Example 3: How many cubes are there in this diagram?



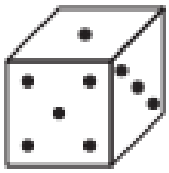
(a) 16 (b) 12 (c) 10 (d) 8

Sol. (b)



So, there are 12 cubes in the given figure, which are illustrated above.

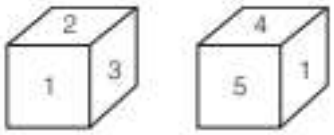
Dice- A dice is a three dimensional figure with 6 square faces.



There are two types of dice:

(a) When the common digit is on different faces- when the common digit is on different faces, then list these digits in clockwise direction starting from common digit and then compare them.

e.g.



Here, 1 is common in both position. So move in, clockwise direction starting from 1.

We get, 1→ 2 → 3

1 → 5 → 4

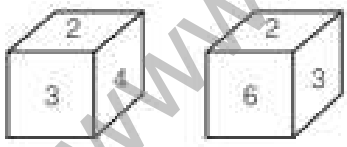
So, 3 is opposite to 4

2 is opposite to 5

and 1 is opposite to 6

(b) When two digits are common

e.g.

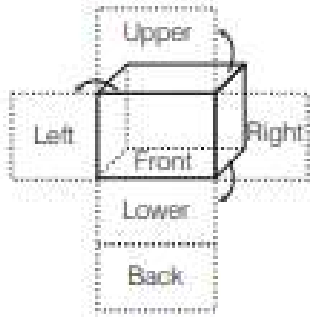


Here, uncommon digits in each dice are opposite to each other.

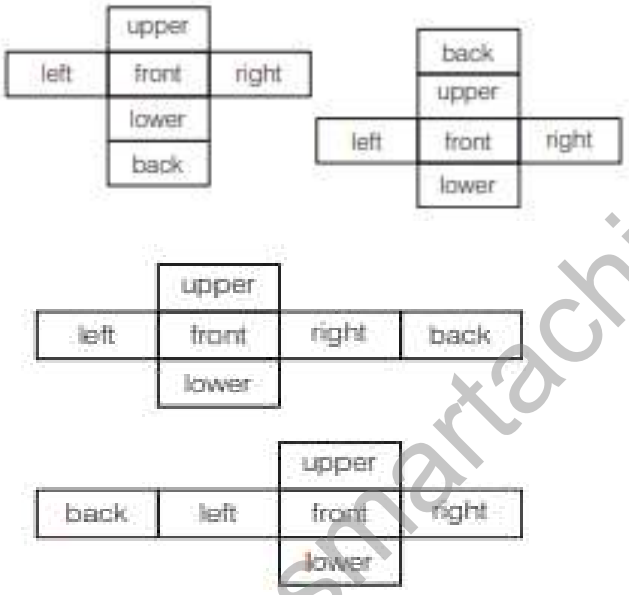
So, 4 is opposite to 6

and 3/2 is opposite to 1/5

Spread out Form of a Dice- The spread out form of a dice is shown on the basis of the front side of the dice.

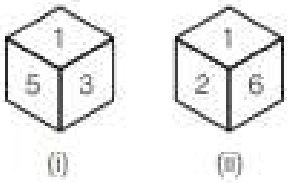


One can unfold a dice in many ways, some of which are given below.



Here, Upper face is opposite to Lower face. Front face is opposite to Back face, and Right face is opposite to Left face.

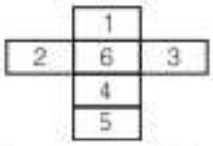
Example 4: What number will come at the opposite face of 1 in the following dice?



(a) 4 (b) 5 (c) 3 (d) 2

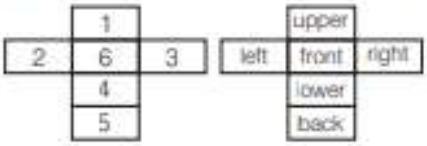
Sol. (a) The adjacent faces of '1' are 2, 3, 5 and 6. So, the remaining face containing number '4' will be opposite to '1'.

Example 5: When the following figure is folded to form a cube, then which number will be opposite to 1?



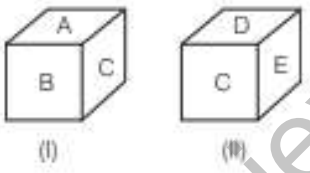
(a) 6 (b) 4 (c) 5 (d) 3

Sol. (b)



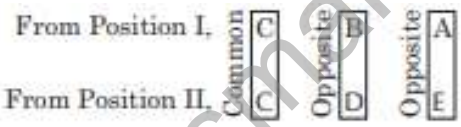
We know that upper face is opposite to lower face. So, 1 is opposite to 4.

Example 6: On the basis of the given two positions of single dice, find the letter at the face opposite to the face having letter A.



(a) B (b) C (c) E (d) D

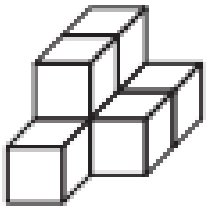
Sol. (c) Common letter = C (on different face)



Clearly, E is opposite to A.

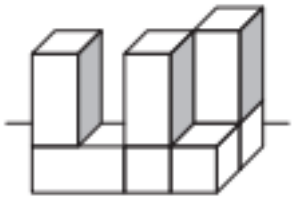
Practice Questions

1. How many cubes are there in the given figure?



(a) 3 (b) 5 (c) 7 (d) 13

2. Count the number of blocks in the given figure.



(a) 7 (b) 11 (c) 13 (d) 15

3. A cube of 3 cm side is divided into smaller cubes of side 1 cm. What will be the total number of middle cubes?

(a) 6 (b) 12 (c) 18 (d) 24

4. If a cube of 12 cm side is divided into smaller cubes of 3 cm side, then find the total number of inner central cubes?

(a) 18 (b) 9 (c) 8 (d) 81

5. A cube having 24 cm side is divided into 64 smaller cubes of equal volume. Find the edge of smaller cubes?

(a) 5 cm (b) 6 cm (c) 3 cm (d) 4 cm

Directions (Q.Nos. 6-8) Read the given information carefully and answer the questions that follow. All the surfaces of a cube of side 15 cm are painted with red colour and then it is cut into smaller cubes of side 3 cm. The smaller cubes so obtained are separated.

6. How many smaller cubes are there having two surfaces painted with red colour?

(a) 8 (b) 24 (c) 36 (d) 54

7. How many smaller cubes are there having only three surfaces painted with red colour?

(a) 8 (b) 10 (c) 32 (d) 64

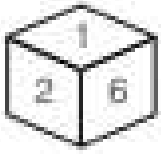
8. How many smaller cubes are there having 4 or more faces painted with red colour?

(a) 8 (b) 0 (c) 4 (d) 2

9. Find the digit at the face opposite to the face having digit 4 in the given dice.

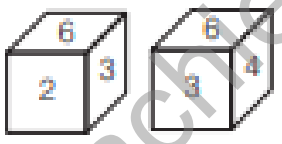
(a) 2 (b) 6/2 (c) 5 (d) 3

10. Find the digit at the face opposite to the face having digit 2 in the dice given below.



(a) 3, 4 (b) 3, 5 (c) 4, 5 (d) 3, 4, 5

11. Two positions of a dice are given. Based on them, find out which number is opposite to number 4 in that dice?

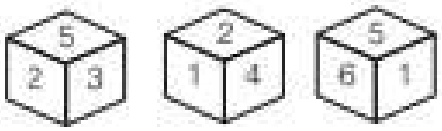


(a) 1 (b) 2 (c) 3 (d) 4

12. From the given two positions of a single dice, find the digit at the face opposite to the face having digit 2.

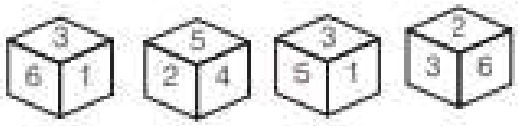
(a) 4 (b) 5 (c) 3 (d) 1

13. Which number is on the face opposite to face having number 1?



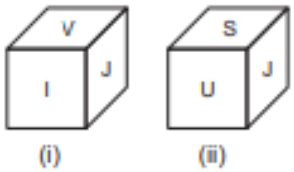
(a) 2 (b) 3 (c) 4 (d) 5

14. Which number is on the face opposite to face having number 3?



(a) 2 (b) 3 (c) 4 (d) 6

15. From the given two positions of a single dice, find the letter at the face opposite to the face having letter V.

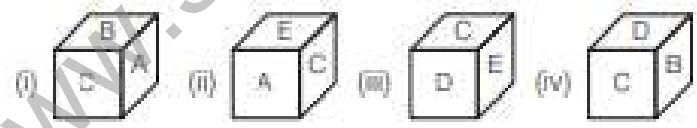


(a) S (b) U (c) J (d) I

16. From the given four positions of a single dice, find the color at the face opposite to the face having green.

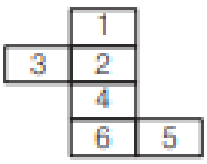
(a) Orange (b) Red (c) Silver (d) Violet

17. Four positions of dice are given below. Which letter will be opposite to D ?



(a) E (b) B (c) A (d) C

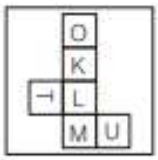
18. When the following figure is folded to form a dice, then which number will be opposite to 5?



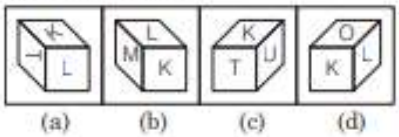
(a) 1 (b) 2 (c) 3 (d) 4

19. Choose the cube which will be formed on folding the question figure.

Question figure



Answer figures



(a) (b) (c) (d)

ANSWERS

1.	(c)	**2.**	(a)	**3.**	(b)	**4.**	(c)	**5.**	(b)	**6.**	(c)	**7.**	(a)	**8.**	(b)	**9.**	(d)	**10.**	(d)
11.	(b)	**12.**	(d)	**13.**	(b)	**14.**	(c)	**15.**	(a)	**16.**	(d)	**17.**	(c)	**18.**	(c)	**19.**	(a)		

Hints & Solutions:

1. (c) Number of cubes in upper row = 2

Number of cubes at the bottom = 5

∴ Total cubes = 2 + 5 = 7

2. (a) Number of blocks at the top = 3

Number of blocks at bottom = 4

∴ Total blocks = 3 + 4 = 7

3. (b) Number of middle cubes = 12 (n – 2)

$$= 12\left(\frac{3}{1} - 2\right) = 12 \times 1 = 12$$

4. (c) Total number of inner central cubes

$$= (n-2)^3 = \left(\frac{12}{3} - 2\right)^3 = (2)^3 = 8$$

5. (b) We know that

$$\text{Number of smaller cubes} = n^3 = 64$$

$$\Rightarrow \quad n = \sqrt[3]{64} = 4$$

$$\text{Also,} \quad n = \frac{\text{Edge of bigger cube}}{\text{Edge of smaller cube}}$$

$$\Rightarrow \text{Edge of smaller cube} = \frac{24}{4} = 6 \text{ cm}$$

Sol. (Q. Nos. 6-8)

6. (c) We know that

$$n = \frac{\text{Side of bigger cube}}{\text{Side of smaller cube}} = \frac{15}{3} = 5$$

7. (a) Smaller cubes having 3 surface painted

= Number of corner cubes = 8

8. (b) There is no such cube with 4 or more faces painted.

9. (d) Here, the sum of adjacent faces.

5 +4 = 9 ; 5 + 1 = 6

1 + 4 = 5 [not equal to 7]

Hence, it is a standard dice.

Now, in a standard dice, sum of opposite faces is 7. Hence, 4 is opposite to 3.

10. (d) Here, the sum of adjacent faces

2 + 1 = 3, 2 + 6 = 8 , 1+ 6 = 7

Hence, it is a general dice.

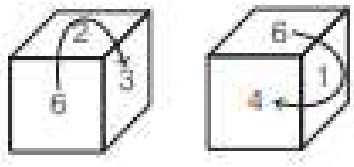
Digits at the opposite face of 2 = 3 , 4 or 5.

11. (b) In the given two figures, two numbers are common, i.e. 3 and 6.

So, remaining two numbers are opposite to each other .

Hence, 2 is opposite to 4.

12. (d) In both the positions, 6 is common.



Moving in clockwise direction from 6, we get

$6 \rightarrow 2 \rightarrow 3$

$6 \rightarrow 1 \rightarrow 4$

Hence, 1 is opposite to 2.

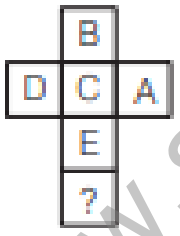
13. (b) The numbers 2, 4, 5 and 6 are on the surfaces adjacent to 1. Hence, 3 is opposite to 1.

14. (c) Figure (i), (iii) and (iv) show that numbers 6, 1, 5 and 2 appears on the surfaces adjacent to the number 3. Hence, 4 will be opposite to number 3.

15. (a) Here J is common in both the positions. Hence, letter 'S' is at the face opposite to the face having letter V.

16. (d) From the given four positions of a single dice, faces adjacent to face having green color = Orange, red, white, silver. Clearly, violet is opposite to green.

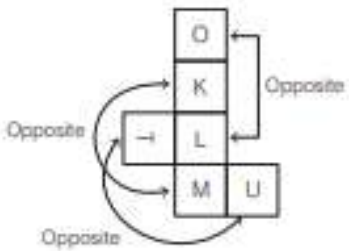
17. (c) Dice can be shown as,



So, from the unfolded dice, it is clear that the letter opposite to D is A.

18. (c) Taking 2 as front face, we get 1 as upper face and 4 as lower face.
Similarly, 3 is left face, 5 is right face and 6 is the back face. Hence, 3 is opposite to 5.

19. (a) The unfolded dice can be represented as



Here, O and L are opposite, K and M are opposite and T and U are opposite.

In answer figure (b), K and M are shown adjacent to each other.

In answer figure (c), T and U are shown adjacent to each other and in answer figure (d), O and L are shown adjacent to each other.

According to the question figure these are opposite to each other, so these alternatives are not possible. Only the cube given in answer figure (a) can be formed because K, L and T can be on adjacent faces.