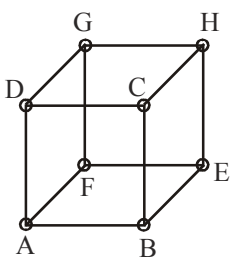
Chapter 16

Cube & Dice

CUBE

INTRODUCTION

A cube is three dimensional figure whose length, breadth and height are equal and any two adjacent faces are inclined to each other at 90°. It has 6 faces, 8 corners and 12 edges.



- Corners of the cube are A, B, C, D, E, F, G and H.
- Edges of the cube are AB, BE, EF, AF, AD, CD, BC, EH, CH, GH, DG and FG.
- Faces of the cube are ABCD, EFGH, CDGH, BCHE, ABEF and ADFG.

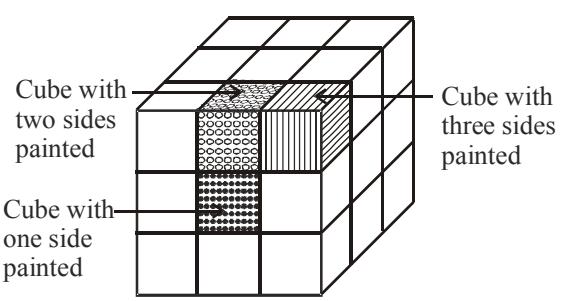
When a cube is painted on all of its faces with any colour and further divided into various smaller cubes of equal size, we get following results :

(i) Smaller cubes with no face painted will present inside faces of the undivided cube.

(ii) Smaller cubes with one face painted will present on the faces of the undivided cube.

(iii) Smaller cubes with two faces painted will present on the edges of undivided cube.

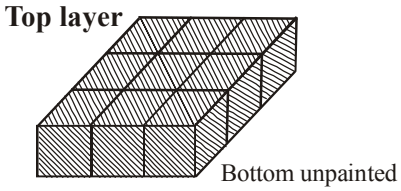
(iv) Smaller cubes with three faces painted will present on the corners of the undivided cube.



The above figure may be analysed by dividing it into three horizontal layers :

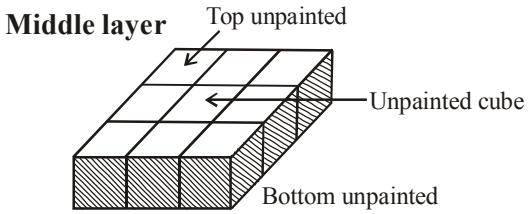
Layer I or top layer :

The central cube has only one face coloured, four cubes at the corner have three faces coloured and the remaining 4 cubes have two faces coloured.



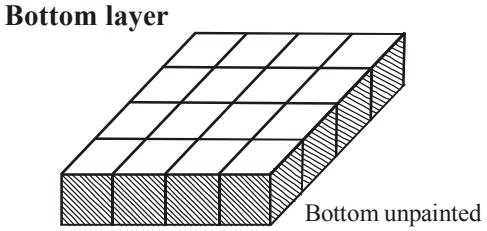
Layer II or middle layer :

The central cube has no face coloured, the four cubes at the corner have two faces coloured and the remaining 4 cubes have only face coloured.



Layer III or bottom layer :

The central cube has only one face coloured, four cubes at the corner have three faces coloured and the remaining 4 cubes have two faces coloured.



Also, if n = no. of divisions on the faces of cube

$$= \frac{\text{Length of the edge of undivided cube}}{\text{Length of the edge of one smaller cube}}.$$

❑ *Shortcut Approach*

- Number of smaller cubes with no face painted = $(n-2)^3$
- Number of smaller cubes with one face painted = $(n-2)^3 \times 6$
- Number of smaller cubes with two faces painted = $(n-2) \times 12$
- Number of smaller cubes with three faces painted = 8

EXAMPLE **1. A cube is painted blue on all faces is cut into 125 cubes of equal size. Now, answer the following question :**

How many cubes are not painted on any face?

Sol. Since, there are 25 smaller cubes of equal size, therefore, n = number of divisions on the face of undivided cube = 5.

Number of cubes with no face painted = $(n-2)^3$

$= (5-2)^3 = 27$

DICE

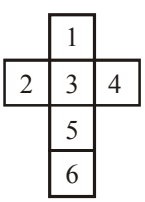
INTRODUCTION

A dice is three-dimensional figure with 6 surfaces. It may be in the form of a cube or a cuboid. After observing these figures, we have to find the different side (opposite or adjacent sides) of the dice.

Dice Formation

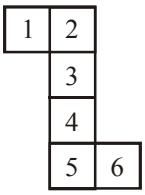
A Dice is formed by folding a sheet of paper. These forms may be

Form 1:



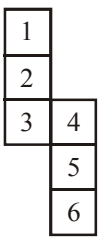
Number 1 is opposite to 5.
Number 2 is opposite to 4.
Number 3 is opposite to 6.

Form 2:



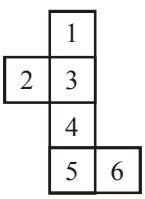
Number 1 is opposite to 6.
Number 2 is opposite to 4.
Number 3 is opposite to 5.

Form 3:



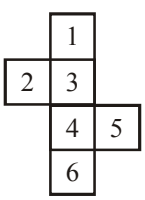
Number 1 is opposite to 3.
Number 2 is opposite to 5.
Number 4 is opposite to 6.

Form 4:

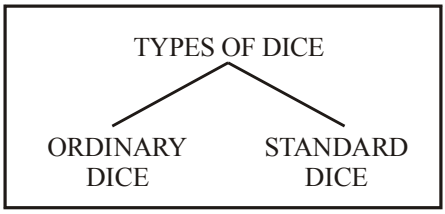


Number 1 is opposite to 4.
Number 2 is opposite to 6.
Number 3 is opposite to 5.

Form 5:

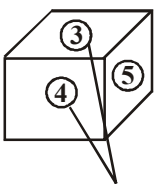


Number 1 is opposite to 4.
Number 2 is opposite to 5.
Number 3 is opposite to 6.



1. Ordinary Dice :

In this type of dice, the sum of opposite sides is not 7 but the sum of two adjacent sides are seven.

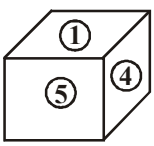


Ordinary Dice

4+3 = 7

2. Standard Dice:

In such type of dice, the sum of opposite sides is 7 or sum of adjacent side is not 7.



Here,
1+4 =5
4+5=9
1+5=6

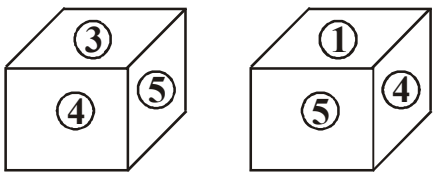
Standard Dice

Opposite of 1 .....6 (since 1+6 =7)
Opposite of 5 .....2 (since 5+2 =7)
Opposite of 3 .....4 (since 3+4 =7)

IMPORTANT RULES

Rule- 1 :

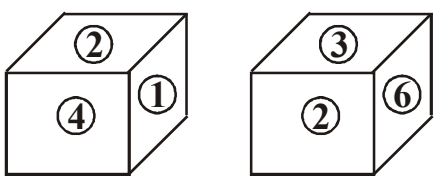
If two sides of cubes are common(has same numbers or symbols), then the remaining two will be opposites of each other.



In above shown two dices, number 4 and 5 are common in both dices, hence, 3 and 1 will be apposite to each other.

Rule 2: If one side of dices is common

If one side of given dices are common then list these sides (numbers on them) either in clock-wise or anti-clockwise. Comparing the numbers obtained from both dices will give you the opposite numbers.



In this figure, number 2 is common in both dices. Now, writing the remaining no, in clock-wise direction, we get:

2.....1.....4 (dice 1)

2.....3.....6 (dice 2)

Through the above observed data, we can say that:

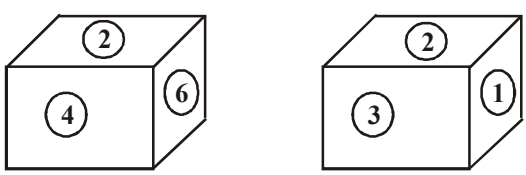
1 is opposite to 3

4 is opposite to 6

2 is opposite to 5

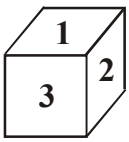
Rule 3 : If one side is common and it's place is same in both dices.

If one side is common in both cubes and it's place is same in both of these dices, then the remaining two sides of respective dices which appear in figure will be the opposite of each other.

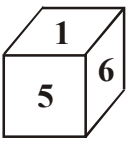


As you can see, number 2 is common in both of these dices and it appears in the same face in both these dices. In such case, the remaining two sides in both dices will be opposite to each other. In this figure, the opposite sides are :
4 is opposite to 3 (as the position of 4 and 3 are same on two dices)
6 is opposite to 1 (as the position of 6 and 1 are same on two dices)
2 is opposite to 5 (we already know the position of 1, 6, 3, 4 and 2. The only one remaining is 5)

EXAMPLE 2. Two positions of a dice are shown, when 4 is at the bottom, what number will be on the top?



(i)



(ii)

(a) 1 **(b) 2**
(c) 5 **(d) 6**

Sol. From the two figures it is clear that the numbers 2, 3, 5 and 6 cannot appear opposite 1. So, 4 appears opposite 1. Therefore, when 4 is at the bottom, 1 will be on the top.

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