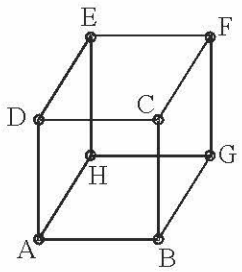
CH 5 CUBE AND DICE

ANSWERS AND EXPLANATIONS

EXERCISE 1

1. (c)

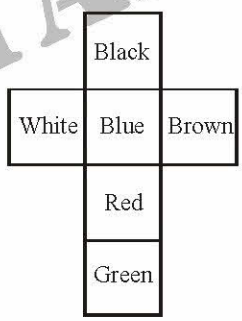


Let faces ABCD, ABGH and CDEF are painted with red colour.

Faces BCFG and ADEH are painted with yellow and EFGH is painted with green colour.

Clearly the cubes which have only one red coloured face and all other faces uncoloured are the four central cubes at each of the three faces ABCD, ABGH and CDEF. Thus, there are $4 \times 3 = 12$ such cubes.

2. (d) When the cube is unfolded, it will look like as



The four colours adjacent to green are black, brown, red and white.

3. (a) The red side is opposite to the black. Therefore, if red is at the bottom, black will be at the top.

4. (d) VI does not add to the information provided by I – V.

5. (b) Adjacent to white, we have brown.

6-9. Since, there are 64 smaller cubes of equal size, therefore, n = no. of divisions on the face of undivided cube = 4

6. (c) no. of cubes with no face coloured = $(n - 2)^3$

$= (4 - 2)^3$

$= 8$

7. (d) no. of cubes with one face painted = $(n - 2)^2 \times 6$

$= (4 - 2)^2 \times 6 = 24$

8. (a) no. of cubes with two red opposite faces = 0

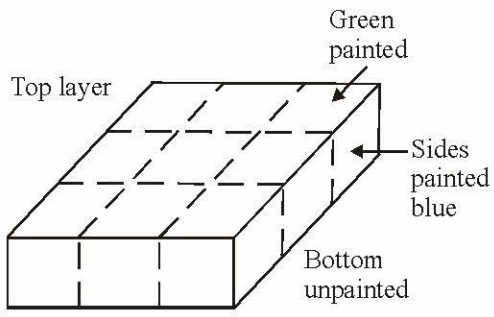
(none of the cubes can have its opposite faces coloured)

9. (c) Number of cubes with three faces coloured

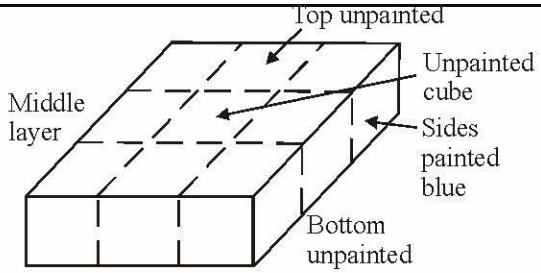
= 4(cubes at top corners) + 4(cubes at bottom corners) = 8

10-14. The figure may be analysed by dividing it into three horizontal layers :

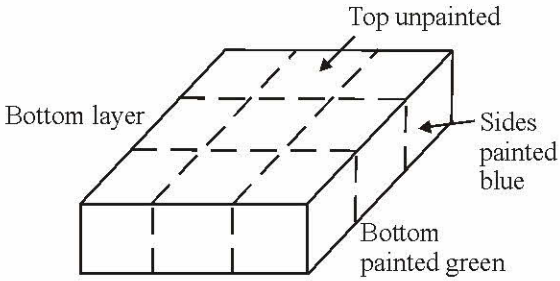
In the top layer, the central cube has only one face painted green, the four cubes at the corner have three faces painted one face green and two faces blue. The remaining four cubes have two faces painted one green and one blue.



In the middle layer, the central cube has no any face painted, four cubes at the corners have two faces painted blue and the remaining four cubes have one face painted blue.



In the bottom layer, the central cube has one face painted green and four cubes at the corners have three faces painted–two blue and one green. The remaining four cubes have two faces painted-one blue and one green.



10. (d) There are four cubes in the middle layer which have one face painted only in blue.

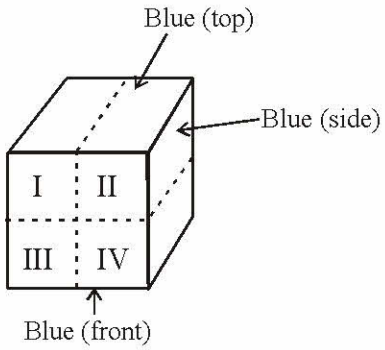
11. (b) There is one (central) cube in the top layer and one (central) cube in the bottom layer which have one face painted only in Green.

12. (c) There are 9 cubes in each of the three layers. Thus there are 27 cubes in all.

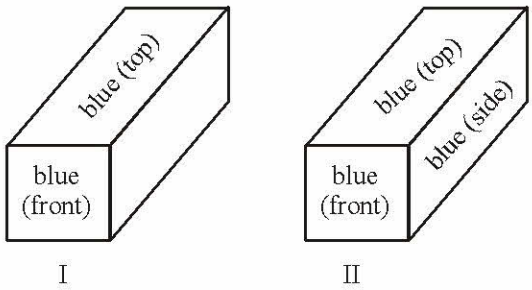
13. (a) number of cubes with three sides painted = 4[cubes in the top corners + 4[cubes in the bottom corners] = 8 cubes

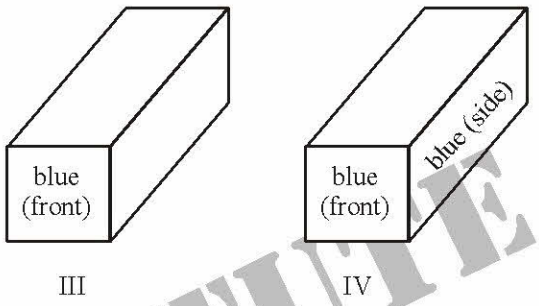
14. (d) Only one central cube in the middle layer has no faces painted at all.

15-17. The adjoining figure shows the cube coloured andcut into four cuboids as stated in the question.

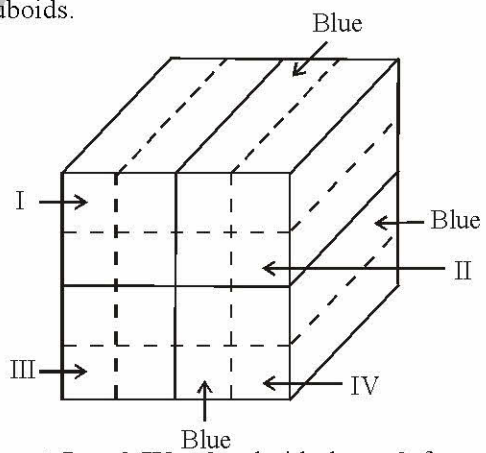


Four cuboids are obtained as shown below :





Now, all uncoloured faces of each cuboid are coloured with pink and then again cut each cuboid into four cuboids.



In set I and IV : 2 cuboids have 2 faces blue, 2 faces pink and 2 faces uncoloured each. 2 cuboids have 1 face blue, 3 faces pink and 2 faces uncoloured each.

In set II : 2 cuboids have 2 faces blue, 2 faces pink and 2 faces uncoloured each.

1 cuboid has 3 faces blue, 1 face pink and 2 faces uncoloured each.

1 cuboid has 1 face blue, 3 faces pink and 2 faces uncoloured each.

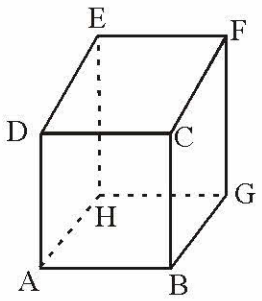
In set III : All the four cuboids have 1 face blue, 3 faces pink and 2 faces uncoloured each.

15. (d) There are 2 cuboids in set I, 2 cuboids in set II and 2 cuboids in set IV having 2 faces pink in each. Thus, there are 2 + 2 + 2 = 6 such cubes.

16. (a) There are 2 cuboids in set I, 1 cuboid in set II, 4 cuboids in set III and 2 cuboids in set IV having 3 faces pink each. Thus, there are 9 such cuboids.

17. (c) There is only one cuboid having three faces blue. This cuboid lies in set II.

18-22.



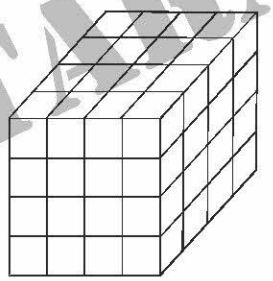
Here,

Faces ABCD, BCFG are painted with red.

Faces ADEH, EFGH are painted with black.

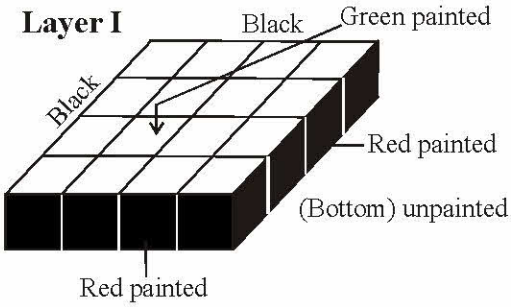
Faces CDEF, ABGH are painted with green.

No. of divisions on the faces of cubes = 4

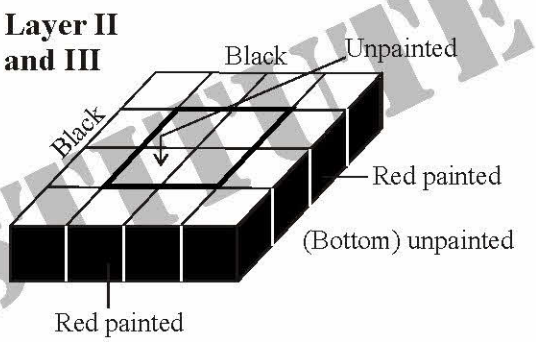


Now, the figure may be analysed by dividing it into four horizontal layers :

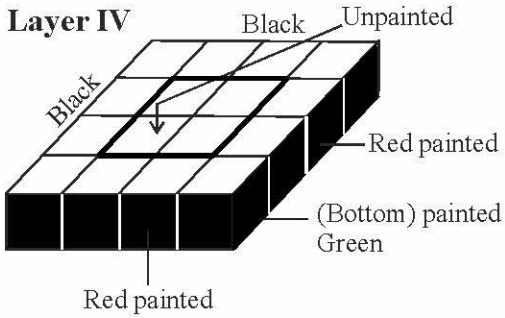
In Layer I : Four central cubes have only one face painted green, four cubes at the corners have three faces painted red, green and black. Out of the remaining 8 cubes, four cubes have two faces painted red and green and four cubes have two faces painted black and green.



In Layer II and III : Four central cubes have no faces painted, four cubes at the corners have two faces painted red and black. Out of the remaining 8 cubes four cubes have only one face painted black and four cubes have only one face painted red.



In Layer IV : Four central cubes have only one face painted green, four cubes at the corners have three faces painted red, green and black. Out of the remaining 8 cubes four cubes have two faces painted green and black and four cubes have two faces painted red and green.



18 (c) There are 8 cubes having no face painted.

19. (c) Cubes only one face painted

$= \underset{\text{(I layer)}}{4} + \underset{\text{(II layer)}}{8} + \underset{\text{(III layer)}}{8} + \underset{\text{(IV layer)}}{4} = 24$

or $(n-2)^2 \times 6 = 24$

20. (d) There are 24 cubes having only one face painted and 24 cubes having only two faces painted.

21. (b) Cubes with three faces painted = 8

22. (b) Cubes with one face green and one of the adjacent faces black or red = 8 (Top Layer) + 8 (Bottom Layer) = 16.

23. (c) A $10 \times 10 \times 10$ cube has 10 cubes of $1 \times 1 \times 1$ cubes along its length, breadth and width each. If we remove a layer of $1 \times 1 \times 1$ cubes (the smaller cubes) then the new cube will have following dimensions :

length = 10 – 1 – 1 = 8; breadth = 10 – 1 – 1 = 8 and

width = 10 – 1 – 1 = 8.

So the number of $1 \times 1 \times 1$ cubes in this $8 \times 8 \times 8$ cube

$= 8 \times 8 \times 8 = 512$.

24. (b) A $5 \times 5 \times 5$ cube has 5 cubes of $1 \times 1 \times 1$ cubes along its length, breadth and width each. If we add a layer of $1 \times 1 \times 1$ cubes (the smaller cubes) then the new cube will have following dimensions :

length = 5 + 1 + 1 = 7; breadth = 5 + 1 + 1 = 7 and

width = 5 + 1 + 1 = 7.

So the number of $1 \times 1 \times 1$ cubes in this $7 \times 7 \times 7$ cube

$= 7 \times 7 \times 7 = 343$.

25. (c) Clearly, in the figure there are --1 column containing

3 cubes, 2 columns containing 2 cubes each and 3 columns containing 1 cube each.

Number of cubes in columns of 3 cubes = $1 \times 3 = 3$;

Number of cubes in columns of 2 cubes = $2 \times 2 = 4$;

Number of cubes in columns of 1 cubes = $3 \times 1 = 3$;

Therefore, total number of cubes = 3 + 4 + 3 = 10.

EXERCISE 2

1. (a) 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.

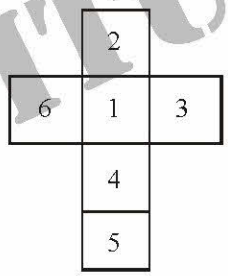
2. (b) From the three given figures, it is clear that the 1, 2, 5 and 4 appear adjacent to 3, so none of these can appear opposite 3. Therefore, 6 appears opposite 3.

3. (a) Since 1, 3, 5 and 6 are adjacent to 2. Therefore, 4 lies opposite 2 i.e. at the bottom face of dice (i).

4. (a) Since 2, 3, 6 and 4 are adjacent to 1. Therefore, 5 lies opposite 1. Hence, 1 lies at the bottom face of dice (iii).

5. (c) Since 1, 4, 2 and 5 are adjacent to 6. Therefore, 3 lies opposite 6.

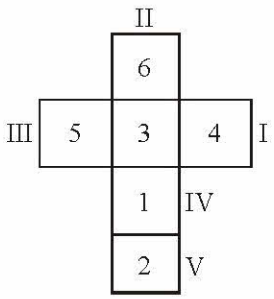
6. (d)



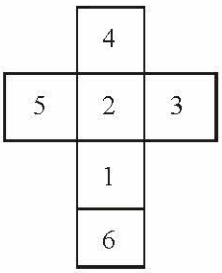
Hence, 1, 5, 3 and 6 are adjacent to 4.

7. (b) From the figure in previous solution, 6 is not adjacent to 3.

8. (c) Common number i.e. 3 to both the dice is placed on the central position of the figure. Now place the numbers in the anticlock wise direction in block I, II, III and IV respectively.Remaining number i.e. 2 will come in the block V. Hence number 4 is opposite to number 5.



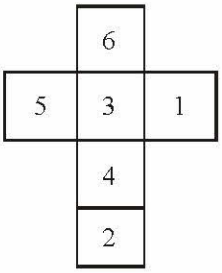
9. (d)



Hence, the numbers that are adjacent to 1 are 5, 2, 6 and 3.

∴ 3 will come in place of '?'.

10. (a)



Since 2, 3, 5 and 1 are adjacent to 4. Therefore, 1 will come in place of '?'.

11. (a) When the sheet shown in fig. (X) is folded to from a cube, then the face bearing the dot lies opposite to the shaded face, the face bearing a circle (With '+' sign inside it) lies opposite to a blank face and the remaining two blank faces lie opposite to each other. Clearly, the cubes shown in figures (B) and (D) cannot be formed since they have the shaded face adjacent to the face bearing a dot and the cube shown in fig. (C) cannot be formed since it shown all the three blank face adjacent to each other. Hence, only the cube shown in fig.(A) can be formed.

12. (b) When the sheet in fig. (X) is folded to form a cube , then 'F' appears opposite 'C' and 'A' appears opposite 'D'. Therefore, the cube in fig. (A) which shows 'F' adjacent to 'B', the cube in fig.(C) which shows 'E' adjacent to 'C' and the cube in fig. (D) which shows 'A' adjacent to 'D' cannot be formed.

13. (c) From figure (i) (ii) and (iv), we conclude that 6, 4, 1 and 2 dots appear adjacent to 3 dots. Clearly, there will be 5 dots on the face opposite the face with 3 dots.

14. (c) When this figure is folded to form a cube then the face bearing three dots will lie opposite the face bearing five dots.

15. (d) From figure (i) (ii) and (iv), we conclude that 6, 5, 2 and3 appear adjacent to 4. Clearly, 1 will be opposite the face of 4.