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8

Mathematics

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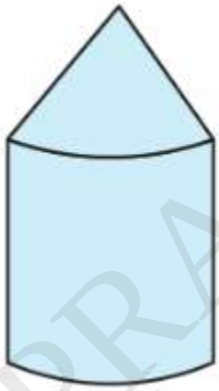
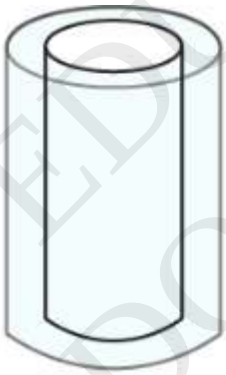
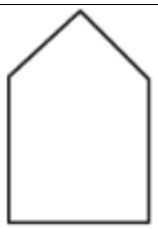
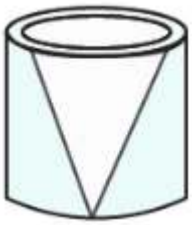
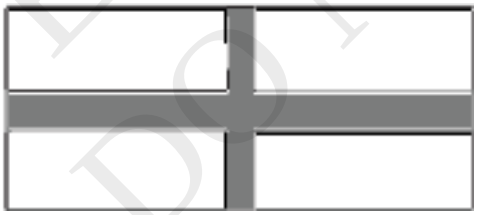
CHAPTER – 17

VISUALISING SOLID SHAPES

Exercise 17.1

1. Match the objects with their shapes:

	Picture (object)	Shape
A tent		**A triangular field adjoining a square field.**
A tin		**A hemispherical shell.**
A bowl		**Two rectangular cross paths inside a rectangular park.**

An agricultural field		**A hemisphere surmounted on a cone.**
A groove		**A circular path around a circular ground.**
A toy		**A cylindrical shell.**
A circular park		**A cone surmounted on a cylinder.**
A cross path		**A cone taken out of a cylinder.**

Solution:

(i) A tent – (g)

A cone surmounted on a cylinder.

(ii) A tin – (f)

A cylindrical shell.

(iii) A bowl – (b)

A hemispherical shell.

(iv) An agricultural field – (a)

A triangular field adjoining a square field.

(v) A groove – (h)

A cone taken out of a cylinder.

(vi) A toy – (d)

A hemisphere surmounted on a cone.

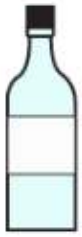
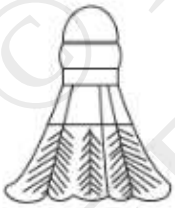
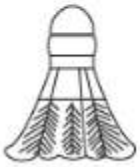
(vii) A circular park – (e)

A circular path around a circular ground.

(viii) A cross path – (c)

Two rectangular cross paths inside a rectangular park.

2. For each of the given solid, the two views are given. Match for each solid the corresponding front and top views.

Object	Front view	Top view
(a) 	(i) 	(u) 
(b) 	(ii) 	(v) 
(c)  A flask	(iii) 	(w) 
(d)  A shuttle cock	(iv) 	(x) 
(e)  A Box	(v) 	(y) 
(f)  A weight	(vi) 	(z) 

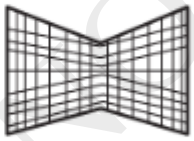
Solution:

Object	Front View	Top View
A bottle	(iii)	(y)
A funnel	(i)	(v)
A flash	(ii)	(u)
A shuttle cock	(vi)	(x)
A box	(iv)	(z)
A weight	(v)	(w)

3. For the given solid, identify the front, side and top views and write it in the space provided.

Solid

(i)  _____

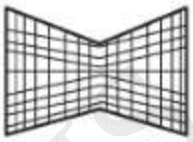
(ii)  _____

(iii)  _____

Solution:

Solid

(i)  Side

(ii)  Top

(iii)  Front

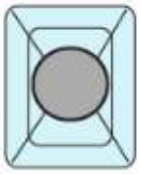
4. For each of the given solid, the three views are given. Identify for each solid the corresponding top, front and side views.

(a)

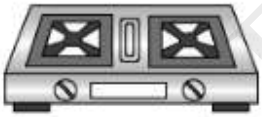
(An inkpot)

(i) 

(ii) 

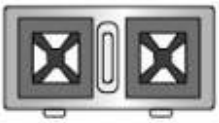
(iii) 

(b)



A gas stove

(i) 

(ii) 

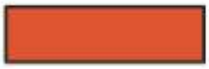
(iii) 

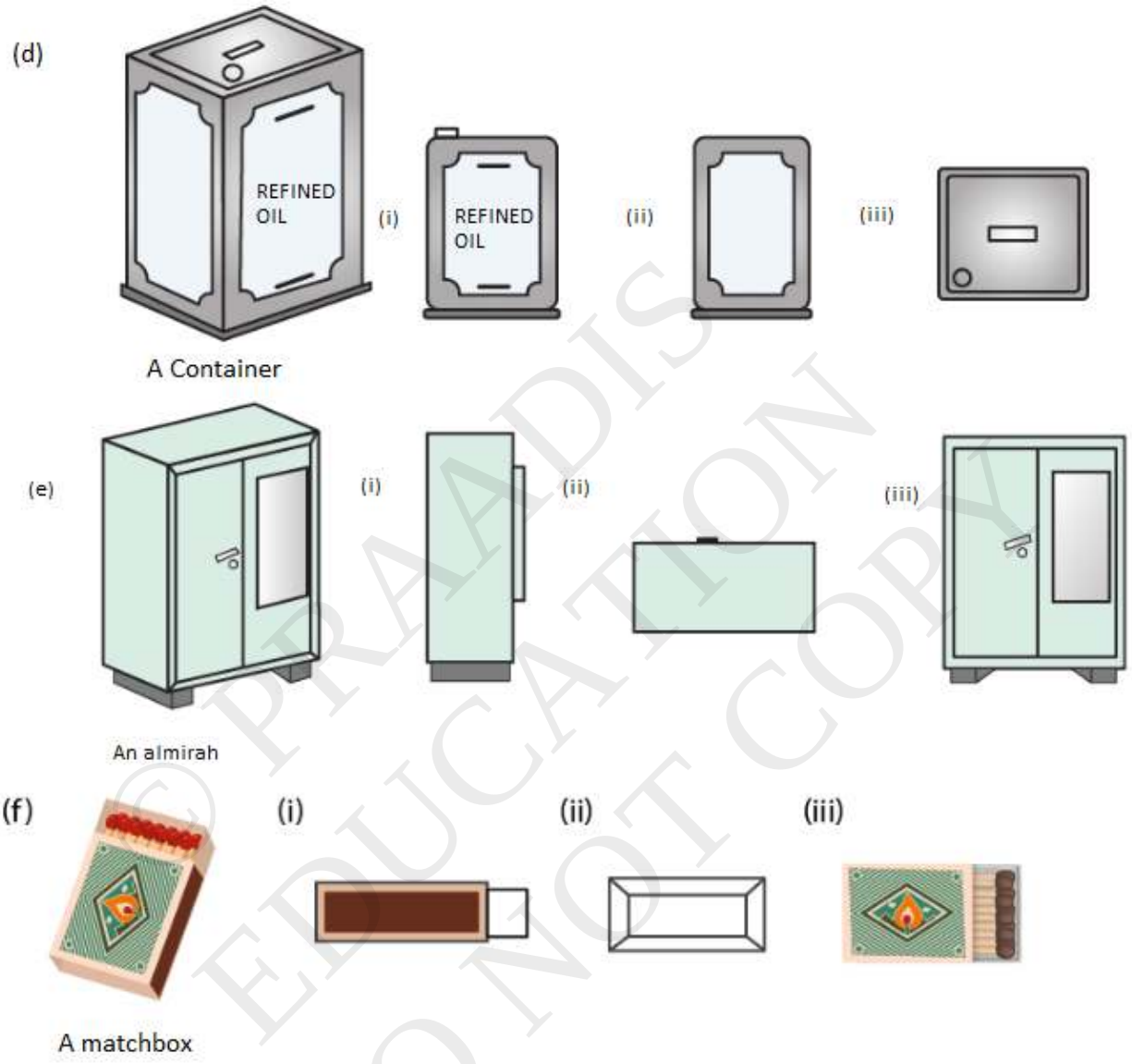
(c)

A brick

(i) 

(ii) 

(iii) 



Solution:

Object Different Views

(a) An inkpot

(i) Front

(ii) Side

(iii) Top

(b) A gas stove

(i) Front

(ii) Top

(iii) Side

(c) A brick

(i) Top

(ii) Front

(iii) Side

(d) A container

(i) Front

(ii) Side

(iii) Top

(e) Almirah

(i) Side

(ii) Top

(iii) Front

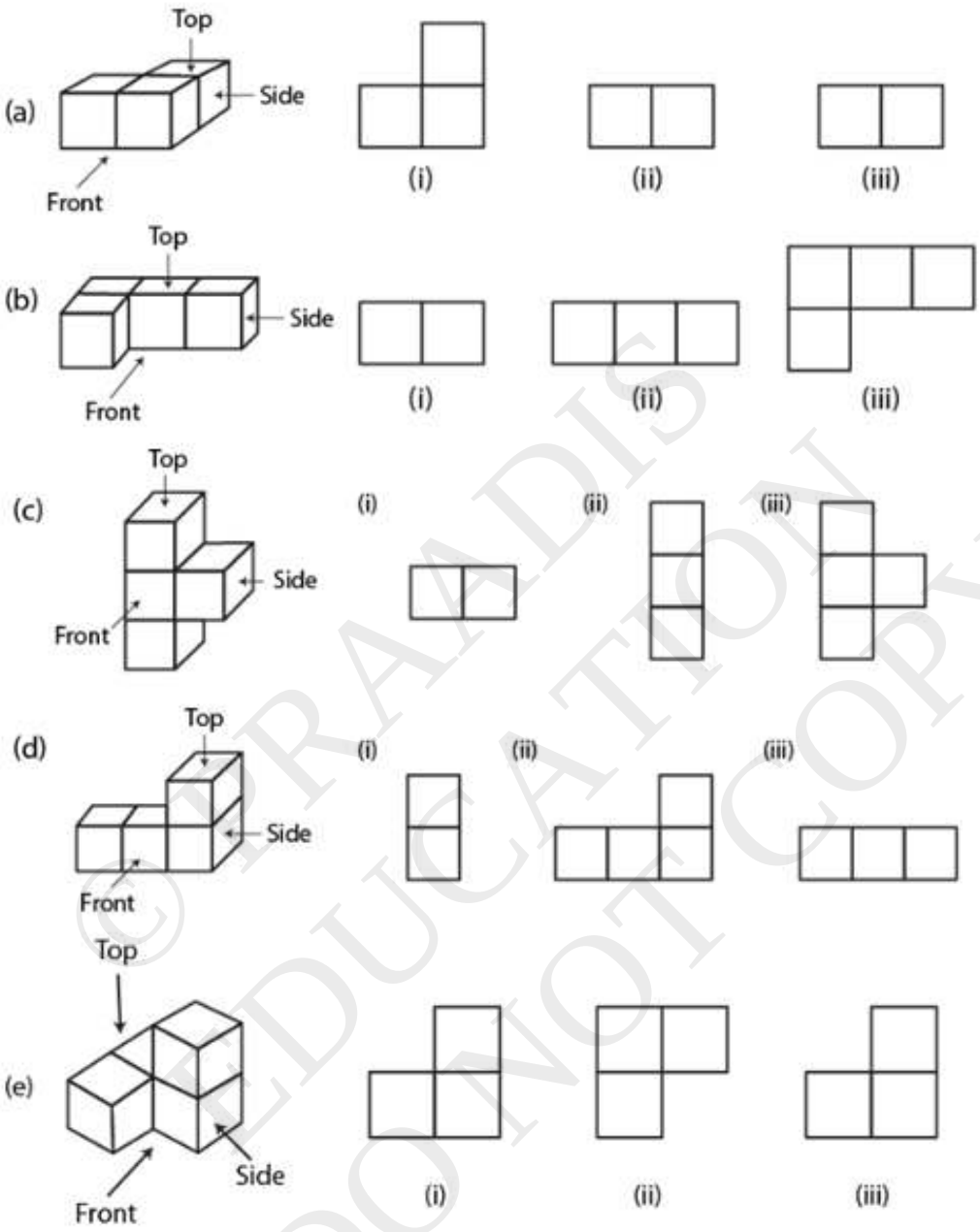
(f) A matchbox

(i) Side

(ii) Front

(iii) Top

5. For each given solid, identify the top view, front view and side view.



Solution:

(a)

(i) Top view

(ii) Side view

(iii) Front view

(b)

(i) Side view

(ii) Front view

(iii) Top view

(c)

(i) Top view

(ii) Side view

(iii) Front view

(d)

(i) Side view

(ii) Front view

(iii) Top view

(e)

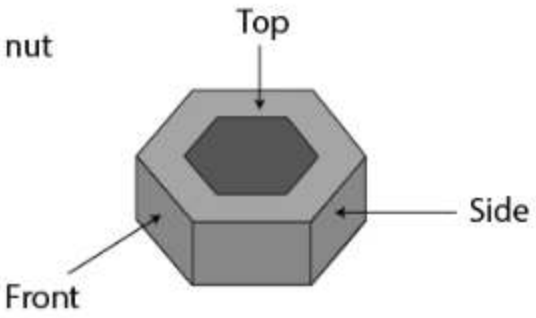
(i) Front view

(ii) Top view

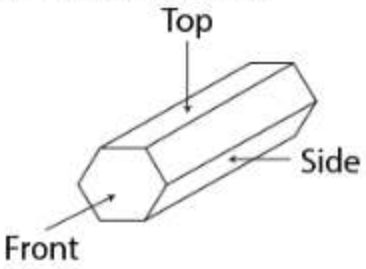
(iii) Side view

6. Draw the front view, side view and top view of the given objects:

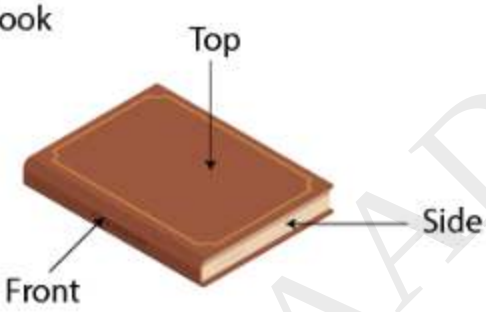
(a) A nut



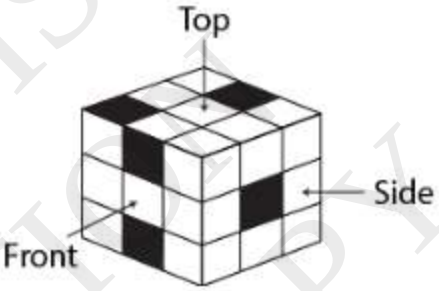
(b) A hexagonal block



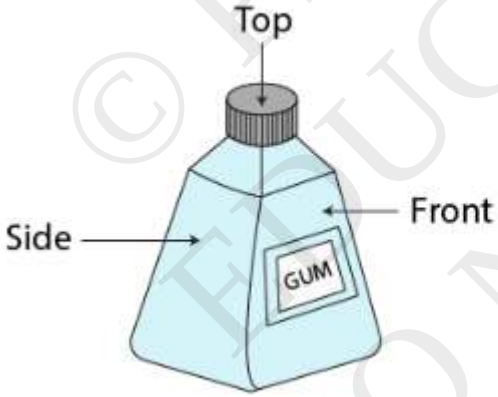
(c) A book



(d) A cube

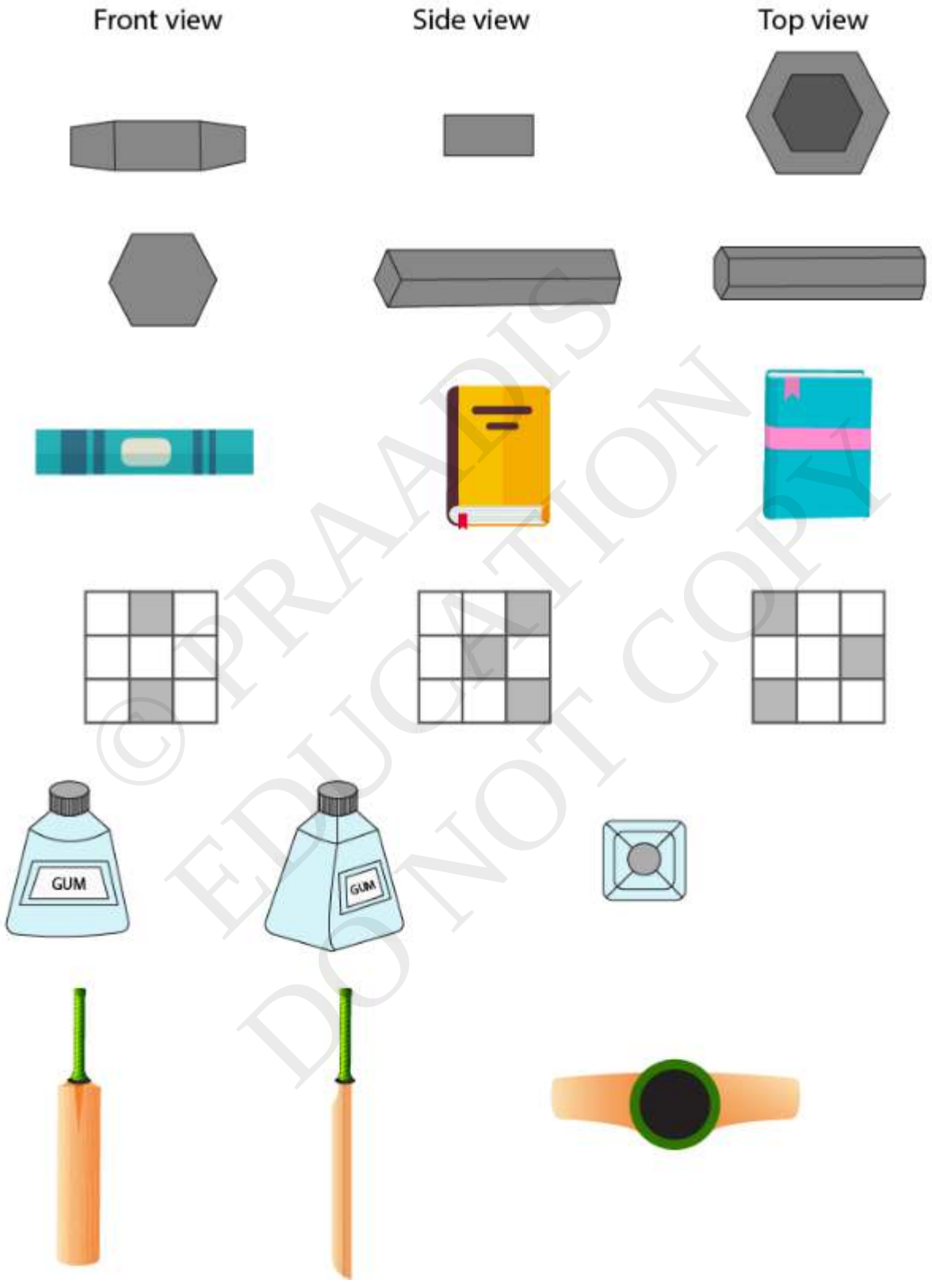


(e) A gum bottle



(f) A bat

Solution:



Exercise 17.2

1. Can a polyhedron have for its faces

(i) 3 triangles?

(ii) 4 triangles?

(iii) a square and four triangles?

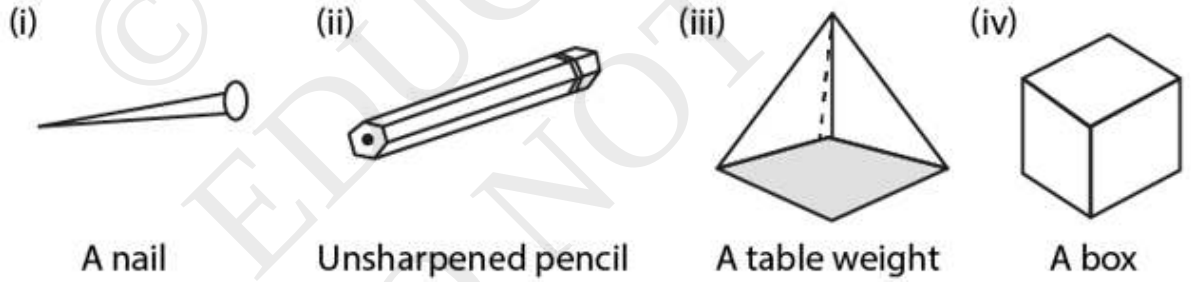
Solution:

(i) No

(ii) Yes

(iii) Yes

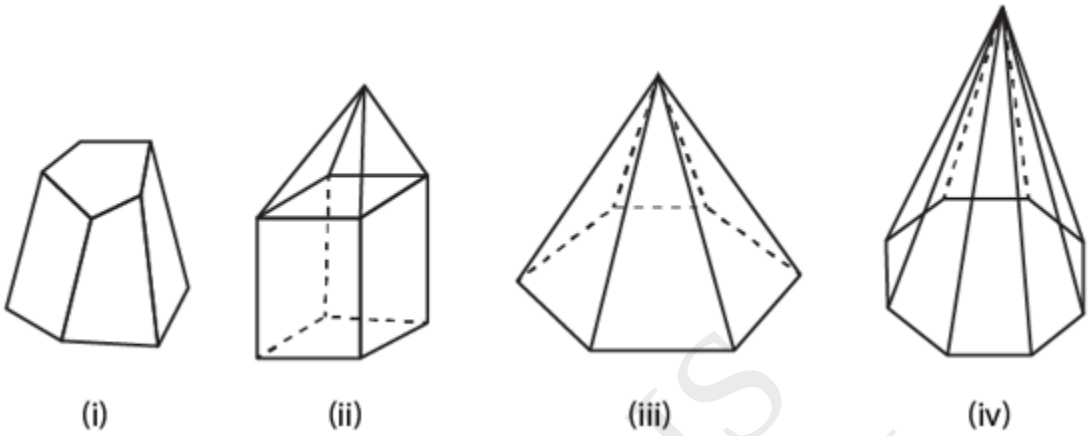
2. Which are prisms among the following?



Solution:

(i) and (iv) are the only prisms.

3. Verify Euler's formula for these solids:



Solution:

	Faces	**Vertices**	**Edges**	**F + V = E + 2**
(i)	7	10	15	7 + 10 = 15 + 2 17 = 17
(ii)	9	5	12	9 + 5 = 12 + 2 14 = 14
(iii)	7	7	12	7 + 7 = 12 + 2 14 = 14
(iv)	9	9	16	9 + 9 = 16 + 2 18 = 18

4. Can a polyhedron have 15 faces, 30 edges and 20 vertices?

Solution:

We know that

F + V = E + 2

Substituting the values

15 + 20 = 35 and 30 + 2 = 32

Here

35 ≠ 32

Therefore, a polyhedron cannot have 15 faces, 30 edges and 20 vertices.

5. If a polyhedron has 8 faces and 8 vertices, find the number of edges.

Solution:

We know that

A polyhedron has 8 faces and 8 vertices.

Here

No. of edges = F + V – 2

Substituting the values

= 8 + 8 – 2

= 14

6. If a polyhedron has 7 faces and 10 vertices, find the number of edges.

Solution:

We know that

A polyhedron has 7 faces and 10 vertices

Here

No. of edges = F + V – 2

Substituting the values

= 7 + 10 – 2

= 15

7. Write the number of faces, vertices and edges in

(i) An octagonal prism

(ii) Decagonal pyramid.

Solution:

	No. of faces	**No. of vertices**	**No. of edges**
(i) an octagonal prism	10	16	24
(ii) decagonal pyramid	11	11	20

8. Using Euler's formula, complete the following table:

	Faces	**Vertices**	**Edges**
(i)	**6**	**–**	**12**
(ii)	**–**	**5**	**8**
(iii)	**14**	**24**	**–**
(iv)	**–**	**16**	**30**
(v)	**16**	**–**	**42**
(vi)	**19**	**19**	**–**

Solution:

	Faces	Vertices	Edges	F + V = E + 2
(i)	6	8	12	12 + 2 = 14 6 + 8 = 14
(ii)	5	5	8	8 + 2 = 10 5 + 5 = 10
(iii)	14	24	36	14 + 24 = 38 38 – 2 = 36
(iv)	16	16	30	30 + 2 = 32 16 + 16 = 32
(v)	16	28	42	42 + 2 = 44 16 + 28 = 44
(vi)	19	19	36	19 + 19 = 38 2 + 36 = 38

Mental Maths

Question 1: Fill in the blanks:
(i) A solid made up of polygonal regions is called ……
(ii) Polyhedrons which are not convex are called ……
(iii) A polyhedron is said to be …… if all of its faces are regular polygons and the same number of faces meet at each vertex.
(iv) A polyhedron whose base and top are congruent polygons and whose lateral faces are parallelograms in shape is called a ……
(v) A prism whose base and top are congruent hexagon is called a …
(vi) A polyhedron whose all lateral faces are triangles is called a …
(vii) A triangular pyramid is also known as ……
(viii) A rectangular prism is also known as ……
(ix) The polygonal regions forming a polyhedron are called ……
Solution:
(i) A solid made up of polygonal regions is called polyhedron.
(ii) Polyhedrons which are not convex are called concave polyhedron.
(iii) A polyhedron is said to be regular polyhedron if all of its faces are regular polygons and the same number of faces meet at each vertex.
(iv) A polyhedron whose base and top are congruent polygons and whose lateral faces are parallelograms in shape is called a prism.
(v) A prism whose base and top are congruent hexagon is called a hexagonal prism.
(vi) A polyhedron whose all lateral faces are triangles is called a triangular pyramid.
(vii) A triangular pyramid is also known as a tetrahedron.
(viii) A rectangular prism is also known as a cuboid.
(ix) The polygonal regions forming a polyhedron are called faces.

Question 2: State which of the following statements are true (T) or false (F):

(i) A cylinder is a polyhedron.
(ii) All the prisms and pyramids are polyhedrons.
(iii) A tetrahedron is the only pyramid which can be a regular polyhedron.
(iv) The line segments where the faces of a polyhedron meet are called edges.
(v) F + E = V + 2 is called a Euler's formula.
(vi) In any prism number of faces is 2 more than number of sides of polygonal base.
(vii) In any pyramid number of edges is twice the number of sides of polygonal base.
(viii) An octagonal prism has 18 vertices.
(ix) All pyramids are prisms.
(x) Lateral faces of a pyramid are triangles.
Solution:
(i) A cylinder is a polyhedron. False
(ii) All the prisms and pyramids are polyhedrons. True

(iii) A tetrahedron is the only pyramid which can be a regular polyhedron. True

(iv) The line segments where the faces of a polyhedron meet are called edges. True
(v) F + E = V + 2 is called a Euler's formula. False
Correct:
It is F + V = E + 2.
(vi) In any prism number of faces is 2 more than the number of sides of polygonal base. True
(vii) In any pyramid number of edges is twice the number of sides of polygonal base. True

(viii) An octagonal prism has 18 vertices. False Correct: It has 8 + 8 = 16

(ix) All pyramids are prisms. False
Correct:

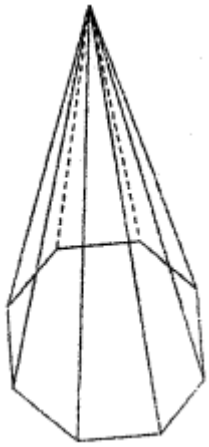
Both are different shapes.
(x) Lateral faces of a pyramid are triangles. True

Multiple Choice Questions

Choose the correct answer from the given four options (3 to 17):
Question 3.
Which of the following is not a 2-dimensional shape?
(a) Triangle
(b) Circle
(c) Sphere
(d) Rectangle
Solution:
Sphere is not a two-dimensional shape, (c)

Question 4: Which of the following is a 3-dimensional shape?
(a) Parallelogram
(b) Cylinder
(c) Square
(d) none of these
Solution:
Cylinder is a 3-dimensional shape. (b)

Question 5: Name the pyramid shown in the given figure.



(a) Nonagonal pyramid
(b) Octagonal pyramid
(c) Decagonal pyramid
(d) Hexagonal pyramid
Solution:
Octagonal pyramid. (b)

Question 6: How many parallel and congruent faces does a cylinder have?
(a) 4
(b) 3
(c) 2
(d) none
Solution:
A cylinder has two parallel and congruent faces. (c)

Question 7: How many pairs of congruent parallel faces does a rectangular prism have?

(a) 8
(b) 6
(c) 4

(d) 3

Solution:

A rectangular prism has 3 pairs of congruent and parallel faces. (d)

Question 8: How many congruent isosceles triangle does a square pyramid have?

(a) 2

(b) 4

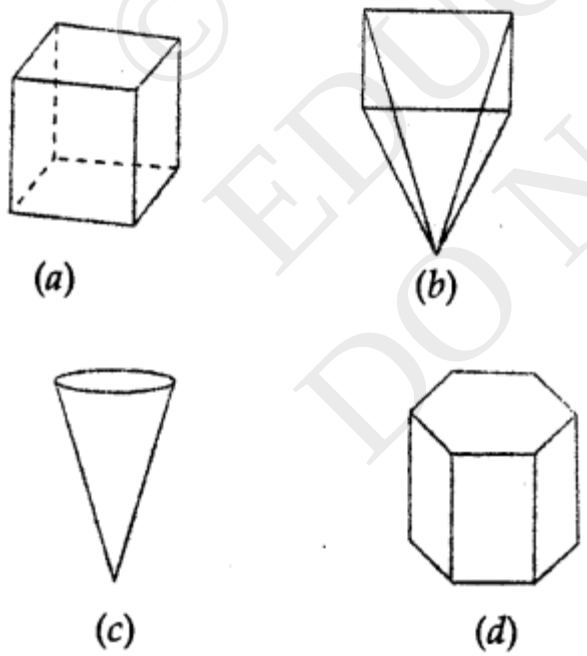
(c) 6

(d) 8

Solution:

A square pyramid has 4 congruent isosceles triangles. (b)

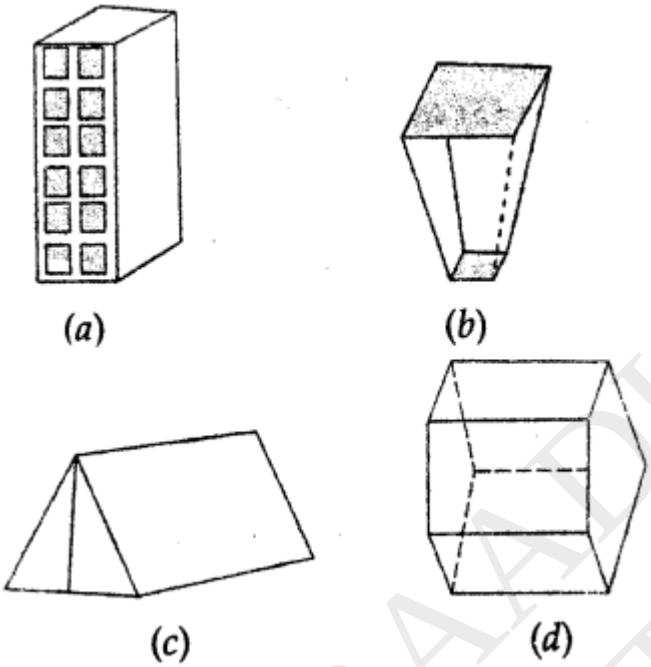
Question 9: Which amongst the following is not a polyhedron?



Solution:

Figure (c) is not a polyhedron. (c)

Question 10: Which of the following is not a prism?



Solution:
Figure (b) is not a prism. (b)

Question 11: The number of triangular faces of a triangular prism are
(a) 2
(b) 3
(c) 4
(d) 5
Solution:
A triangular prism has 2 triangular faces, (a)

Question 12: The number of edges in a pentagonal pyramid are
(a) 5
(b) 10
(c) 15
(d) 20

Solution:
A pentagonal pyramid has 10 edges. (b)

Question 13: The number of rectangular faces in a hexagonal prism are
(a) 6
(b) 8
(c) 10
(d) 12
Solution:
A hexagonal prism has 6 rectangular faces. (a)

Question 14: In a polyhedron E = 15, V = 10, then F is
(a) 3
(b) 5
(c) 7
(d) 9
Solution:
E = 15, V = 10
F + V = E + 2
$\Rightarrow$ F = E + 2 – V = 15 + 2 – 10 = 7 (c)

Question 15: In a polyhedron F = 5, E = 8, then V is
(a) 3
(b) 5
(c) 7
(d) 9
Solution:
F + V = E + 2
$\Rightarrow$ 5 + V = 8 + 2

⇒ 5 + V = 10
⇒ V = 10 – 5 = 5 (b)

Question 16: In a polyhedron F = 17, V = 30, then E is
(a) 30
(b) 45
(c) 60
(d) none of these
Solution:
F = 17, V = 30
F + V = E + 2
⇒ E = F + V – 2
⇒ E = 17 + 30 – 2 = 45 (b)

Question 17: A polyhedron have 4 faces, 4 vertices and 6 edges. Name the polyhedron.
(a) A rectangular prism
(b) A triangular prism
(c) A rectangular pyramid
(d) A triangular pyramid
Solution:
A polyhedron has 4 faces, 4 vertices and 6 edges.
∴ It is triangular pyramid. (d)

Higher Order Thinking Skills (Hots)

Question 1: Which of the following nets can be folded to form a cone?

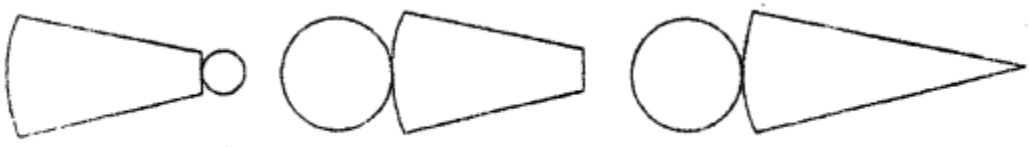


Figure 1 Figure 2 Figure 3

Solution:
Net in figure (3) can be folded to form a cone.

Question 2: Which of the following nets can be folded to form a cylinder?

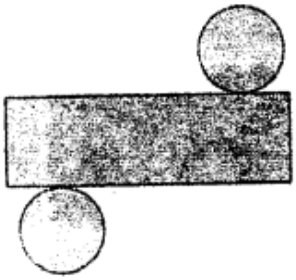


Figure 1

Figure 2

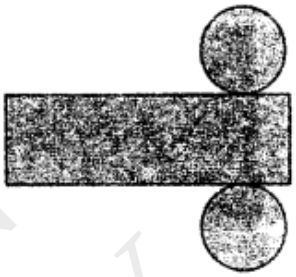


Figure 3

Solution:
Net in the figure (1) and (2) can be folded to form a cylinder.

Check Your Progress

Question 1: Write the number of faces, vertices and edges of a
(i) hexagonal pyramid
(ii) octagonal pyramid
(iii) decagonal pyramid
(iv) nonagonal pyramid
(v) heptagonal prism
(vi) decagonal prism.
Solution:

	Faces	Vertices	Edges
(i) hexagonal pyramid	7	7	12
(ii) octagonal pyramid	9	9	16
(iii) decagonal pyramid	11	11	20
(iv) nonagonal pyramid	10	10	18
(v) heptagonal prism	9	14	21
(vi) decagonal prism	12	20	30

Question 2: Give three examples of 3-dimensional shapes around you which are the combinations of 2 or more 3-dimensional shapes.

Solution:
3-dimensional shapes which are the combination of
2 or more 3-dimensional shapes.
(i) A funnel: Combination of cone and cylinder.
(ii) A toy: Combination of a cone and hemisphere.
(iii) An ice-cream cone: Combination of a cone and hemisphere.
(iv) A circus tent: Combination of a cylinder and a cone.

Question 3: Give two examples of solids which are not polyhedrons.
Solution:
Sides which are not polyhedron:
(i) Cylinder
(ii) Sphere
(iii) Cone

Question 4: Why a pentagonal pyramid having all its edges congruent cannot be a regular polyhedron?

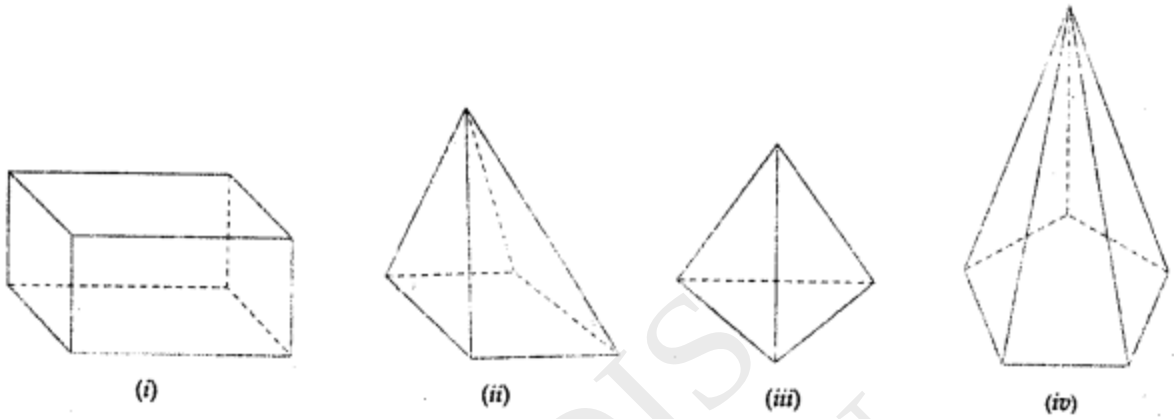
Solution:
A pentagonal pyramid having all its edges congruent cannot be a regular polyhedron because all the vertices of it are not formed by the same number of faces.

Question 5: In a polyhedron, if F = 8 and V = 12 then find the number of edges.

Solution:

In a polyhedron,
F = 8, V = 12, then edges
F + V = E + 2
⇒ E = F + V- 2
⇒ Edges = 8 + 12 – 2 = 18

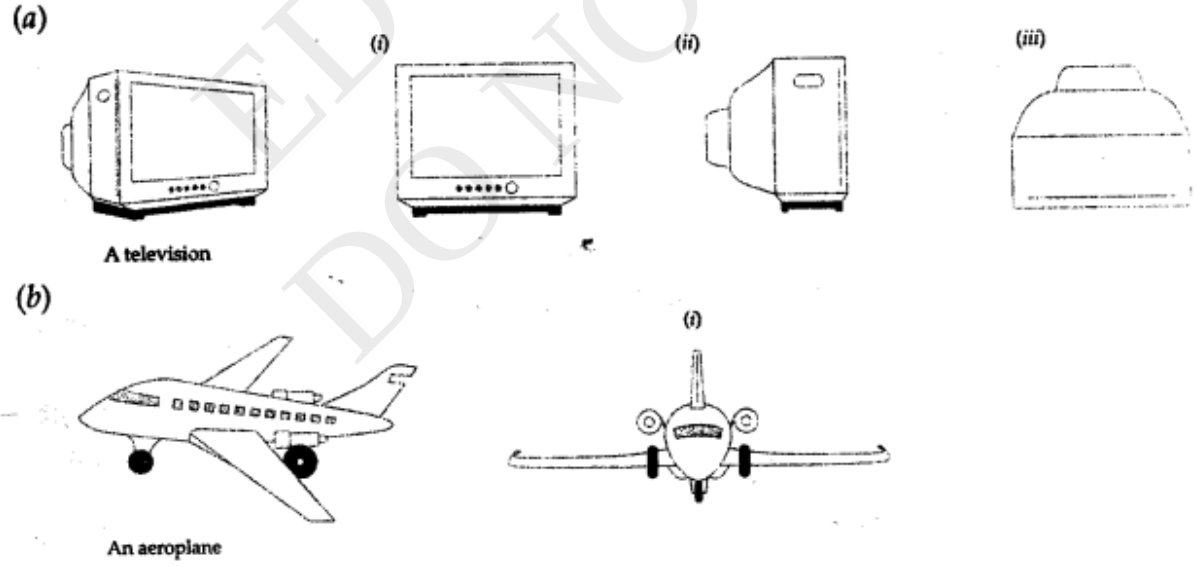
Question 6: Verify Euler's formula for the following figures:

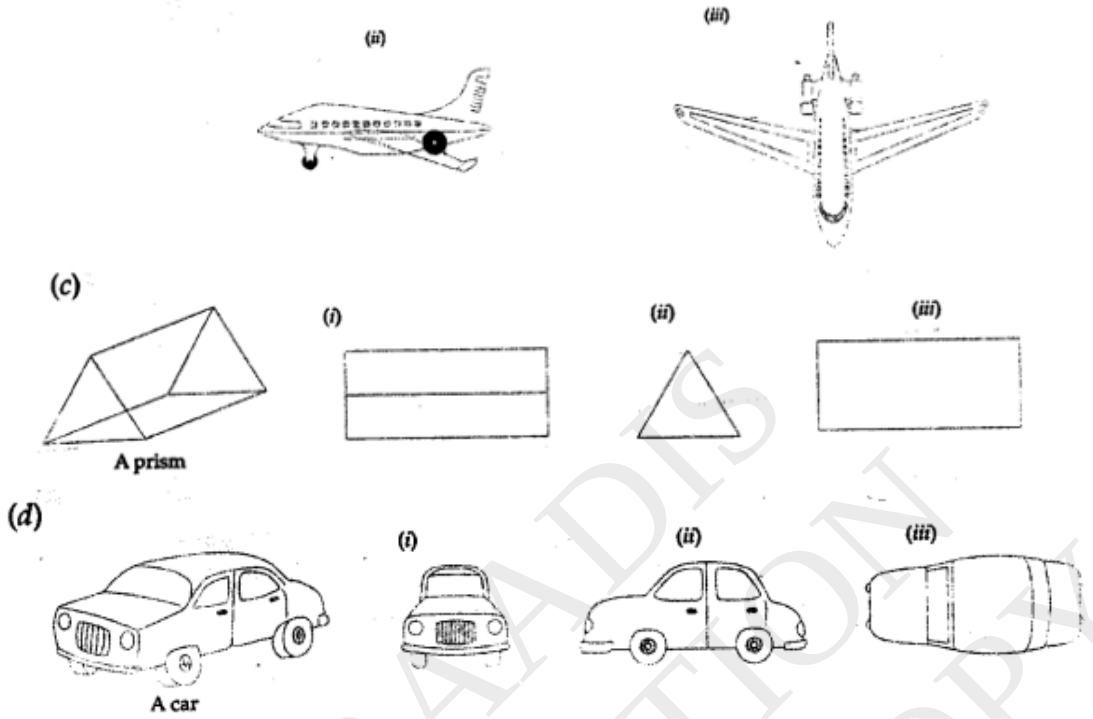


Solution:

	Faces	Vertices	Edges	F + V = E + 2
(i) Cuboid	6	8	12	6 + 8 = 12 + 2
(ii) Square pyramid	5	5	8	5 + 5 = 8 + 2
(iii) Tertahedron	4	4	6	4 + 8 = 6 + 2
(iv) Pentagonal pyramid	6	6	10	6 + 6 = 10 + 2

Question 7: For each of the given solid, the three views are given. Identify for each solid the corresponding top, front and side views:





Solution:

(a) A television
(i) Front view
(ii) Side view
(iii) Top view

(b) An aeroplane
(i) Front view
(ii) Side view
(iii) Top view

(c) A prism
(i) Top view
(ii) Front view
(iii) Side view

(d) A car
(i) Front view
(ii) Side view
(iii) Top view