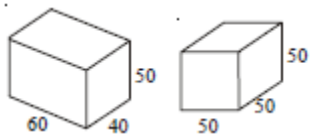
Surface Area & Volume (Cube-Cuboid)

Exercise 14.1

Q. 1. There are two cuboidal boxes as shown in the given figure. Which box requires the less amount of material to make?



Answer : Measurement of box 1

Length = 60 cm,

Breadth = 40 cm and,

Height = 50 cm

Volume of cuboid = Length × Breadth × Height

= 60 × 40 × 20

= 12000 cm^3

Measurement of box 2

Side = 50cm

Volume of cube = $(side)^3$

= $(50)^3$

= 50 × 50 × 50

= 125000 cm^3

Box 1 requires less amount of material.

Q. 2. Find the side of a cube whose surface area is 600 cm^2.

Answer : Let the side be S.

∴ Surface area of cube = 6 × $side^2$

$\Rightarrow 600 = 6 \times s^2$

$\Rightarrow \frac{600}{6} = s^2$

$\Rightarrow s^2 = 100$

$\Rightarrow s = \sqrt{100}$

$\Rightarrow s = 10$ cm

Q. 3. Prameela painted the outer surface of a cabinet of measures 1m × 2m × 1.5m. Find the surface area she cover if she painted all except the bottom of the cabinet?

Answer : Measurement of the cuboid

Length (L) = 1 m breadth(B) = 2 m and height(H) = 1.5 m

Total surface area = 2(LB + BH + LH)

= 2(1 × 2 + 2 × 1.5 + 1 × 1.5)

= 2(2 + 3 + 1.5)

= 2(6.5)

= 13 cm^2

Area of bottom surface = 1 × 2 = $2m^2$

Hence, area covered by painting = 13 – 2 = 11 m^2

Q. 4. Find the cost of painting a cuboid of dimensions 20cm × 15 cm × 12 cm at the rate of 5 paisa per square centimeter.

Answer : Measurement of the cuboid

Length(L) = 20 cm breadth(B) = 15 cm and height(H) = 12cm

Total surface area = 2(LB + BH + LH)

= 2(20 × 15 + 15 × 12 + 20 × 12)

= 2(300 + 180 + 240)

= 2(720)

= 1440 cm^2

Rate of painting 1cm^2 = ₹0.05

Rate of painting a whole cuboid = 0.05 × 1440

= ₹72

Exercise 14.2

Q. 1. Find the volume of the cuboid whose dimensions are given below.

	Length	Breadth	Height
(i)	8.2 m	5.3 m	2.6 m
(ii)	5.0 m	4.0 m	3.5 m
(iii)	4.5 m	2.0 m	2.5 m

Answer : i: Length = 8.2 m Breadth = 5.3m and Height = 2.6m

Volume of cuboid = Length × Breadth × Height

= 8.2 × 5.3 × 2.6

= 112.996 m^3

ii: Length = 5.0 m Breadth = 4.0m and Height = 3.5m

Volume of cuboid = Length × Breadth × Height

= 5 × 4 × 3.5

= 70 m^3

iii: Length = 4.5 m Breadth = 2m and Height = 2.5m

Volume of cuboid = Length × Breadth × Height

= 4.5 × 2 × 2.5

= 22.5 m^3

Q. 2. Find the capacity of the tanks with the following internal dimensions. Express the capacity in cubic meters and liters for each tank.

	Length	Breadth	Height
(i)	3m 20cm	2m 90cm	1m 50 cm
(ii)	2m 50cm	1m 60cm	1m 30 cm
(iii)	7m 30cm	3m 60cm	1m 40 cm

Answer : i: Length = 3m 20cm = 3.2m

Breadth = 2m 90cm = 2.9m

Height = 1m 50cm = 1.5m

Volume of cuboid = Length × Breadth × Height

= 3.2 × 2.9 × 1.5

= 13.92 m^3

ii: Length = 2m 50cm = 2.5m

Breadth = 1m 60cm = 1.6m

Height = 1m 30cm = 1.3m

Volume of cuboid = Length × Breadth × Height

= 2.5 × 1.6 × 1.3

= 5.2 m^3

iii: Length = 7m 30cm = 7.3m

Breadth = 3m 60cm = 3.6m

Height = 1m 40cm = 1.4m

Volume of cuboid = Length × Breadth × Height

= 7.3 × 3.6 × 1.4

= 36.792 m^3

Q. 3. What will happen to the volume of a cube if the length of its edge is reduced to half? Is the volume get reduced? If yes, how much?

Answer : Let x be the length of the cube

Volume of cube = $(\text{side})^3$

$= x^3$

If the length of its edge is reduced to half, then length would be = $\frac{x}{2}$

Now, Volume of cube = $\left(\frac{x}{2}\right)^3$

$= \frac{x^3}{8}$

Yes, the volume gets reduced by $\frac{1}{8}$ m^3.

Q. 4. Find the volume of each of the cube whose sides are.

(i) 6.4 cm (ii) 1.3 m (iii) 1.6 m.

Answer : (i) Side = 6.4cm

Volume of cube = $(\text{side})^3$

$= (6.4)^3$

$= 6.4 \times 6.4 \times 6.4$

$= 262.144\ cm^3$

(ii) Side = 1.3cm

Volume of cube = $(\text{side})^3$

$= (1.3)^3$

$= 1.3 \times 1.3 \times 1.3$

$= 2.197\ m^3$

(iii) Side = 1.6m

Volume of cube = $(\text{side})^3$

$= (1.6)^3$

$= 1.6 \times 1.6 \times 1.6$

$= 4.096\ m^3$

Q. 5. How many bricks will be required to build a wall of 8 m long, 6m height and 22.5 cm thick, if each brick measures 25 cm by 11.25 cm by 6 cm?

Answer : Measurements of Wall:

Length = 800cm Breadth = 600cm and Height = 22.5cm

Volume of wall = Length × Breadth × Height

$= 800 \times 600 \times 22.5$

Measurements of Brick:

Length = 25cm Breadth = 11.25cm and Height = 6cm

Volume of wall = Length × Breadth × Height

$= 25 \times 11.25 \times 6$

$$\text{Number of bricks required build a wall} = \frac{\text{Volume of Wall}}{\text{volume of brick}}$$

$$= \frac{800 \times 600 \times 22.5}{25 \times 11.25 \times 6}$$

$= 32 \times 100 \times 2$

$= 64 \times 100$

$= 6400$

Hence, 6400 bricks are required to build the wall.

Q. 6. A cuboid is 25 cm long, 15 cm broad, and 8 cm high. How much of its volume will differ from that of a cube with the edge of 16 cm?

Answer : Measurement of cuboid

Length = 25 cm Breadth = 15 cm and Height = 8 cm

Volume of cuboid = Length × Breadth × Height

= 25 × 15 × 8

= 3000 cm^3

Measurement of cube

Side = 16cm

Volume of cube = $(side)^3$

= $(16)^3$

= 16 × 16 × 16

= 4096 cm^3

Difference between the volumes = 4096 – 3000 cm^3 = 1096 cm^3

Volume of cuboid differs from volume of cube by 1096 cm^3.

Q. 7. A closed box is made up of wood which is 1cm thick. The outer dimensions of the box is 5 cm × 4 cm × 7 cm. Find the volume of the wood used.

Answer : Measurement of box from outside:

Length = 5 cm Breadth = 4 cm and Height = 7 cm

Volume of cuboid = Length × Breadth × Height

= 5 cm × 4 cm × 7 cm

= 140 cm^3

Measurement of box from the inside

Length = 4 cm

Breadth = 3 cm and Height = 6 cm

Volume of cuboid = Length × Breadth × Height

= 4 cm × 3 cm × 6 cm

= 72 cm^3

Volume of wood used = volume of the box from outside – volume of the box from inside

= 140 – 72

= 68 cm^3

Q. 8. How many cubes of edge 4cm, each can be cut out from cuboid whose length, breadth and height are 20 cm, 18 cm and 16 cm respectively.

Answer : Measurement of cuboid

Length = 20 cm Breadth = 18 cm and Height = 16 cm

Volume of cuboid = Length × Breadth × Height

= 20 × 18 × 16

= 5760 cm^3

Measurement of cube

Side = 4 cm

Volume of cube = $(side)^3$

= $(4)^3$

= 4 × 4 × 4

= 64 cm^3

Number of cube which can be cut from the cuboid = $\frac{Volume\ of\ Cuboid}{Volume\ of\ Cube}$

$= \frac{5760}{64}$

$= \frac{720}{8}$

= 90

90 cubes can be cut out from the cuboid.

Q. 9. How many cuboids of size 4 cm × 3 cm × 2 cm can be made from a cuboid of size 12 cm × 9 cm × 6 cm?

Answer : Measurement of bigger cuboid

Length = 12 cm Breadth = 9 cm and Height = 6 cm

Volume of cuboid = Length × Breadth × Height

= 12cm × 9cm × 6cm

Measurement of smaller cuboid

Length = 4 cm Breadth = 3 cm and Height = 2 cm

Volume of cuboid = Length × Breadth × Height

= 4cm × 3cm × 2cm

Number of smaller cuboids which can be made from bigger cuboid

$$= \frac{\text{volume of bigger cuboid}}{\text{volume of smaller cuboid}}$$

$$= \frac{12\text{cm} \times 9\text{cm} \times 6\text{cm}}{4\text{cm} \times 3\text{cm} \times 2\text{cm}}$$

= 3 × 3 × 3

= 27 cuboids

27 cuboids of smaller cuboids can be made from bigger cuboid.

Q. 10. A vessel in the shape of a cuboid is 30 cm long and 25 cm wide. What should be its height to hold 4.5 liters of water?

Answer : We know that,

1 liter is $1000cm^3$,

∴ 4.5 liters = 4.5 × 1000 = 4500 cm^3

Measurement of vessel

Length = 30 cm,

Breadth = 25cm,

And Height =?

Let the height be h cm.

We are given the capacity which this vessel can hold i.e. the volume of the vessel.

Volume of vessel = Length × Breadth × Height

4500 = 300 × 25 × h cm

4500 = 750 × h

h = $\frac{4500}{750}$

h = $\frac{90}{15}$

h = 6 cm

Hence, height of the vessel is 6cm which can hold 4.5 liters.