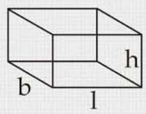
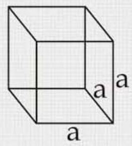
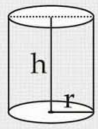
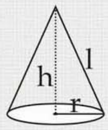
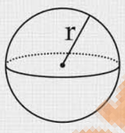
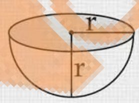
Volume and Surface Area of Solids
Ex 20.A

Name of the solid	Figure	Volume	Laterial/Curved Surface Area	Total Surface Area
Cuboid		lbh	$2lh + 2bh$ or $2h(l+b)$	$2lh+2bh+2lb$ or $2(lh+bh+lb)$
Cube		a^3	$4a^2$	$4a^2+2a^2$ or $6a^2$
Right circular cylinder		$\pi r^2 h$	$2\pi rh$	$2\pi rh + 2\pi r^2$ or $2\pi r(h+r)$
Right circular cone		$\frac{1}{3}\pi r^2 h$	πrl	$\pi rl + \pi r^2$ or $\pi r(l+r)$
Sphere		$\frac{4}{3}\pi r^3$	$4\pi r^2$	$4\pi r^2$
Hemisphere		$\frac{2}{3}\pi r^3$	$2\pi r^2$	$2\pi r^2+\pi r^2$ or $3\pi r^2$

Q1.

Answer :

Volume of a cylinder = $\pi r^2 h$
Lateral surface$= 2\pi rh$
Total surface area $= 2\pi r(h+r)$

(i) Base radius = 7 cm; height = 50 cm
Now, we have the following:
Volume$= \frac{22}{7} \times 7 \times 7 \times 50 = 7700\ cm^3$
Lateral surface area$= 2\pi rh = 2 \times \frac{22}{7} \times 7 \times 50 = 2200\ cm^2$
Total surface area $= 2\pi r(h+r) = 2 \times \frac{22}{7} \times 7(50+7) = 2508\ cm^2$

(ii) Base radius = 5.6 m; height = 1.25 m
Now, we have the following:
Volume$= \frac{22}{7} \times 5.6 \times 5.6 \times 1.25 = 123.2\ m^3$
Lateral surface area$= 2\pi rh = 2 \times \frac{22}{7} \times 5.6 \times 1.25 = 44\ m^2$
Total surface area $= 2\pi r(h+r) = 2 \times \frac{22}{7} \times 5.6(1.25+5.6) = 241.12\ m^2$

(iii) Base radius = 14 dm = 1.4 m, height = 15 m
Now, we have the following:
Volume$= \frac{22}{7} \times 1.4 \times 1.4 \times 15 = 92.4\ m^3$
Lateral surface area$= 2\pi rh = 2 \times \frac{22}{7} \times 1.4 \times 15 = 132\ m^2$
Total surface area $= 2\pi r(h+r) = 2 \times \frac{22}{7} \times 1.4(15+1.4) = 144.32\ cm^2$

Q2.

Answer :

$r = 1.5 \text{ m}$
$h = 10.5 \text{ m}$
Capacity of the tank $=$ volume of the tank $= \pi r^2 h = \frac{22}{7} \times 1.5 \times 1.5 \times 10.5 = 74.25 \text{ m}^3$
We know that $1 \text{ m}^3 = 1000 \text{ L}$
$\therefore 74.25 \text{ m}^3 = 74250 \text{ L}$

Q3.

Answer :

Height = 7 m
Radius = 10 cm = 0.1 m
Volume$= \pi r^2 h = \frac{22}{7} \times 0.1 \times 0.1 \times 7 = 0.22 \text{ m}^3$
Weight of wood = 225 kg/m^3
∴ Weight of the pole$= 0.22 \times 225 = 49.5\ kg$

Q4.

Answer :

Diameter = 2*r* = 140 cm
i.e., radius, *r* = 70 cm = 0.7 m

Now, volume $= \pi r^2 h = 1.54 \text{ m}^3$

$\Rightarrow \frac{22}{7} \times 0.7 \times 0.7 \times h = 1.54$
$\therefore h = \frac{1.54 \times 7}{0.7 \times 0.7 \times 22} = \frac{154 \times 7}{154 \times 7} = 1\ m$

Q5.

Answer :

Volume$= \pi r^2 h = 3850 \text{ cm}^3$
Height = 1 m =100 cm

Now, radius, $r = \sqrt{\frac{3850}{\pi \times h}} = \sqrt{\frac{3850 \times 7}{22 \times 100}} = 1.75 \times 7 = 3.5\ cm$
∴ Diameter =2(radius) $= 2 \times 3.5 = 7\ cm$

Q6.

Answer :

Diameter = 14 m
Radius $= \frac{14}{2} = 7\ m$
Height = 5 m

∴ Area of the metal sheet required = total surface area

$= 2\pi r \left(h + r\right)$
$= 2 \times \frac{22}{7} \times 7 \left(5 + 7\right)\ m^2$
$= 44 \times 12\ m^2$
$= 528 \text{ m}^2$

Q7.

Answer :

Circumference of the base = 88 cm
Height = 60 cm

Area of the curved surface $= circumference \times height = 88 \times 60 = 5280\ cm^2$
Circumference $= 2\pi r = 88\ cm$
Then radius$= r = \frac{88}{2\pi} = \frac{88 \times 7}{2 \times 22} = 14\ cm$
∴ Volume$= \pi r^2 h = \frac{22}{7} \times 14 \times 14 \times 60 = 36960 \text{ cm}^3$

Q8.

Answer :

Length = height = 14 m

Lateral surface area$= 2\pi rh = 220 \ m^2$

Radius $= r = \frac{220}{2\pi h} = \frac{220\times7}{2\times22\times14} = \frac{10}{4} = 2.5 \ m$

$\therefore$ Volume$= \pi r^2 h = \frac{22}{7} \times 2.5 \times 2.5 \times 14 = 275 \ m^3$

Q9.

Answer :

Height = 8 cm

Volume$= \pi r^2 h = 1232 \ cm^3$

Now, radius$= r = \sqrt{\frac{1232}{\pi h}} = \sqrt{\frac{1232\times7}{22\times8}} = \sqrt{49} = 7cm$

Also, curved surface area $= 2\pi rh = 2 \times \frac{22}{7} \times 7 \times 8 = 352 \ cm^2$

$\therefore$ Total surface area

$= 2\pi r\left(h + r\right) = \left(2 \times \frac{22}{7} \times 7 \times 8\right) + \left(2 \times \frac{22}{7} \times (7)^2\right) = 352 + 308 = 660 \ cm^2$

Q10.

Answer :

We have: $\frac{radius}{height} = \frac{7}{2}$

i.e., $r = \frac{7}{2} h$

Now, volume $= \pi r^2 h = \pi\left(\frac{7}{2}h\right)^2 h = 8316 \ cm^3$

$\Rightarrow \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} \times h^3 = 8316$

$\Rightarrow h^3 = \frac{8316\times2}{11\times7} = 108 \times 2 = 216$

$\Rightarrow h = \sqrt[3]{216} = 6 \ cm$

Then $r = \frac{7}{2} h = \frac{7}{2} \times 6 = 21 \ cm$

$\therefore$ Total surface area $= 2\pi r\left(h + r\right) = 2 \times \frac{22}{7} \times 21 \times \left(6 + 21\right) = 3564 \ cm^2$

Q11.

Answer :

Curved surface area $= 2\pi rh = 4400 \ cm^2$

Circumference $= 2\pi r = 110 \ cm$

Now, height$= h = \frac{curved \ surface \ area}{circumference} = \frac{4400}{110} = 40 \ cm$

Also, radius, $r = \frac{4400}{2\pi h} = \frac{4400\times7}{2\times22\times40} = \frac{35}{2}$

$\therefore$ Volume$= \pi r^2 h = \frac{22}{7} \times \frac{35}{2} \times \frac{35}{2} \times 40 = 22 \times 5 \times 35 \times 10 = 38500 \ cm^3$

Q12.

Answer :

For the cubic pack:
Length of the side, a = 5 cm
Height = 14 cm
Volume= $a^2h = 5 \times 5 \times 14 = 350\ cm^3$

For the cylindrical pack:
Base radius $= r = 3.5\ cm$
Height = 12 cm
Volume= $\pi r^2 h = \frac{22}{7} \times 3.5 \times 3.5 \times 12 = 462\ cm^3$

We can see that the pack with a circular base has a greater capacity than the pack with a square base.
Also, difference in volume= $462 - 350 = 112\ cm^3$

Q13.

Answer :

Diameter = 48 cm
Radius = 24 cm = 0.24 m
Height = 7 m

Now, we have:
Lateral surface area of one pillar= $\pi dh = \frac{22}{7} \times 0.48 \times 7 = 10.56\ m^2$
Surface area to be painted = total surface area of 15 pillars $= 10.56 \times 15 = 158.4\ m^2$
∴ Total cost= $\text{Rs}\ (158.4 \times 2.5) = \text{Rs}\ 396$

Q14.

Answer :

Volume of the rectangular vessel $= 22 \times 16 \times 14 = 4928\ cm^3$
Radius of the cylindrical vessel = 8 cm
Volume= $\pi r^2 h$

As the water is poured from the rectangular vessel to the cylindrical vessel, we have:
Volume of the rectangular vessel = volume of the cylindrical vessel

∴ Height of the water in the cylindrical vessel= $\frac{volume}{\pi r^2} = \frac{4928 \times 7}{22 \times 8 \times 8} = \frac{28 \times 7}{8} = \frac{49}{2} = 24.5\ cm$

Q15.

Answer :

Diameter of the given wire = 1 cm
Radius = 0.5 cm
Length = 11 cm
Now, volume= $\pi r^2 h = \frac{22}{7} \times 0.5 \times 0.5 \times 11 = 8.643\ cm^3$
The volumes of the two cylinders would be the same.
Now, diameter of the new wire = 1 mm = 0.1 cm
Radius = 0.05 cm
∴ New length $= \frac{\text{volume}}{\pi r^2} = \frac{8.643 \times 7}{22 \times 0.05 \times 0.05} = 1100.02\ cm \cong$ 11 m

Q16.

Answer :

Length of the edge, a = 2.2 cm
Volume of the cube $= a^3 = (2.2)^3 = 10.648\ cm^3$
Volume of the wire= $\pi r^2 h$
Radius = 1 mm = 0.1 cm
As volume of cube = volume of wire, we have:

$h = \frac{volume}{\pi r^2} = \frac{10.648 \times 7}{22 \times 0.1 \times 0.1} = 338.8\ cm$

Q17.

Answer :

Diameter = 7 m
Radius = 3.5 m
Depth = 20 m

Volume of the earth dug out $= \pi r^2 h = \frac{22}{7} \times 3.5 \times 3.5 \times 20 = 770\ m^3$
Volume of the earth piled upon the given plot$= 28 \times 11 \times h = 770\ m^3$

$\therefore h = \frac{770}{28 \times 11} = \frac{70}{28} = 2.5\ m$

Q18.

Answer :

Inner diameter = 14 m
i.e., radius = 7 m
Depth = 12 m
Volume of the earth dug out$= \pi r^2 h = \frac{22}{7} \times 7 \times 7 \times 12 = 1848\ m^3$

Width of embankment = 7 m
Now, total radius $= 7 + 7 = 14\ m$

$$\text{Volume of the embankment} = \text{total volume} - \text{inner volume}$$
$$= \pi r_o^2 h - \pi r_i^2 h = \pi h (r_o^2 - r_i^2)$$
$$= \frac{22}{7} h \left(14^2 - 7^2\right) = \frac{22}{7} h (196 - 49)$$
$$= \frac{22}{7} h \times 147 = 21 \times 22h$$
$$= 462 \times h\ m^3$$

Since volume of embankment = volume of earth dug out, we have:
$1848 = 462\ h$
$\Rightarrow h = \frac{1848}{462} = 4\ m$
∴ Height of the embankment = 4 m

Q19.

Answer :

Diameter = 84 cm
i.e., radius = 42 cm
Length = 1 m = 100 cm
Now, lateral surface area $= 2\pi rh = 2 \times \frac{22}{7} \times 42 \times 100 = 26400\ cm^2$
∴ Area of the road
$= \text{lateral surface area} \times \text{no. of rotations} = 26400 \times 750 = 19800000\ cm^2 = 1980\ m^2$

Q20.

Answer :

Thickness of the cylinder = 1.5 cm
External diameter = 12 cm
i.e., radius = 6 cm
also, internal radius = 4.5 cm
Height = 84 cm

Now, we have the following:
Total volume$= \pi r^2 h = \frac{22}{7} \times 6 \times 6 \times 84 = 9504\ cm^3$
Inner volume $= \pi r^2 h = \frac{22}{7} \times 4.5 \times 4.5 \times 84 = 5346\ cm^3$
Now, volume of the metal = total volume − inner volume $= 9504 - 5346 = 4158\ cm^3$
∴ Weight of iron $= 4158 \times 7.5 = 31185\ g = 31.185\ kg$ [Given: $1\ cm^3 = 7.5 g$]

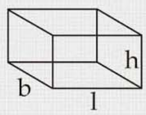
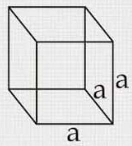
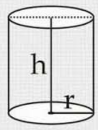
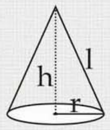
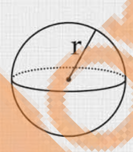
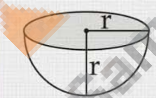
Q21.

Answer :

Length = 1 m = 100 cm
Inner diameter = 12 cm
Radius = 6 cm
Now, inner volume$= \pi r^2 h = \frac{22}{7} \times 6 \times 6 \times 100 = 11314.286\ \mathrm{cm}^3$
Thickness = 1 cm
Total radius = 7 cm

Now, we have the following:
Total volume$= \pi r^2 h = \frac{22}{7} \times 7 \times 7 \times 100 = 15400\ \mathrm{cm}^3$
Volume of the tube $=$ **total volume** $-$ **inner volume** $= 15400 - 11314.286 = 4085.714\ cm^3$
Density of the tube = 7.7 g/cm^3
∴ Weight of the tube $=$ **volume** $\times$ **density** $= 4085.714 \times 7.7 = 31459.9978\ \mathrm{g} = 31.459\ \mathrm{kg}$

Volume and Surface Area of Solids
Ex 20.B

Name of the solid	Figure	Volume	Laterial/Curved Surface Area	Total Surface Area
Cuboid		lbh	2lh + 2bh or 2h(l+b)	2lh+2bh+2lb or 2(lh+bh+lb)
Cube		a^3	$4a^2$	$4a^2+2a^2$ or $6a^2$
Right circular cylinder		πr^2h	$2\pi rh$	$2\pi rh + 2\pi r^2$ or $2\pi r(h+r)$
Right circular cone		$\frac{1}{3}\pi r^2h$	πrl	$\pi rl + \pi r^2$ or $\pi r(l+r)$
Sphere		$\frac{4}{3}\pi r^3$	$4\pi r^2$	$4\pi r^2$
Hemisphere		$\frac{2}{3}\pi r^3$	$2\pi r^2$	$2\pi r^2+\pi r^2$ or $3\pi r^2$

Q1.

Answer :

Volume of a cuboid $= (Length \times Breadth \times Height)$ cubic units
Total surface area $= 2(lb + bh + lh)$ sq units
Lateral surface area $= [2(l + b) \times h]$ sq units

(i) Length = 22 cm, breadth = 12 cm, height = 7.5 cm
Volume $= (Length \times Breadth \times Height) = (22 \times 12 \times 7.5) = 1980\ cm^3$
Total surface area
$= 2(lb + bh + lh) = 2[(22 \times 12) + (22 \times 7.5) + (12 \times 7.5)] = 2[264 + 165 + 90] = 1038\ cm^2$
Lateral surface area $= [2(l + b) \times h] = 2(22 + 12) \times 7.5 = 510\ cm^2$

(ii) Length = 15 m, breadth = 6 m, height = 9 dm = 0.9 m
Volume $= (Length \times Breadth \times Height) = (15 \times 6 \times 0.9) = 81\ m^3$
Total surface area $= 2(lb + bh + lh)$
$= 2[(15 \times 6) + (15 \times 0.9) + (6 \times 0.9)] = 2[90 + 13.5 + 5.4] = 217.8\ m^2$
Lateral surface area $= [2(l + b) \times h] = 2(15 + 6) \times 0.9 = 37.8\ m^2$

(iii) Length = 24 m, breadth = 25 cm = 0.25 m, height = 6 m

Volume $= (Length \times Breadth \times Height) = (24 \times 0.25 \times 6) = 36\ m^3$

Total surface area$= 2(lb + bh + lh)$

$= 2[(24 \times 0.25) + (24 \times 6) + (0.25 \times 6)] = 2[6 + 144 + 1.5] = 303\ m^2$

Lateral surface area $= [2(l + b) \times h] = 2(24 + 0.25) \times 6 = 291\ m^2$

(iv) Length = 48 cm = 0.48 m, breadth = 6 dm = 0.6 m, height = 1 m

Volume $= (Length \times Breadth \times Height) = (0.48 \times 0.6 \times 1) = 0.288\ m^3$

Total surface area

$= 2(lb + bh + lh) = 2[(0.48 \times 0.6) + (0.48 \times 1) + (0.6 \times 1)] = 2[0.288 + 0.48 + 0.6] = 2.736$

Lateral surface area $= [2(l + b) \times h] = 2(0.48 + 0.6) \times 1 = 2.16\ m^2$

Q2.

Answer :

$1\ m = 100\ cm$

Therefore, dimensions of the tank are:

$2\ m\ 75\ cm \times 1\ m\ 80\ cm \times 1\ m\ 40\ cm = 275\ cm \times 180\ cm \times 140\ cm$

$\therefore$ Volume = $\text{Length} \times \text{Breadth} \times \text{Height} = 275 \times 180 \times 140 = 6930000\ \text{cm}^3$

Also, $1000 cm^3 = 1L$

$\therefore$ Volume $= \frac{6930000}{1000} = 6930\ L$

Q3.

Answer :

$1m = 100cm$

$\therefore$ Dimensions of the iron piece = $105\ \text{cm} \times 70\ \text{cm} \times 1.5\ \text{cm}$

Total volume of the piece of iron $= (105 \times 70 \times 1.5) = 11025\ cm^3$

1 cm^3 measures 8 gms.

$\therefore$Weight of the piece

$= 11025 \times 8 = 88200\ g = \frac{88200}{1000} = 88.2\ kg \qquad (because\ 1\ kg = 1000\ g)$

Q4.

Answer :

$1\ cm = 0.01\ m$

Volume of the gravel used $= \text{Area} \times Height = (3750 \times 0.01) = 37.5\ \text{m}^3$

Cost of the gravel is Rs 6.40 per cubic meter.

$\therefore$ Total cost $= (37.5 \times 6.4) =$ Rs 240

Q5.

Answer :

Total volume of the hall$= (16 \times 12.5 \times 4.5) = 900\ m^3$

It is given that $3.6\ m^3$ of air is required for each person.

The total number of persons that can be accommodated in that hall

$= \frac{\text{Total volume}}{\text{Volume required by each person}} = \frac{900}{3.6}$

$= 250$ people

Q6.

Answer :

Volume of the cardboard box $= (120 \times 72 \times 54) = 466560\ cm^3$

Volume of each bar of soap$= (6 \times 4.5 \times 4) = 108\ cm^3$

Total number of bars of soap that can be accommodated in that box
$= \frac{\text{Volume of the box}}{\text{Volume of each soap}} = \frac{466560}{108} = 4320$ bars

Q7.

Answer :

Volume occupied by a single matchbox$= (4 \times 2.5 \times 1.5) = 15\ cm^3$

Volume of a packet containing 144 matchboxes $= (15 \times 144) = 2160\ cm^3$

Volume of the carton$= (150 \times 84 \times 60) = 756000\ cm^3$

Total number of packets is a carton$= \frac{\text{Volume of the carton}}{\text{Volume of a packet}} = \frac{75600}{2160} = 350$ packets

Q8.

Answer :

Total volume of the block $= (500 \times 70 \times 32) = 1120000\ cm^3$

Total volume of each plank $= 200 \times 25 \times 8 = 40000\ cm^3 = 200 \times 25 \times 8 = 40000\ cm^3$

$\therefore$ Total number of planks that can be made$= \frac{\text{Total volume of the block}}{\text{Volume of each plank}} = \frac{1120000}{40000} = 28$ planks

Q9.

Answer :

Volume of the brick $= 25 \times 13.5 \times 6 = 2025\ cm^3$
Volume of the wall $= 800 \times 540 \times 33 = 14256000\ cm^3$

Total number of bricks $= \frac{\text{Volume of the wall}}{\text{Volume of each brick}} = \frac{14256000}{2025} = 7040$ bricks

Q10.

Answer :

Volume of the wall$= 1500 \times 30 \times 400 = 18000000\ cm^3$
Total quantity of mortar$= \frac{1}{12} \times 18000000 = 1500000\ cm^3$
$\therefore$ Volume of the bricks$= 18000000 - 1500000 = 16500000\ cm^3$

Volume of a single brick$= 22 \times 12.5 \times 7.5 = 2062.5\ cm^3$

$\therefore$ Total number of bricks$= \frac{\text{Total volume of the bricks}}{\text{Volume of a single brick}} = \frac{16500000}{2062.5} = 8000$ bricks

Q11.

Answer :

Volume of the cistern$= 11.2 \times 6 \times 5.8 = 389.76\ m^3 = 389.76 \times 1000 = 389760$ litres

Area of the iron sheet required to make this cistern = Total surface area of the cistern
$= 2(11.2 \times 6 + 11.2 \times 5.8 + 6 \times 5.8) = 2(67.2 + 64.96 + 34.8) = 333.92\ cm^2$

Q12.

Answer :

Volume of the block$= 0.5\ m^3$
We know:
$1\ hectare\ = 10000\ m^2$
Thickness$= \frac{\text{Volume}}{\text{Area}} = \frac{0.5}{10000} = 0.00005\ \text{m} = 0.005\ \text{cm}\ = 0.05\ \text{mm}$

Q13.

Answer :

Rainfall recorded = 5 cm = 0.05 m
Area of the field = 2 hectare = $2 \times 10000\ \text{m}^2\ = 20000\ \text{m}^2$
Total rain over the field =
$\text{Area of the field} \times \text{Height of the field} = 0.05 \times 20000 = 1000\ \text{m}^3$

Q14.

Answer :

Area of the cross-section of river $= 45 \times 2 = 90\ m^2$

Rate of flow$= 3\ {}^{km}/_{hr} = \frac{3 \times 1000}{60} = 50\ \frac{m}{min}$

Volume of water flowing through the cross-section in one minute $= 90 \times 50 = 4500\ m^3$ per minute

Q15.

Answer :

Let the depth of the pit be *d* m.
$\text{Volume} = \text{Length} \times \text{width} \times \text{depth} = 5\ \text{m} \times 3.5\ \text{m} \times d\ m$
But,
Given volume = 14 m^3
$\therefore$ Depth $= d = \frac{\text{volume}}{\text{length} \times \text{width}} = \frac{14}{5 \times 3.5} = 0.8\ \text{m}$ = 80 cm

Q16.

Answer :

Capacity of the water tank $= 576 \text{ litres} = 0.576 \text{ m}^3$
Width = 90 cm = 0.9 m
Depth = 40 cm = 0.4 m

Length = $= \frac{\text{capacity}}{\text{width} \times \text{depth}} = \frac{0.576}{0.9 \times 0.4} = 1.600 \text{ m}$

Q17.

Answer :

Volume of the beam$= 1.35 \text{ m}^3$

Length = 5 m

Thickness = 36 cm = 0.36 m

Width = $= \frac{\text{volume}}{\text{thickness} \times \text{length}} = \frac{1.35}{5 \times 0.36} = 0.75 \text{ m} = 75 \text{ cm}$

Q18.

Answer :

Volume $= \text{height} \times \text{area}$
Given:
Volume = 378 m^3
Area = 84 m^2

$\therefore$ Height $= \frac{\text{volume}}{\text{area}} = \frac{378}{84} = 4.5 \text{ m}$

Q19.

Answer :

Length of the pool = 260 m
Width of the pool = 140 m

Volume of water in the pool = 54600 cubic metres

$\therefore$ Height of water $= \frac{\text{volume}}{\text{length} \times \text{width}} = \frac{54600}{260 \times 140} = 1.5$ metres

Q20.

Answer :

External length = 60 cm
External width = 45 cm
External height = 32 cm

External volume of the box$= 60 \times 45 \times 32 = 86400 \text{ cm}^3$

Thickness of wood = 2.5 cm

$\therefore$ Internal length $= 60 - (2.5 \times 2) = 55$ cm
Internal width $= 45 - (2.5 \times 2) = 40$ cm
Internal height $= 32 - (2.5 \times 2) = 27$ cm

Internal volume of the box$= 55 \times 40 \times 27 = 59400 \text{ cm}^3$

Volume of wood = External volume - Internal volume$= 86400 - 59400 = 27000 \text{ cm}^3$

Q21.

Answer :

External length = 36 cm
External width = 25 cm
External height = 16.5 cm

External volume of the box $= 36 \times 25 \times 16.5 = 14850 \text{ cm}^3$

Thickness of iron = 1.5 cm

$\therefore$ Internal length $= 36 - (1.5 \times 2) = 33$ cm
Internal width $= 25 - (1.5 \times 2) = 22$ cm
Internal height $= 16.5 - 1.5 = 15$ cm (as the box is open)

Internal volume of the box $= 33 \times 22 \times 15 = 10890 \text{ cm}^3$

Volume of iron = External volume – Internal volume $= 14850 - 10890 = 3960 \text{ cm}^3$

Given:
$1 \text{ cm}^3 \text{ of iron} = 8.5 \text{ grams}$

Total weight of the box $= 3960 \times 8.5 = 33660 \text{ grams} = 33.66 \text{ kilograms}$

Q22.
Answer :

External length = 56 cm
External width = 39 cm
External height = 30 cm

External volume of the box $= 56 \times 39 \times 30 = 65520 \text{ cm}^3$

Thickness of wood = 3 cm

$\therefore$ Internal length $= 56 - (3 \times 2) = 50$ cm
Internal width $= 39 - (3 \times 2) = 33$ cm
Internal height $= 30 - (3 \times 2) = 24$ cm

Capacity of the box = Internal volume of the box $= 50 \times 33 \times 24 = 39600 \text{ cm}^3$

Volume of wood = External volume – Internal volume $= 65520 - 39600 = 25920 \text{ cm}^3$

Q23.
Answer :

External length = 62 cm
External width = 30 cm
External height = 18 cm

$\therefore$ External volume of the box $= 62 \times 30 \times 18 = 33480\ cm^3$

Thickness of the wood = 2 cm

Now, internal length $= 62 - (2 \times 2) = 58$ cm
Internal width $= 30 - (2 \times 2) = 26$ cm
Internal height $= 18 - (2 \times 2) = 14$ cm

$\therefore$ Capacity of the box = internal volume of the box $= (58 \times 26 \times 14)\ cm^3 = 21112\ cm^3$

Q24.

Answer :

External length = 80 cm
External width = 65 cm
External height = 45 cm

∴ External volume of the box$= 80 \times 65 \times 45 = 234000\ cm^3$

Thickness of the wood = 2.5 cm

Then internal length$= 80 - (2.5 \times 2) = 75$ cm
Internal width $= 65 - (2.5 \times 2) = 60$ cm
Internal height $= 45 - (2.5 \times 2) = 40$ cm

Capacity of the box = internal volume of the box$= (75 \times 60 \times 40)\ cm^3 = 180000\ cm^3$

Volume of the wood = external volume – internal volume$= (234000 - 180000)\ cm^3 = 54000\ cm^3$

It is given that $100\ \text{cm}^3$ of wood weighs 8 g.

∴ Weight of the wood $= \frac{54000}{100} \times 8\ \text{g} = 4320\ \text{g} = 4.32\ \text{kg}$

Q25.
Answer :

(i) Length of the edge of the cube = *a* = 7 m
Now, we have the following:
Volume$= a^3 = 7^3 = 343\ m^3$
Lateral surface area $= 4a^2 = 4 \times 7 \times 7 = 196\ m^2$
Total Surface area$= 6a^2 = 6 \times 7 \times 7 = 294\ m^2$

(ii) Length of the edge of the cube = a = 5.6 cm
Now, we have the following:
Volume$= a^3 = 5.6^3 = 175.616\ cm^3$
Lateral surface area $= 4a^2 = 4 \times 5.6 \times 5.6 = 125.44\ cm^2$
Total Surface area$= 6a^2 = 6 \times 5.6 \times 5.6 = 188.16\ cm^2$

(iii) Length of the edge of the cube = a = 8 dm 5 cm = 85 cm
Now, we have the following:
Volume$= a^3 = 85^3 = 614125\ cm^3$
Lateral surface area $= 4a^2 = 4 \times 85 \times 85 = 28900\ cm^2$
Total Surface area$= 6a^2 = 6 \times 85 \times 85 = 43350\ cm^2$

Q26.
Answer :

Let *a* be the length of the edge of the cube.
Total surface area$= 6a^2 = 1176\ cm^2$
$\Rightarrow a = \sqrt{\frac{1176}{6}} = \sqrt{196} = 14\ cm$
∴ Volume$= a^3 = 14^3 = 2744\ cm^3$

Q27.
Answer :

Let *a* be the length of the edge of the cube.

Then volume $= a^3 = 729\ cm^3$

Also, $a = \sqrt[3]{729} = 9\ cm$

∴ Surface area$= 6a^2 = 6 \times 9 \times 9 = 486\ cm^2$

Q28.

Answer :

1 m = 100 cm
Volume of the original block $= 225 \times 150 \times 27 = 911250\ cm^3$

Length of the edge of one cube = 45 cm
Then volume of one cube$= 45^3 = 91125\ cm^3$

$\therefore$ Total number of blocks that can be cast $= \frac{\text{volume of the block}}{\text{volume of one cube}} = \frac{911250}{91125} = 10$

Q29.
Answer :

Let *a* be the length of the edge of a cube.
Volume of the cube$= a^3$
Total surface area$= 6a^2$

If the length is doubled, then the new length becomes 2*a*.
Now, new volume $= (2a)^3 = 8a^3$
Also, new surface area=$= 6(2a)^2 = 6 \times 4a^2 = 24a^2$
$\therefore$ The volume is increased by a factor of 8, while the surface area increases by a factor of 4.

Q30.

Answer :

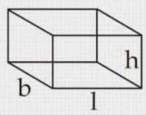
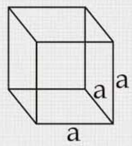
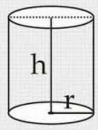
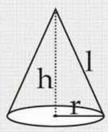
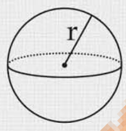
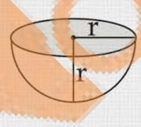
Cost of wood = Rs $500/\mathrm{m}^3$

Cost of the given block = Rs 256

$\therefore$ Volume of the given block $= \mathrm{a}^3 = \frac{256}{500} = 0.512\ \mathrm{m}^3 = 512000\ \mathrm{cm}^3$

Also, length of its edge = a $= \sqrt[3]{0.512} = 0.8\ m$ = 80 cm

Volume and Surface Area of Solids
Ex 20.C

Name of the solid	Figure	Volume	Laterial/Curved Surface Area	Total Surface Area
Cuboid		lbh	2lh + 2bh or 2h(l+b)	2lh+2bh+2lb or 2(lh+bh+lb)
Cube		a^3	$4a^2$	$4a^2+2a^2$ or $6a^2$
Right circular cylinder		$\pi r^2 h$	$2\pi rh$	$2\pi rh + 2\pi r^2$ or $2\pi r(h+r)$
Right circular cone		$\frac{1}{3}\pi r^2 h$	πrl	$\pi rl + \pi r^2$ or $\pi r(l+r)$
Sphere		$\frac{4}{3}\pi r^3$	$4\pi r^2$	$4\pi r^2$
Hemisphere		$\frac{2}{3}\pi r^3$	$2\pi r^2$	$2\pi r^2+\pi r^2$ or $3\pi r^2$

Q1.

Answer :

(b) 17

Length of the diagonal of a cuboid $=\sqrt{l^2+b^2+h^2}$

$\therefore \sqrt{l^2+b^2+h^2}=\sqrt{12^2+9^2+8^2}=\sqrt{144+81+64}=\sqrt{289}=17\ cm$

Q2.

Answer :

(b) $125\ cm^3$

Total surface area $=6a^2=150\ cm^2$, where a is the length of the edge of the cube.
$\Rightarrow 6a^2=150$
$\Rightarrow a=\sqrt{\frac{150}{6}}=\sqrt{25}=5\ cm$
$\therefore$ Volume$=a^3=5^3=125\ cm^3$

Q3.

Answer :

(c) $294\ cm^2$

Volume$= a^3 = 343\ cm^3$
$\Rightarrow a = \sqrt[3]{343} = 7\ cm$
$\therefore$ Total surface area$= 6a^2 = 6 \times 7 \times 7 = 294\ cm^2$

Q4.

Answer :

(c) $294\ cm^2$

Volume$= a^3 = 343\ cm^3$
$\Rightarrow a = \sqrt[3]{343} = 7\ cm$
$\therefore$ Total surface area$= 6a^2 = 6 \times 7 \times 7 = 294\ cm^2$

Q5.

Answer :

(c) 6400

Volume of each brick$= 25 \times 11.25 \times 6 = 1687.5\ cm^3$
Volume of the wall$= 800 \times 600 \times 22.5 = 10800000\ cm^3$
$\therefore$ No. of bricks $= \frac{10800000}{1687.5} = 6400$

Q6.

Answer :

(c) 1000

Volume of the smaller cube$= (10\ cm)^3 = 1000\ cm^3$
Volume of box$= (100\ cm)^3 = 1000000\ cm^3$ [1 m = 100 cm]
$\therefore$ Total no. of cubes $= \frac{100 \times 100 \times 100}{10 \times 10 \times 10} = 1000$

Q7.

Answer :

(a) $48\ cm^3$

Let *a* be the length of the smallest edge.
Then the edges are in the proportion *a* : 2*a* : 3*a*.
Now, surface area$= 2(a \times 2a + a \times 3a + 2a \times 3a) = 2(2a^2 + 3a^2 + 6a^2) = 22a^2 = 88\ cm^2$

$\Rightarrow a = \sqrt{\frac{88}{22}} = \sqrt{4} = 2$
Also, 2*a* = 4 and 3*a* = 6
$\therefore$ Volume$= a \times 2a \times 3a = 2 \times 4 \times 6 = 48\ cm^3$

Q8.

Answer :

(b) 1: 9

$\frac{\text{Volume 1}}{\text{Volume 2}} = \frac{1}{27} = \frac{a^3}{b^3}$

$\Rightarrow a = \frac{b}{\sqrt[3]{27}} = \frac{b}{3}$ or $b = 3a$ or $\frac{b}{a} = 3$

Now, $\frac{\text{surface area 1}}{\text{surface area 2}} = \frac{6a^2}{6b^2} = \frac{a^2}{b^2} = \frac{(b/3)^2}{b^2} = \frac{1}{9}$

$\therefore$ Ratio of the surface areas $= 1 : 9$

Q9.

Answer :

(c) 164 sq cm

Surface area $= 2(10 \times 4 + 10 \times 3 + 4 \times 3) = 2(40 + 30 + 12) = 164\ cm^2$

Q10.

Answer :

(c) 36 kg

Volume of the iron beam $= 9 \times 0.4 \times 0.2 = 0.72\ m^3$

$\therefore$ Weight$= 0.72 \times 50 = 36\ kg$

Q11.

Answer :

(a) 2 m

42000 L = 42 m^3

Volume $= lbh$

$\therefore$ Height $(h) = \frac{\text{volume}}{lb} = \frac{42}{6\times3.5} = \frac{6}{6\times0.5} = 2\ m$

Q12.

Answer :

(b) 88

Volume of the room$= 10 \times 8 \times 3.3 = 264\ m^3$

One person requires 3 m^3.

$\therefore$ Total no. of people that can be accommodated$= \frac{264}{3} = 88$

Q13.

Answer :

(a) 30000

Volume $= 3 \times 2 \times 5 = 30\ m^3 = 30000$ L

Q14.

Answer :

(b) $1390\ cm^2$

Surface area$= 2(25 \times 15 + 15 \times 8 + 25 \times 8) = 2(375 + 120 + 200) = 1390\ cm^2$

Q15.

Answer :

(d) $64\ cm^2$

Diagonal of the cube$= a\sqrt{3} = 4\sqrt{3}\ cm$

i.e., a = 4 cm

$\therefore$ Volume$= a^3 = 4^3 = 64\ cm^3$

Q16.

Answer :

(b) 486 sq cm

Diagonal $= \sqrt{3}a\ cm\ =\ 9\sqrt{3}cm$
i.e., $a = 9$
$\therefore$ Total surface area $= 6a^2 = 6 \times 81 = 486\ cm^2$

Q17.

Answer :

(d) If each side of the cube is doubled, its volume becomes 8 times the original volume.

Let the original side be *a* units.
Then original volume = a^3 cubic units
Now, new side = $2a$ units
Then new volume = $(2a)^3$ sq units = 8 a^3cubic units
Thus, the volume becomes 8 times the original volume.

Q18.

Answer :

(b) becomes 4 times.

Let the side of the cube be a units.
Surface area = $6a^2$ sq units
Now, new side = $2a$ units
New surface area = $6(2a^2)$ sq units = $24a^2$ sq units.
Thus, the surface area becomes 4 times the original area.

Q19.

Answer :

(a) 12 cm

Total volume $= 6^3 + 8^3 + 10^3 = 216 + 512 + 1000 = 1728\ cm^3$
$\therefore$ Edge of the new cube$= \sqrt[3]{1728} = 12\ cm$

Q20.

Answer :

(d) $625\ cm^3$

Length of the cuboid so formed = 25 cm
Breadth of the cuboid = 5 cm
Height of the cuboid = 5 cm
$\therefore$ Volume of cuboid$= 25 \times 5 \times 5 = 625\ cm^3$

Q21.

Answer :

(d) 44 m^3

Diameter = 2 m
Radius = 1 m
Height = 14 m
$\therefore\ \text{Volume} = \pi r^2 h = \frac{22}{7} \times 1 \times 1 \times 14 = 44\ m^3$

Q22.

Answer :

(b) 12 m

Diameter = 14 m
Radius = 7 m
Volume = 1848 m^3

$\text{Now, volume} = \pi r^2 h = \frac{22}{7} \times 7 \times 7 \times h = 1848\ m^3$
$\therefore\ h\ =\ \frac{1848}{22\times7} = 12\ m$

Q23.

Answer :

(c) 4 : 3

Here,
$\frac{\text{Total surface area}}{\text{Lateral surface area}} = \frac{2\pi r(h+r)}{2\pi rh}$
$= \frac{h+r}{h}$
$= \frac{20+60}{60}$
$= \frac{4}{3}$
$= 4:3$

Q24.

Answer :

(d) 640
$\text{Total no. of coins} = \frac{\text{volume of cylinder}}{\text{volume of each coin}} = \frac{\pi\times3\times3\times8}{\pi\times0.75\times0.75\times0.2} = 640$

Q25.

Answer :

(b) 84 m
$\text{Length} = \frac{\text{volume}}{\pi r^2 2} = \frac{66\times7}{22\times0.05\times0.05} = 8400\ cm = 84\ m$

Q26.

Answer :

(a) 1100 cm^3
Volume$= \pi r^2 h = \frac{22}{7} \times 5 \times 5 \times 14 = 1100\ cm^3$

Q27.

Answer :

(a) 1837 cm^2
Diameter = 7 cm
Radius =3.5 cm
Height = 80 cm
$\therefore$ Total surface area$= 2\pi r\left(r+h\right) = 2 \times \frac{22}{7} \times 3.5\left(3.5+80\right) = 22\left(83.5\right) = 1837\ cm^2$

Q28.

Answer :

(b) 396 cm^3
Here, curved surface area$= 2\pi rh = 264\ cm^3$
$\Rightarrow r = \frac{264\times7}{2\times22\times14} = 3\ cm$
$\therefore\ \text{Volume} = \pi r^2 h = \frac{22}{7} \times 3 \times 3 \times 14 = 396\ cm^3$

Q29.

Answer :

(a) 770 cm^3

Diameter = 14 cm

Radius = 7 cm

Now, curved surface area$= 2\pi rh = 220\ cm^2$

$\Rightarrow h = \frac{220\times7}{2\times22\times7} = 5\ cm$

$\therefore\ \text{Volume} = \pi r^2 h = \frac{22}{7} \times 7 \times 7 \times 5 = 770\ cm^3$

Q30.

Answer :

(c) 20:27

We have the following :

$\frac{r_1}{r_2} = \frac{2}{3}$

$\frac{h_1}{h_2} = \frac{5}{3}$

$\therefore \frac{V_1}{V_2} = \frac{\pi r_1{}^2 h_1}{\pi r_2{}^2 h_2} = \frac{20}{27}$