EXERCISE 13.3

1. Metal spheres, each of radius 2 cm, are packed into a rectangular box of internal dimensions 16 cm × 8 cm × 8 cm. When 16 spheres are packed the box is filled with preservative liquid. Find the volume of this liquid. Give your answer to the nearest integer. [Use π =3.14]

Solution:

According to the question,
Radius of each sphere, r = 2 cm
Volume of a sphere is given by
Volume of 1 sphere = $4/3\ \pi r^3$
Since there are 16 spheres in our question,
Volume of 16 spheres = $16 \times 4/3\ \pi r^3$
$= 16 \times 4/3 \times 3.14 \times 2^3$
$= 535.89\ cm^3$
We know that,
Dimensions of rectangular box = 16 cm × 8 cm × 8 cm
Volume of rectangular box = $16 \times 8 \times 8 = 1024\ cm^3$
In order to find volume of the liquid that is filled in rectangular box,
We need to find the space left in the rectangular box after the space occupied by the spheres.
So, we can say that,
Volume of the liquid = (Volume of the rectangular box) – (Volume of the 16 spheres)
⇒ Volume of the liquid = 1024 – 535.89
$= 488.11\ cm^3$
Thus, volume of this liquid is $488.11\ cm^3$.

2. A storage tank is in the form of a cube. When it is full of water, the volume of water is 15.625 m^3.If the present depth of water is 1.3 m, find the volume of water already used from the tank.

Solution:

When the cubical tank is full:
Volume of water = Volume of cube = $15.625\ m^3$
So, we know that,
Volume of cube = $(\text{length of edge of cube})^3$
⇒ $(\text{length of edge of cube})^3 = 15.625$
⇒ length of edge of cube = $\sqrt[3]{15.625}$
$= 2.5$ m
We know that,
Length of the edge of the cube = 2.5 m.
When the present depth of the water is 1.3 m:
Length of tank = 2.5 m
Breadth of tank = 2.5 m
So, volume of water upto 1.3 m depth = length × breadth × depth
$= 2.5 \times 2.5 \times 1.3$
$= 8.125\ m^3$
Then, volume of water already used from the tank = (Volume of tank when it was full of water) – (Volume of water when depth is 1.3 m)

$= 15.625 – 8.125$
$= 7.5\ m^3$

Thus, volume of water already used from the tank is 7.5 m^3.

3. Find the amount of water displaced by a solid spherical ball of diameter 4.2 cm, when it is completely immersed in water.

Solution:

Water displaced when a solid spherical ball is immersed completely in water equals to its own volume.

According to the question,

Diameter of spherical ball = 4.2 cm

$\Rightarrow$ radius of spherical ball = 4.2/2 = 2.1 cm

So, volume of a sphere = $4/3\ \pi r^3$

$(4/3)\ (22/7)(2.1)^3 = 38.81$

Thus, volume of water displaced is 38.81 cm^3.

4. How many square metres of canvas is required for a conical tent whose height is 3.5 m and the radius of the base is 12 m?

Solution:

According to the question,

Dimensions of conical tent are:

Height = 3.5 m

Radius = 12 m

Curved surface area of cone = $\pi r\sqrt{(r^2 + h^2)}$

$= 22/7 \times 12\ \sqrt{(12^2 + 3.5^2)}$

$= 22/7 \times 12 \times \sqrt{156.25}$

$= 22/7 \times 12 \times 12.5$

$= 471.43\ m^2$

Since, area of canvas = curved surface area of conical tent

Therefore, area of canvas required is 471.43 m^2.