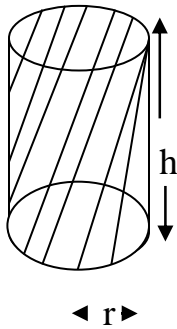


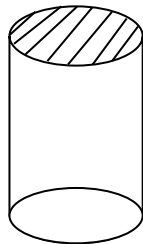
CHAPTER EIGHT

CYLINDERS AND CONES

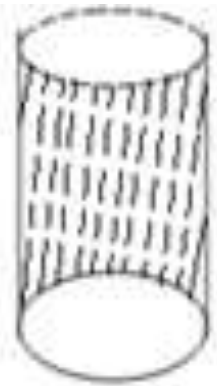
The cylinder:



- The above figure is known as a cylinder.
- The height of this cylinder is h and its radius is r .
- The shaded portion is called the total surface area of the cylinder, also referred to as the area of the cylinder.
- The area of a cylinder is made up of three parts and these are:
 1. The top circular flat surface area, which is also referred to as the top surface area, and which is indicated in the next diagram, by means of shading:

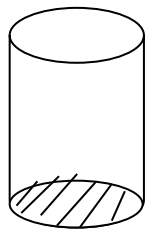


- The flat top circular surface area $= \pi r^2$, since it is circular in shape where r = the radius.
 2. The curved surface area, which is indicated by means of shading, in the next figure:



- The curved surface area = $2\pi rh$, where h = the height.

The bottom circular surface area, which is indicated in the next diagram by means of shading:

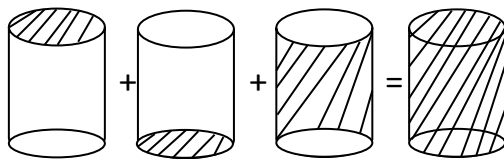


- The bottom surface area = πr^2 , since it is also circular in shape.

The area of a cylinder:

The total surface area of a cylinder is therefore had by adding together all these three surface areas,

i.e



$$\pi r^2 + \pi r^2 + 2\pi rh = 2\pi r^2 + 2\pi rh = 2\pi r(r + h).$$

Q1. The height of a cylinder is 5cm and its radius is 2cm. Calculate

- its flat top circular area.

- b) its flat bottom circular area.
- c) its curved surface area.
- d) its total surface area. [Take $\pi = 3.14$].

Soln.

$h = 5\text{cm}$, $r = 2\text{cm}$ and $\pi = 3.14$.

- a. The flat top surface area $= \pi r^2 = 3.14 \times 2^2 = 3.14 \times 4 = 12.56\text{cm}^2$
- b. The flat bottom surface area $= \pi r^2 = 3.14 \times 2^2 = 3.14 \times 4 = 12.56\text{cm}^2$
- c. The curved surface area $= 2\pi rh = 2 \times 3.14 \times 2 \times 5 = 62.8\text{cm}^2$
- d. The total surface area = top surface area + bottom surface area + curved surface area $= 12.56\text{cm}^2 + 12.56\text{cm}^2 + 62.8\text{cm}^2 = 87.9\text{cm}^2$.

N/B: Also the total surface area $= 2\pi r(r + h) = 2 \times 3.14 \times 2(2 + 5) = 12.56(7) = 87.9\text{cm}^2$.

Q2. A cylinder has a height of 40m and a diameter of 12m. Determine

- a. its bottom circular area .
- b. its curved surface area.
- c. Its total surface area.

[Take $\pi = 3.142$]

Soln:

Since $d = 12\text{m} \Rightarrow r = \frac{12}{2} = 6\text{m}$.

Also $\pi = 3.142$ and $h = 40\text{m}$.

- a. The bottom circular surface area $= \pi r^2 = 3.142 \times 6^2 = 3.142 \times 36 = 113\text{m}^2$
- b. The curved surface area $= 2\pi rh = 2 \times 3.142 \times 6 \times 40 = 1508\text{m}^2$
- c. The total surface area $= 2\pi r(r + h) = 2 \times 3.142 \times 6(6 + 40) = 1734\text{m}^2$.

Q3. A water storage tank is to be constructed using aluminum. If it is to have a diameter of 40m and a height of 120m, determine the amount of aluminum that will be needed to construct

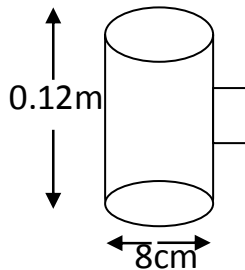
- a. its curved surface area .
- b. the whole tank. [Take π or *pie* = 3.14].

Soln.

Since $d = 40m \Rightarrow r = \frac{40}{2} = 20m$. Also $\pi = 3.14$ and $h = 120m$.

- a. The amount of aluminum which is needed to construct the curved surface area = the curved surface area = $2\pi rh = 2 \times 3.14 \times 20 \times 120 = 15072m^2$
- b. The amount of aluminum needed to construct the whole tank = the total surface area = $2\pi r(r + h) = 2 \times 3.14 \times 20(20 + 120) = 126(140) = 17640m^2$

Q4.



The given figure is that of a drinking cup, which is to be constructed using plastic. If it is to be 0.12m long and have a diameter of 8cm, determine the quantity of plastic needed for its construction. [Take $\pi = 3.142$].

N/B:

- A drinking cup has no top surface area \Rightarrow *plastic* will only be needed to construct the curved surface area and the bottom surface area.
- Also since the height is given in metres and the diameter in centimetres, the metres must be converted into centimetres.

Soln.

$$h = 0.12m = 0.12 \times 100 = 12cm.$$

$$D = 8cm \Rightarrow r = 4cm.$$

The amount of plastic needed to construct the curve surface area $= 2\pi rh = 2 \times 3.142 \times 4 \times 12 = 302cm^2$.

The amount of plastic needed to construct the bottom surface area = bottom surface area $= \pi r^2 = 3.142 \times 4^2 = 3.142 \times 16 = 50cm^2$.

The quantity of plastic needed to construct the cup = amount of plastic needed to construct the curved portion + the amount of plastic needed to construct the bottom surface $= 302 + 50 = 352cm^2$.

Q5. The curved surface area of a cylinder of height 80cm is $2880cm^2$. Calculate

- i. Its total surface area .
- ii. Its circular top surface area. [Take $\pi = 3.14$]

Soln.

The curved surface area $= 2\pi rh$, and since the curved surface area of the cylinder is given as $2880cm^2 \Rightarrow 2\pi rh = 2880, \Rightarrow 2 \times 3.14 \times r \times 80 = 2880$,

$$\Rightarrow 502r = 2880, \Rightarrow r = \frac{2880}{502} \Rightarrow r = 5.7cm.$$

- i. The total surface area $= 2\pi r(r + h) = 2 \times 3.14 \times 5.7(5.7 + 80) = 36(85.7) = 3085cm^2$
- ii. The top circular surface area $= \pi r^2 = 3.14 \times 5.7^2 = 102cm^2$.

N/B: Since in the question the heights as well as the curved surface areas were given, we must first determine the radius.

- In the next question, the curved surface area is given as well as the radius. We must therefore first determine the height.

Q6. The curved surface area of a cylinder whose radius is 5cm is $628cm^2$. Determine its total surface area.

Soln.

$r = 5\text{cm}$ and $h = ?$

Since the curved surface area = 628cm^2 , then $2\pi rh = 628 \Rightarrow 2 \times 3.14 \times 5 \times h = 628, \Rightarrow 31.4h = 628 \Rightarrow h = \frac{628}{3.14} = 20$.

Total surface area = $2\pi r(r + h) = 2 \times 3.14 \times 5(5 + 20) = 31.4(25) = 785\text{cm}^2$

Q7. A cylinder has a top surface area of 12.56cm^2 and a height of 0.8m . Calculate

- its curved surface area.
- its total surface area.

[Take $\pi = 3.142$]

Soln.

Top surface area = 12.56cm^2 , $h = 0.8\text{m} = 0.8\text{m} \times 100 = 80\text{cm}$.

$\pi = 3.142$ and $r = ?$

The top surface area is given by πr^2 , and since this = 12.56cm^2 , then

$$\pi r^2 = 12.56, \Rightarrow r^2 = \frac{12.56}{3.142} = 4.$$

Since $r^2 = 4 \Rightarrow r = \sqrt{4} = 2$.

- Curved surface area = $2\pi rh = 2 \times 3.142 \times 2 \times 80 = 1005\text{cm}^2$
- The total surface area = $2\pi r(r + h) = 2 \times 3.142 \times 2(2 + 80) = 12.56(82) = 1030\text{cm}^2$.