Surface Area of a Sphere

Objective

To find the surface area of sphere with the help of an activity.

Prerequisite Knowledge

Curved surface area (C.S. A.)of a right circular cylinder = $2\pi rh$(where r =radius of the base and h = height of the cylinder)

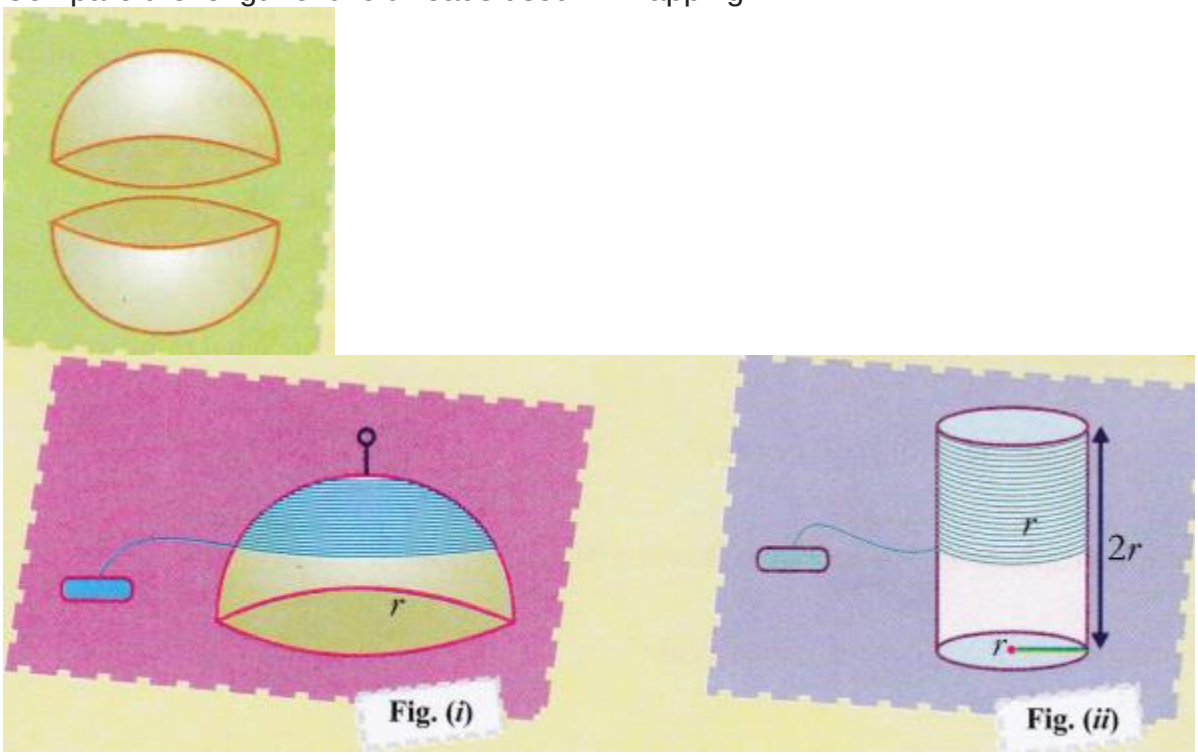
Materials Required

A solid spherical plastic ball, a cylinder with height equal to the diameter of the sphere, thread, cutter, pins, sketch pen etc. (Let radius of sphere be rand height of the cylinder be h)

Procedure

1. Divide the spherical plastic ball into two hemispherical portion with the help of a cutter.
2. Fix a pin at the top most point of the hemisphere.
3. Take a roll of thread and wind it closely on the curved surface of the hemisphere completely in the form of spiral starting with the pin on the surface of the hemisphere
4. Take another roll of thread and wind it completely along the curved surface of the cylinder in the form of a spiral.
5. Unwind the threads from the hemisphere and cylinder.

6. Compare the length of two threads used in wrapping.



Observation

1. The length of the thread used to cover the cylinder is two times more than the length of the thread used to cover the hemisphere.
2. Curved surface area of the hemisphere =$\frac{1}{2}$ x curved surface area of cylinder
   $\frac{1}{2} \times 2\pi rh$
   πrh
   $2\pi r^2$ (i.e h=2r because height of the cylinder = diameter of sphere)
   Total surface area of sphere =2x $2\pi r^2$

Result

Surface area of a sphere =$4\pi r^2$ (verified experimentally).

Learning Outcome

Students will derive the formula for surface area of a sphere through an activity.

Activity Time

Let the radii of a sphere and of the base of a cylinder are same. Find the ratio of the curved surface area of a sphere to curved surface area of a cylinder if the height of the cylinder is 2 times of its radius.

Viva Voce

Question 1:
What is a hemisphere ?
Answer:
Half of a sphere is called a hemisphere.

Question 2:
How many hemispheres make a sphere ?
Answer:
Two

Question 3:
What is the curved surface area of a hemisphere ?
Answer:
$2\pi r^2$

Question 4:
What is the curved surface area of a sphere ?
Answer:
$4\pi r^2$

Question 5:
What is the total surface area of a hemisphere ?
Answer:
$3\pi r^2$

Question 6:
What is the surface area of a sphere of diameter 14 cm ?
Answer:
616 cm^2

Question 7:
What is the radius of a hemisphere whose total surface area is 942 cm ? [Take 71 — 3.14]
Answer:
10 cm

Question 8:
What is the curved surface area of a sphere of radius 3 cm ? ’
Answer:
36π cm^2

Multiple Choice Questions

Question 1:
Surface area of a sphere of diameter 21 cm is
(a) 1386 cm^2
(b) 1368 cm^2
(c) 1683 cm^2
(d) 1863 cm^2

Question 2:
Find the total surface area of a hemisphere of radius 10cm. [Taken = 3.14]
(a) 924 cm^2
(b) 492 cm^2
(c) 942 cm^2
(d) None

Question 3:
The radius of a spherical balloon increases from 7 cm to 14 cm as air is being pumped into it. Find the ratio of surface areas of the balloon in the two cases.
(a) 4:1
(b) 1:4
(c) 1:1
(d) 4:4

Question 4:
What is the radius of a sphere whose surface area is 154 cm" ?
(a) 3.5 cm
(b) 3.3 cm
(c) 5.3 cm
(d) 5.5 cm

Question 5:
The diameter of the moon is approximately one- fourth of the diameter of the earth. Find the ratio of their surface areas.
(a) 1:16
(b) 16:1
(c) 1:4
(d) none of these

Question 6:
A right circular cylinder just encloses a sphere of radius r. Then what is the ratio of surface area of the sphere to curved surface area of the cylinder ?
(a) 1:1
(b) 4:1

(c) 1:4
(d) none of these

Question 7:
A sphere of radius rhas the same volume as that of a cone with a circular base of radius r. Find the height of the cone.
(a) 2 r
(b) 4 r
(c) 3 r
(d) none of these

Question 8:
What is the surface area of a sphere of diameter 3.5 m ?
(a) 38.5 m^2
(b) 35.8 m^2
(c) 53.8 m^2
(d) none of these

Question 9:
If the radii of a sphere and base of a cylinder are same, then find the ratio of the curved surface area of sphere to curved surface area of the cylinder if height of the cylinder is 4 times of its radius.
(a) 2:1
(b) 1:2
(c) 1:4
(d) 4:1

Question 10:
If the surface area of a sphere is 5544 cm^2, then its diameter is
(a) 42 cm
(b) 24 cm
(c) 22 cm
(d) 44 cm

Answers

1. (a)
2. (c)
3. (b)
4. (a)
5. (a)
6. (a)
7. (b)
8. (a)
9. (b)
10. (b)