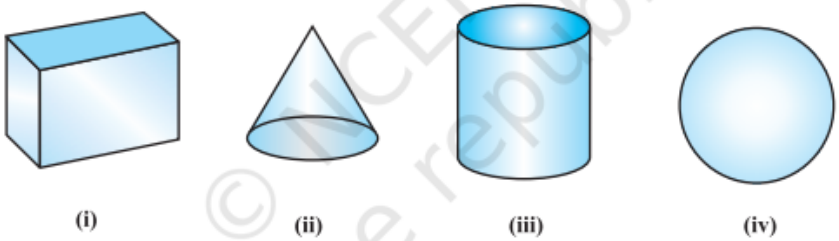
🟦 Chapter 12: Surface Areas and Volumes

📌 Introduction

- You've already learned about **cuboid, cone, cylinder, and sphere** (📍 Fig. 12.1).



- Many real-life objects are **combinations** of these solids.
  E.g. tankers, toys, test tubes, rockets.

🧱 12.2 Surface Area of a Combination of Solids

To find the **total surface area (TSA)** of such objects:

🟢 **Example 1**: A cylinder with hemispheres on both ends (📍 Fig. 12.4)

Fig. 12.4

TSA = CSA of cylinder + CSA of 2 hemispheres

$= 2\pi rh + 2 \times 2\pi r^2$

🟢 **Example 2**: A toy made of a **cone on a hemisphere** (📍 Fig. 12.5, 12.6)

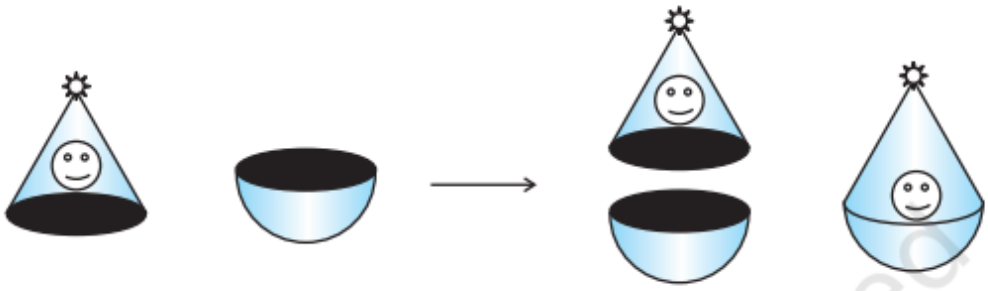


Fig. 12.5

TSA = CSA of cone + CSA of hemisphere

$= \pi rl + 2\pi r^2$

🟢 **Example 3**: Cube with a hemisphere on top (📍 Fig. 12.7)

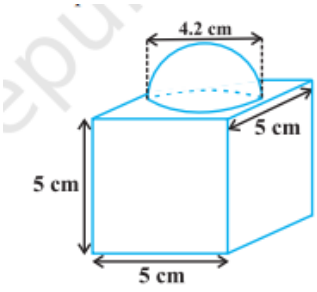


Fig. 12.7

TSA = TSA of cube − base area of hemisphere + CSA of hemisphere

$= 6a^2 - \pi r^2 + 2\pi r^2 = (6a^2 + \pi r^2)$

🟢 **Example 4**: Cone on a cylinder (📍Fig. 12.8)

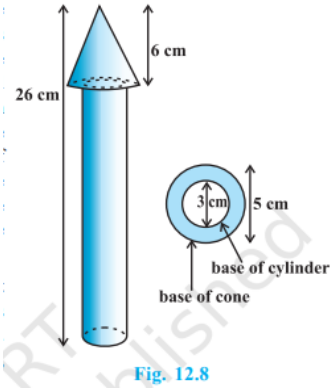


Fig. 12.8

TSA = CSA of cone + extra base area of cone − base area of cylinder +

CSA of cylinder + base of cylinder $= \pi rl + \pi r^2 - \pi r^2 + 2\pi r'h' + \pi r^2$

🟢 **Example 5**: Bird-bath shaped as a cylinder + hemispherical depression (📍Fig. 12.9)

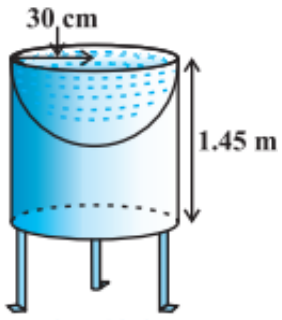


Fig. 12.9

TSA = CSA of cylinder + CSA of hemisphere $= 2\pi r(h + r)$

🧮 12.3 Volume of a Combination of Solids

To find volume: **Add individual volumes** (no surface loss here).

🟢 **Example 6**: Shed = cuboid + half-cylinder (📍Fig. 12.12)

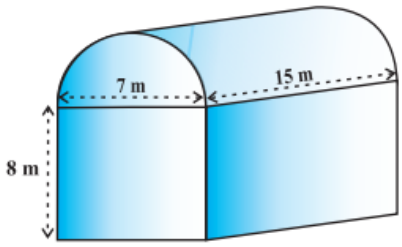


Fig. 12.12

Volume = Volume of cuboid + ½ × Volume of cylinder = l × b × h + (½)πr²h

🟢 **Example 7**: Glass with hemispherical bottom (📍 Fig. 12.13)

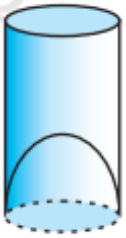


Fig. 12.13

Apparent Volume = πr²h

Actual Volume = πr²h − (2/3)πr³

🟢 **Example 8**: Cone on hemisphere (📍 Fig. 12.14)

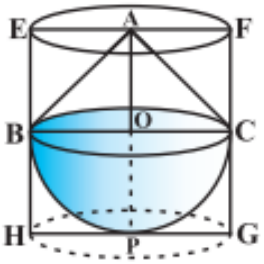


Fig. 12.14

Volume = Volume of cone + Volume of hemisphere = (1/3)πr²h + (2/3)πr³

🗒️ Quick Formulas Revision

🔹 Surface Area Formulas

Cube (side a)	=	$6a^2$
Cuboid (l, b, h)	=	$2(lb + bh + hl)$
Cylinder	=	$2\pi rh + 2\pi r^2$
Cone (slant l)	=	$\pi rl + \pi r^2$
Sphere	=	$4\pi r^2$
Hemisphere	=	$3\pi r^2$ ($2\pi r^2$ CSA + πr^2 base)

🔹 Volume Formulas

- Cube = a^3
- Cuboid = $l \times b \times h$
- Cylinder = $\pi r^2 h$
- Cone = $(1/3)\pi r^2 h$
- Sphere = $(4/3)\pi r^3$
- Hemisphere = $(2/3)\pi r^3$

📊 Previous Year Question Trends

Concept	Frequency
Surface area of combination solids	★★★★★
Volume of composite solids	★★★★
Real-life application (shed, tank, toys)	★★★★
Capsule-type, rocket-type structures	★★★

📌 Summary

1. Combine curved or total surface areas of **visible parts only**.
2. For volume, **simply add** the volumes of the components.
3. Always **check units** (convert cm to m or mm if needed).