

3D Shapes & Volume Capacity

3D ਆਕਾਰ, ਘਣਫਲ (Volume) ਅਤੇ ਪਾਣੀ ਦੀ ਟੈਂਕੀ/ਡੱਬਿਆਂ ਦੀ ਸਮਰੱਥਾ (Capacity)

1. What is Volume and Capacity? (ਘਣਫਲ ਅਤੇ ਸਮਰੱਥਾ ਕੀ ਹੈ?)

While 2D shapes deal with flat surface area, 3D shapes deal with **Volume**—the total space an object occupies or how much liquid/material it can hold inside (Capacity).

KEY VOLUME FORMULAS & UNIT CONVERSION

Box/Cuboid Volume = Length × Width × Height

Cylinder Volume = $\pi \times r^2 \times \text{Height}$

Key Rule: 1 cubic metre (m^3) = 1,000 Litres

2. Real-Life Practical Scenarios

Scenario A: Water Tank Capacity in Litres (ਟੈਂਕੀ ਵਿੱਚ ਪਾਣੀ ਦੀ ਸਮਰੱਥਾ)

Example: You build an underground rectangular water tank with dimensions: **Length = 2 metres**, **Width = 1.5 metres**, and **Height = 1 metre**. How many litres of water will it hold?

1. Step 1: Calculate Volume in Cubic Metres (m^3)

$$\text{Volume} = 2 \text{ m} \times 1.5 \text{ m} \times 1 \text{ m} = 3 \text{ m}^3$$

2. Step 2: Convert m^3 to Litres

$$\text{Water Capacity} = 3 \times 1,000 = 3,000 \text{ Litres}$$



Pro Tip: If dimensions are in feet, calculate cubic feet (Length × Width × Height) and multiply by **28.3** to get total litres!

Scenario B: Cylindrical Overhead Water Tank (ਗੋਲ ਟੈਂਕੀ ਦਾ ਹਿਸਾਬ)

Example: A plastic overhead water tank has a radius of **0.7 metres** and a height of **1 metre**. Calculate its water capacity.

1. Step 1: Calculate Cylinder Volume

$$\text{Volume} = \pi \times r^2 \times h = (22/7) \times (0.7)^2 \times 1 = (22/7) \times 0.49 \times 1 = 1.54 \text{ m}^3$$

2. Step 2: Convert to Litres

$$\text{Capacity} = 1.54 \times 1,000 = 1,540 \text{ Litres}$$

3. 3D Shapes & Everyday Applications

Shape	Volume Formula	Real-Life Everyday Examples
Cuboid (ਇੱਟ ਵਰਗਾ ਆਕਾਰ)	Length $\times$ Width $\times$ Height	Cardboard delivery boxes, rooms, water sumps
Cylinder (ਬੋਲਣ ਆਕਾਰ)	$\pi \times r^2 \times \text{Height}$	Cold drink cans, buckets, water pipes, gas cylinders
Sphere (ਗੋਲਾ)	$(4/3) \times \pi \times r^3$	Footballs, water storage globes, scoops of ice cream

4. Practical Practice Exercises (ਅਭਿਆਸ ਲਈ ਪ੍ਰਸ਼ਨ)

Q1 Storage Box Fitting: A storage trunk measures 1.2 m in length, 0.5 m in width, and 0.5 m in height. What is the total storage volume in cubic metres?

Answer: Volume = $1.2 \times 0.5 \times 0.5 = 0.3 \text{ m}^3$.

Q2 Soil for Garden Bed: You have a raised wooden planter box measuring 6 feet long, 3 feet wide, and 1 foot deep. How many cubic feet of soil are needed to fill it?

Answer: Volume = $6 \times 3 \times 1 = 18 \text{ cubic feet of soil}$.

Q3 Bucket Water Capacity: A cylindrical plastic bucket has a radius of 14 cm and a height of 30 cm. How many litres of water can it hold? ($1,000 \text{ cm}^3 = 1 \text{ Litre}$)

Answer: Volume = $(22/7) \times (14)^2 \times 30 = (22/7) \times 196 \times 30 = 18,480 \text{ cm}^3$. Capacity = $18,480 / 1,000 = 18.48 \text{ Litres}$.