Class 9 Maths Chapter 14: Math of Space: Surface Area and Volume - Notes, Important Questions and MCQs (2026-27)

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These Class 9 Maths Chapter 14 notes (Part II, Chapter 14) cover “Math of Space: Surface Area and Volume” from the new NCERT textbook Ganita Manjari (Part II, 2026-27): surface areas and volumes of cuboids, cubes, right circular cylinders, cones, pyramids, spheres and hemispheres, their nets and why the formulas work – with a full formula sheet, worked numericals, Q&A, 10 MCQs and a free PDF.

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Chapter Overview

Surface area is the total area covering a solid – what we need for painting, wrapping or making a container – while volume is the space it occupies or holds. Opening a solid into a flat net shows how surface area formulas come from familiar rectangles, circles and sectors.

A cylinder unrolls into a rectangle and two circles, a cone into a sector and a circle, and a sphere’s surface equals four times the area of its great circle. Volumes follow patterns too: a cone holds one-third of the cylinder with the same base and height, and a sphere holds two-thirds of its enclosing cylinder.

Important Topics and Concepts

Cuboid and Cube

- Cuboid ($l \times w \times h$): total surface area = $2(lw + wh + hl)$; lateral surface area = $2h(l + w)$; volume = lwh.
- Cube (side a): TSA = $6a^2$; LSA = $4a^2$; volume = a^3.
- Nets of cuboids and cubes have 6 rectangular/square faces.

Right Circular Cylinder

- Net = a rectangle ($2\pi r \times h$) and two circles.
- Curved surface area = $2\pi rh$.
- TSA (closed at both ends) = $2\pi r(h + r)$; open at one end = $\pi r(2h + r)$.
- Volume = $\pi r^2 h$.

Right Circular Cone

- Slant height $l = \sqrt{(r^2 + h^2)}$.
- Curved surface area = πrl (net is a sector); TSA = $\pi r(l + r)$.
- Volume = $\frac{1}{3}\pi r^2 h$ – one-third of a cylinder with the same base and height (verified by filling experiments).

Pyramids

- A pyramid has a polygon base and triangular faces meeting at an apex.
- Surface area = area of base + sum of areas of triangular faces.
- Volume = $\frac{1}{3} \times$ base area $\times$ height.

Sphere and Hemisphere

- Sphere: surface area = $4\pi r^2$ (string-winding activity shows it equals 4 great circles); volume = $(4/3)\pi r^3$.
- Hemisphere: curved surface area = $2\pi r^2$; total surface area = $3\pi r^2$; volume = $(2/3)\pi r^3$.
- Spheres appear in balls, planets and bubbles – the shape with least surface area for a given volume.

Worked Numericals

Use $\pi = 22/7$.

- Cuboid 10 cm × 8 cm × 5 cm. TSA = $2(80 + 40 + 50) = 340$ cm²; volume = 400 cm³.
- Cylinder $r = 7$ cm, $h = 10$ cm. CSA = $2 \times 22/7 \times 7 \times 10 = 440$ cm²; volume = $22/7 \times 49 \times 10 = 1540$ cm³.
- Cone $r = 6$ cm, $h = 8$ cm. $l = 10$ cm; CSA = $\pi \times 6 \times 10 = 60\pi \approx 188.57$ cm²; volume = $\frac{1}{3}\pi \times 36 \times 8 = 96\pi \approx 301.71$ cm³.
- Sphere $r = 7$ cm. SA = $4 \times 22/7 \times 49 = 616$ cm²; volume = $4/3 \times 22/7 \times 343 \approx 1437.33$ cm³.
- Hemispherical bowl $r = 21$ cm. Volume = $2/3 \times 22/7 \times 9261 = 19404$ cm³ ≈ 19.4 litres.

Surface Area and Volume Formula Sheet

Solid	Surface area	Volume
Cuboid	2(lw + wh + hl)	lwh
Cube	$6a^2$	a^3
Cylinder	CSA $2\pi rh$; TSA $2\pi r(h + r)$	$\pi r^2 h$
Cone	CSA πrl; TSA $\pi r(l + r)$	$\frac{1}{3}\pi r^2 h$
Pyramid	Base + triangular faces	$\frac{1}{3}$ × base area × h
Sphere	$4\pi r^2$	$(4/3)\pi r^3$
Hemisphere	CSA $2\pi r^2$; TSA $3\pi r^2$	$(2/3)\pi r^3$

Important Terms and Formulas

Term	Meaning
Surface area	Total area of all faces/surfaces
Volume	Space occupied by a solid
Net	Flat pattern that folds into a solid
Lateral surface area	Area of side faces only
Curved surface area	Area of the curved part
Slant height	$l = \sqrt{(r^2 + h^2)}$ for a cone
Right circular cone	Apex directly above centre of circular base
Hemisphere	Half of a sphere
Great circle	Largest circle on a sphere
1 litre	1000 cm^3

Short Answer Questions

Q1. Write the formula for the TSA of a cuboid.

2(lw + wh + hl).

Q2. Find the volume of a cube of side 5 cm.

125 cm^3.

Q3. What is the curved surface area of a cylinder?

$2\pi rh$.

Q4. Find the slant height of a cone with r = 3 cm, h = 4 cm.

$\sqrt{(9 + 16)} = 5$ cm.

Q5. How is the volume of a cone related to that of a cylinder?

It is one-third of a cylinder with the same base and height.

Q6. Write the surface area of a sphere.

Q7. Find the TSA of a hemisphere of radius 7 cm.

$3 \times 22/7 \times 49 = 462$ cm².

Q8. How many cm³ make one litre?

1000 cm³.

Long Answer Questions

Q1. A cylindrical tank has radius 1.4 m and height 2 m. Find its capacity in litres and the area of metal sheet for a closed tank.

Volume = $22/7 \times 1.4 \times 1.4 \times 2 = 12.32$ m³.

1 m³ = 1000 L → 12,320 L.

TSA = $2 \times 22/7 \times 1.4 \times (2 + 1.4)$.

$= 8.8 \times 3.4 = 29.92$ m².

So capacity 12,320 L; sheet 29.92 m².

Q2. A conical tent has radius 6 m and height 8 m. Find the canvas needed and the volume of air inside.

$l = \sqrt{(36 + 64)} = 10$ m.

Canvas = CSA = $\pi rl = 22/7 \times 6 \times 10 \approx 188.57$ m².

Volume = $⅓ \times 22/7 \times 36 \times 8$.

≈ 301.71 m³.

Canvas ≈ 188.57 m²; air ≈ 301.71 m³.

Q3. Show that a sphere's volume is two-thirds of the cylinder that just encloses it.

Enclosing cylinder: radius r, height 2r.

Cylinder volume = $\pi r^2 \times 2r = 2\pi r^3$.

Sphere volume = $(4/3)\pi r^3$.

Ratio = $(4/3)/2 = 2/3$.

So the sphere fills two-thirds of the cylinder.

MCQs with Answers

1. Volume of cube of side 4 cm(a) 16 cm³ (b) 48 cm³ (c) 64 cm³ (d) 96 cm³Answer: (c) 64 cm³

2. CSA of cylinder(a) $\pi r^2 h$ (b) $2\pi rh$ (c) $2\pi r(h + r)$ (d) πrlAnswer: (b) $2\pi rh$

3. Volume of cone(a) $\pi r^2 h$ (b) $⅓\pi r^2 h$ (c) $½\pi r^2 h$ (d) $4/3\pi r^3$Answer: (b) $⅓\pi r^2 h$

4. Surface area of a sphere(a) $2\pi r^2$ (b) $3\pi r^2$ (c) $4\pi r^2$ (d) πr^2Answer: (c) $4\pi r^2$

5. TSA of hemisphere(a) $2\pi r^2$ (b) $3\pi r^2$ (c) $4\pi r^2$ (d) πr^2Answer: (b) $3\pi r^2$

6. Slant height when r = 5, h = 12(a) 13 (b) 17 (c) 7 (d) 10Answer: (a) 13

7. Volume of sphere r = 3 cm (in terms of π)(a) 36π (b) 27π (c) 12π (d) 9πAnswer: (a) 36π

9. A cylinder r = 7, h = 2 has volume (π = 22/7)(a) 308 (b) 154 (c) 44 (d) 616Answer: (a) 308

10. Pyramid volume(a) base area × h (b) ⅓ × base area × h (c) ½ × base area × h (d) 2 × base area × hAnswer: (b) ⅓ × base area × h

Quick Revision Points

- Cuboid $2(lw + wh + hl)$, lwh; cube $6a^2$, a^3.
- Cylinder $2\pi rh$, $2\pi r(h + r)$, πr^2h.
- Cone $l = \sqrt{(r^2 + h^2)}$; πrl; $\frac{1}{3}\pi r^2h$.
- Pyramid ⅓ × base × h.
- Sphere $4\pi r^2$, $(4/3)\pi r^3$; hemisphere $3\pi r^2$, $(2/3)\pi r^3$.
- 1 m^3 = 1000 L; 1 L = 1000 cm^3.

Chapter Summary

Surface area measures the covering of a solid and volume measures the space inside. Nets explain surface area formulas: a cylinder unrolls to a rectangle and two circles, a cone to a sector and a circle, and a sphere's surface equals four great circles.

Volumes follow neat relationships: cones and pyramids are one-third of the corresponding prism or cylinder, and a sphere is two-thirds of its enclosing cylinder. Knowing the formula sheet and units lets you solve real problems about tanks, tents, bowls and containers.

Exam Tips and PYQ Pattern

- Memorise the formula sheet table.
- Find slant height first in cone problems.
- Convert units (m^3 to litres) carefully.
- Use π = 22/7 when the radius is a multiple of 7.
- Read whether a container is open or closed.

Frequently Asked Questions

Is this chapter in the 2026-27 CBSE syllabus?

Yes. It is part of the new NCERT Class 9 Maths textbook "Ganita Manjari" (Part II), prescribed for the 2026-27 session.

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What is the volume of a cone?

$\frac{1}{3}\pi r^2h$ – one-third of a cylinder with the same base and height.

What is the surface area of a sphere?

$4\pi r^2$, four times the area of its great circle.

Conclusion

Math of Space gives the formulas behind every container and building. Learn the formula sheet, practise the numericals here and save the free PDF for revision.

More Notes: Class 9 Maths Chapter 13: Two Variables, One Line notes | All Class 9 Maths notes

Author Bio: Written and reviewed by the Nextoper Editorial Team, a group of CBSE mathematics educators who build chapter notes directly from the NCERT textbook and past board paper patterns.

Freshness Note: These notes follow the NCERT Class 9 Maths textbook, Ganita Manjari (Parts I and II, first edition 2026, NCF-SE 2023), and the CBSE syllabus for the 2026-27 session. Last checked on 24 November 2026.