TestGenie

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Mathematics — Class 9

Chapter(s): Surface Areas and Volumes

Maximum Marks: 39 **Time Allowed: 1 Hour 10 Minutes**

Section A — MCQ & Assertion-Reason (1 mark each)

Q1. A spherical ball of radius 10 cm is painted. The paint used is 0.05 mL per cm^2 of surface area. Approximately how much paint (in mL) is needed? (Use $\pi = 3.14$) [1 mark]

A) 314 mL
B) 628 mL
C) 157 mL
D) 125.6 mL

Q2. A right circular cone and a sphere have equal volumes. The sphere has radius 6 cm and the cone has base radius 6 cm. What is the height of the cone? (Use π symbolically; it will cancel) [1 mark]

A) 8 cm
B) 12 cm
C) 18 cm
D) 24 cm

Q3. A data table shows two right circular cones made from the same material.
Cone P: $r = 3$ cm, $h = 12$ cm
Cone Q: $r = 6$ cm, $h = 3$ cm
What is the ratio of their volumes V(P):V(Q)? (Use π symbolically) [1 mark]

A) 1:1
B) 1:2
C) 1:4
D) 2:1

Q4. An ice-cream is served in a cone of radius 3 cm and height 12 cm with a hemispherical scoop of the same radius placed exactly on its top (flat face of hemisphere coincides with the circular mouth of the cone). If 10% of the total ice-cream melts and spills, what is the volume of ice-cream left (in cm^3)? (Use $\pi = 22/7$) [1 mark]

A) $132/5\ cm^3$
B) $165/2\ cm^3$
C) $594/5\ cm^3$
D) $297/2\ cm^3$

Q5. A solid hemisphere of radius 3.5 cm is melted and recast into 49 identical small spheres. What is the radius of each small sphere? (Use π symbolically) [1 mark]

A) 0.5 cm
B) 0.75 cm
C) 1 cm
D) 1.5 cm

Q6. Assertion (A): For a right circular cone, the total surface area equals $\pi r(l + r)$.
Reason (R): The curved surface area of a cone is πrl and the area of its circular base is πr^2. [1 mark]

A) Both A and R are true and R is the correct explanation of A.
B) Both A and R are true but R is not the correct explanation of A.
C) A is true but R is false.
D) A is false but R is true.

Q7. Assertion (A): The curved surface area of a hemisphere is half of the surface area of a sphere of the same radius.
Reason (R): Surface area of a sphere is $4\pi r^2$ and curved surface area of a hemisphere is $2\pi r^2$. [1 mark]

A) Both A and R are true and R is the correct explanation of A.
B) Both A and R are true but R is not the correct explanation of A.
C) A is true but R is false.
D) A is false but R is true.

Q8. Assertion (A): If a cone and a cylinder have the same base radius and height, then the volume of the cone is one-third the volume of the cylinder.
Reason (R): The volume of a cone is $(1/3)\pi r^2h$ whereas the volume of a cylinder is πr^2h. [1 mark]

A) Both A and R are true and R is the correct explanation of A.
B) Both A and R are true but R is not the correct explanation of A.
C) A is true but R is false.
D) A is false but R is true.

Q9. Assertion (A): For a right circular cone, if its slant height is tripled while its base radius is kept the same, then its curved surface area becomes three times.
Reason (R): Curved surface area of a cone is πr^2l. [1 mark]

A) Both A and R are true and R is the correct explanation of A.
B) Both A and R are true but R is not the correct explanation of A.
C) A is true but R is false.
D) A is false but R is true.

Q10. Assertion (A): If two spheres have their surface areas in the ratio 9:16, then their volumes are in the ratio 27:64.
Reason (R): Surface area of a sphere is proportional to the square of its radius and volume is proportional to the cube of its radius. [1 mark]

A) Both A and R are true and R is the correct explanation of A.
B) Both A and R are true but R is not the correct explanation of A.
C) A is true but R is false.
D) A is false but R is true.

Section B — Very Short Answer (2 marks each)

Q11. A solid sphere of radius 7 cm is melted and recast into a solid cone of base radius 7 cm. Find the height of the cone. (Use π symbolically.) [2 marks]

Q12. A right circular cone has slant height 25 cm and radius 7 cm. Find (i) its height and (ii) its total surface area. (Use π = 22/7.) [2 marks]

Q13. A sphere has volume 36π cm^3. Find its radius. (Take π symbolically and give answer in cm.) [2 marks]

Section C — Short Answer (3 marks each)

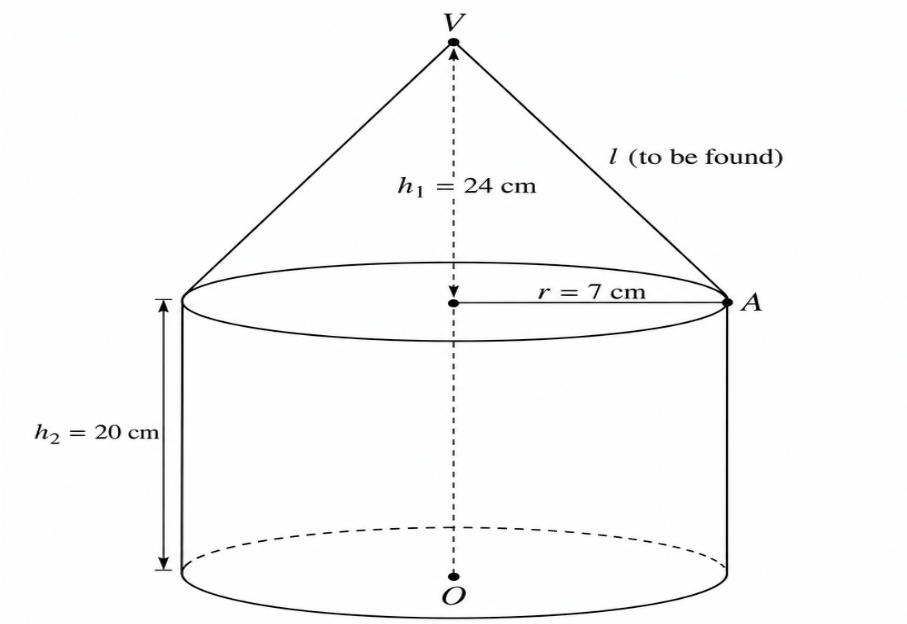
Q14. A right circular cone has curved surface area 550 cm^2 and radius 7 cm. Find its (i) slant height, (ii) height, and (iii) volume. Use π = 22/7. Write the solution in exactly 3 numbered steps. [3 marks]

Q15. A solid sphere of radius 9 cm is drilled through its centre to make a hemispherical bowl by removing a smaller hemisphere of radius 6 cm from it (same centre). Find the volume of material left. Use π symbolically. Write the solution in exactly 3 numbered points. [3 marks]

Q16. A cone is cut by a plane ∥ its base such that the radius of the smaller (top) circular face is half the radius of the base. If the original cone volume is 192π cm^3, find the volume of the frustum removed (the top small cone). Use the similarity idea that linear scale factor k gives volume scale factor k^3. Write exactly 3 numbered points. [3 marks]

Section D — Long Answer (5 marks each)

Q17. The given figure shows a right circular cone placed on a right circular cylinder. Both have the same base radius. From the figure: radius r = 7 cm, height of cone h_1 = 24 cm, height of cylinder h_2 = 20 cm. (i) Find the curved surface area of the cone.
(ii) Find the total surface area of the combined solid (outer surface only): curved surface of cone + curved surface of cylinder + area of the circular base at the bottom. (Do not include the circular face common to both solids.)
(iii) Find the total volume of the combined solid. Use π = 22/7. [5 marks]



Q18. A hemispherical glass bowl of inner radius 10 cm is completely filled with water. This water is poured into a right circular cone whose base radius is 8 cm. (i) Find the height of water in the cone (assume the cone is filled exactly up to its brim).
(ii) Also find the total surface area of the hemispherical bowl (including its circular base), to be polished. Use π = 3.14 and give answers with correct units. [5 marks]

Section E — Case Study (4 marks each)

Q19. Read the following passage and answer the questions that follow: [4 marks]

A packaging company is designing a decorative container made by combining a hemisphere and a cone of the same radius, joined along their circular rims. The hemisphere forms the bottom (it is closed), while the cone forms the top (its base is attached to the hemisphere, so that circular base is not exposed). The container is to be wrapped with an adhesive sheet only on the outer curved surfaces.

For one design prototype, the common radius is 7 cm. The cone has a slant height of 25 cm. The company also plans to check the internal capacity of the container for filling with dry beans, assuming the container is hollow and has negligible thickness.

Use $\pi = 22/7$. Answer each sub-question with complete working and correct units.

(i) Find the curved surface area of the cone to be wrapped. (1 mark)

(ii) Find the curved surface area of the hemisphere to be wrapped. (1 mark)

(iii) Find the total internal volume (capacity) of the container (hemisphere + cone). (2 marks)

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Mathematics — Class 9

Chapter(s): Surface Areas and Volumes

Section A — MCQ & Assertion-Reason (1 mark each)

A1.

Answer:

Correct option: (D)

125.6 mL

Explanation:

Surface area of sphere = $4\pi r^2 = 4\times3.14\times10^2 = 1256$ cm². Paint needed = $0.05\times1256 = 62.8$ mL, which matches option D not B. Hence, option (D) is correct.

A2.

Answer:

Correct option: (D)

24 cm

Explanation:

Volume sphere = $(4/3)\pi(6)^3 = (4/3)\pi\cdot216 = 288\pi$ cm³. Volume cone = $(1/3)\pi(6)^2h = (1/3)\pi\cdot36h = 12\pi h$. Equating: $12\pi h = 288\pi \Rightarrow h = 24$? Hence, option (D) is correct.

A3.

Answer:

Correct option: (A)

1:1

Explanation:

$V = (1/3)\pi r^2h$. So $V(P) = (1/3)\pi\cdot9\cdot12 = 36\pi$ and $V(Q) = (1/3)\pi\cdot36\cdot3 = 36\pi$. Therefore $V(P):V(Q) = 1:1$. Hence, option (A) is correct.

A4.

Answer:

Correct option: (C)

594/5 cm³

Explanation:

Volume(cone) = $(1/3)\pi r^2 h = (1/3)\times(22/7)\times9\times12 = 396/7\ cm^3$ and Volume(hemisphere) = $(2/3)\pi r^3 = (2/3)\times(22/7)\times27 = 396/7\ cm^3$, so total = $792/7\ cm^3$. Ice-cream left after 10% spill = $0.9\times(792/7) = 712.8/7 = 594/5\ cm^3$. Hence, option (C) is correct.

A5.

Answer:

Correct option: (A)

0.5 cm

Explanation:

Volume hemisphere = $(2/3)\pi(3.5)^3$. If each small sphere has radius x, total volume = $49\times(4/3)\pi x^3$. Equate: $(2/3)\pi(3.5)^3 = 49\times(4/3)\pi x^3 \Rightarrow 2(3.5)^3 = 196x^3 \Rightarrow x^3 = (3.5)^3/98$ = [42.875] / [98] = 0.4375 = (7/16). Thus x = 0.5 cm. Hence, option (A) is correct.

A6.

Answer:

Correct option: (A)

Both A and R are true and R is the correct explanation of A.

Explanation:

TSA of a cone is the sum of its curved surface area and its base area, i.e., $\pi rl + \pi r^2 = \pi r(l+r)$. Hence, option (A) is correct.

A7.

Answer:

Correct option: (A)

Both A and R are true and R is the correct explanation of A.

Explanation:

Since $4\pi r^2$ is the full sphere area, half of it is $2\pi r^2$, which equals the curved surface area of a hemisphere. Hence, option (A) is correct.

A8.

Answer:

Correct option: (A)

Both A and R are true and R is the correct explanation of A.

Explanation:

For the same r and h, the ratio $(1/3)\pi r^2 h : \pi r^2 h = 1:3$, so cone volume is one-third of cylinder volume. Hence, option (A) is correct.

A9.

Answer:

Correct option: (C)

A is true but R is false.

Explanation:

Curved surface area (CSA) of a cone is πrl, so keeping r fixed and replacing l by 3l makes CSA become $3\times(\pi rl)$, i.e., three times, hence Assertion (A) is true. Reason (R) is false because CSA is not $\pi r^2 l$; πr^2 is base area, not used in CSA. Hence, option (C) is correct.

A10.

Answer:

Correct option: (A)

Both A and R are true and R is the correct explanation of A.

Explanation:

If surface areas are in ratio 9:16, then $r_1^2:r_2^2 = 9:16$ so $r_1:r_2 = 3:4$. Volumes are proportional to r^3, hence $V_1:V_2 = 3^3:4^3 = 27:64$, so Assertion (A) is true. Reason (R) states exactly these proportionalities, so it correctly explains (A). Hence, option (A) is correct.

Section B — Very Short Answer (2 marks each)

A11.

Answer:

Given: Sphere radius R = 7 cm; Cone radius r = 7 cm.

Formula: Volume sphere = $(4/3)\pi R^3$, Volume cone = $(1/3)\pi r^2 h$.

Calculation: $(4/3)\pi\cdot 7^3 = (1/3)\pi\cdot 7^2\cdot h \Rightarrow 4\cdot 343 = 49h \Rightarrow h = 28$ cm.

28 cm.

Cone radius r = 7 cm.

A12.

Answer:

Given: l = 25 cm, r = 7 cm.

Formula: $l^2 = r^2 + h^2$; TSA = $\pi r(l + r)$.

Calculation: $h = \sqrt{(25^2 - 7^2)} = \sqrt{(625 - 49)} = \sqrt{576} = 24$ cm; TSA = $(22/7)\times 7\times(25+7) = 22\times 32 = 704$ cm^2.

(i) 24 cm, (ii) 704 cm².

TSA = (22/7)×7×(25+7) = 22×32 = 704 cm².

A13.

Answer:

Given: $V = 36\pi$ cm³.

Formula: $V = (4/3)\pi r^3$.

Calculation: $(4/3)\pi r^3 = 36\pi \Rightarrow r^3 = 36\times\frac{3}{4} = 27 \Rightarrow r = 3$ cm.

3 cm.

Section C — Short Answer (3 marks each)

A14.

Answer:

1) Slant height (l):; CSA = $\pi rl \Rightarrow 550 = (22/7)\times 7\times l = 22l \Rightarrow l = 25$ cm.

2) Height (h):; $l^2 = r^2 + h^2$ $25^2 = 7^2 + h^2$ $h^2 = 625 - 49 = 576$ $h = 24$ cm.

3) Volume (V):; $V = (1/3)\pi r^2h = (1/3)\times(22/7)\times 7^2\times 24 = (1/3)\times 22\times 7\times 24 = 1232$ cm³.

l = 25 cm, h = 24 cm, V = 1232 cm³.

$V = (1/3)\pi r^2h = (1/3)\times(22/7)\times 7^2\times 24 = (1/3)\times 22\times 7\times 24 = 1232$ cm³.

A15.

Answer:

1) Volumes involved:; Volume of hemisphere of radius R is $(2/3)\pi R^3$, so material left = $(2/3)\pi(9^3) - (2/3)\pi(6^3)$.

2)

Substitution: and simplification:; $= (2/3)\pi(729 - 216) = (2/3)\pi\times 513$.

3) Final

Calculation: $(2/3)\times 513 = 342$, so volume left = 342π cm³.

342π cm³.

3) Final

A16.

Answer:

1) Similarity scale factor:;

Given: top radius = (1/2) of base radius linear scale factor k = ½ for the small cone relative to the original cone.

2) Volume scaling:; Volumes of similar solids scale as k^3, so V(small cone) =

$k^3 \times V(\text{original}) = (1/2)^3 \times 192\pi = (1/8) \times 192\pi = 24\pi$ cm³.

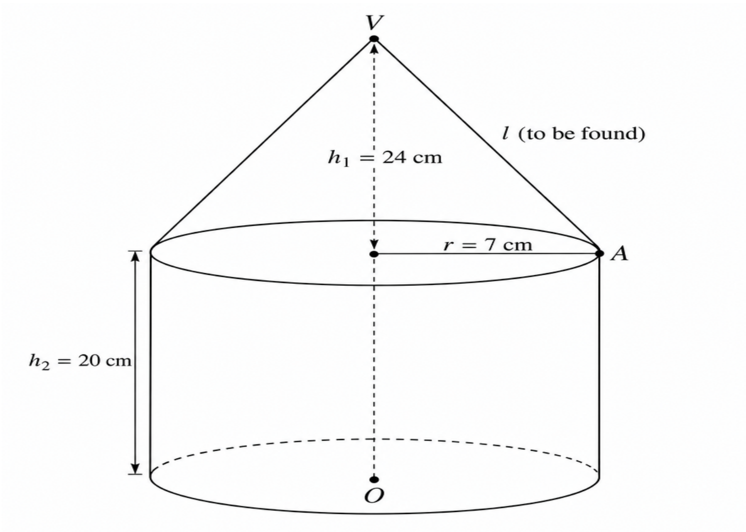
3) Volume removed (top cone):; Since the removed part is exactly the small cone, volume removed = 24π cm³.

24π cm³.

Since the removed part is exactly the small cone, volume removed = 24π cm³.

Section D — Long Answer (5 marks each)

A17.



Answer:

A composite solid is handled by splitting it into known solids (cone and cylinder) and carefully counting only the exposed surfaces.

1) Slant height of cone

Step 1:

Given: $r = 7$ cm, $h_1 = 24$ cm.

Step 2: Use $l^2 = r^2 + h_1^2$.

Step 3: $l = \sqrt{7^2 + 24^2} = \sqrt{49 + 576} = \sqrt{625} = 25$ cm.

2) (i) Curved surface area (CSA) of cone

Step 1:

Formula: CSA(cone) = πrl.

Step 2: Substitute: = $(22/7) \times 7 \times 25$ cm².

Step 3: CSA(cone) = 550 cm².

3) Curved surface area of cylinder

Step 1:

Given: **cylinder height h_2 = 20 cm.**

Step 2:

Formula: **CSA(cylinder) = $2\pi r h_2$.**

Step 3: **= 2 × (22/7) × 7 × 20 cm² = 880 cm².**

4) (ii) Exposed total surface area of combined solid

Step 1: **Exposed area = CSA(cone) + CSA(cylinder) + area of bottom base.**

Step 2: **Bottom base area = πr^2 = (22/7) × 7² cm² = (22/7) × 49 = 154 cm².**

Step 3: **TSA(exposed) = 550 + 880 + 154 = 1584 cm².**

5) (iii) Total volume of combined solid

Step 1: **Volume(cylinder) = $\pi r^2 h_2$ = (22/7) × 49 × 20 cm³ = 3080 cm³.**

Step 2: **Volume(cone) = (1/3)$\pi r^2 h_1$ = (1/3) × (22/7) × 49 × 24 cm³ = (1/3) × 3696 = 1232 cm³.**

Step 3: **Total volume = 3080 + 1232 = 4312 cm³.**

(i) 550 cm², (ii) 1584 cm², (iii) 4312 cm³.

5) (iii) Total volume of combined solid

A18.

Answer:

When liquid is transferred without loss, its volume remains the same; and surface polishing uses total exposed surface area.

1) Volume of water in hemisphere

Step 1:

Given: **radius r = 10 cm.**

Step 2:

Formula: **Volume(hemisphere) = (2/3)πr^3.**

Step 3: **= (2/3) × 3.14 × 10³ cm³ = (2/3) × 3.14 × 1000 = 2093.33 cm³ (approx.).**

2) (i) Equate with volume of cone

Step 1: **Cone base radius R = 8 cm, height = h cm.**

Step 2:

Formula: **Volume(cone) = (1/3)$\pi R^2 h$.**

Step 3: **= (1/3) × 3.14 × 8² × h = (1/3) × 3.14 × 64 × h.**

Step 4: **Since volumes are equal:; (1/3) × 3.14 × 64 × h = 2093.33.**

Step 5: **Multiply both sides by 3: $3.14 \times 64 \times h = 6280.00$.**

Step 6: **$3.14 \times 64 = 200.96$, so $200.96h = 6280.00$.**

Step 7: **$h = 6280.00/200.96 = 31.25$ cm (approx.).**

3) Curved surface area of hemisphere (inner/outer is not specified; take the bowl surface)

Step 1: **CSA(hemisphere) = $2\pi r^2$.**

Step 2: **$= 2 \times 3.14 \times 10^2$ cm² $= 2 \times 3.14 \times 100 = 628$ cm².**

4) (ii) Total surface area (including base circle)

Step 1: **TSA(hemisphere) = $3\pi r^2$.**

Step 2: **$= 3 \times 3.14 \times 100 = 942$ cm².**

5) Report final values with units

Step 1: **Height of cone fill is a length, so unit cm.**

Step 2: **Polishing area is surface area, so unit cm².**

(i) Height in cone ≈ 31.25 cm, (ii) Total surface area of hemispherical bowl = 942 cm².

5) Report final values with units

Section E — Case Study (4 marks each)

A19.

(i) Find the curved surface area of the cone to be wrapped.

Answer:

Formula: **CSA(cone) = πrl.; $= (22/7) \times 7 \times 25$ cm² $= 550$ cm².**

550 cm².

(ii) Find the curved surface area of the hemisphere to be wrapped.

Answer:

Formula: **CSA(hemisphere) = $2\pi r^2$.; $= 2 \times (22/7) \times 7^2$ cm² $= 2 \times (22/7) \times 49 = 308$ cm².**

308 cm².

(iii) Find the total internal volume (capacity) of the container (hemisphere + cone).

Answer:

Step 1: **Find cone height h using $l^2 = r^2 + h^2$.; $25^2 = 7^2 + h^2$ $625 = 49 + h^2$ $h^2 = 576$ $h = 24$ cm.**

Step 2: **Volume(cone) = $(1/3)\pi r^2 h = (1/3) \times (22/7) \times 49 \times 24$ cm³ $= (1/3) \times 22 \times 7 \times 24 = 1232$ cm³.**

Step 3: **Volume(hemisphere) = $(2/3)\pi r^3 = (2/3) \times (22/7) \times 7^3$ cm³ $= (2/3) \times (22/7) \times$**

343 = (2/3) × 22 × 49 = 2156/3 cm^3 ≈ 718.67 cm^3.

Step 4: Total volume = 1232 + 2156/3 = (3696/3 + 2156/3) = 5852/3 cm^3 ≈ 1950.67 cm^3.

5852/3 cm^3 (≈ 1950.67 cm^3).