Unit 5 · Area and Volume

ANSWER KEY · FOR TEACHERS

Full marks 33

Give the marks for the points in the marking scheme; an answer in other words that says the same is right.

1 Key words

1. slant height → **d.** the height of a sloping face, from the apex to the middle of a base edge
2. vertical height → **c.** the distance from the apex straight down to the center of the base
3. lateral surface area → **e.** the area of the sloping faces only
4. total surface area → **b.** the area of every face, the base included
5. $\frac{1}{3}\,a^2\,h$ → **g.** the volume of a square pyramid
6. $\pi\,r\,l$ → **a.** the curved surface area of a cone

Each carries 0.5 mark. K · 3

2 Fill the diagram

1. h
2. l
3. e
4. O

Each carries 0.5 mark. K · 2

3 Multiple choice

i. **b.** 13 cm U · 1

The slant height is the longest side of a right triangle whose other sides are the height, 12 cm, and half the base edge, 5 cm: $\sqrt{144 + 25} = 13$. 15.6 cm uses the whole base edge.

ii. **a.** 100 cm^3 U · 1

A cone holds a third of the cylinder with the same base and height: $300 \div 3 = 100$.

iii. **b.** 220 cm^2 A · 1

$\pi\,r\,l = \frac{22}{7} \times 7 \times 10 = 220$. 154 cm^2 is the base; 374 cm^2 is the total surface area.

iv. **a.** doubles A · 1

$V = \frac{1}{3}\,\pi\,r^2\,h$ has h once, so doubling it doubles V. Doubling the radius would make it 4 times as much.

v. **a.** $2\pi\,rh + 2\pi\,r^2$ A · 1

The tower's curved surface $2\pi\,rh$ and the dome's curved surface $2\pi\,r^2$. The circle where they join is inside, so it isn't counted; $3\pi\,r^2$ adds it.

4 Very short answers

a. MARKING SCHEME K · 1

✓ The formula written correctly.

b. MARKING SCHEME U · 1

✓ 96 cm^2.

c. MARKING SCHEME U · 1

✓ 462 cm^3.

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5 Short answers

a. MARKING SCHEME U · 2

- ✓ h, $a/2$ and l make a right triangle with l the hypotenuse.
- ✓ $l^2 = h^2 + (a/2)^2 > h^2$.

b. MARKING SCHEME U · 2

- ✓ The volume needs the vertical height, 24 cm, not the slant height.
- ✓ 1,232 cm^3.

c. MARKING SCHEME A · 2

- ✓ $22l = 550$.
- ✓ $l = 25$ cm.

6 Problems

a. ANSWER A · 2

$V = \frac{1}{3} \times 30^2 \times 25 = 7500$ cm^3. Since 1,000 cm^3 is a liter: **7,500 cm^3, or 7.5 liters**.

MARKING SCHEME

- ✓ $V = \frac{1}{3} \times 30^2 \times 25$.
- ✓ 7,500 cm^3, or 7.5 liters.

b. ANSWER A · 3

$\frac{22}{7} r^2 = 154$, so $r^2 = 49$ and r **= 7 m**. $\frac{1}{3} \times 154 \times h = 1232$, so h **= 24 m**.

MARKING SCHEME

- ✓ $\frac{22}{7} r^2 = 154$.
- ✓ $r = 7$ m.
- ✓ $\frac{1}{3} \times 154 \times h = 1232$, $h = 24$ m.

c. ANSWER A · 3

Cone: $49 - 14 = 35$ cm high; $l = \sqrt{1225 + 196} = \sqrt{1421} \approx 37.696$ cm.
TSA $= \pi r(l + 2r) = 44 \times (37.696 + 28) \approx$ **2,890.63 cm^2**.

MARKING SCHEME

- ✓ The cone is $49 - 14 = 35$ cm high.
- ✓ $l = \sqrt{35^2 + 14^2} \approx 37.696$ cm.
- ✓ TSA $= \pi r l + 2\pi r^2 \approx 2{,}890.63$ cm^2.

d. ANSWER A · 4

Walls $4 \times 10^2 = 400$ sq ft; cost $400 \times 340 = 136000$. It **rises by Rs 22,600**.

MARKING SCHEME

- ✓ The new room's walls: $4 \times 10^2 = 400$ sq ft.
- ✓ Its cost: $400 \times 340 =$ Rs 1,36,000.
- ✓ The first room's cost, Rs 1,13,400.
- ✓ It rises by Rs 22,600.

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7 Think

ANSWER HA · 2

They hold the same. Both volumes are $\frac{1}{3} \times$ base area $\times$ height, and both the base areas and the heights are equal.

MARKING SCHEME

✓ Both are $\frac{1}{3} \times$ base area $\times$ height.

✓ So they hold the same.

8 Activity: Roll a cone

(not marked)

WHAT STUDENTS SHOULD FIND

The sector's curved edge becomes the cone's rim, so $2\pi r = 2\pi l \times$ angle/360: radii 5, 3.33 and 2.5 cm, and heights about 8.66, 9.43 and 9.68 cm. Measured values come within a few millimeters (the tape's overlap makes the cone a little narrower). The smallest sector makes the tallest, narrowest cone: its rim is short, so more of the 10 cm slant goes into height.

Marks by level	Knowledge	Understanding	Application	Higher ability	Total
Marks	6	8	17	2	**33**

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