Unit 5 · Area and Volume

HARDER WORKSHEET · ANSWER KEY

Full marks 25

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

1 Find the unknown

ANSWER A · 3

$\frac{1}{3}a^2 \times 8 = 384$, so $a^2 = 144$ and $a = 12$ cm.

$l = \sqrt{8^2 + 6^2} = 10$ cm.

TSA $= 144 + 2 \times 12 \times 10 =$ **384 cm²**. (The same number as the volume, but in different units: a coincidence of these sizes.)

MARKING SCHEME

- ✓ $a^2 = 144$, $a = 12$ cm.
- ✓ $l = 10$ cm.
- ✓ TSA 384 cm².

2 Show it

ANSWER HA · 3

The sector's arc becomes the cone's rim: $2\pi r = 2\pi \times 12 \times \frac{120}{360} = 8\pi$, so $r = 4$ cm. ✓

The radius 12 cm becomes the slant height: $h = \sqrt{12^2 - 4^2} = \sqrt{128} \approx 11.314$ cm.

$V = \frac{1}{3} \times \frac{22}{7} \times 16 \times 11.314 \approx$ **189.64 cm³**.

MARKING SCHEME

- ✓ The arc 8π equals the rim $2\pi r$, so $r = 4$ cm.
- ✓ $h = \sqrt{128} \approx 11.314$ cm.
- ✓ $V \approx 189.64$ cm³.

3 Is the claim true?

ANSWER HA · 2

No. $V = \frac{1}{3}a^2 h$: doubling a multiplies a^2 by 4, and halving h divides by 2. The volume **doubles**.

MARKING SCHEME

- ✓ Doubling a makes a^2 four times as much; halving h halves it.
- ✓ Not right: the volume doubles.

4 Spot the error

MARKING SCHEME U · 3

- ✓ The joining circle is not on the outside: only the two curved surfaces count.
- ✓ $l \approx 10.440$ cm.
- ✓ 155.01 cm².

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5 Melt and recast

ANSWER **A · 3**

Cylinder: $\pi \times 6^2 \times 14 = 504\pi$ cm^3. One cone: $\frac{1}{3}\,\pi \times 3^2 \times 7 = 21\pi$ cm^3.

$504\pi \div 21\pi =$ **24 cones**. (Halving both the radius and the height makes each cone $\frac{1}{3} \times \frac{1}{4} \times \frac{1}{2} = \frac{1}{24}$ of the cylinder.)

MARKING SCHEME

- ✓ The cylinder's volume, 504π.
- ✓ One cone's volume, 21π.
- ✓ 24 cones.

6 Work backwards

ANSWER **A · 3**

Area painted: $59400 \div 120 = 495$ m^2. $\frac{22}{7} \times 7 \times l = 22l = 495$, so $l = 22.5$ m.

$h = \sqrt{22.5^2 - 7^2} = \sqrt{457.25} \approx$ **21.38 m**.

MARKING SCHEME

- ✓ Curved surface 495 m^2.
- ✓ $l = 22.5$ m.
- ✓ $h \approx 21.38$ m.

7 In a real setting

ANSWER **A · 4**

Canvas: $2\pi rh + \pi r l = \frac{22}{7} \times 3.5 \times (2 \times 2 + 3.7) = 11 \times 7.7 = 84.7$ m^2. Cost $84.7 \times 250 =$ **Rs 21,175**.

The cone's height: $\sqrt{3.7^2 - 3.5^2} = \sqrt{1.44} = 1.2$ m.

Air: $\pi r^2 \times 2 + \frac{1}{3}\,\pi r^2 \times 1.2 = 38.5 \times 2 + 38.5 \times 0.4 = 77 + 15.4 =$ **92.4 m^3**.

MARKING SCHEME

- ✓ Canvas 84.7 m^2.
- ✓ Cost Rs 21,175.
- ✓ The cone's height 1.2 m.
- ✓ Air 92.4 m^3.

8 Make your own

ANSWER **HA · 2**

Half the base edge, the height and the slant height must be a Pythagorean triple. For example base edge 6, height 4, slant height 5 (from 3, 4, 5): $V = \frac{1}{3} \times 36 \times 4 = 48$ cm^3, TSA $= 36 + 2 \times 6 \times 5 = 96$ cm^2.

(Others: 10, 12, 13; 16, 15, 17; 16, 6, 10.)

MARKING SCHEME

- ✓ Sizes with $(a/2)^2 + h^2 = l^2$, all whole numbers.
- ✓ Its volume and total surface area worked out correctly.

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9 Think

ANSWER HA · 2

The slope stays the same, so the radius doubles with the height. $V = \frac{1}{3}\,\pi\,r^2\,h$ becomes

$\frac{1}{3}\,\pi\,(2r)^2\,(2h) = 8 \times \frac{1}{3}\,\pi\,r^2\,h$: **8 times as much**.

MARKING SCHEME

- ✓ The same slope means the radius doubles too.
- ✓ 8 times as much sand.

Marks by level	Knowledge	Understanding	Application	Higher ability	Total
Marks	0	3	13	9	**25**

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