

## Surface Area of Cylinders, Spheres and Cones

### Starter

1. **(Review of last lesson)** The base radius,  $r$ , of a cone is the same as the radius of a sphere. Given that the volume of the solids is the same, express the height of the cone  $h$  in terms of its radius,  $r$ .

### Notes

Here are the formulae for various shapes:

#### Cylinders

The surface area of a cylinder is made up of 2 circles (top and bottom =  $2\pi r^2$ ) and a rectangular curved part ( $2\pi rh$ ).

$$\text{Surface area of a cylinder} = 2\pi r^2 + 2\pi rh$$

If only the **curved** surface area of a cylinder is required, we exclude the top and the bottom.

$$\text{Curved surface area of a cylinder} = 2\pi rh$$

**E.g. 1** Write down the formula for the surface area of cylinder which is open at the top.

### Spheres

$$\text{Surface area of a sphere} = 4\pi r^2$$

**E.g. 2** A hemisphere is half a sphere. Write down the formula for:

- the curved surface area of a hemisphere (i.e. not including the base)
- total surface area of a hemisphere. (i.e. including the base)

**E.g. 3** The volume of a sphere is  $6044 \text{ m}^3$ . Find the surface area, correct to the nearest integer.

### Pyramids

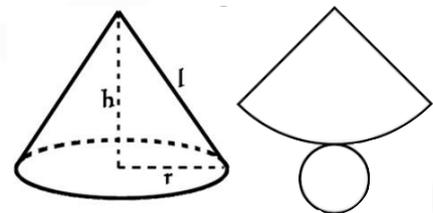
$$\text{Surface area of a pyramid} = \text{sum of areas of all faces}$$

### Cones

The surface area of a cone is made up of a circular base ( $\pi r^2$ ) and a curved part ( $\pi rl$ ) which unfolds to form a sector (see diagrams).

$$\text{Surface area of a cone} = \pi r^2 + \pi rl$$

where  $r$  is the radius of the base of the cone and  $l$  is the slant height of the cone (see diagram)



How are the slant height ( $l$ ), the base radius ( $r$ ) and perpendicular height ( $h$ ) connected?

$$\text{Using Pythagoras we get: } r^2 + h^2 = l^2$$

**E.g. 4** A cone has base radius of 56 cm and **perpendicular** height 33 cm. Find the exact surface area of the cone. Express your answer in terms of  $\pi$ .

Video: [Surface area of a cylinder](#)  
Video: [Surface area of a sphere](#)  
Video: [Surface area of cone](#)

[Solutions to Starter and E.g.s](#)

### Exercise

9-1 class textbook: p445 E13.8 Qu 1-13  
A\*-G class textbook: p401 E13.5 Qu 1-14  
9-1 homework book: p153 E13.8 Qu 1-8  
A\*-G homework book: p112 E13.5 Qu 1-6

### Summary

Surface area of a cylinder =  $2\pi r^2 + 2\pi rh$

Curved surface area of a cylinder =  $2\pi rh$

Surface area of a sphere =  $4\pi r^2$

Surface area of a pyramid = sum of areas of all faces

Surface area of a cone =  $\pi r^2 + \pi rl$  where  $r$  is the radius of the base of the cone and  
 $l$  is the slant height of the cone

The slant height ( $l$ ), the base radius ( $r$ ) and perpendicular height ( $h$ ) are connected via  
Pythagoras:  $r^2 + h^2 = l^2$

[Homework book answers \(only available during a lockdown\)](#)