# 3.3 Mensuration, sectors and solids

Name: _____ Class: _____ Date: _____ **Total: 29 marks**

**KEY WORDS** sector

## Mensuration, sectors and solids

## Objective

Use area and volume formulae, circle and sector formulae, and the sphere, pyramid, cone and frustum programme with composite solids (rows G14–G16, G18 with the Extension additions).

## 1 Key knowledge and worked examples

**Areas.** Triangle $\frac{1}{2}bh$, parallelogram $bh$, trapezium $\frac{1}{2}(a+b)h$, circle $\pi r^2$ with circumference $2\pi r$; volume $V = Ah$ for constant cross-sections. Sectors (Extension): arc $\frac{\theta}{360} \times 2\pi r$, area $\frac{\theta}{360} \times \pi r^2$.

**Solids (Extension).** Sphere $V = \frac{4}{3}\pi r^3$, $SA = 4\pi r^2$; cone $V = \frac{1}{3}\pi r^2 h$ with curved surface $\pi r l$; pyramid $V = \frac{1}{3}Ah$; frustums by subtracting the removed cone. A cone $r = 5$, $h = 12$: slant 13, $V = 100\pi$, curved surface $65\pi$.

## 2 Practice

**2.1** Find the area of a trapezium with parallel sides 7 and 11 and height 4 [2]

**2.2** A sector has $r = 9$, $\theta = 40°$. Find its arc and area. [3]

**2.3** Find the volume and surface area of a sphere of radius 6, in terms of $\pi$. [3]

**2.4** A cone has $r = 5$ and $h = 12$. Find its slant, volume and curved surface, in terms of $\pi$. [4]

**2.5** A cylinder has $r = 4$, $h = 10$. Find its volume and total surface area, in terms of $\pi$. [3]

## 3 Exam-style questions

**3.1** *(Original, 1E cone-proportion family.)* A frustum is made by removing a cone of radius $3r$ and height $4r$ from a similar cone of radius $5r$ and height $\frac{20}{3}r$. (a) Show that the removed volume is $12\pi r^3$. (b) Show that the frustum's volume is $\frac{392}{9}\pi r^3$. (c) The large cone's radius is 15 cm; find the removed cone's height. [5]

**3.2** *(Original.)* A silo is a cylinder ($r = 3$ m, $h = 7$ m) topped by a hemisphere. (a) Find the total volume in terms of $\pi$. (b) Find the surface area of the curved surfaces (the silo stands on the ground), in terms of $\pi$. [5]

**3.3** *(Original.)* A sphere fits exactly inside a closed cylinder (radius $r$). Show that the ratio of their volumes is $2 : 3$, and find the ratio of their surface areas. [4]