

TG **3** A spherical bubble is expanding so that its volume increases at the constant rate of 70
ROC mm^3 per second.

What is the rate of increase of its surface area when the radius is 10 mm?

$$\text{Volume of a sphere } V = \frac{4}{3}\pi r^3$$

$$V = \frac{4}{3}\pi r^3$$

$$\frac{dV}{dr} = 4\pi r^2$$

$$\frac{dV}{dr}(10) = 4\pi(10)^2$$

$$= 400\pi$$

$$\text{Also, } \frac{dV}{dt} = 70$$

$$\frac{dV}{dt} = \frac{dV}{dr} \cdot \frac{dr}{dt}$$

$$70 = 400\pi \times \frac{dr}{dt}$$

$$\frac{dr}{dt} = \frac{70}{400\pi}$$

$$= \frac{7}{40\pi}$$

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

$$A = 4\pi r^2$$

$$\frac{dA}{dr} = 8\pi r$$

$$\frac{dA}{dr}(10) = 8\pi(10)$$

$$= 80\pi$$

$$\text{Also, } \frac{dr}{dt} = \frac{7}{40\pi}$$

$$\frac{dA}{dt} = \frac{dA}{dr} \cdot \frac{dr}{dt}$$

$$\frac{dA}{dt} = 80\pi \times \frac{7}{40\pi}$$

$$\frac{dA}{dt} = 14$$

\therefore the surface area increases at $14 \text{ mm}^2\text{s}^{-1}$

* These solutions have been provided by [projectmaths](http://projectmaths.com.au) and are not supplied or endorsed by NESA.

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