

$$\frac{dh}{dt} = \frac{dh}{dV} \times \frac{dV}{dt}$$

Where h is the height of the cone in mm, and V is the volume of the cone in mm^3

$$\frac{dh}{dt} = \frac{dh}{dV} \times k$$

$$\frac{r}{h} = \frac{40}{160}$$

$$r = \frac{1}{4}h$$

$$V = \frac{1}{3}\pi r^2 h = \frac{1}{3}\pi \left(\frac{1}{4}h\right)^2 h = \frac{1}{48}\pi h^3$$

$$\frac{dV}{dh} = \frac{1}{16}\pi h^2$$

$$\frac{dh}{dV} = \frac{16}{\pi h^2}$$

$$\frac{dh}{dt} = \frac{16}{\pi h^2} \times k = \frac{16k}{\pi h^2}$$

Interested in 10 seconds

$$V = k \text{ mm}^3 \text{ s}^{-1} \times 10 \text{ s} = 10k \text{ mm}^3$$

$$\frac{1}{48}\pi h^3 = 10k$$

$$\pi h^3 = 480k$$

$$\frac{1}{2} = \frac{16k}{\pi h^2}$$

$$\pi h^2 = 32k$$

$$\pi h^3 = 480k$$

$$\pi h^2 = 32k$$

$$\Rightarrow h = 15$$

$$\pi \times 15^2 = 32k$$

$$k = \frac{225}{32}\pi$$

M1

M1

M1

M1

M1

M1

M1

M1

M1

M1

M1

B1

[12]

[12 marks]