

A rectangular vessel when full of water takes 10 minute to be empties through an orifice in the bottom .how much time will it take to be emptied when half filled with water ?

**Solution:**

$h_1 = H$  – hight of the water when vessel is full;

$t_1 = 10\text{min}$  – time after which vessel is empty (height  $h_1$ );

$h_2 = \frac{H}{2}$  – hight of the water when vessel is half filled;

$t_2$  – time after which vessel is empty (height  $h_2$ )

the emptying time is proportional to the height of water:

$t = \alpha \sqrt{\frac{2h}{g}}$ ,  $h$  – height of water,  $\alpha$  – some coefficient of proportionality

$$t_1 = \alpha \sqrt{\frac{2H}{g}} \quad (1)$$

$$t_2 = \alpha \sqrt{\frac{2h_2}{g}} = \alpha \sqrt{\frac{2 \cdot \frac{H}{2}}{g}} = \alpha \sqrt{\frac{H}{g}} \quad (2)$$

(2) ÷ (1):

$$\frac{t_2}{t_1} = \alpha \sqrt{\frac{H}{g}} \cdot \frac{1}{\alpha \sqrt{2H}} = \frac{1}{\sqrt{2}}$$

$$t_2 = \frac{t_1}{\sqrt{2}} = \frac{10 \text{ minutes}}{\sqrt{2}} = 7 \text{ minutes}$$

**Answer:** time after which vessel is empty, is equal to 7 minutes.