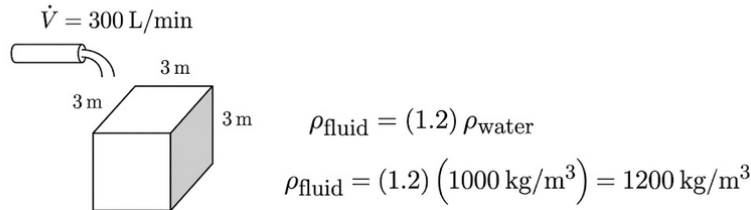


A pump discharges into a 3m per side cubical tank. The flow rate is 300 L/min and the fluid has a density of 1.2 times that of water (density of water = 1000 kg/m³). Determine

- The flowrate in kg/s.
- The time it takes to fill the tank.

Given:



Determine the Flow Rate in $\frac{\text{kg}}{\text{s}}$

Calculate the density (ρ) of the fluid:

$$\rho = (SG)(\rho_w) = (1.20) \left(1000 \frac{\text{kg}}{\text{m}^3} \right) = 1,200 \frac{\text{kg}}{\text{m}^3}$$

Convert the volumetric flow rate (V) from L/min to m³/s:

$$V = \left(\frac{300}{6,000} \frac{\text{m}^3}{\text{s}} \right) \left(\frac{1}{1,000} \frac{\text{m}^3}{\text{L}} \right) \left(\frac{1 \text{ min}}{60 \text{ s}} \right) = 0.005 \frac{\text{m}^3}{\text{s}}$$

Calculate the mass flow rate (m)

$$m = \left(1200 \frac{\text{kg}}{\text{m}^3} \right) \left(0.005 \frac{\text{m}^3}{\text{s}} \right)$$

$$m = 6 \frac{\text{kg}}{\text{s}}$$

Determine the Time to Fill the Tank

Calculate the total volume (V) of the cubical tank: $V = b^3 = (3\text{m})^3 = 27\text{m}^3$

Instead of using seconds, it's easier to use the original flow rate in cubic meters per minute (m³/min) to get an answer directly in minutes:

$$V = \left(300 \frac{\text{L}}{\text{min}} \right) \left(\frac{1 \text{ m}^3}{1000 \text{ L}} \right) = 0.3 \frac{\text{m}^3}{\text{min}}$$

Now divide the total volume by this flow rate:

$$t = \frac{27 \text{ m}^3}{0.3 \frac{\text{m}^3}{\text{min}}} = 90 \text{ min}$$

*First, because the fluid is 20% denser than plain water, every cubic meter traveling through the pipe carries more physical substance than water would. Moving 300 Liters of this heavy fluid every minute means that exactly **6 kilograms** of matter exit the pump nozzle every single second.*

*Second, the structural capacity of the tank defines the time constraint. A 3-meter cube holds a massive volume of 27cubic meters (27,000 L). Pumping at a steady stream of 300 Liters every minute means it takes exactly **90 minutes** (or 1.5 hours) to fill that structural space to the brim.*