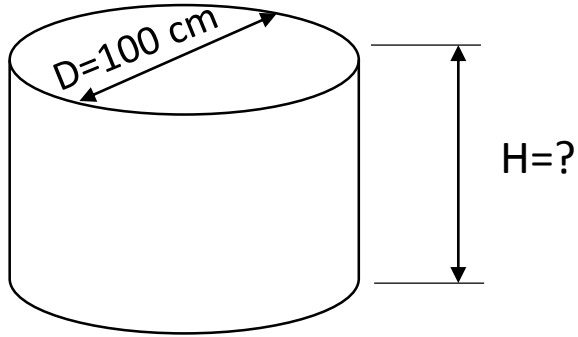


QUIZ 5:

- 1) (70 pts) Initially, pressure of air in the tank is 7 bar and air mass is 1 kg in it. Due to leakage, pressure decreases to 5 bar. Determine the escaped mass of air, and tank height. (The temperature of air is 18 °C, and $R_{\text{air}}=0.287$ kJ/kg.K)



- 2) (30 pts) Explain the terms *inviscid flow region*, and *turbulent flow*, briefly.

SOLUTION

Initial situation; $PV = mRT$

$$V = \frac{mRT}{P} = \frac{(1 \text{ kg})(0,287 \text{ kJ/kgK})(291 \text{ K})}{700 \text{ kPa}}$$

$$V = 0,11931 \text{ m}^3 = \frac{\pi D^2}{4} H = \frac{\pi \cdot 0,1^2}{4} H$$

$$\Rightarrow H = 0,151 \text{ m} = \underline{\underline{15,1 \text{ cm}}}$$

Final situation; $PV = mRT$

$$m = \frac{PV}{RT} = \frac{500 \cdot 0,11931}{0,287 \cdot 291}$$

$$m = 0,714 \text{ kg}$$

$$m_{\text{leakage}} = 1 - 0,714 = \underline{\underline{0,286 \text{ kg}}}$$

Inviscid flow region: Flow far away from boundary walls.

Flow away from walls remains undisturbed and laminar. Fluid velocity is mainly uniform and this, in turn, results in considerably small fluid friction between fluid layers. Flow is dominated by gravity, inertial forces and pressure forces.

Turbulent Flow: When fluid is high, friction between fluid particles can not balance inertia forces. As a result fluid layers lose their stability as a result of lagging of adjacent flow streams. Turbulence is characterized by random motion of fluid particles changing their speed and direction in a continuous manner in time. Turbulence is highly transient in character. Solid walls are the causes of turbulence.

In the absence of walls, turbulence decays with time, finally flow is re-laminarized.

