① GIVEN

* Rigid tank
  - » $V_{tank} = 15\ m^3$
  - » separated into 2 sections by membrane each filled w/ $N_2(g)$
  - » Section A has $\rho_A = 1.6\ kg/m^3$, Vol = V_A, P_A
  - » Section B $m_B = 6\ kg$, vol = V_B, P_B
  - » after membrane punctured $\rho_{tank} = 1.8\ kg/m^3$
  - » M = molar mass of Nitrogen 14.006

FIND

Initial density (kg/m^3) of $N_2(g)$ @ Section B

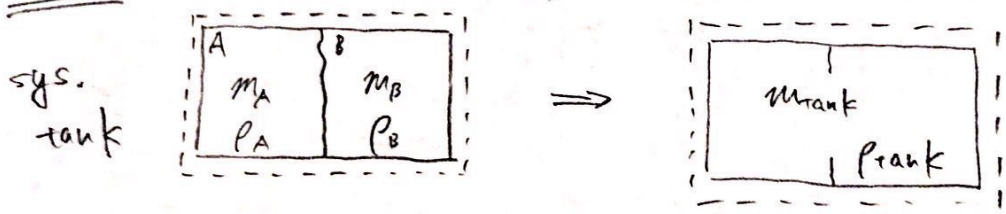
EQUATION

$$\rho = \frac{m}{V}$$

ASSUMPTION

gas is ideal gas. Quasiequilibrium.
- closed system.

EFD



SOLN

initially : $\rho_A = \frac{m_A}{V_A}$ ... ①, $\rho_B = \frac{m_B}{V_B}$ ... ②

after : $\rho_{tank} = \frac{m_{tank}}{V_{tank}}$ ... ③

$\because m_{tank} = m_A + m_B$

③ $\Rightarrow \rho_{tank} = \frac{m_A + m_B}{V_{tank}}$

$$m_A = \rho_{tank} V_{tank} - m_B = \left(\frac{1.8\ kg}{m^3}\right)(15\ m^3) - 6\ kg = 21\ kg$$

$\therefore V_A = \frac{m_A}{\rho_A} = (21\ kg)\left(\frac{m^3}{1.6\ kg}\right) = 13.125\ m^3$

$V_B = 15 - 13.125 = 1.875\ m^3$

$$\rho_B = \frac{m_B}{V_B} = (6\ kg)\left(\frac{1}{1.875\ m^3}\right) = \boxed{3.20\ kg/m^3}$$