$V = 100\ m^3$ N_2 $P = 10\ MPa$ $T = 65°C$) condition 1

ndition 2: $V = 100 m^3$ N_2 $P = 18\ MPa$ $T = 85°C = 358.15 K$

Calculate mass of nitrogen added to tank

a) IGL: $n_1 = \frac{PV}{RT} = \frac{(10{,}000\ kPa)(100\ m^3)}{(8.314)(338.15\ K)}$

$n_1 = \underline{355.7\ Kmoles}$

$n_2 = \frac{(18{,}000)(100 m^3)}{8.314\ (358.15)} = \underline{604.5}$

$\Delta n = 604.5 - 355.7$

$\Delta n = 248.8\ Kmoles$

$\Delta m = 248.8\ Kmoles \left(\frac{28\ kg}{Kmol}\right) = \underline{6966\ kg}$

c) VDW: $a = 1.38\ atm\left(\frac{m^3}{Kmol}\right)^2$ $b = 3.94 \times 10^{-2}\ \frac{m^3}{Kmol}$

$P = \frac{RT}{V_m - b} - \frac{a}{V_m^2}$ $V_m = \frac{V}{n}$ $V_{m\,old_1} = \frac{100\ m^3}{355.7\ Kmol} = 0.281$

$V_m = \frac{RT}{P + \frac{a}{V_m^2}} + b$ $V_{m\,old_2} = \frac{100\ m^3}{604.5} = 0.1654$

$V_{m(new)} = \frac{(8.314)(338.15\ K)}{(10{,}000) + \frac{(1.38\ atm)\left(\frac{101.325\ kPa}{1\ atm}\right)}{V_m^2}} + 0.0394 = 0.278\ \frac{m^3}{Kmol}$

iteration 2 = $\boxed{0.2775\ \frac{m^3}{Kmol}}$

$V_{m(new)_2} = \frac{(8.314)(358.15\ K)}{18000 + \frac{1.38 \cdot 101.325}{V_m^2}} + 0.0394 = 0.1682\ \frac{m^3}{Kmol}$

iteration 2 = $\boxed{0.1692\ m^3/Kmol}$

$m = \left[\frac{100\ m^3}{0.1692\ m^3/Kmol} - \frac{100\ m^3}{0.2775\ m^3/Kmol}\right]\left(\frac{28\ kg}{Kmol}\right) = \boxed{6458\ kg}$

could also use cubic form of the VDW equation