1

$n = 2{,}00\ \text{mol}$

$T = 35{,}5\,^\circ C = 308{,}65\ K = \text{const}$

(a) $V_1 = 1{,}5\ m^3 \longrightarrow V_2 = 3{,}50\ m^3$

$$pV = nRT$$

$$p(V) = nRT\left(\frac{1}{V}\right)$$

$$\Delta p = p_2 - p_1 = nRT\left(\frac{1}{V_2} - \frac{1}{V_1}\right)$$

$$\Delta p = 2{,}00\ \cancel{mol} \cdot 8{,}31448\ \frac{J}{\cancel{mol}\,\cancel{K}} \cdot 308{,}65\ \cancel{K} \cdot$$

$$\cdot \left(\frac{1}{3{,}50\ m^3} - \frac{1}{1{,}5\ m^3}\right)$$

$$\underline{\Delta p = -1955{,}24895\ \frac{J}{m^3}}$$

$$\frac{J}{m^3} = \frac{kg\ \cancel{m^2}}{s^2\ \cancel{m^3}} = \frac{kg}{m\,s^2} = Pa$$

$$\underline{\underline{\Delta p = -2{,}0 \cdot 10^3\ Pa = -2{,}0\ kPa}}$$

(b) $W = -\int^{V_2} p(V)\,dV$

(1b) $$W = -\int_{V_1} p(V)\, dV$$

$$W = -\int_{V_1}^{V_2} nRT\left(\frac{1}{V}\right) dV = -nRT \int_{V_1}^{V_2} \frac{1}{V}\, dV$$

$$W = -nRT \cdot \left(\ln V\right)_{V_1}^{V_2} = -nRT\,(\underbrace{\ln V_2 - \ln V_1}_{\ln \frac{V_2}{V_1}})$$

$$\underline{W = -nRT \cdot \ln \frac{V_2}{V_1}}$$

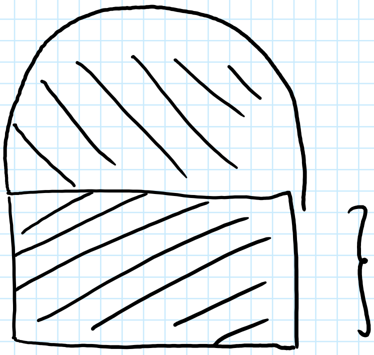
$$W = -2{,}00\,\cancel{mol} \cdot 8{,}31448\,\frac{J}{\cancel{mol}\,\cancel{K}} \cdot 308{,}65\,\cancel{K} \cdot \ln \frac{3{,}50\,\cancel{m^3}}{1{,}5\,\cancel{m^3}}$$

2 Stellen

$$W = -4348{,}78\ J$$

$$\underline{\underline{W = -4{,}3\ kJ}}$$

2 I



$$U = 54{,}28\,m + 54{,}28\,m + 265\,m + \frac{U_0}{2}$$

$(U_0 = \text{Kreisumfang})$

$$\frac{U_0}{2} = r\pi = 132{,}5\,m \cdot \pi = 416{,}261\,m = \underline{\underline{416\,m}}$$

$$\left(r = \frac{1}{2} \cdot \underline{\underline{265\,m}}\right)$$

$$U = 789{,}56\,m$$

$$\underline{\underline{U = 790\,m}}$$

$$A = 54{,}28\,m \cdot 265\,m + \frac{1}{2}\,(132{,}5\,m)^2\,\pi$$

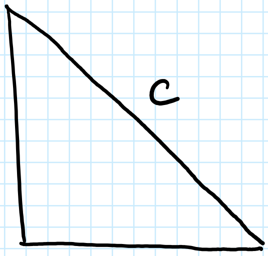
$$A = 14384{,}2\,m^2 + 27577{,}293\,m^2$$

$$A = 1{,}44 \cdot 10^4\,m^2 + 2{,}76 \cdot 10^4\,m^2$$

$$A = 4{,}20 \cdot 10^4\,m^2$$

$\underline{\underline{}}$

II



$$c = \sqrt{(37\,m)^2 + (250\,m)^2}$$

$$c = 252{,}7232\,m$$

$$\underline{c = 2{,}5 \cdot 10^2\,m}$$

$$U = 37\,m + 2{,}5 \cdot 10^2\,m + 2{,}5 \cdot 10^2\,m$$

$$U = 5{,}37 \cdot 10^2\,m$$

$$\underline{\underline{U = 5{,}4 \cdot 10^2\,m}}$$

$$A = \frac{1}{2} \cdot 37\,m \cdot 2{,}5 \cdot 10^2\,m = 4625\,m^2$$

$$\underline{\underline{A = 4{,}6 \cdot 10^3\,m^2}}$$

3 $r = 12{,}0\,\mu m$

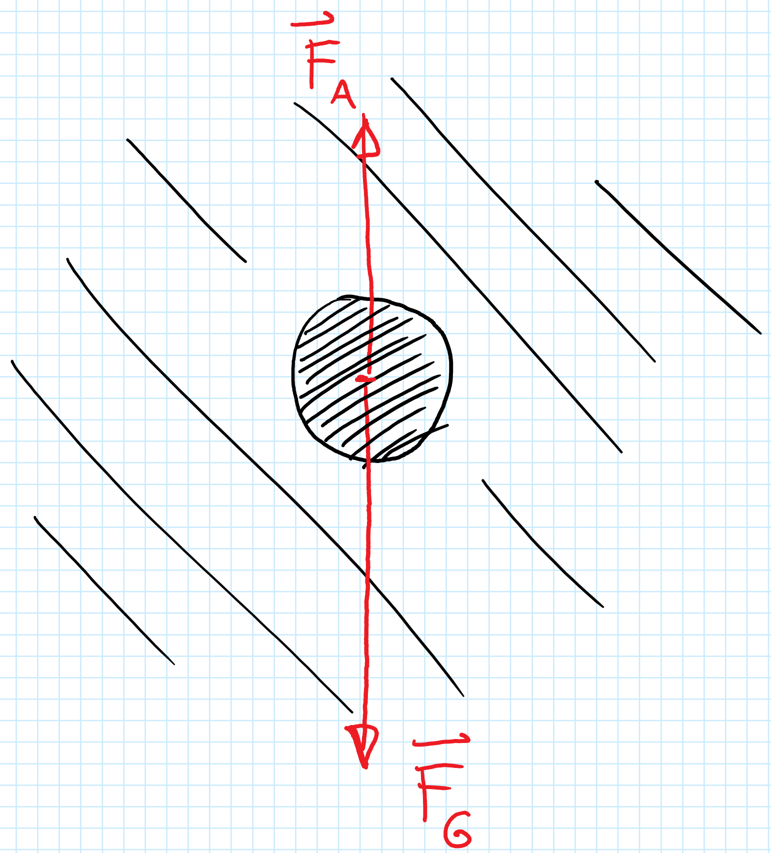
$\rho = 0{,}925\,\frac{g}{}$ $\qquad 1\,m^3 = 10^6\,cm^3$

$$\rho_n = 0{,}925 \, \frac{g}{cm^3} \qquad 1\,m^3 = 10^6\,cm^3$$

$$1\,kg = 10^3\,g$$

$$\rho_n = 925 \, \frac{kg}{m^3}$$

(a)



(b) $F_A = ?$

$$F_A = \rho_n V g \qquad V = \frac{4}{3} r^3 \pi \qquad r = 12{,}0 \cdot 10^{-6}\,m$$

$$V = 7{,}23823 \cdot 10^{-15}\,m^3$$

$$F_A = 925 \, \frac{kg}{\cancel{m^3}} \cdot 7{,}23823 \cdot 10^{-15}\,\cancel{m^3} \cdot 9{,}81 \, \frac{m}{s^2}$$

$$F_A = 6{,}568151 \cdot 10^{-11} \, \frac{kg\,m}{s^2}$$

$$F_A = 6{,}568151 \cdot 10^{-11} \ \frac{kg\,m}{s^2}$$

$$\downarrow$$

$$N$$

$$\underline{\underline{F_A = 6{,}57 \cdot 10^{-11} \ N}}$$

(c) Schweben: $F_A \overset{!}{=} F_G$

$$F_G = mg = \rho \cdot V \cdot g \overset{!}{=} F_A$$

(des Tröpfchens)

$$\rho V g = F_A$$

$$\rho = \frac{F_A}{V \cdot g}$$

$$\rho = \frac{6{,}568151 \cdot 10^{-11} \ \frac{kg\,\cancel{m}}{\cancel{s^2}}}{7{,}23823 \cdot 10^{-15} \, m^3 \cdot 9{,}81 \ \frac{\cancel{m}}{\cancel{s^2}}}$$

$$\rho = 925{,}00002 \ \frac{kg}{m^3}$$

$$\rho = 925 \frac{kg}{m^3}$$

$$\Rightarrow \rho = \rho_M$$