6.304 $\rho = 950 \frac{kg}{m^3}$ $\quad r = \frac{d}{2} = \frac{0{,}50mm}{2} = 0{,}25 \cdot 10^{-3} m$

$L = 100m$

$M = ?$

$M = \rho \cdot V = \rho \cdot A \cdot L = \rho \cdot \pi \cdot r^2 \cdot L = 950 \frac{kg}{m^3} \cdot \pi \cdot (0{,}25 \cdot 10^{-3} m)^2 \cdot 100m$

$= 0{,}01865 kg = \underline{19g}$

6.307

$d = 12{,}4cm \pm 0{,}2cm$

$h = 18{,}2cm \pm 0{,}2cm$

$m = 5{,}275kg \pm 0{,}005kg$

$\rho_{max} = \frac{m_{max}}{V_{min}} = \frac{5{,}280kg}{\frac{\pi}{4} \cdot 12{,}2^2 cm^2 \cdot 18{,}0cm}$

$= 2{,}50929 \cdot 10^{-3} \frac{kg}{cm^3}$

$\rho_{min} = \frac{m_{min}}{V_{max}} = \frac{5{,}270kg}{\frac{\pi}{4} \cdot 12{,}6^2 \cdot 18{,}4 cm^3}$

$= 2{,}29700 \cdot 10^{-3} \frac{kg}{cm^3}$

$V = \pi r^2 \cdot h = \pi \cdot \left(\frac{d}{2}\right)^2 \cdot h$

$= \frac{\pi}{4} d^2 \cdot h$

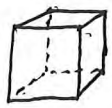
$\delta\rho = \frac{\rho_{max} - \rho_{min}}{2} = \frac{(2{,}50929 - 2{,}29700) \cdot 10^{-3}}{2} \frac{kg}{cm^3}$

$= \frac{0{,}21229 \cdot 10^{-3}}{2} \frac{kg}{cm^3} = \underline{1{,}06 \cdot 10^{-4} \frac{kg}{cm^3}}$

$\rho = \frac{m}{V}$ $\quad \bar{\rho} = \frac{\bar{m}}{\bar{V}} = \frac{5{,}275\ kg}{\frac{\pi}{4} \cdot 12{,}4^2 \cdot 18{,}2\ cm^3} = 2{,}4000 \cdot 10^{-3} \frac{kg}{cm^3}$

$\rho = \bar{\rho} \pm \delta\rho = \underline{(2{,}4 \pm 0{,}1) \cdot 10^{-3} \frac{kg}{cm^3}}$

6.309 +



$m = (1{,}55 \pm 0{,}05)\,kg$

$h = (80 \pm 2)\,mm$

$l = (50 \pm 1)\,mm$

$b = (30 \pm 1)\,mm$

a) $V_{max} = 82 \cdot 51 \cdot 31\,mm^3 = 129642\,mm^3$

$V_{min} = 78 \cdot 49 \cdot 29\,mm^3 = 110838\,mm^3$

$$\delta V = \frac{V_{max} - V_{min}}{2} = \frac{129642 - 110838}{2}\,mm^3 = 9402\,mm^3 \approx 9\,cm^3$$

b) $$\bar{\rho} = \frac{\bar{m}}{\bar{V}} = \frac{1{,}55\ kg}{80 \cdot 50 \cdot 30\ mm^3} = 1{,}2916 \cdot 10^{-5}\,\frac{kg}{mm^3} = 1{,}29\,\frac{kg}{mm^3}$$

$$\rho_{max} = \frac{m_{max}}{V_{min}} = \frac{1{,}60\ kg}{110838\,mm^3} = 1{,}4435 \cdot 10^{-5}\,\frac{kg}{mm^3}$$

$$\rho_{min} = \frac{m_{min}}{V_{max}} = \frac{1{,}50\ kg}{129642\,mm^3} = 1{,}1570 \cdot 10^{-5}\,\frac{kg}{mm^3}$$

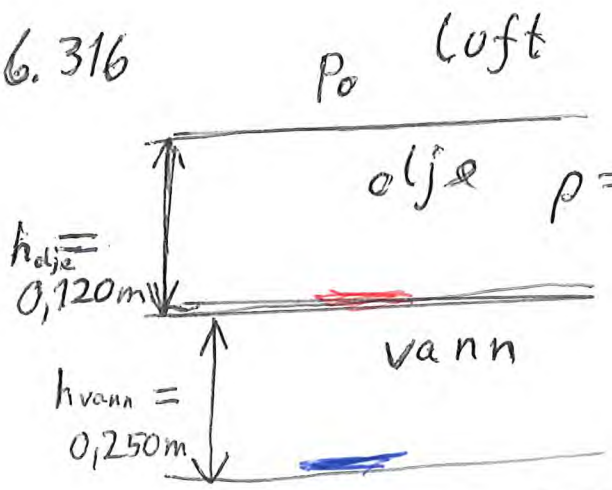
$$\delta\rho = \frac{\rho_{max} - \rho_{min}}{2} = \frac{1{,}4435 - 1{,}1570}{2} \cdot 10^{-5}\,\frac{kg}{mm^3} = 0{,}143 \cdot 10^{-5}\,\frac{kg}{mm^3}$$

$$\rho = (1{,}29 \pm 0{,}14) \cdot 10^{-5}\,\frac{kg}{mm^3} = (1{,}3 \pm 0{,}1) \cdot 10^{-5}\,\frac{kg}{mm^3}$$

$$= (1{,}3 \cdot 0{,}1) \cdot 10^{-2}\,\frac{kg}{cm^3} = (13 \pm 1)\,\frac{kg}{dm^3}$$

$$= \underline{(13 \pm 1) \cdot 10^{3}\,\frac{kg}{m^3}}$$

6.316



a)

$$p_{olje} = \rho_{olje} \cdot g \cdot h_{olje}$$

$$= 600 \frac{kg}{m^3} \cdot 9{,}81 \frac{N}{kg} \cdot 0{,}120\,m$$

$$= 706\,Pa$$

$$p_{bunn} = p_{olje} + p_{vann}$$

$$= 3{,}15\,kPa$$

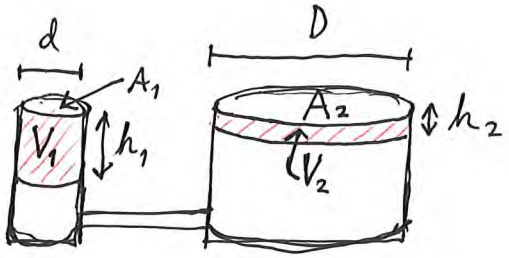
$$p_{vann} = \rho_{vann} \cdot g \cdot h_{vann}$$

$$= 998 \frac{kg}{m^3} \cdot 9{,}81 \frac{N}{kg} \cdot 0{,}250\,m$$

$$= 2447\,Pa$$

6.319+ $d = 0{,}020\,m$

$D = 0{,}15\,m$



a) $h_1 = 0{,}50\,m$

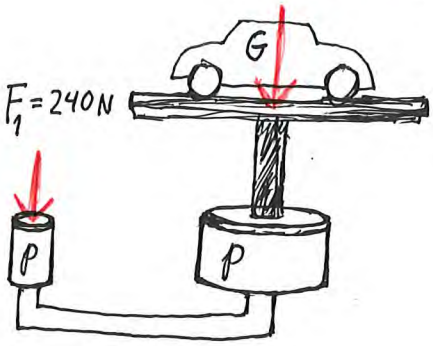
$V_2 = V_1$

$A_2 \cdot h_2 = A_1 \cdot h_1$

$$h_2 = \frac{A_1}{A_2} \cdot h_1 = \frac{\pi r_1^2}{\pi r_2^2} \cdot h_1 = \frac{\left(\frac{d}{2}\right)^2}{\left(\frac{D}{2}\right)^2} \cdot h_1 = \frac{d^2}{D^2} \cdot h_1$$

$$= \left(\frac{0{,}020\,m}{0{,}15\,m}\right)^2 \cdot 0{,}50\,m = 8{,}888 \cdot 10^{-3}\,m = \underline{8{,}9\,mm}$$

b)



$$p = \frac{F_1}{A_1} = \frac{G}{A_2}$$

$$\frac{A_2 \cdot F_1}{A_1} = G \qquad \text{og } G = mg$$

$$m = \frac{A_2 \cdot F_1}{A_1 \cdot g}$$

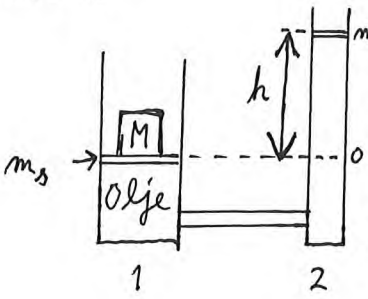
$$m = \frac{\pi r_2^2 \cdot F_1}{\pi r_1^2 \cdot g} = \frac{D^2 \cdot F_1}{d^2 \cdot g} = \frac{(0{,}15\,m)^2 \cdot 240\,N}{(0{,}020\,m)^2 \cdot 9{,}81\,\frac{m}{s^2}}$$

$$= 1376\,kg = \underline{1{,}4 \cdot 10^3\,kg}$$

c) $W = F \cdot s = F_1 \cdot h_1 = 240\,N \cdot 0{,}50\,m = 120\,J = \underline{0{,}12\,kJ}$

d) $W = F \cdot s = mgh_2 = 1376\,kg \cdot 9{,}81\,\frac{m}{s^2} \cdot 8{,}888 \cdot 10^{-3}\,m = 119{,}9\,J = \underline{0{,}12\,kJ}$

6.320+



$h = 1{,}00\,m$

$\rho = 800\,\frac{kg}{m^3}$

$A_1 = 0{,}50\,m^2$

$A_2 = 1{,}00 \cdot 10^{-4}\,m^2$

$m_s = 51\,kg$

$m = ?$

$M = 510\,kg$ $\quad p = \frac{F_1}{A_1} = \frac{F_2}{A_2}$

Trykket opp grunnet det tunge loddet og det tunge stempelet er lik trykket ned grunnet oljesøylen og det lette stempelet i høyden null.

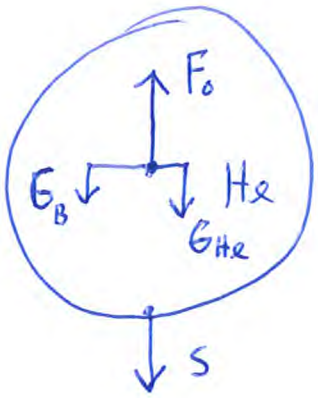
$$p = \frac{(M + m_s)g}{A_1} = \frac{(m + \rho A_2 h)g}{A_2}$$

$$\frac{A_2}{A_1}(M + m_s) = m + \rho A_2 h$$

$$m = \frac{A_2}{A_1}(M + m_s) - \rho A_2 h$$

$$m = \frac{1{,}00 \cdot 10^{-4}\,m^2}{0{,}50\,m^2}(510 + 51)\,kg - 800\,\frac{kg}{m^3} \cdot 1{,}00 \cdot 10^{-4}\,m^2 \cdot 1{,}00\,m = 0{,}0322\,kg = \underline{32\,g}$$

6.323



$V_B = 40 dm^3$

$\rho_L = 1{,}24 \frac{kg}{m^3}$

$\rho_{He} = 0{,}182 \frac{kg}{m^3}$

a) $F_o = \rho_L \cdot V_B \cdot g = 1{,}24 \frac{kg}{m^3} \cdot 40 \cdot (10^{-1} m)^3 \cdot 9{,}81 \frac{N}{kg} = 0{,}4865 N$

$= \underline{0{,}49 N}$

b) $\sum F = 0$

$F_o - S - G_B - G_{He} = 0$

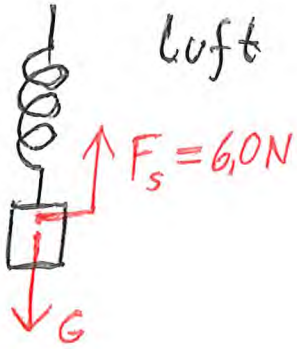
$F_o - m_B \cdot g - m_{He} \cdot g = S$

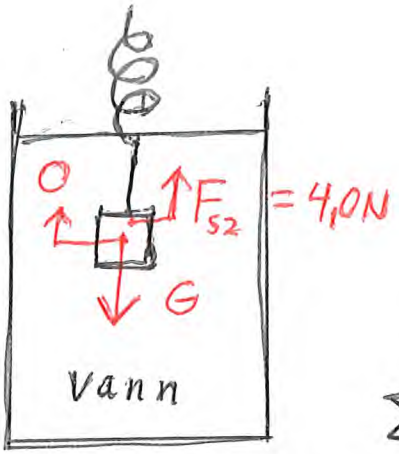
$S = F_o - (m_B + \rho_{He} \cdot V_B) \cdot g$

$S = 0{,}4865 N - \left(0{,}010 kg + 0{,}182 \frac{kg}{m^3} \cdot 40 \cdot 10^{-3} m^3\right) \cdot 9{,}81 \frac{N}{kg}$

$= 0{,}3169 N \approx \underline{0{,}32 N}$

6.324





$\rho_{Lodd} = ?$

$\Sigma F = 0$

$F_s = G$

$F_s = m_L g$

$m_L = \frac{F_s}{g} = \frac{6{,}0N}{9{,}81\frac{N}{kg}} = 0{,}6116kg$

$\Sigma F = 0$

$F_{s2} + O = G$

$O = G - F_{s2}$

$\rho_v \cdot V_L \cdot g = F_s - F_{s2}$

$V_L = \frac{F_s - F_{s2}}{\rho_v \cdot g}$

$V_L = \frac{6{,}0N - 4{,}0N}{998\frac{kg}{m^3} \cdot 9{,}81\frac{N}{kg}}$

$V_L = 2{,}042 \cdot 10^{-4} m^3$

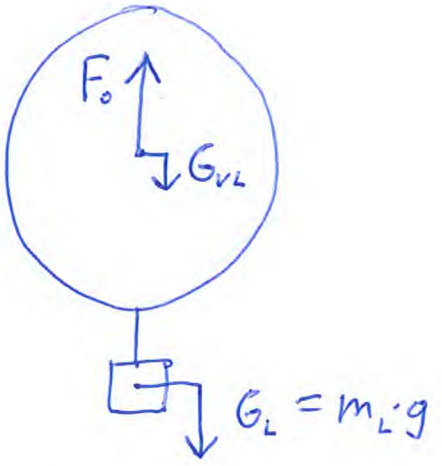
$\rho_L = \frac{m_L}{V_L} = \frac{0{,}6116kg}{2{,}042 \cdot 10^{-4} m^3}$

$= 3{,}0\frac{kg}{dm^3}$ $\left(2995\frac{kg}{m^3}\right)$

6.325

$\rho_L = 1{,}25 \frac{kg}{m^3}$

$\rho_{VL} = 0{,}93 \frac{kg}{m^3}$



$$\Sigma F = 0$$

$$F_o = G_{VL} + G_L$$

$$\rho_L \cdot V_B \cdot g = \rho_{VL} \cdot V_B \cdot g + m_L \cdot g$$

$$\rho_L \cdot V_B - \rho_{VL} \cdot V_B = m_L$$

$$V_B (\rho_L - \rho_{VL}) = m_L$$

$$V_B = \frac{m_L}{(\rho_L - \rho_{VL})}$$

$$V_B = \frac{400 kg}{(1{,}25 - 0{,}93) \frac{kg}{m^3}} \approx 1250 m^3$$

$$= 1{,}3 \cdot 10^3 m^3$$

6.331 $A = 6{,}0\,m \cdot 4{,}0\,m = 24{,}0\,m^2$

$h = 3{,}0 \cdot 10^{-2}\,m$

$\Delta V = A \cdot h = 24{,}0\,m^2 \cdot 3{,}0 \cdot 10^{-2}\,m = 0{,}72\,m^3$

$\left(m = \rho_v \Delta V = 998\,\frac{kg}{m^3} \cdot 0{,}72\,m^3 = 718{,}5\,kg = \underline{0{,}72 \cdot 10^3\,kg} \right)$

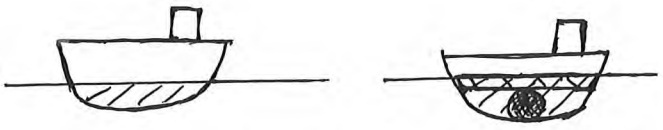
$\sum F = 0$

$F_0 = G$

$\rho_v \cdot \Delta V \cdot g = mg$

$G = 998\,\frac{kg}{m^3} \cdot 0{,}72\,m^3 \cdot 9{,}81\,\frac{N}{kg} = 7049\,N = \underline{7{,}0\,kN}$

6.333+



lastevolum $V_l = 3{,}0\,m^3$

$\rho_l = 0{,}90\,\frac{kg}{dm^3}$

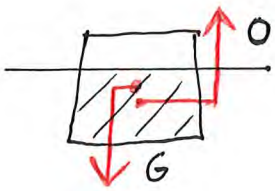
$\sum F = 0$ ekstra krefter på båten etter at lasten er om bord.

$m_l \cdot g - \rho_v \cdot V_{FV} \cdot g = 0$

$\rho_l \cdot V_l = \rho_v \cdot V_{FV}$

$V_{FV} = \frac{\rho_l}{\rho_v} \cdot V_l = \frac{0{,}90\,\frac{kg}{dm^3}}{1{,}025\,\frac{kg}{dm^3}} \cdot 3{,}0\,m^3 = \underline{2{,}6\,m^3}$

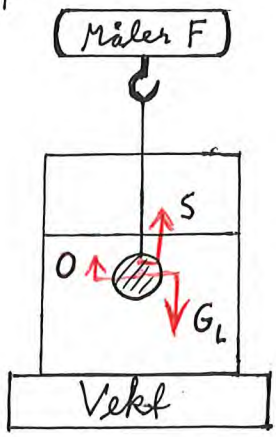
6.334+ $\frac{9}{10}$ av volumet under vann på jorda.



$$\Sigma F = 0$$
$$G - O = 0$$
$$mg = \rho_v \cdot V_{FV} \cdot g$$
$$\rho_{is} \cdot V_{is} = \rho_v \cdot V_{FV} \quad 2)$$
$$\frac{\rho_{is}}{\rho_v} = \frac{V_{FV}}{V_{is}}$$

Vi ser at g ikke har noen betydning.

6.335+



$$M_{vann} = 0{,}510\,kg$$
$$G_L = 8{,}73\,N$$
$$\Delta V = (413 - 300)\,ml = 113 \cdot 10^{-3}\,dm^3$$

$$\Sigma F = 0$$
$$S + O = G_L$$
$$S = G_L - O = G_L - \rho_v \cdot \Delta V \cdot g$$

Kraftmåleren:
$$= 8{,}73\,N - 0{,}998\,\frac{kg}{dm^3} \cdot 113 \cdot 10^{-3}\,dm^3 \cdot 9{,}81\,\frac{m}{s^2}$$
$$= 7{,}6236\,N = \underline{7{,}62\,N}$$

Vekta viser tyngden av vannet + tyngden av det fortrengte vannet.

$$M_{vann} + \rho_v \cdot \Delta V = 0{,}510\,kg + 0{,}998\,\frac{kg}{dm^3} \cdot 113 \cdot 10^{-3}\,dm^3 = \underline{0{,}623\,kg}$$

6.343 a) $E_k = \frac{3}{2} kT$ ← Temperaturen målt i Kelvin.

↑ kinetisk energi til et molekyl/atom

↖ Boltzmanns konstant

b) O_2 $t = 20°C$ $T = t + 273K = (20 + 273)K = 293K$

$$E_k = \frac{3}{2} kT = \frac{3}{2} \cdot 1{,}38 \cdot 10^{-23} \frac{J}{K} \cdot 293K = \underline{6{,}07 \cdot 10^{-21} J}$$

c) $\frac{1}{2} m v^2 = E_k$ $m_{O_2} = 2 \cdot 16{,}00 \cdot 1{,}66 \cdot 10^{-27} kg$

$= 5{,}312 \cdot 10^{-26} kg$

$$v^2 = \frac{2E_k}{m}$$

$$v = \sqrt{\frac{2E_k}{m}} = \sqrt{\frac{2 \cdot 6{,}07 \cdot 10^{-21} J}{5{,}312 \cdot 10^{-26} kg}} = \underline{478 \frac{m}{s}}$$

6.348. $T_1 = (20 + 273)K = 293K$ $V_1 = 2{,}0 m^3$ $V_2 = 3{,}0 m^3$

$p = konst.$

$$\frac{p_1 V_1}{T_1} = \frac{p_2 V_2}{T_2}$$

$$T_2 = T_1 \cdot \frac{V_2}{V_1}$$

$$T_2 = 293K \cdot \frac{3{,}0 m^3}{2{,}0 m^3} = 439{,}5K$$

$$t_2 = (439{,}5 - 273)K = 167°C = \underline{1{,}7 \cdot 10^2 °C}$$

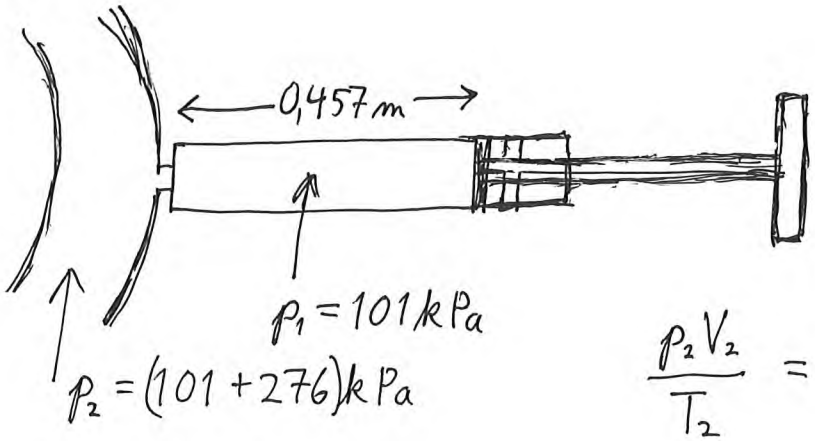
6.355 $T_1 = (20 + 273)K = 293K$ $p_1 = 1{,}2 \cdot 10^5 Pa$ V_1

$T_2 = (60 + 273)K = 333K$ $p_2 = ?$ $V_2 = 1{,}03 V_1$

$$\frac{p_2 V_2}{T_2} = \frac{p_1 V_1}{T_1}$$

$$p_2 = \frac{p_1 V_1 \cdot T_2}{T_1 \cdot 1{,}03 V_1} = \frac{1{,}2 \cdot 10^5 Pa \cdot 333K}{293K \cdot 1{,}03} = \underline{1{,}3 \cdot 10^5 Pa}$$

6.360+



$$\frac{p_2 V_2}{T_2} = \frac{p_1 V_1}{T_1} \quad \text{og} \quad T_1 = T_2$$

$$p_2 V_2 = p_1 V_1$$

$$p_2 \cdot A \cdot x_2 = p_1 \cdot A \cdot x_1$$

$$x_2 = \frac{p_1}{p_2} \cdot x_1 = \frac{101\,kPa}{377\,kPa} \cdot 0{,}457\,m = 0{,}122\,m$$

Endring i x:

$$\Delta x = x_1 - x_2 = (0{,}457 - 0{,}122)\,m = 0{,}335\,m = \underline{33{,}5\,cm}$$

6.366 $V_0 = 40\,m^3$ $T = 273\,K$ $p_0 = 101{,}3\,kPa$

a) $p_0 V_0 = N k T_0$

$$N = \frac{p_0 V_0}{k T_0} = \frac{101{,}3 \cdot 10^3 \frac{N}{m^2} \cdot 40\,m^3}{1{,}38 \cdot 10^{-23} \frac{J}{K} \cdot 273\,K} = 1{,}075 \cdot 10^{27} = \underline{1{,}1 \cdot 10^{27}}$$

b) $$O = \rho_L \cdot V_{FL} \cdot g = 1{,}29 \frac{kg}{m^3} \cdot 40\,m^3 \cdot 9{,}81 \frac{m}{s^2} = 506\,N = \underline{0{,}51\,kN}$$

c) $\sum F = ma$ og $s = 0$

$$O - G = ma$$

$$a = \frac{O - mg}{m} = \frac{506\,N - 20\,kg \cdot 9{,}81 \frac{m}{s^2}}{20\,kg} = (25{,}3 - 9{,}81) \frac{m}{s^2} = \underline{15 \frac{m}{s^2}}$$

d) $p_2 = 50{,}0\,kPa$ $T = T_0$

$$\frac{p_1 V_1}{T_1} = \frac{p_0 V_0}{T_0}$$

$$V_1 = \frac{p_0}{p_1} \cdot V_0 = \frac{101{,}3\,kPa}{50{,}0\,kPa} \cdot 40\,m^3 = \underline{81\,m^3} \quad (81{,}04\,m^3)$$

e) $T_2 = (273 - 30)\,K = 243\,K$

$$\frac{p_2 V_2}{T_2} = \frac{p_1 V_1}{T_1} \quad \text{og} \quad p_2 = p_1$$

$$V_2 = \frac{T_2}{T_1} \cdot V_1 = \frac{243\,K}{273\,K} \cdot 81{,}04\,m^3 = \underline{72\,m^3}$$

f)