Aufgabe 1 $\quad pV = N k_B T = n \cdot R \cdot T$

a) $V_1 p_1 = N k_B T_1$

$V_2 p_2 = N k_B T_2$ ✓

$\Rightarrow V_2 = \frac{T_2}{p_2} N k_B = \frac{T_2}{p_2} \frac{V_1 p_1}{T_1} = 0{,}10628206\ m^3$ ✓ 1

b) $n = \frac{p_1 V_1}{R T_1} = 6{,}61626\ mol$ ✓

$M_L = 2\left(\frac{4}{5} 14 + \frac{1}{5} 16\right) = 14{,}4\ \frac{g}{mol}$ 2 $\quad N \equiv N1$ und $O = O1$ 0 5

$\Rightarrow n M_L = 95{,}27\ g$ 2

1 5/2

Aufgabe 2

a) $N_n = N_0 \left(\frac{4}{5}\right)^n$ ✓

$T_n = T_0 \quad V_n = V_0$

$\Rightarrow p_n = p_0 \left(\frac{4}{5}\right)^n$ ✓

$p_4 = 0{,}4096\ p_0$ ✓ $\quad \rho_4 = 0{,}4096\ \rho_0$ ✓ 2

b) $\frac{\log(0{,}1)}{\log(4/5)} = 10{,}31885 \Rightarrow$ 11 Kolbenhübe. ✓ 1

3/3

Aufgabe 3

Ideales Gasgesetz in 3D: $pV = \frac{1}{3} N m \overline{v^2}$

$pV = N k_B T$

In 2D:

$\overline{v^2} = \overline{v_x^2} + \overline{v_y^2} \Rightarrow \overline{v_x^2} = \frac{1}{2} \overline{v^2}$ ✓

$p = \frac{1}{2} m n \overline{v^2}$ → ja, warum? mit $n = \frac{N}{A}$ folgt → über die Kraft auf die Wand ausdrücken

$pA = \frac{1}{2} m N \overline{v^2}$

→ über $k_B T$ ausdrücken

2/4

Aufgabe 4

a) $p = p_0 \exp\left(\frac{\rho_1 g h}{p_0}\right)$ ✓ $\Rightarrow \rho = \rho_0 \frac{p}{p_0}$ ✓ $0°C = 273{,}25\,K$

$m = 500\,kg$

$T_i = 353{,}25\,K$ $T_a = 283{,}25\,K$

$R_s = \frac{p_0}{273{,}25\,K\ \rho_0}$

$\rho_1 = \frac{p_0}{T_a\ R_s}$

$m \overset{!}{=} \Delta\rho \cdot V$ $\Delta\rho = \frac{p}{R_s T_a} - \frac{p}{R_s T_i}$ ✓

$\Rightarrow V = \frac{m}{\Delta\rho} = 2424{,}69\,m^3$ ✓

3 5

b) $\Delta\rho = \frac{p}{R_s T_a} - \frac{p}{R_s T_i}$ mit $T_a = 263{,}25\,K$ wobei $\rho_1 = \frac{p_0}{T_a\ R_s}$

$(\Delta\rho \cdot V - m) = 182{,}244\ kg$ zusätzlich. ✓

0 5

4/4

In[ ]:=
```
V1 = 0.06;
T1 = 273.15; T2 = 303.15;
p1 = 2.5 × 100 000; p2 = 2.65 × 100 000;
kB = 1.380649 × 10^-23;
R = 8.3;
T2 / p2  V1 p1 / T1
p1 V1 / (R T1)
p1 V1 / (R T1) * 14.4
```

Out[ ]= 0.0628206

Out[ ]= 6.61625

Out[ ]= 95.274

In[ ]:=
```
m = 500;
p0 = 101 300;
h = 1500;
ρ0 = 1.293;
Rs = p0 / (273.25 ρ0);
Ti = 353.25; Ta = 283.25;
ρ1 = p0 / (Ta Rs);
g = 9.81;
p = p0 Exp[(-ρ1 g h) / p0]
Δρ = p / (Rs Ta) - p / (Rs Ti)
V = m / Δρ
```

Out[ ]= 84 512.1

Out[ ]= 0.206212

Out[ ]= 2424.69

In[ ]:=
```
Ta = 263.25;
ρ1 = p0 / (263.25 Rs);
p = p0 Exp[(-ρ1 g h) / p0]
Δρ = p / (Rs Ta) - p / (Rs Ti)
V Δρ - m
```

Out[ ]= 83 356.6

Out[ ]= 0.281372

Out[ ]= 182.241

191.69719169719178`