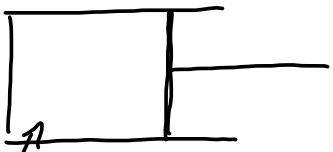
6.20



$p_1 = 100\ kPa$

$V_1 = 1{,}50\ dm^3$

$T_1 = 27°C + 273 = 300\ K$

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

$V_2 = 0{,}800\ dm^3$

$T_2 = 327 + 273 = 600\ K$

$$p_2 = \frac{p_1 \cdot V_1}{T_1} \cdot \frac{T_2}{V_2} = \frac{100[kPa] \cdot 1{,}50[dm^3] \cdot 600[K]}{300[K] \cdot 0{,}800[dm^3]}$$

$$= 375\ [kPa]$$

$$\frac{p_1 \cdot V_1}{T_1} = \frac{p_2 \cdot V_2}{T_2} = C = k \cdot N$$

N: antall molekyler i gassen

k: Boltzmann's konstant $1{,}38 \cdot 10^{-23} \left[\frac{J}{K}\right]$

$$\frac{pV}{T} = k \cdot N$$

Massetetthet $\rho = \frac{m}{V}$ ← massen til gassen

N: antall molekyler

$m = N \cdot m_m$

m_m: Massen til et molekyl

Eks: CO_2 ← molekylet består av ett C atom og to O atom

Det finnes tabeller over massen til hvert atom. → Massen blir angitt i [u] (beregnede)

Finner nå massen til molekylet i [u]

Deretter gjør vi om til [kg]

$1\,u = 1{,}66 \cdot 10^{-27}\,[kg]$

CO_2

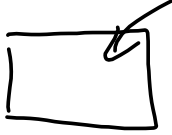
$C \Rightarrow 12{,}01\,[u] = 12{,}0\,[u]$

$2 \cdot O \Rightarrow 2 \cdot 15{,}99\,[u] = 32{,}0\,[u]$

$+ \quad m_m = 44{,}0\,[u] \rightarrow 44{,}0 \cdot 1{,}66 \cdot 10^{-27}\,[kg]$

$= 73{,}0 \cdot 10^{-27}\,[kg]$

6.25



$N = 2{,}4 \cdot 10^{24}$ $p = 200\,kPa$ $V = 48\,dm^3$

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

$\frac{p \cdot V}{T} = k \cdot N$

$p \cdot V = k \cdot N \cdot T$

Pa

$$T = \frac{p \cdot V}{k \cdot N} = \frac{200 \cdot 10^3 \left[\frac{N}{m^2}\right] \cdot 48 \cdot 10^{-3} [m^3]}{1{,}38 \cdot 10^{-23} \left[\frac{J}{K}\right] \cdot 2{,}4 \cdot 10^{24}}$$

$$= \frac{9600\ [N \cdot m]}{3{,}312 \cdot 10^{-23+24} \left[\frac{J}{K}\right]} = \frac{9600}{33{,}12} \left[\frac{J}{\frac{J}{K}}\right] = 289{,}85[K] \approx 290[K]$$

$T = 290 - 273 = 17\,°C$

6) $\rho_{CO_2} = \frac{m}{V} = \frac{N \cdot m_m}{48 \cdot 10^{-3} [m^3]} = \frac{2{,}4 \cdot 10^{24} \cdot 73 \cdot 10^{-27} [kg]}{48 \cdot 10^{-3}\ [m^3]}$

$$= \frac{175{,}2 \cdot 10^{24-27} [kg]}{48 \cdot 10^{-3}\ [m^3]} = 3{,}65 \left[\frac{kg}{m^3}\right]$$

$$= 3{,}65 \cdot 10^{-3} \cdot 10^3 \left[\frac{kg}{m^3}\right] = 3{,}65 \cdot 10^{-3} \left[\frac{kg}{dm^3}\right]$$

Generelle

6.26

$p = 30\ kPa \quad T = 240\ K$

$V = 12\ dm^3$

a) $p \cdot V = kT \cdot N$

$$N = \frac{p \cdot V}{k \cdot T} = \frac{30 \cdot 10^3 \left[\frac{N}{m^2}\right] \cdot 12 \cdot 10^{-3} [m^3]}{1{,}38 \cdot 10^{-23} \left[\frac{J}{K}\right] \cdot 240 [K]}$$

$$= \frac{360\ [N \cdot m]}{331{,}2 \cdot 10^{-23} [J]} = 1{,}087 \cdot 10^{23}$$

b) $N_2 \Rightarrow 2 \cdot N = 2 \cdot 14{,}01 [u] = 28{,}0 [u]$

$$\rho = \frac{m}{V} = \frac{28{,}0 [u] \cdot 1{,}66 \cdot 10^{-27} \left[\frac{kg}{u}\right] \cdot 1{,}087 \cdot 10^{23}}{12\ [dm^3]}$$

$$= 0{,}42 \left[\frac{kg}{m^3}\right] = 0{,}42 \cdot 10^{-3} \cdot 10^3 \left[\frac{kg}{m^3}\right]$$

$$= 0{,}42 \cdot 10^{-3} \left[\frac{kg}{dm^3}\right]$$