Série n° 1 Chimie 02 2022/2023

1) La dimension de R et sa valeur Exo 1

→ D'après la loi des gaz parfait :

$$PV = nRT$$

P : Pression
V : Volume
n : nombre de mole
T : température
R : constante des gaz parfait.

1 mol de gaz parfait dans les conditions standard : $V_m = 22,4\ l$.
$T = 0°C \rightarrow 273\ K$.
$P = 1\ atm$

a/ R en l.atm/mol.K.

$$R = \frac{PV}{nT} = \frac{1 \cdot 22,4}{1 \cdot 273} = \boxed{0,082\ l.atm/mol.K}$$

b/ en J/mol.K.

1 atm = 1 bar = 1,013.10^5 Pa

$1\ Pa = 10^{-5}\ bar$

$1\ hPa = 10^{-3}\ bar$

$\boxed{1\ atm = 1,013.10^{5}\ Pa} = 76\ mmHg$

$1\ J = 1\ Pa.m^3$

$22,4\ l = 22,4.10^{-3} m^3$

$1\ l \rightarrow 10^{-3} m^3$

$1\ m^3 \rightarrow 10^3\ l$

$1\ ml \rightarrow 1\ cm^3$

$$R = \frac{PV}{n \cdot T} = \frac{1{,}013 \cdot 10^{5} \cdot 22{,}4 \cdot 10^{-3}}{1 \cdot 273}$$

$$\boxed{R = 8{,}31 \ J/mol/K}$$

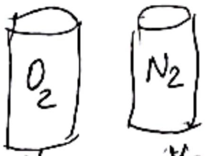
c/ en cal/mol.K.

$1 \ Cal = 4{,}18 \ J$

$$\boxed{R = \frac{8{,}31}{4{,}18} \simeq 2 \ cal/mol/K}$$

2/ Exo2

a/



$V_1 = V_2$

$m_1 = 1 \ kg$. $\quad m_2 = 1 \ kg$

$P_1 = 3 \ atm \quad P_2 = ?$

$T, V \quad T, V$

$$P_1 \cdot V = n_1 RT \Rightarrow T = \frac{P_1 \cdot V}{n_1 R}$$

$$P_2 \cdot V = n_2 \cdot RT \Rightarrow T = \frac{P_2 \cdot V}{n_2 \cdot R}$$

$$T = T \Leftrightarrow \frac{P_1 \cancel{V}}{n_1 \cancel{R}} = \frac{P_2 \cancel{V}}{n_2 \cancel{R}}$$

$$\frac{P_1}{n_1} = \frac{P_2}{n_2}$$

$$\boxed{P_2 = \frac{P_1 \cdot n_2}{n_1}} = \frac{P_1 \cdot \frac{m_2}{M_2}}{\frac{m_1}{M_1}}$$

$$P_2 = \frac{P_1 \cdot M_1}{M_2} = \frac{3 \cdot 32}{28} = \boxed{3{,}42 \ atm}$$

$m_{N_2} = ?$ $P_{N_2} = 2 atm$.

On a

$$\frac{P_1}{n_1} = \frac{P_2}{n_2}$$

$$n_2 = \frac{P_2 . n_1}{P_1}$$

$$n_2 = \frac{m_2}{M_2} = \frac{P_2 . \frac{m_1}{M_1}}{P_1}$$

$$\boxed{m_2 = \frac{P_2 . m_1 . M_2}{P_1 . M_1}}$$

$$m_2 = \frac{2 . 10^3 . 28}{3 . 32}$$

$$\boxed{m_2 = 1,75 . 10^3 g} = 1,75 kg.$$

0,58 kg

Exo3

$$\begin{cases} T_1 = 20°C \\ P_1 = 2,1 bar \\ V_1 \end{cases} \longrightarrow \begin{cases} P_2 = 2,3 bar \\ T_2 = ? \\ V_2 \end{cases}$$

$V_1 = V_2$.

$$P_1 . V_1 = nRT_1 \Rightarrow V_1 = \frac{nRT_1}{P_1}$$

$$P_2 V_2 = nRT_2 \Rightarrow V_2 = \frac{nRT_2}{P_2}$$

$$V_1 = V_2 \Leftrightarrow \frac{\cancel{nR}T_1}{P_1} = \frac{\cancel{nR}T_2}{P_2}$$

$$\frac{T_1}{P_1} = \frac{T_2}{P_2}$$

$$\boxed{T_2 = \frac{T_1 . P_2}{P_1}}$$

$$T_2 = \frac{(20+273) . 2,3}{2,1}$$

21,9°C

$$\boxed{T_2 = 320,9 °C}$$ $T \nearrow$, $P \nearrow$.

$T_2 \simeq 47,9°C$

Exo4

$$H_2 \begin{cases} 0,4 mol \\ P = 2 bar \end{cases} + O_2 \begin{cases} 0,6 mol \\ P = 2 bar \end{cases}$$

a) → calcul de la fraction molaire.

$$y_{H_2} = \frac{n_{H_2}}{n_T} = \frac{0,4}{0,4+0,6} = 0,4$$

$$y_{O_2} = \frac{n_{O_2}}{n_T} = \frac{0,6}{0,4+0,6} = 0,6$$

b) Les pression partielles :

Loi de Dalton :

$$P_i = x_i . P_T$$

$$P_{H_2} = y_{H_2} . P_T = 0,4 . 2 = \underline{0,8 bar}$$

$$P_{O_2} = y_{O_2} . P_T = 0,6 . 2 = \underline{1,2 bar}$$

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