

Quantitative Analytik

- Lösung -

- $N = n \times N_A = 3,16 \text{ mol} \times 6,022 \times 10^{23} \text{ 1/mol} = \mathbf{1,9 \times 10^{24}}$
- $n = N / N_A = 1,2044 \times 10^{16} / 6,022 \times 10^{23} \text{ 1/mol} = \mathbf{2 \times 10^{-8} \text{ mol}}$
- $n = m / M = 0,1 \text{ g} / 55,85 \text{ g/mol} = 0,0018 \text{ mol}$
 $N = n \times N_A = 0,0018 \text{ mol} \times 6,022 \times 10^{23} \text{ 1/mol} = \mathbf{1,08 \times 10^{21}}$
- $n = m / M \rightarrow M = m / n = 20 \text{ g} / 0,769 \text{ mol} = 26 \text{ g/mol}$
 $\rightarrow \mathbf{Al}$
- $5 \% \text{ von } 5 \text{ kg} = \mathbf{250 \text{ g}}$
- a) $V_{mn} = V / n = 22,4 \text{ l/mol}$
 $n(\text{N}_2) = m / M = 7 \text{ g} / 28 \text{ g/mol} = 0,25 \text{ mol}$
 $\mathbf{V(\text{N}_2) = V_{mn} \times n = 22,4 \text{ l/mol} \times 0,25 \text{ mol} = 5,6 \text{ l}}$
 $n(\text{O}_2) = N / N_A = 10^{20} / 6,022 \times 10^{23} \text{ 1/mol} = 0,00017 \text{ mol}$
 $\mathbf{V(\text{O}_2) = V_{mn} \times n = 22,4 \text{ l/mol} \times 0,00017 \text{ mol} = 0,0037 \text{ l}}$

b) $V_1 \times p_1 / T_1 = V_n \times p_n / T_n$
 $V_1 = V_n \times p_n \times T_1 / p_1 \times T_n = 5,6 \text{ l} \times 293 \text{ K} / 273 \text{ K} = \mathbf{6,01 \text{ l}}$

c) $V_1 = V_n \times p_n \times T_1 / p_1 \times T_n =$
 $= 0,0037 \text{ l} \times 1013 \text{ hPa} \times 673 \text{ K} / 500 \text{ hPa} \times 273 \text{ K} = \mathbf{0,018 \text{ l}}$
- $n = m / M = 15 \text{ g} / 2 \text{ g/mol} = 7,5 \text{ mol}$
 $V = V_{mn} \times n = 22,4 \text{ l/mol} \times 7,5 \text{ mol} = \mathbf{168 \text{ l}}$
- $V_1 \times p_1 / T_1 = V_n \times p_n / T_n$
 $V_n = p_1 \times V_1 \times T_n / T_1 \times p_n = 950 \text{ mbar} \times 235 \text{ l} \times 273 \text{ K} / 318 \text{ K} \times 1013 \text{ mbar} =$
 $= 189,20 \text{ l}$
 $n = V / V_{mn} = 189,20 \text{ l} / 22,4 \text{ l/mol} = \mathbf{8,45 \text{ mol}}$
- $\text{O}_2 + 2 \text{H}_2 \rightarrow 2 \text{H}_2\text{O}$

 $n(\text{O}_2) / n(\text{H}_2) = 1 / 2 \quad n(\text{O}_2) = 1/2 \times n(\text{H}_2)$
 $n(\text{H}_2) = m / M = 30 \text{ g} / 2 \text{ g/mol} = 15 \text{ mol}$
 $n(\text{O}_2) = 7,5 \text{ mol}$
- $\text{Zn} + 2 \text{HCl} \rightarrow \text{H}_2 + \text{ZnCl}_2$

 $n(\text{Zn}) / n(\text{H}_2) = 1 / 1 \quad n(\text{Zn}) = n(\text{H}_2)$
 $n(\text{H}_2) = V / V_{mn} = 4 \text{ l} / 22,4 \text{ l/mol} = 0,18 \text{ mol}$
 $n(\text{Zn}) = 0,18 \text{ mol}$

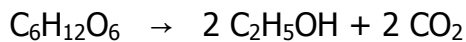
$$m(\text{Zn}) = n \times M = 0,18 \text{ mol} \times 65,39 \text{ g/mol} = \mathbf{11,68 \text{ g}}$$

$$11. n = V / V_{\text{mn}} = m / M$$

$$M = m \times V_{\text{mn}} / V = 12,5 \text{ g} \times 22,4 \text{ l/mol} / 10 \text{ l} = 28 \text{ g/mol}$$

→ N₂

12. in 1 l Wein (~ 1000g) 9 %, also 90 g Alkohol



$$\text{a) } n(\text{C}_6\text{H}_{12}\text{O}_6) / n(\text{C}_2\text{H}_5\text{OH}) = 1 / 2 \quad n(\text{TZ}) = \frac{1}{2} \times n(\text{Alk})$$

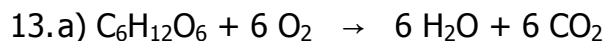
$$n(\text{Alk}) = m / M = 90 \text{ g} / 46 \text{ g/mol} = \mathbf{1,96 \text{ mol}}$$

$$n(\text{TZ}) = \frac{1}{2} \times 1,96 \text{ mol} = 0,98 \text{ mol}$$

$$m = n \times M = 0,98 \text{ mol} \times 180 \text{ g/mol} = \mathbf{176,4 \text{ g}}$$

$$\text{b) } n(\text{CO}_2) = n(\text{Alk}) = \mathbf{1,96 \text{ mol}}$$

$$V = n \times V_{\text{mn}} = 1,96 \text{ mol} \times 22,4 \text{ l/mol} = \mathbf{43,9 \text{ l}}$$



$$n(\text{O}_2) / n(\text{TZ}) = 6 / 1 \quad n(\text{O}_2) = 6 \times n(\text{TZ})$$

$$n(\text{TZ}) = m / M = 20 \text{ g} / 180 \text{ g/mol} = 0,11 \text{ mol}$$

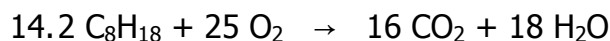
$$n(\text{O}_2) = 0,66 \text{ mol}$$

$$V = n \times V_{\text{mn}} = 0,66 \text{ mol} \times 22,4 \text{ l/mol} = \mathbf{14,8 \text{ l}}$$

$$\text{b) } n(\text{H}_2\text{O}) = n(\text{O}_2) = 0,66 \text{ mol}$$

$$m = n \times M = 0,66 \text{ mol} \times 18 \text{ g/mol} = \mathbf{11,88 \text{ g}}$$

c) In der Luft sind 21 % Sauerstoff enthalten, d.h. wir müssten 70,5 l Luft einatmen!



Es werden 54 l Benzin verbraucht!

$$\rho = m / V \quad m = \rho \times V = 0,7 \text{ g/ml} \times 54000 \text{ ml} = 37800 \text{ g}$$

$$n(\text{Benzin}) = m / M = 37800 \text{ g} / 114 \text{ g/mol} = 331,58 \text{ mol}$$

$$n(\text{CO}_2) / n(\text{Benzin}) = 16 / 2 \quad n(\text{CO}_2) = 8 \times n(\text{Benzin}) = 2652,63 \text{ mol}$$

$$V = n \times V_{\text{mn}} = 2652,63 \text{ mol} \times 22,4 \text{ l/mol} = \mathbf{59418,9 \text{ l}}$$

$$m = n \times M = 2652,63 \text{ mol} \times 44 \text{ g/mol} = \mathbf{116715,72 \text{ g}}$$

$$15. V / V_{\text{mn}} = m / M \\ = 2 \text{ g/mol}$$

$$M = m \times V_{\text{mn}} / V = 0,125 \text{ g} \times 22,4 \text{ l/mol} / 1,4 \text{ l} =$$

→ **Wasserstoff**