

PROBLEMAS DE QUÍMICA



RED-OX

Problema 827: Dada a seguinte reacción:

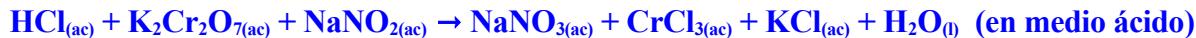


1. Axuste as ecuacións iónica e molecular polo método do ión-electrón.

2. Calcule o volume de dicromato de potasio 2,0 M necesario para oxidar 20 g de nitrito de sodio.

ABAU-Xuño-2023

Axustamos a reacción en medio ácido:



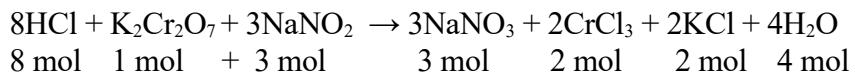
Disociamos e números de oxidación que cambian:	$\begin{aligned} \text{H}^+ + \text{Cl}^- + 2 \text{K}^+ + \overset{+6}{\text{Cr}_2\text{O}_7^{2-}} + \text{Na}^+ + \overset{+3}{\text{NO}_2^-} &\rightarrow \\ \rightarrow \text{Na}^+ + \overset{+5}{\text{NO}_3^-} + \overset{+3}{\text{Cr}^{+3}} + 3 \text{Cl}^- + \text{K}^+ + \text{Cl}^- + \text{H}_2\text{O} & \\ \overset{+6}{\text{Cr}_2\text{O}_7^{2-}} + \overset{+3}{\text{NO}_2^-} &\rightarrow \overset{+5}{\text{NO}_3^-} + \overset{+3}{\text{Cr}^{+3}} \end{aligned}$
Semirreaccións:	$\begin{aligned} \text{NO}_2^- &\rightarrow \text{NO}_3^- && \text{oxidación} \\ \text{Cr}_2\text{O}_7^{2-} &\rightarrow \text{Cr}^{+3} && \text{reducción} \end{aligned}$
Axustar elementos:	$\begin{aligned} \text{NO}_2^- &\rightarrow \text{NO}_3^- \\ \text{Cr}_2\text{O}_7^{2-} &\rightarrow 2 \text{Cr}^{+3} \end{aligned}$
Axustar osíxeno:	$\begin{aligned} \text{NO}_2^- + \text{H}_2\text{O} &\rightarrow \text{NO}_3^- \\ \text{Cr}_2\text{O}_7^{2-} &\rightarrow 2 \text{Cr}^{+3} + 7 \text{H}_2\text{O} \end{aligned}$
Axustar hidróxeno:	$\begin{aligned} \text{NO}_2^- + \text{H}_2\text{O} &\rightarrow \text{NO}_3^- + 2 \text{H}^+ \\ \text{Cr}_2\text{O}_7^{2-} + 14 \text{H}^+ &\rightarrow 2 \text{Cr}^{+3} + 7 \text{H}_2\text{O} \end{aligned}$
Axustar carga:	$\begin{aligned} \text{NO}_2^- + \text{H}_2\text{O} &\rightarrow \text{NO}_3^- + 2 \text{H}^+ + 2\text{e}^- \\ \text{Cr}_2\text{O}_7^{2-} + 14 \text{H}^+ + 6\text{e}^- &\rightarrow 2 \text{Cr}^{+3} + 7 \text{H}_2\text{O} \end{aligned}$
Igualar e^- :	$\begin{aligned} 3 \text{NO}_2^- + 3 \text{H}_2\text{O} &\rightarrow 3 \text{NO}_3^- + 6 \text{H}^+ + 6\text{e}^- \\ \text{Cr}_2\text{O}_7^{2-} + 14 \text{H}^+ + 6\text{e}^- &\rightarrow 2 \text{Cr}^{+3} + 7 \text{H}_2\text{O} \end{aligned}$
Sumar e engadir ións de acompañamento:	<p>3 NO₂⁻ + Cr₂O₇²⁻ + 8 H⁺ → 3 NO₃⁻ + 2 Cr⁺³ + 4 H₂O (Ecuación iónica)</p> <p>8HCl + 3NO₂⁻ + Cr₂O₇²⁻ → 3NO₃⁻ + 2Cr⁺³ + 4H₂O + 8Cl⁻</p> <p>8HCl + K₂Cr₂O₇ + 3NO₂⁻ → 3NO₃⁻ + 2Cr⁺³ + 4H₂O + 8Cl⁻ + 2K⁺</p> <p>8HCl + K₂Cr₂O₇ + 3NaNO₂ → 3NO₃⁻ + 2Cr⁺³ + 4H₂O + 8Cl⁻ + 2K⁺ + 3Na⁺</p> <p>8HCl + K₂Cr₂O₇ + 3NaNO₂ → 3NaNO₃ + 2Cr⁺³ + 4H₂O + 8Cl⁻ + 2K⁺</p> <p>8HCl + K₂Cr₂O₇ + 3NaNO₂ → 3NaNO₃ + 2CrCl₃ + 4H₂O + 2Cl⁻ + 2K⁺</p> <p>8HCl + K₂Cr₂O₇ + 3NaNO₂ → 3NaNO₃ + 2CrCl₃ + 2KCl + 4H₂O</p> <p>8HCl + K₂Cr₂O₇ + 3NaNO₂ → 3NaNO₃ + 2CrCl₃ + 2KCl + 4H₂O (Ecuación molecular)</p>

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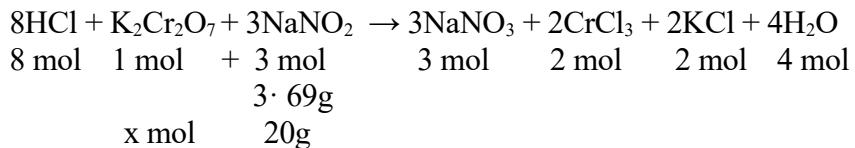
RED-OX



b) Resolvemos o problema de estequiométria:



$$M_m(\text{NaNO}_2) = 23 + 14 + 2 \cdot 16 = 69 \frac{\text{g}}{\text{mol}}$$



$$\frac{x \text{ mol } K_2\text{Cr}_2\text{O}_7}{20 \text{ g NaNO}_2} = \frac{1 \text{ mol } K_2\text{Cr}_2\text{O}_7}{3 \cdot 69 \text{ g NaNO}_2}$$

$$x \text{ mol } K_2\text{Cr}_2\text{O}_7 = \frac{1 \text{ mol } K_2\text{Cr}_2\text{O}_7 \cdot 20 \text{ g NaNO}_2}{3 \cdot 69 \text{ g NaNO}_2} = 0,097 \text{ mol } K_2\text{Cr}_2\text{O}_7$$

Calculamos o volume a partir da molaridade:

$$M = \frac{n}{V} \quad V = \frac{n}{M} = \frac{0,097 \text{ mol}}{2,0 \text{ mol/L}} = 0,0483 \text{ L} = 48,3 \text{ mL}$$