

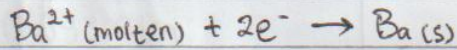
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Elektrokimia

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- 1) Consider the electrolysis of molten Barium Chloride, BaCl_2 . (a) Write the half-reactions
(b) How many grams of Barium metal can be produced by supplying 0.5 A for 30 minutes?

(a) Half-Reactions



(b) $i = 0.5 \text{ A}$

$$e = \frac{137}{2} = 86.5$$

$$t = 30 \text{ minutes} = 1800 \text{ s}$$

$$\text{Ar Ba} = 137$$

$$W = \frac{e \cdot i \cdot t}{96500}$$

$$W = \frac{(86.5)(0.5)(1800)}{96500} \Rightarrow W = 0.6389 \text{ gram}$$

- 2) Considering only the cost of electricity, would it be cheaper to produce a ton of Sodium or a ton of Aluminium by electrolysis?

Rumus Umum:

$$W = \frac{e \cdot i \cdot t}{96500} \Rightarrow i = \frac{W \cdot 96500}{e \cdot t} \text{ yang mana } i \approx 1$$

$$e_{\text{Sodium}} = \frac{23}{1} = 23$$

$$e_{\text{Alu}} = \frac{27}{3} = 9$$

Semakin besar nilai e maka semakin kecil nilai i

Jadi, untuk memproduksi Sodium lebih murah jika dibandingkan dengan memproduksi Aluminium

- 3) Calculate the amounts of Cu dan Br_2 produced in 1.0 h at inert electrodes in a Solution of CuBr_2 by a Current of 4.50 A.

$$W_{\text{Cu}} = \frac{e \cdot i \cdot t}{96500} \quad 60 \text{ menit} = 3600 \text{ s}$$

$$W_{\text{Cu}} = \frac{(63.5/2)(4.5)(3600)}{96500}$$

$$W_{\text{Cu}} = 5.33 \text{ gram}$$

$$W_{\text{Br}} = \frac{e \cdot i \cdot t}{96500}$$

$$= \frac{(80/1)(4.5)(3600)}{96500}$$

$$W_{\text{Br}} = 13.43 \text{ gram}$$

- 4) The Passage of a Current of 0.750 A for 25 minutes deposited 0.369 gram of Copper from a CuSO_4 Solution. From this information, Calculate the value of molar mass of Copper.

$$W = \frac{i \cdot e \cdot t}{96500} \quad 25 \text{ menit} = 1500 \text{ s}$$

$$e = \frac{W \cdot 96500}{i \cdot t} \Rightarrow e = \frac{(0.369) 96500}{(0.750)(1500)}$$

$$e = 31.625$$

$$e \approx 32$$

$$e = \frac{\text{Ar}}{n}$$

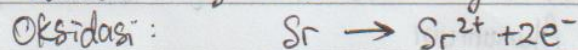
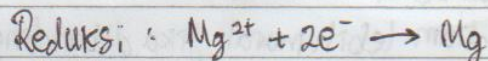
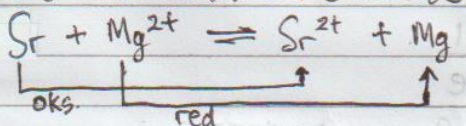
$$32 = \frac{\text{Ar}}{2} \Rightarrow \text{Ar} = 64$$

5) A constant electric current flows for 3.75 hour through two electrolytic cells connected in series. One contains a solution of AgNO_3 and the second a solution of CuCl_2 . During this time 2.00 gram of silver are deposited in the first cell. (a) How many grams of copper are deposited in second cell? (b) What is the current flowing, in Amperes?

$$\begin{aligned} \text{(a)} \quad \frac{W_{\text{Cu}}}{W_{\text{Ag}}} &= \frac{e_{\text{Cu}}}{e_{\text{Ag}}} & W_{\text{Cu}} &= \frac{(63.5)(2.00)}{2 \cdot 108} \\ & & W_{\text{Cu}} &= 0.58796 \text{ gram} \end{aligned}$$

$$\begin{aligned} \text{(b)} \quad W_{\text{Ag}} &= \frac{e_{\text{Ag}} \cdot i \cdot t}{96500} \\ i &= \frac{W_{\text{Ag}} \cdot 96500}{e_{\text{Ag}} \cdot t} \\ i &= \frac{(2)(96500)}{(108)(13500)} \Rightarrow i = 0.13237 \text{ Ampere} \end{aligned}$$

6) The equilibrium constant for the reaction
 $\text{Sr(s)} + \text{Mg}^{2+}(\text{aq}) \rightleftharpoons \text{Sr}^{2+}(\text{aq}) + \text{Mg(s)}$
 is 2.69×10^{12} at 25°C . Calculate E° for a cell made up of Sr/Sr^{2+} and Mg/Mg^{2+} half cells



mol elektron (n) = 2

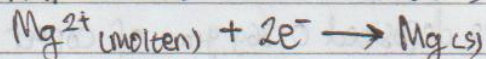
$$E^\circ_{\text{cell}} = \frac{RT}{nF} \ln(K)$$

$$E^\circ_{\text{cell}} = \frac{(8.314)(298)}{(2)(96500)} \ln(2.69 \times 10^{12})$$

$$E^\circ_{\text{cell}} = 0.0128 (28.62)$$

$$E^\circ_{\text{cell}} = 0.366 \text{ Volt}$$

7) The half-Reaction at an electrode is



Calculate the number of grams of magnesium that can be produced by supplying 1.00 F to the electrode

$$\frac{\text{Mol } e^-}{\text{mol Mg}} = \frac{2}{1}$$

$$\text{Mol Mg} = \frac{1}{2} \text{ mol } e^-$$

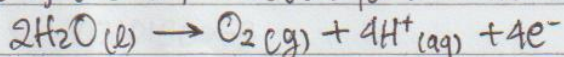
$$\frac{\text{gr Mg}}{\text{Ar Mg}} = \frac{1}{2} \text{ mol } e^-$$

$$\text{gr Mg} = \frac{\text{mol } e^- \times \text{Ar Mg}}{2}$$

$$= \frac{1}{2} \times 24.312$$

$$\text{gr Mg} = 12.156 \text{ gram}$$

8) One of the half-reactions for the electrolysis of water is



If 0.076 L of O_2 is collected at 25°C and 755 mmHg, how many moles of electrons had to pass through the solution?

$$P = 755 \text{ mmHg} \times \frac{1 \text{ atm}}{760 \text{ mmHg}} \quad PV = n_{\text{O}_2} RT$$

$$P = 0.993 \text{ atm} \quad n_{\text{O}_2} = \frac{(0.993)(0.076)}{(0.0821)(298)}$$

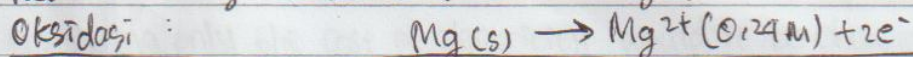
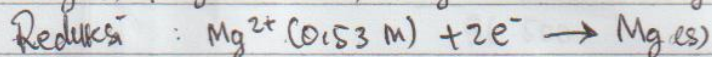
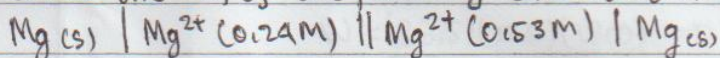
$$n_{\text{O}_2} = 3.082 \times 10^{-3} \text{ mol}$$

$$\frac{\text{mol } e^-}{\text{mol } \text{O}_2} = \frac{4}{1} \Rightarrow \text{mol } e^- = 4 \times \text{mol } \text{O}_2$$

$$\text{mol } e^- = 4 (3.082 \times 10^{-3})$$

$$\text{mol } e^- = 12.349 \text{ mmol}$$

9) Calculate the emf of the following Concentration cell:



$$K = \frac{0.24}{0.53}$$

$$E^\circ = -2.37 + 2.37$$

$$E^\circ = 0 \text{ V}$$

$$E = E^\circ - \frac{0.0257}{2} \ln(K)$$

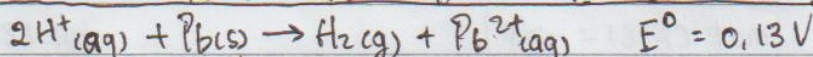
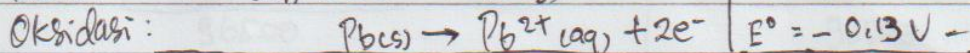
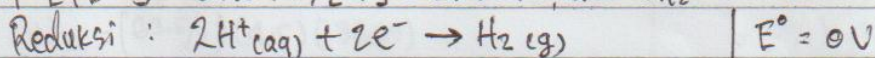
$$E = 0 - \frac{0.0257}{2} \ln\left(\frac{0.24}{0.53}\right)$$

$$E = 0 - (-0.0102)$$

$$E = 0.0102 \text{ V}$$

10) What is the emf of a cell consisting of a Pb^{2+}/Pb half-cell and a $\text{Pt}/\text{H}^+/\text{H}_2$ half-cell

If $[\text{Pb}^{2+}] = 0.10 \text{ M}$, $[\text{H}^+] = 0.050 \text{ M}$, and $P_{\text{H}_2} = 1.0 \text{ atm}$?



$$K = \frac{[\text{Pb}^{2+}] P_{\text{H}_2}}{[\text{H}^+]^2}$$

$$K = \frac{(0.1)(1)}{(0.05)^2}$$

$$K = 40$$

$$E = E^\circ - \frac{RT}{nF} \ln(K)$$

$$E = 0.13 - \frac{0.0257}{2} \ln(40)$$

$$E = 0.13 - 0.0474$$

$$E = 0.0826 \text{ V}$$