

Решение типовых задач по аналитической химии (2006 год)

1. Дано:

$$m(\text{K}_2\text{Cr}_2\text{O}_7) = 0.2375 \text{ г}$$

$$V(\text{K}_2\text{Cr}_2\text{O}_7) = 500 \text{ см}^3$$

$$L = 1 \text{ см}$$

$$D = 0,823$$

$$\lambda = 350 \text{ нм}$$

$$\epsilon = ? \quad E = ?$$

Решение:

$$D = \epsilon \cdot L \cdot C$$

$$C = m / M \cdot V$$

$$C = 0.2375 / 294 \cdot 0.5 = 0.00165 \text{ моль/л}$$

$$D = \epsilon \cdot w \cdot l$$

$$W = m(\text{в-ва}) / m(\text{р-ра})$$

$$W = 0.2375 / 500 = 0.000475 \cdot 100\% = 0,0475\%$$

$$E = 0,823 / 0,0475 \cdot 1 = 17,33$$

$$\epsilon = 0,823 / 0.00165 \cdot 1 = 499 \text{ л} \cdot \text{моль}^{-1} \cdot \text{см}^{-1}$$

Ответ:  $499 \text{ л} \cdot \text{моль}^{-1} \cdot \text{см}^{-1}$ ; 17,33.

2. Дано:

$$\epsilon = 2170 \text{ дм}^3 \cdot \text{моль}^{-1} \cdot \text{см}^{-1}$$

$$\lambda = 486 \text{ нм}$$

$$L = 2 \text{ см}$$

$$D = 0,736$$

$$T(\text{KMnO}_4) = ?$$

Решение:

$$D = \epsilon \cdot L \cdot C$$

$$C = D / \epsilon \cdot L$$

$$C = 0.736 / 2170 \cdot 2 = 1.70 \cdot 10^{-4} \text{ моль/л}$$

$$T = C \cdot M / 1000$$

$$T(\text{KMnO}_4) = 1.70 \cdot 10^{-4} \cdot 158.03 / 1000 = 0.27 \cdot 10^{-4} \text{ г/мл}$$

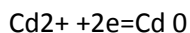
Ответ:  $0.27 \cdot 10^{-4} \text{ г/мл}$

3. Дано:

$$C_m(\text{Cd}(\text{NO}_3)_2) = 0.01 \text{ моль/л}$$

$$\text{ЭДС}(\text{H}_2) = ?$$

Решение:



$$E^0(\text{Cd}^{2+} / \text{Cd}) = -0.400 \text{ В}$$

$$E^0(2\text{H}^+ / \text{H}_2) = 0.000 \text{ В}$$

$$E(\text{Cd}^{2+} / \text{Cd}) = E^0 + 0.059/2 \cdot \lg [\text{Cd}^{2+}]$$

$$E(\text{Cd}^{2+} / \text{Cd}) = -0.4 + 0.0295 \cdot \lg 0.01 = -0.4 + 0.0295 \cdot (-2) = -0.459 \text{ В}$$

$$\text{ЭДС}(\text{H}_2) = E(\text{Cd}^{2+} / \text{Cd}) - E^0(2\text{H}^+ / \text{H}_2) = -0.459 \text{ В}$$

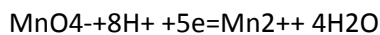
4. Дано:

$$\text{pH} = 1$$

$$[\text{MnO}_4^-] = [\text{Mn}^{2+}]$$

$$E = ?$$

Решение:



$$[\text{H}^+] = 10^{-\text{pH}} = 10^{-1}$$

$$E^0(\text{MnO}_4^- / \text{Mn}^{2+}) = 1.51 \text{ В}$$

$$E = E^0 + 0.059/n \cdot \lg [\text{Ox}]^a \cdot [\text{H}^+]^m / [\text{RedOx}]^b$$

$$E = 1.51 + 0.059/5 \cdot \lg [\text{MnO}_4^-] \cdot [\text{H}^+]^8 / [\text{Mn}^{2+}] = 1.42 \text{ В}$$

Ответ: 1.42 В

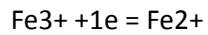
5. Дано:

Р-р FeSO<sub>4</sub>

Оттитровка на 99%

E(Pt)-?

Решение:



$$E^0(\text{Fe}^{3+} / \text{Fe}^{2+}) = 0.77\text{В}$$

$$[\text{Fe}^{3+}] / [\text{Fe}^{2+}] = 99/1 = 99$$

$$E(\text{Pt}) = 0.77 + 0.059 * \lg 99 = 0.887\text{В}$$

Ответ: 0.887В

6. Дано:

$$L = 5 \text{ см}$$

$$D = 0,610$$

$$\lambda = 630 \text{ нм}$$

$$\epsilon = 1300 \text{ дм}^3 * \text{моль}^{-1} * \text{см}^{-1}$$

C (Cu<sup>2+</sup>)-?

Решение:

$$C = D / \epsilon * L$$

$$C = 0.610 / 1300 * 5 = 0,94 * 10^{-4} \text{ моль/л}$$

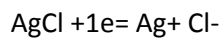
Ответ: 0,94 \* 10<sup>-4</sup> моль/л.

7. Дано:

$$E(\text{AgCl}/\text{Ag}) = 0.518 \text{ В}$$

ПР (AgCl)-?

Решение:



$$E^0(\text{Ag}^+ / \text{Ag}) = 0.800\text{В}$$

$$E^0(2\text{H}^+ / \text{H}_2) = 0.000 \text{ В}$$

$$E(\text{Ag}^+ / \text{Ag}) = E^0 + 0.059 * \lg [\text{Ag}^+]$$

$$\lg [\text{Ag}^+] = (E(\text{Ag}^+ / \text{Ag}) - E^0(\text{Ag}^+ / \text{Ag})) / 0.059$$

$$\lg [\text{Ag}^+] = 0.518 - 0.800 / 0.059 = -4.78$$

$$[\text{Ag}^+] = 10^{-4.78} = 1.66 * 10^{-5} \text{ моль/л}$$

$$\text{ПР}(\text{AgCl}) = [\text{Ag}^+]^2 = (1.66 * 10^{-5})^2 = 2.76 * 10^{-10}$$

Ответ: 2.76 \* 10<sup>-10</sup>.