

Answer on Question #74509, Chemistry / General Chemistry:

An aqueous sodium chloride solution is electrolyzed using a current of 2.05 a. How much time is required to collect 19.5 L of chlorine if the gas is collected over water at 20C and then the total pressure is 109.9 kpa? Express answer in minutes.

Solution.

$$I = 2.05A$$

$$F = 96500$$

$$V(Cl_2) = 19.5L$$

$$T = 293K$$

$$P = 109.9kpa$$

$$t = ?$$

The amount of chlorine can be calculated:

$$pV = \frac{m}{M}RT = \nu RT$$

$$\nu = \frac{pV}{RT}$$

$$m = \frac{pV \cdot M}{RT}$$

The Faraday law for electrolysis:

$$m = \frac{Alt}{nF}$$

$$\text{And: } \frac{pV \cdot M}{RT} = \frac{Alt}{nF}$$

Than:

$$\frac{pV \cdot M}{RT} = \frac{Mit}{4F}$$

$$\frac{pV}{RT} = \frac{It}{4F}$$

$$t = \frac{4pV \cdot F}{IRT}$$

The time of electrolysis:

$$t = \frac{4 \cdot 109900 \cdot 19.5 \cdot 10^{-3} \cdot 96500}{2.05 \cdot 8.314 \cdot 293} = 162478s$$

$$t = 2708 \text{ min}$$

Answer: $t = 2708 \text{ min}$