Answer on Question #71801, Chemistry / General Chemistry :

A Zn wire and Ag/AgCl reference electrode (E° = 0.197 V) are placed into a solution of $ZnSO_4$. The Zn wire is attached to the positive terminal and the Ag/AgCl electrode is attached to the negative terminal of the potentiometer. Calculate the [Zn^{2+}] in the solution if the cell potential, Ecell, is -1.061 V. The standard reduction potential of the Zn^{2+} /Zn half-reaction is –0.762 V.

[Zn^{2+}]= ? M .

Solution.

$$E^0 = 0.197V$$
$$E = 1.061V$$
$$E\left(Zn^{2+} / Zn\right) = -0.762V$$

$$\left[Zn^{2+}\right] - ?$$

The cell potential, Ecell, is -1.061 V:

$$E = 1.061V = E^0 - E\left(Zn^{2+} / Zn\right)$$

And:

$$1.061V = 0.197V - \left(E^0\left(Zn^{2+} / Zn\right) + \frac{0,059}{2}\cdot \lg\left[Zn^{2+}\right]\right)$$
$$1.061V = 0.197V - \left(-0.762 + \frac{0,059}{2}\cdot \lg\left[Zn^{2+}\right]\right)$$
$$\frac{0,059}{2}\cdot \lg\left[Zn^{2+}\right] = 0.197V + 0.762V - 1.061V$$
$$\lg\left[Zn^{2+}\right] = -3.457$$
$$\left[Zn^{2+}\right] = 10^{-3.457} = 3.486\cdot 10^{-4}M$$
$$\left[Zn^{2+}\right] = 3.486\cdot 10^{-4}M$$

Answer: $\left[Zn^{2+}\right] = 3.486\cdot 10^{-4}M$ **.**