Quiz 19.4 – Electrolytic Cells

Name: *Key*

Consider a cell designed for electrolytic refinement of impure copper. Two copper electrodes (one pure and one impure) are placed in an acid solution and a voltage is applied

$$2\,e^-$$

Question 1

If your goal is to dissolve the impure copper electrode and increase the mass of the pure copper, which electrode (pure or impure) should be placed as the anode, and which should be placed as the cathode?

Anode: impure   Cathode: pure

Question 2

If the system runs at a current of $3.5\ A$, how many g of pure copper will be recovered after $3hours$?

$$\frac{3h}{}\left|\frac{60\ min}{1h}\right|\frac{60\ s}{1\ min}\left|\frac{3.5\ C}{1\ s}\right|\frac{1\ mol\ e^-}{96,485\ C}\left|\frac{1\ mol\ Cu}{2\ mol\ e^-}\right|\frac{63.5\ g}{1\ mol\ Cu} = 12.4\ g\ Cu$$

Consider a cell designed for electroplating silver as a thin layer over cheaper metals. One electrode of pure silver and one electrode of the cheaper metal are placed in an acid solution and a voltage is applied

$$1\,e^-$$

Question 3

If your goal is to cover the cheap metal electrode in a thin layer of pure silver, which electrode (silver or other) should be placed as the anode, and which should be placed as the cathode?

Anode: Silver   Cathode: cheap metal

Question 4

If the system runs at a current of $0.75\ A$, how long should the apparatus run to plate a total of $0.30g$ silver?

$$\frac{0.30g\ Ag}{}\left|\frac{1\ mol\ Ag}{107.868\ g\ Ag}\right|\frac{1\ mol\ e^-}{1\ mol\ Ag}\left|\frac{96,485\ C}{1\ mol\ e^-}\right|\frac{1\ s}{0.75\ C} = 358\ s$$

Question 5

If you need to plate $0.250g$ of silver in $15minutes$, what current should be applied?

$$\rightarrow 900\,s$$

$$\frac{0.250g\ Ag}{}\left|\frac{1\ mol\ Ag}{107.868g\ Ag}\right|\frac{1\ mol\ e^-}{1\ mol\ Ag}\left|\frac{96,485\ C}{1\ mol\ e^-}\right. = \frac{223.6\ C}{900\ s} = 0.248\ A$$