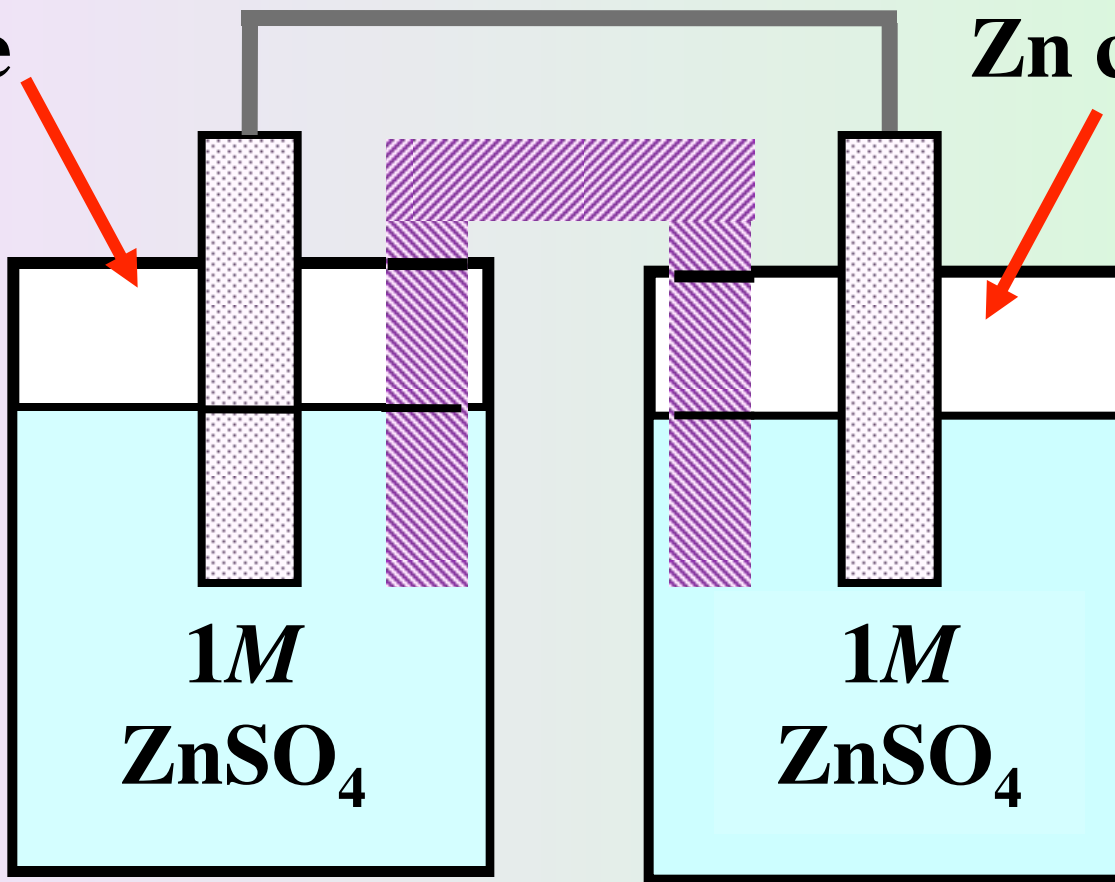


Concentration Cells

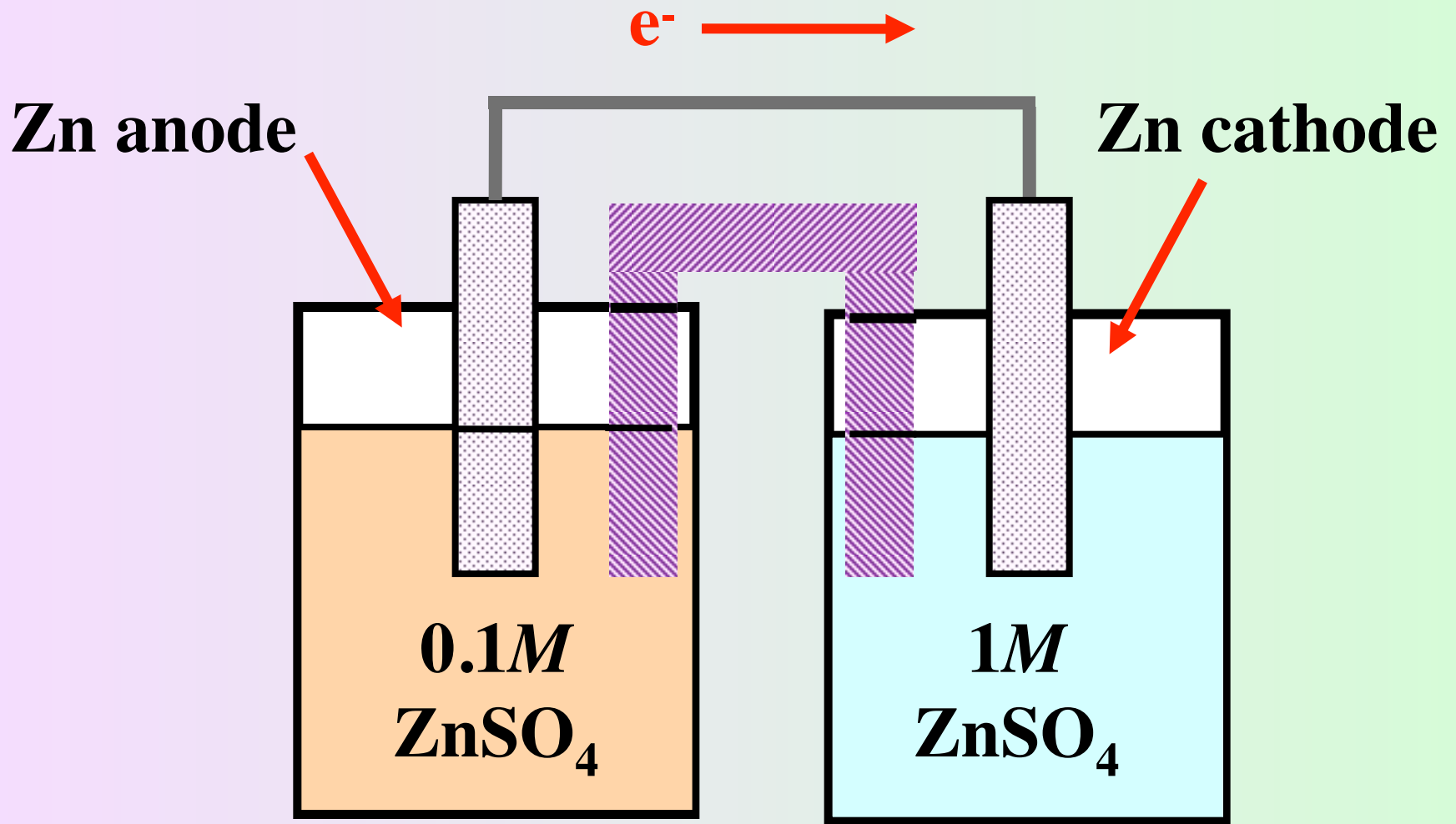
A galvanic cell in which both compartments contain the same components but differ in concentrations.

Zn anode

Zn cathode



The EMF of the cell is Zero.



What is the EMF of the cell ?

What is the emf of the cell ?



$$\varepsilon = \varepsilon^\circ - \frac{0.0591\text{v}}{n} \log Q$$

$$\varepsilon = \varepsilon^\circ - \frac{0.0591\text{v}}{n} \log \frac{[\text{Zn}^{2+}]}{[\text{Zn}^{2+}]}$$

What is the emf of the cell ?



$$\varepsilon = \varepsilon^\circ - \frac{0.0592}{n} \log Q$$

$$\varepsilon = 0.0296 \text{ V}$$

$$\varepsilon = 0 - \frac{0.0592}{2} \log \frac{0.1}{1.0}$$

Electrolysis

Electrolysis

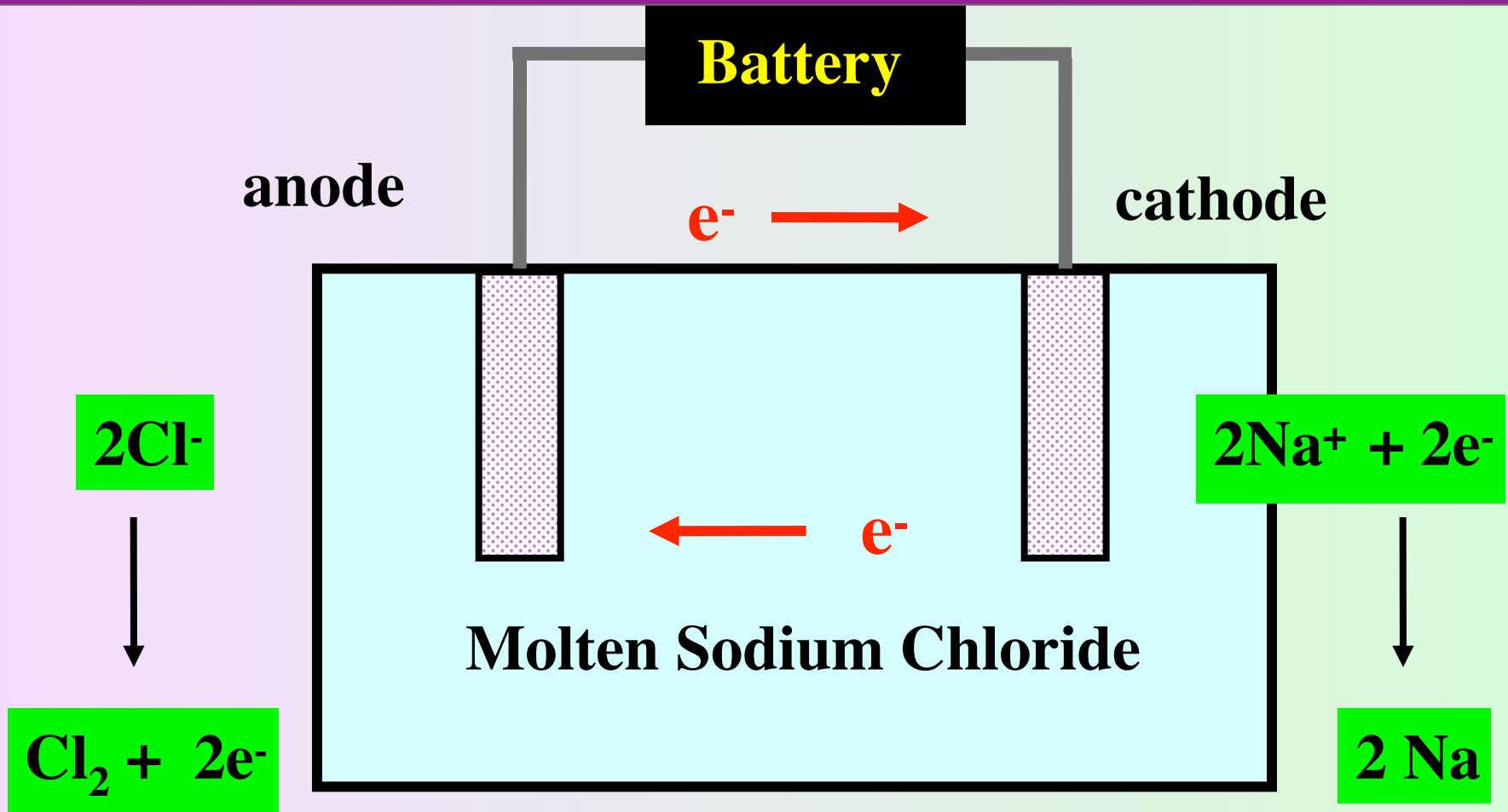
the process in which electrical energy is used to cause a nonspontaneous chemical reaction to occur

has many important applications in industry, mainly in the extraction and purification of metals

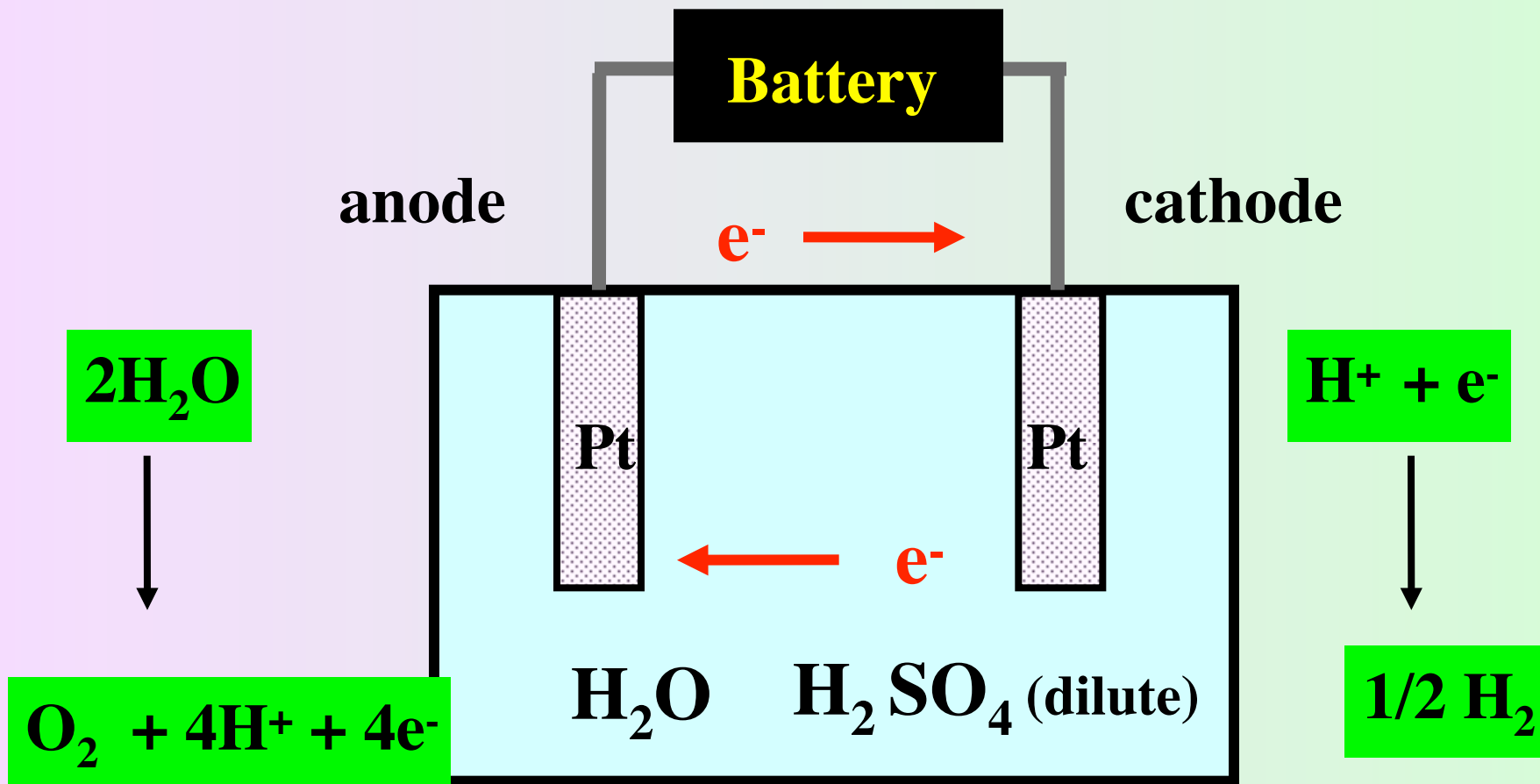
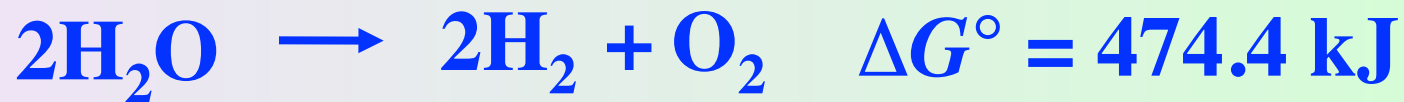
two examples

the battery serves as an electron pump

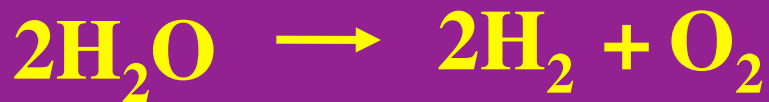
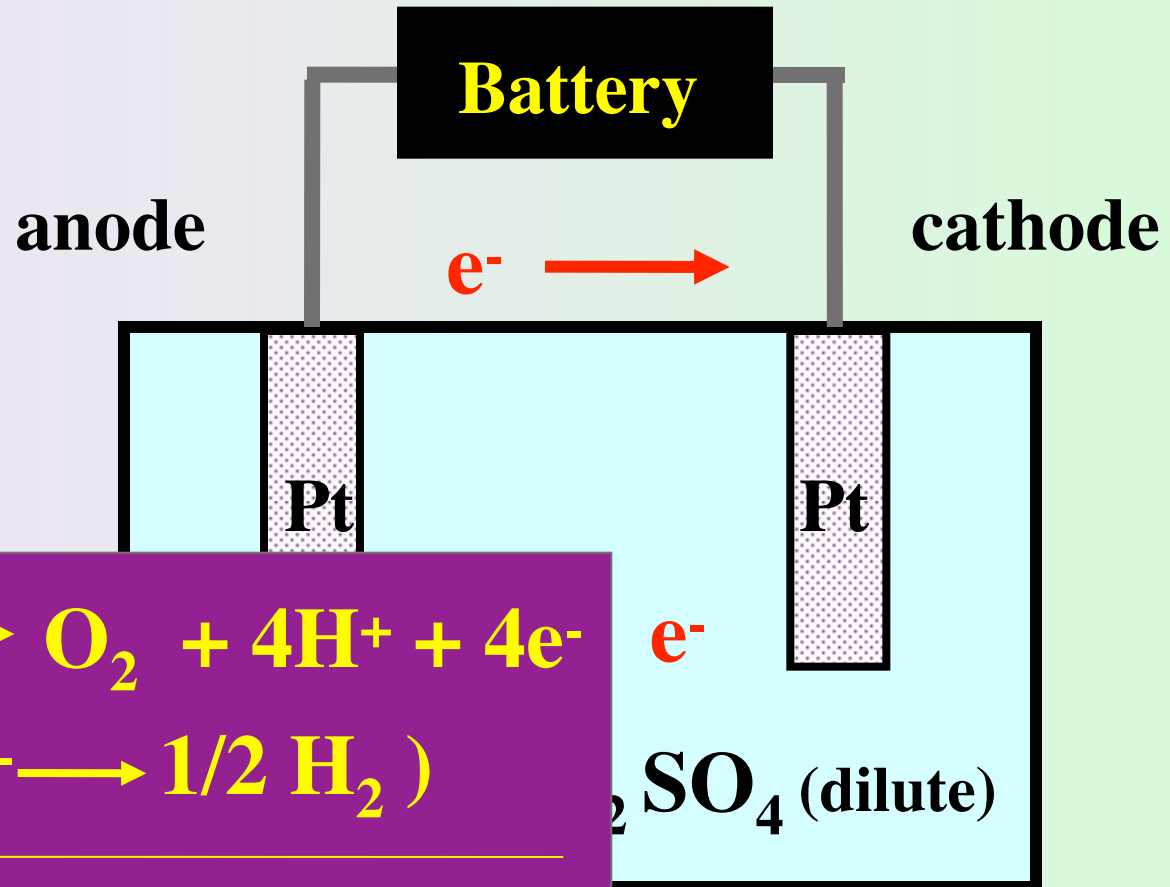
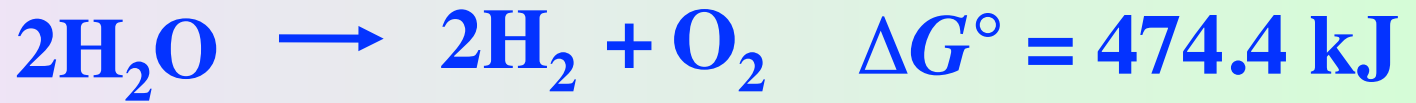
- driving electrons to the cathode
- withdrawing electrons from the anode



water



water



Quantitative Aspects of Electrolysis

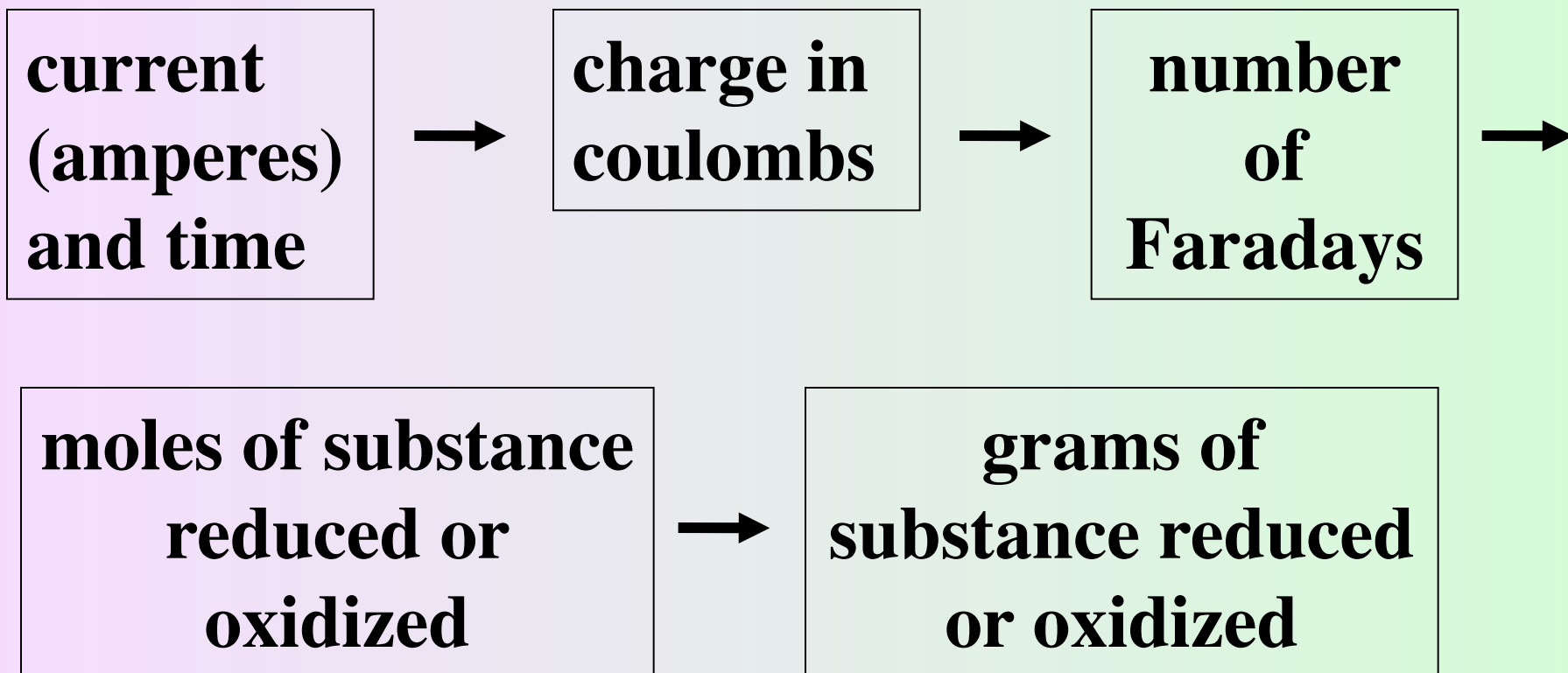
Quantitative Aspects of Electrolysis

Faraday observed that the mass of product formed (or reactant consumed) at an electrode is proportional to both the amount of electricity transferred and the molar mass of the substance in question

We generally measure the amount of electricity transferred (current) in **amperes, A**

$$\text{amperes} = \frac{\text{coulomb}}{\text{second}}$$

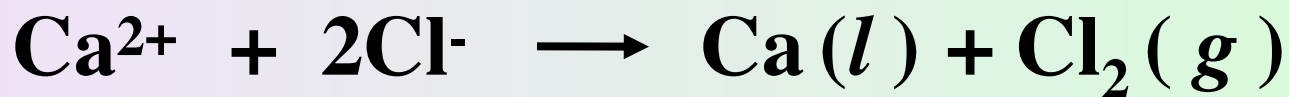
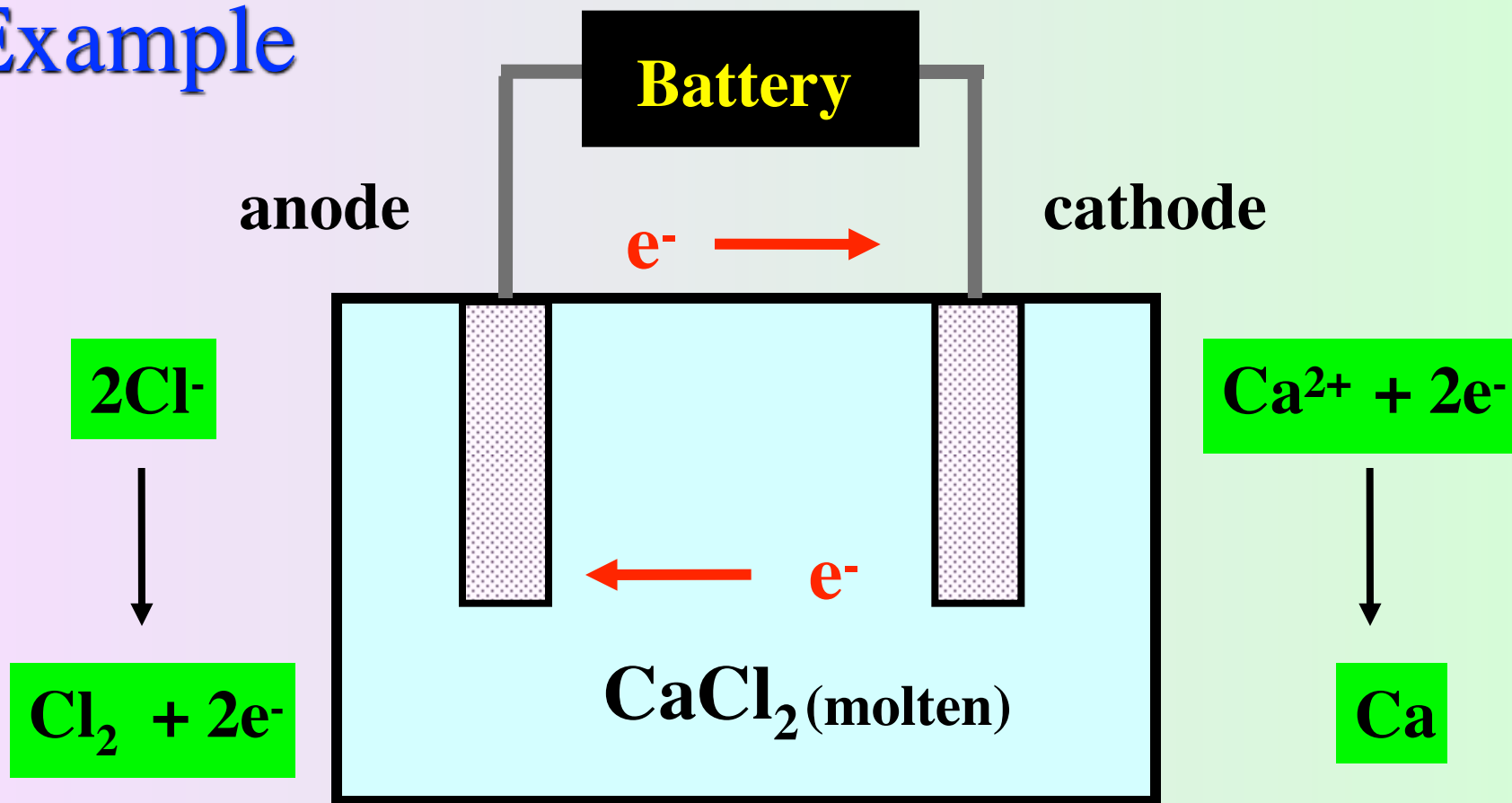
The steps involved in calculating amounts of substances reduced or oxidized in electrolysis



Example

A current of 0.452 A is passed through an electrolytic cell containing molten CaCl_2 for 1.50 hours. Write the electrode reactions and calculate the quantity of products formed at the electrodes.

Example



$$1.50 \text{ h} \times \frac{0.452 \text{ C}}{\text{s}} \times \frac{3600 \text{ s}}{1 \text{ h}} \times \frac{1 \text{ mol e}^-}{96485 \text{ C}}$$

$$\times \frac{1 \text{ mol Ca}^{2+}}{2 \text{ mol e}^-} \times \frac{40 \text{ g}}{1 \text{ mol Ca}^{2+}} = 0.506 \text{ g Ca}$$

$$1.50 \text{ h} \times \frac{0.452 \text{ C}}{\text{s}} \times \frac{3600 \text{ s}}{1 \text{ h}} \times \frac{1 \text{ mol e}^-}{96485 \text{ C}}$$

$$\times \frac{1 \text{ mol Cl}_2}{2 \text{ mol e}^-} \times \frac{70 \text{ g}}{1 \text{ mol Cl}_2} = 0.896 \text{ g Cl}_2$$