

13-2

## ~~13-2~~ Galvanic cells : (or) Voltaic cell :- ①

### Electrochemical cells :

Electrochemical cells consists of electrodes immersed in electrolyte solution and frequently connected by a salt bridge.

### Electrodes :

When the reaction involves the metallic form of the metal, the cathode (or anode) electrode is usually made of the metal - otherwise an inert material, such as Pt, is normally used for the electrode.

### Salt bridge :

A salt bridge is an ionic medium with semipermeable barrier on each end. Small molecules and ions can cross a semipermeable barrier, but large molecules cannot.

The purpose of a salt bridge is to maintain electroneutrality (no charge build-up) throughout the cell.

The function of the salt bridge is allow ion motion between the two components without allowing mixing of the solutions.

The salt bridge symbol || represents the two phase boundaries on either side of the bridge.

Types of electrochemical cells:

Galvanic (or) voltaic cells:-

Galvanic cell is a device in which chemical energy is converted to electrical energy.

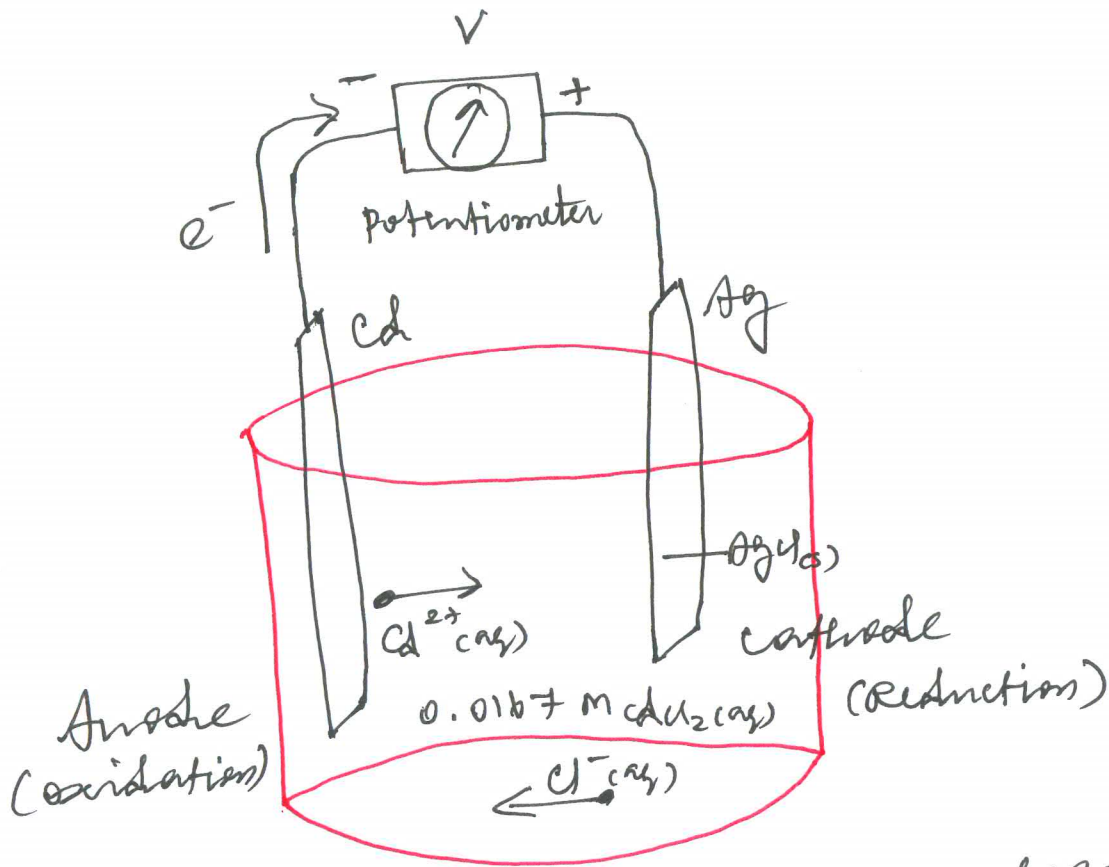
Galvanic cell produces electrical energy spontaneously (spontaneous cell reaction).

Electrolytic cells:

Electrolytic cell requires electrical energy from an external source.

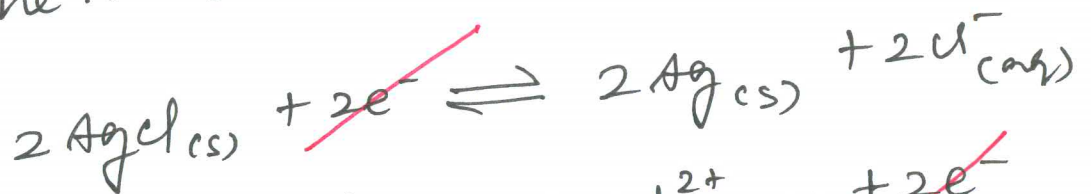
# A simple Galvanic cell.

(3) 2a

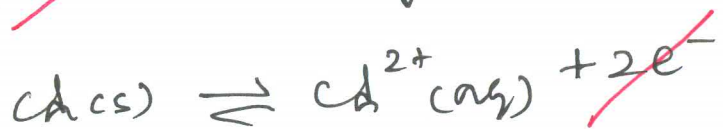


The potentiometer is a device for measuring voltage. It has two terminals (Connectors) are labelled "+" and "-" and are called the +ve and -ve terminals. When electrons flow into the -ve terminal, as in this illustration, the voltage is +ve.

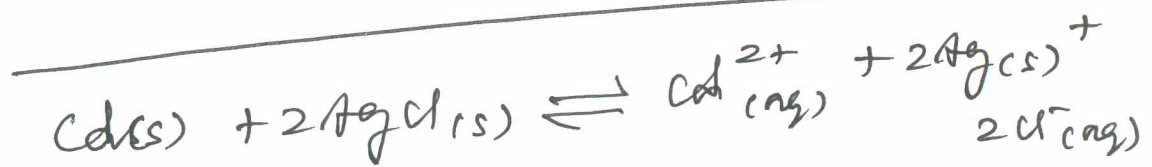
Reduction:



Oxidation:



net reaction:





(4)

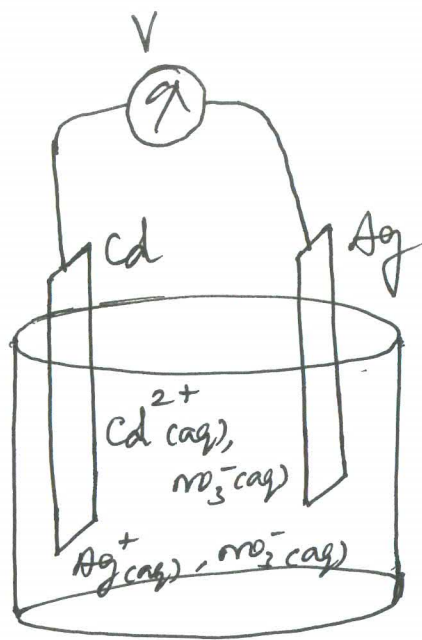
The net reaction is composed of a reduction and an oxidation reaction, each of which is called a half-reaction.

The two half reactions are written with equal numbers of electrons so that their sum includes no free electrons.

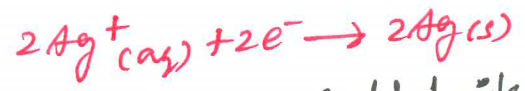
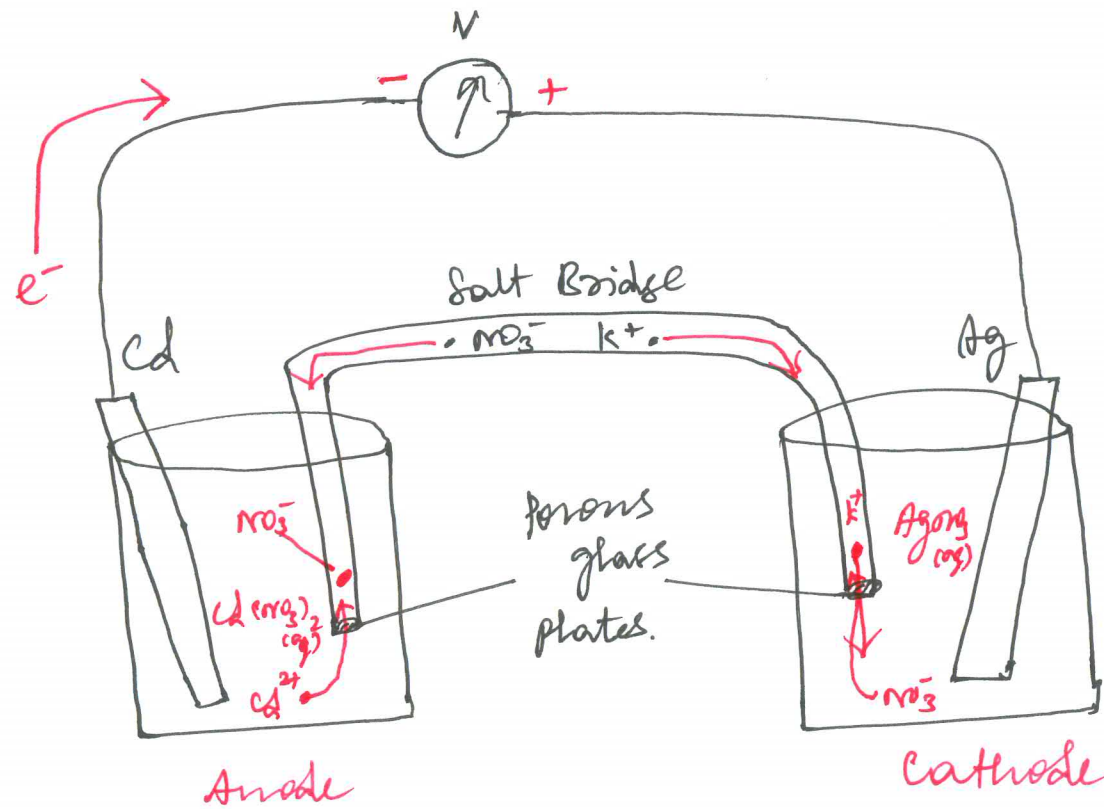
oxidation of Cd metal - to produce  $\text{Cd}^{2+}_{(aq)}$  provides electrons that flow through the circuit to the Ag electrode as shown in the figure.

At the surface of the Ag electrode,  $\text{Ag}^+$  (from  $\text{AgCl}$ ) is reduced to  $\text{Ag}(s)$ . Chloride from  $\text{AgCl}$  goes into solution.

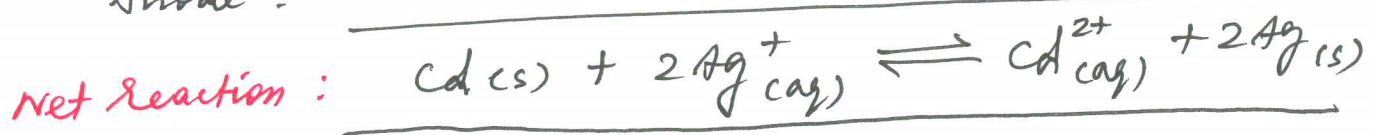
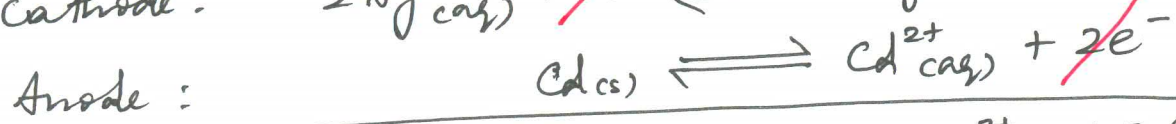
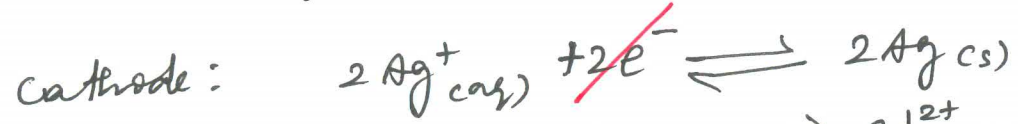
The free energy change for the net reaction,  $-150 \text{ kJ per mol of Cd}$ , provide the driving force that pushes ~~the~~ electrons through the circuit.



A cell that will not work.  
The solution contains  $\text{Cd}(\text{NO}_3)_2$  and  $\text{AgNO}_3$ .



A cell that works — thanks to the salt bridge.



## Line notation :-

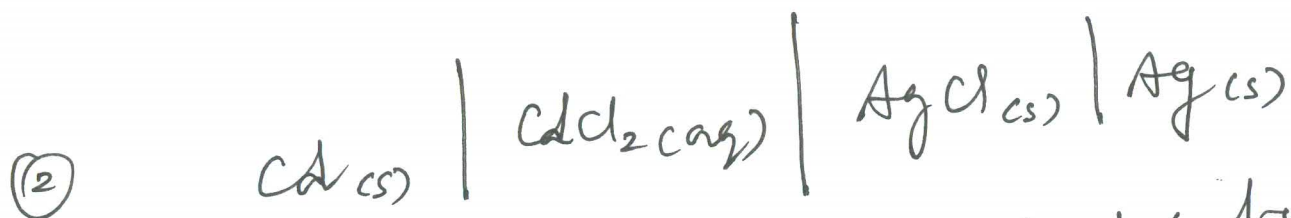
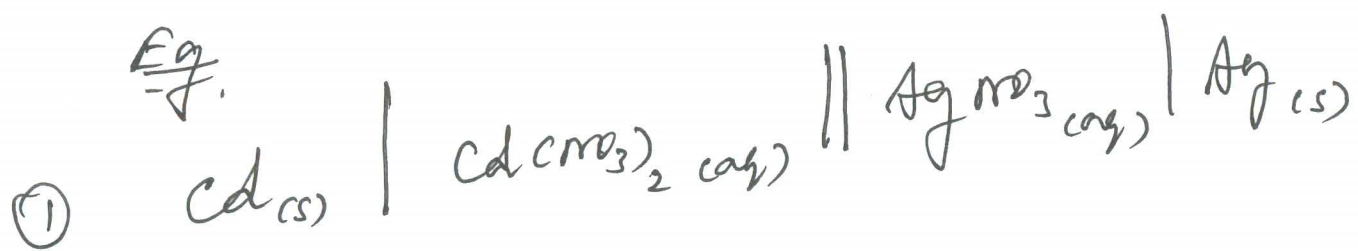
Electrochemical cells are described by a notation employing just two symbols.

| phase boundary.

|| salt bridge.

The salt bridge symbol || represents the two phase boundaries on either side of the bridge.

Eg.



Each phase boundary is indicated by a

vertical line.

The electrodes are shown at the extreme left - and right - hand sides of the line diagram.

## Salt Bridge and its function :-

In order to keep contact between the solutions of electrolytes, the link electrolytes are used. These link electrolytes are, themselves, not involved in the electrochemical changes but provide the contacts between the solution of electrolytes. These are made from the solutions of salts and hence the name as salt bridge.

Thus a salt bridge is a device which maintains the internal continuity between the two half-cells of a galvanic cell but does not permit the mixing of two electrolytic solutions.

The accumulation of charges in the two half cells is prevented by using salt bridge, which provides a passage for the flow of the charge in the internal circuit.



(7)

Types of changes in the cathode and anode in electrolytic and electrochemical cells? -

Electrolytic cell	Electrochemical cell
<p>① At cathode, the +vely charged ions get reduced.</p> <p><u>Eg.</u> <math>Cu^{2+} + 2e^{-} \rightarrow Cu</math></p> <p>② At anode, the -vely charged ions get oxidised.</p> <p><u>Eg.</u> <math>2Cl^{-} \rightarrow Cl_2 + 2e^{-}</math></p>	<p>cathodes are +vely charged and at cathode, +ve ions get reduced by electrons coming from the anode.</p> <p>Anodes are -vely charged electrodes and oxidation take place on it.</p> <p>Due to chemical reaction, electrons will be released to this electrode.</p>