

ELECTROCHEMISTRY

CLASS-12

SUB-CHEMISTRY

STANDARD HYDROGEN ELECTRODE - DEFINITION

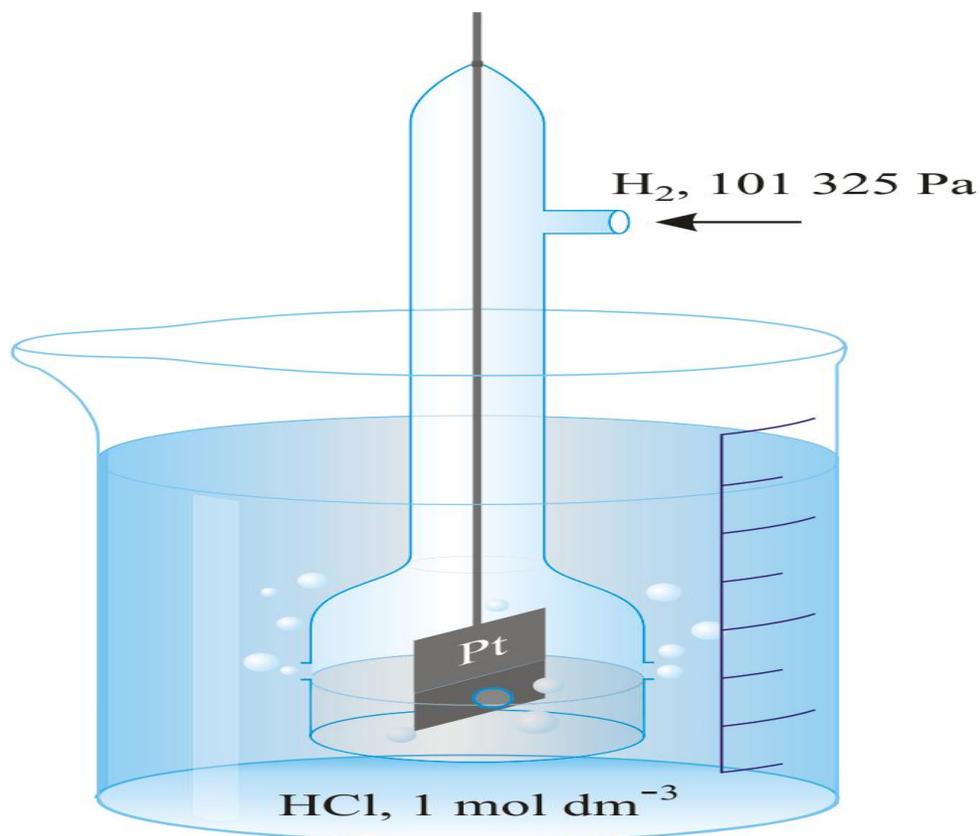
The Standard Hydrogen Electrode is often abbreviated to SHE, and its standard electrode potential is declared to be 0 at a temperature of 298K. This is because it acts as a reference for comparison with any other electrode .

The redox half cell of the SHE is where the following reaction takes place:



The reaction given above generally takes place on a platinum electrode. The pressure of the hydrogen gas present in this half cell equals 1 bar.

WORKING OF S.H.E -



S.H.E. consists of a platinum wire which is connected to a square shaped platinum electrode which is covered with finely divided platinum black. This covering of particles of platinum black helps in increasing the surface area of the electrode, which helps in efficient conduction of electricity. The whole apparatus is then kept in a glass tube and is placed in a beaker containing 1M HCl solution. During the working of S.H.E. either of the following reactions can take place at the surface of the platinum:

Reduction :-



Oxidation:-



Depending upon the tendency of other electrode, S.H.E. can either act as a Cathode (Reduction reaction will take place) or as an Anode (Oxidation reaction will take place). If natural tendency of other electrode is to undergo Oxidation, S.H.E. will act as a Cathode and if natural tendency of other electrode is to undergo Reduction, S.H.E. will act as a Anode.

REFERENCE ELECTRODE - DEFINITION

A reference electrode is an electrode which has a stable electrode potential and its value is known. Such stable potential is achieved by maintaining the concentrations of constituent species at a fixed value. Reference electrodes are used at various places, but the most important of all is in the electrochemical cell. This is where it's used as a half cell in the electrochemical cell to allow for the determination of the other half's cell potential. Common examples include Standard hydrogen electrode, Saturated calomel electrode, Silver chloride electrode etc.

ELECTROCHEMICAL SERIES - DEFINITION

	Half Reaction	Standard Potential (V)
↑ stronger oxidizing agent	$F_2 + 2e^- \rightleftharpoons 2F^-$	+2.87
	$Pb^{4+} + 2e^- \rightleftharpoons Pb^{2+}$	+1.67
	$Cl_2 + 2e^- \rightleftharpoons 2Cl^-$	+1.36
	$O_2 + 4H^+ + 4e^- \rightleftharpoons 2H_2O$	+1.23
	$Ag^+ + 1e^- \rightleftharpoons Ag$	+0.80
	$Fe^{3+} + 1e^- \rightleftharpoons Fe^{2+}$	+0.77
	$Cu^{2+} + 2e^- \rightleftharpoons Cu$	+0.34
	$2H^+ + 2e^- \rightleftharpoons H_2$	0.00
	$Pb^{2+} + 2e^- \rightleftharpoons Pb$	-0.13
	$Fe^{2+} + 2e^- \rightleftharpoons Fe$	-0.44
	$Zn^{2+} + 2e^- \rightleftharpoons Zn$	-0.76
	$Al^{3+} + 3e^- \rightleftharpoons Al$	-1.66
	$Mg^{2+} + 2e^- \rightleftharpoons Mg$	-2.36
	$Li^+ + 1e^- \rightleftharpoons Li$	-3.05
	↓ stronger reducing agent	

The standard reduction potentials of a large number of electrodes have been measured using standard hydrogen electrode as the reference electrode. These various electrodes can be arranged in increasing or decreasing order of their reduction potentials. The arrangement of elements in order of increasing reduction potential values is called '**Electrochemical series**'. It is also called '**Activity series**'.