

## Electrochemical Series

It is obtained by arranging elements in increasing order of their standard reduction potentials.

	↓ reducing agent	SRP (V)	SOP (V)
$\text{Li}^+(\text{aq}) + \text{e}^- \rightarrow \text{Li}(\text{s})$		-3.05 V	3.05
$\text{K}^+(\text{aq}) + \text{e}^- \rightarrow \text{K}(\text{s})$		-2.93 V	2.93
✓ $2\text{H}^+(\text{aq}) + 2\text{e}^- \rightarrow 2\text{H}(\text{s})$		0.00 V	0.00
$\text{Fe}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Fe}(\text{s})$		-0.44 V	0.44
$2\text{H}^+(\text{aq}) + 2\text{e}^- \rightarrow \text{H}_2(\text{g})$		0	
✓ $\text{Cu}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Cu}(\text{s})$		+0.34 V	-0.34 V
$\text{Ag}^+(\text{aq}) + \text{e}^- \rightarrow \text{Ag}(\text{s})$		+0.8 V	
$\text{F}_2(\text{g}) + 2\text{e}^- \rightarrow 2\text{F}^-(\text{aq})$	oxidising agent	+2.87	

Conclusion from electrochemical series

i) More is reduction potential of an element, more is its tendency to get reduced, hence better is its oxidising power. Thus it acts as an oxidising agent.



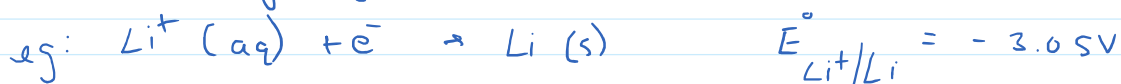
$$\Delta G^\circ = -nFE^\circ = -2F(2.87) < 0$$

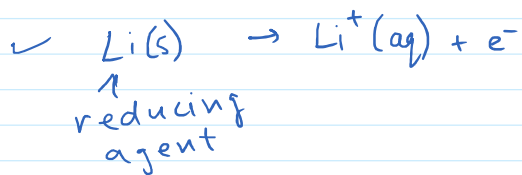
$\Delta G^\circ < 0 \Rightarrow$  reaction is spontaneous

when  $E^\circ > 0 \Rightarrow$  reaction is spontaneous

Elements at bottom of electrochemical series are good oxidising agents

ii) Lower is value of standard reduction potential, higher is standard oxidation potential, means element has tendency to get oxidised, thus it reduces others and hence acts as reducing agent.





$$E_{\text{Li/Li}^+}^{\circ} = \underline{+3.05\text{V}}$$

Thus elements at top of the series are good reducing agents.

$$3. \quad E_{\text{cell}}^{\circ} = E_{\text{reduction}}^{\circ}(\text{cathode}) - E_{\text{reduction}}^{\circ}(\text{anode})$$

For spontaneous reaction i.e for functioning of cell

$$E_{\text{cell}}^{\circ} > 0$$

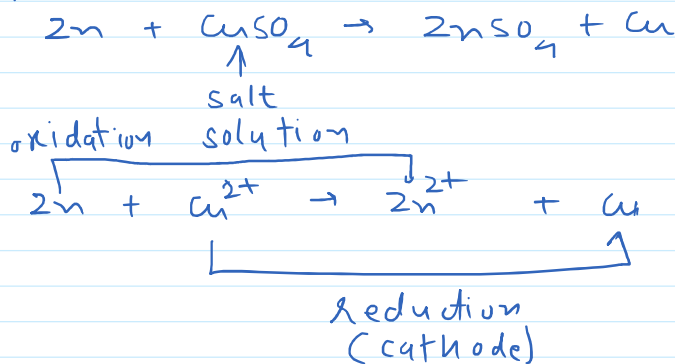
$$E_{\text{reduction}}^{\circ}(\text{cathode}) - E_{\text{reduction}}^{\circ}(\text{anode}) > 0$$

$$E_{\text{reduction}}^{\circ}(\text{cathode}) > E_{\text{reduction}}^{\circ}(\text{anode})$$

anode  $\rightarrow$  up

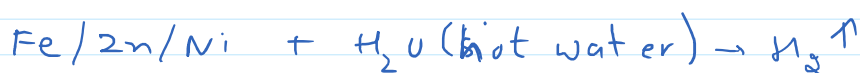
4. Element present above in the series can displace element present below in series from its salt solution

example:



5. On moving down in the series, electropositive nature of metal decreases, thus metals become less reactive

Alkali metal / alkaline earth metal + cold water  $\rightarrow$   $\text{H}_2$



6. Metal present above hydrogen in electrochemical series will release hydrogen on reaction with dilute acid, while metals present below hydrogen will not release.

