

1. SRP Table

Standard Reduction Potential (SRP) Table

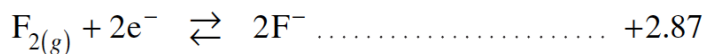
Similarly to BL-acids and bases, oxidizing and reducing agents vary in strengths as well.

Oxidizing Agents are REDUCED.

Its potential to be reduced is called its

_____.

The table is read _____ to _____.

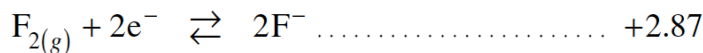


Reducing Agents are OXIDIZED.

Its potential to be oxidized is called its

_____.

The table is read _____ to _____.



STANDARD REDUCTION POTENTIALS OF HALF-CELLS
Ionic concentrations are at 1M in water at 25°C.

Oxidizing Agents	Reducing Agents	E° (Volts)
$F_2 + 2e^-$	$2F^-$	+2.87
$S_2O_8^{2-} + 2e^-$	$2SO_4^{2-}$	+2.01
$H_2O_2 + 2H^+ + 2e^-$	$2H_2O$	+1.78
$MnO_4^- + 8H^+ + 5e^-$	$Mn^{2+} + 4H_2O$	+1.51
$Br_2 + 2e^-$	$2Br^-$	+1.30
$IO_3^- + 6H^+ + 5e^-$	$I_2 + 3H_2O$	+1.48
$ClO_2 + 4H^+ + 5e^-$	$Cl^- + 2H_2O$	+1.39
$Cl_2 + 2e^-$	$2Cl^-$	+1.36
$Cr_2O_7^{2-} + 14H^+ + 6e^-$	$2Cr^{3+} + 7H_2O$	+1.33
$FeCl_3 + 3e^-$	Fe	+1.23
$MnO_4^- + 4H^+ + 3e^-$	$Mn^{2+} + 2H_2O$	+1.22
$N_2 + 10H^+ + 8e^-$	$2NH_4^+ + 3H_2O$	+1.20
$H_2O_2 + 2H^+ + 2e^-$	$2H_2O$	+1.00
$AsCl_3 + 3e^-$	As	+1.00
$NO_3^- + 4H^+ + 3e^-$	$NO + 2H_2O$	+0.96
$Hg^{2+} + 2e^-$	Hg	+0.85
$2ClO_2 + 2H^+ + 2e^-$	$2HClO_2$	+0.82
$2NO_3^- + 4H^+ + 2e^-$	$N_2O_4 + 2H_2O$	+0.80
$Ag^+ + e^-$	Ag	+0.80
$2Hg^{2+} + 2e^-$	$2Hg$	+0.80
$ClO_2 + 2H^+ + e^-$	$HOCl$	+0.77
$O_2 + 2H^+ + 2e^-$	H_2O_2	+0.70
$MnO_4^- + 2H_2O + 3e^-$	$MnO_2 + 4OH^-$	+0.60
$I_2 + 2e^-$	$2I^-$	+0.54
$Cu^+ + e^-$	Cu	+0.52
$H_2SO_3 + 4H^+ + 4e^-$	$S_2O_4^{2-} + 2H_2O$	+0.45
$Cr^{3+} + 3e^-$	Cr	+0.54
$SO_3^{2-} + 4H^+ + 2e^-$	$H_2SO_3 + H_2O$	+0.17
$ClO_2 + e^-$	ClO_2^-	+0.15
$Sn^{4+} + 2e^-$	Sn^{2+}	+0.15
$S_2O_8^{2-} + 2e^-$	$2SO_4^{2-}$	+0.14
$2H^+ + 2e^-$	H_2	+0.00
$Fe^{3+} + e^-$	Fe^{2+}	-0.13
$Sn^{4+} + 2e^-$	Sn^{2+}	-0.14
$Nb^{5+} + 2e^-$	Nb	-0.26
$H_2PO_4^- + 2H^+ + 2e^-$	$H_3PO_3 + H_2O$	-0.28
$Cr^{3+} + 3e^-$	Cr	-0.28
$S_2O_8^{2-} + 2H^+ + 2e^-$	$2SO_3$	-0.40
$Cr^{2+} + 2e^-$	Cr	-0.41
$2H_2O + 2e^-$	$H_2 + 2OH^- (10^{-7} M)$	-0.41
$Fe^{2+} + 2e^-$	Fe	-0.45
$Ag_2S_2O_8 + 2e^-$	$2Ag_2S + 8S^{2-}$	-0.60
$Cl_2 + 2e^-$	$2Cl^-$	-0.74
$Zn^{2+} + 2e^-$	Zn	-0.76
$Tl_2^{2+} + 2e^-$	$2Tl$	-0.79
$2H_2O + 2e^-$	$H_2 + 2OH^-$	-0.83
$Mg^{2+} + 2e^-$	Mg	-1.30
$Al^{3+} + 3e^-$	Al	-1.66
$Mg^{2+} + 2e^-$	Mg	-1.77
$Na^+ + e^-$	Na	-2.71
$Cu^{2+} + 2e^-$	Cu	-0.37
$Sr^{2+} + 2e^-$	Sr	-2.89
$Ba^{2+} + 2e^-$	Ba	-2.91
$K^+ + e^-$	K	-2.93
$Br^- + e^-$	Br_2	-2.98
$Cr^3+ + 3e^-$	Cr	-3.03
$Li^+ + e^-$	Li	-3.04

Example:

Strongest Reducing Agent:	Co	Sr	Al
Strongest Oxidizing Agent:	Fe ³⁺	Cu ⁺	Na ⁺
Greatest Reduction Potential:	Br ⁻	I ⁻	Sn ⁴⁺
<i>Values:</i>			
Greatest Oxidation Potential:	Cr ³⁺	Pb	Hg
<i>Values:</i>			

Consider the following (unbalanced) redox reaction



- Identify (and balance) the two half reactions:
 - ✓ Note 1: Since "voltage" is the work done per electron, do not multiple the E° value for the reduction of Ag^+ by 3.
 - ✓ Note 2: If a half-reaction is reversed, the sign of its E° value is also reversed.
- What is the total cell potential? Is it spontaneous?

Spontaneous or non-spontaneous?

Br ₂ and I ⁻	Br ⁻ and I ₂
Br ₂ is a(n) _____ agent. Half reaction:	Br ⁻ is a(n) _____ agent. Half reaction:
I ⁻ is a(n) _____ agent. Half reaction:	I ₂ is a(n) _____ agent. Half reaction:
Which is higher on the table?	Which is higher on the table?
$\text{Br}_{2(\ell)} + 2\text{e}^- \rightleftharpoons 2\text{Br}^- \dots\dots\dots +1.09$ $\text{AuCl}_4^- + 3\text{e}^- \rightleftharpoons \text{Au}_{(s)} + 4\text{Cl}^- \dots\dots\dots +1.00$ $\text{O}_3^- + 4\text{H}^+ + 3\text{e}^- \rightleftharpoons \text{NO}_{(g)} + 2\text{H}_2\text{O} \dots\dots\dots +0.96$ $\text{Hg}^{2+} + 2\text{e}^- \rightleftharpoons \text{Hg}_{(\ell)} \dots\dots\dots +0.85$ $\text{H}^+(10^{-7} \text{ M}) + 2\text{e}^- \rightleftharpoons \text{H}_2\text{O} \dots\dots\dots +0.82$ $\text{O}_3^- + 4\text{H}^+ + 2\text{e}^- \rightleftharpoons \text{N}_2\text{O}_4 + 2\text{H}_2\text{O} \dots\dots\dots +0.80$ $\text{Ag}^+ + \text{e}^- \rightleftharpoons \text{Ag}_{(s)} \dots\dots\dots +0.80$ $\frac{1}{2}\text{Hg}_2^{2+} + \text{e}^- \rightleftharpoons \text{Hg}_{(\ell)} \dots\dots\dots +0.80$ $\text{Fe}^{3+} + \text{e}^- \rightleftharpoons \text{Fe}^{2+} \dots\dots\dots +0.77$ $\text{O}_2(\text{g}) + 2\text{H}^+ + 2\text{e}^- \rightleftharpoons \text{H}_2\text{O}_2 \dots\dots\dots +0.70$ $\text{MnO}_4^- + 2\text{H}_2\text{O} + 3\text{e}^- \rightleftharpoons \text{MnO}_2(\text{s}) + 4\text{OH}^- \dots\dots\dots +0.60$ $\text{I}_2(\text{s}) + 2\text{e}^- \rightleftharpoons 2\text{I}^- \dots\dots\dots +0.54$	$\text{Br}_{2(\ell)} + 2\text{e}^- \rightleftharpoons 2\text{Br}^- \dots\dots\dots +1.09$ $\text{AuCl}_4^- + 3\text{e}^- \rightleftharpoons \text{Au}_{(s)} + 4\text{Cl}^- \dots\dots\dots +1.00$ $\text{O}_3^- + 4\text{H}^+ + 3\text{e}^- \rightleftharpoons \text{NO}_{(g)} + 2\text{H}_2\text{O} \dots\dots\dots +0.96$ $\text{Hg}^{2+} + 2\text{e}^- \rightleftharpoons \text{Hg}_{(\ell)} \dots\dots\dots +0.85$ $\text{H}^+(10^{-7} \text{ M}) + 2\text{e}^- \rightleftharpoons \text{H}_2\text{O} \dots\dots\dots +0.82$ $\text{O}_3^- + 4\text{H}^+ + 2\text{e}^- \rightleftharpoons \text{N}_2\text{O}_4 + 2\text{H}_2\text{O} \dots\dots\dots +0.80$ $\text{Ag}^+ + \text{e}^- \rightleftharpoons \text{Ag}_{(s)} \dots\dots\dots +0.80$ $\frac{1}{2}\text{Hg}_2^{2+} + \text{e}^- \rightleftharpoons \text{Hg}_{(\ell)} \dots\dots\dots +0.80$ $\text{Fe}^{3+} + \text{e}^- \rightleftharpoons \text{Fe}^{2+} \dots\dots\dots +0.77$ $\text{O}_2(\text{g}) + 2\text{H}^+ + 2\text{e}^- \rightleftharpoons \text{H}_2\text{O}_2 \dots\dots\dots +0.70$ $\text{MnO}_4^- + 2\text{H}_2\text{O} + 3\text{e}^- \rightleftharpoons \text{MnO}_2(\text{s}) + 4\text{OH}^- \dots\dots\dots +0.60$ $\text{I}_2(\text{s}) + 2\text{e}^- \rightleftharpoons 2\text{I}^- \dots\dots\dots +0.54$
Total Voltage:	Total Voltage:
<i>Spontaneous or non-spontaneous?</i>	<i>Spontaneous or non-spontaneous?</i>

When there are **more than two** chemicals available to react, the SRP table is used to predict which species will react.

The predominant redox reaction will be between:

_____ and _____

Practice:

1. What will the predominant redox reaction be with a mixture of Cl_2 , Ag^+ , Sn^{2+} and I^- ?

Oxidizing Agents

Reducing Agents

2. Sn^{4+} , Br^- , Zn^{2+} and Ag

Oxidizing Agents

Reducing Agents

3. CuBr_2 and Al

4. Na^+ , Cu^+ and F^-

5. Copper metal and bromine liquid in a solution of iron (III) iodide

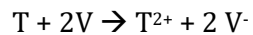
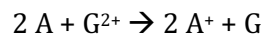
6. I_2 and CaF_2

7. Al , Fe^{2+} and Cu^{2+}

8. Br_2 and NaCl

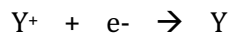
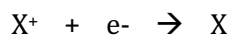
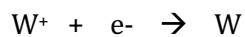
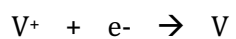
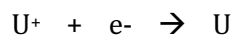
9. Sn and Al^{3+}

For the following redox reactions, write each half reaction as a reduction:



E^+ oxidizes X to X^{2+}

Reorder the following reactions to produce an SRP table with five half-reactions.



1. A solution of Y^+ reacts spontaneously with V but not with U .
2. Solutions of U^+ , V^+ , Y^+ , and X^+ do not react spontaneously with W .
3. V^+ reacts spontaneously with X .