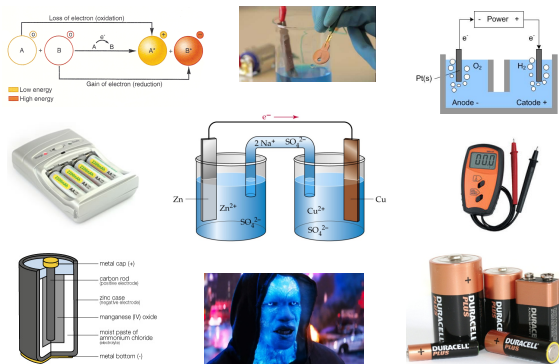


Intro to Redox



Electrochemistry

Study of the interchange of chemical and electrical energy

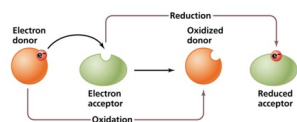
• Electron transfer reactions are called oxidation-reduction reactions or **REDOX** reactions

• Electrochemical processes that result in the generation of an electric current (electricity) or can be caused by imposing an electric current



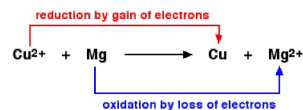
Redox Reactions

- **OXIDATION NUMBER:** Assigned charge on an atom
- **OXIDATION:** Loss of electrons (increase in oxidation number or charge... "+")
- **REDUCTION:** Gain of electrons (decrease in oxidation number or charge... "-")



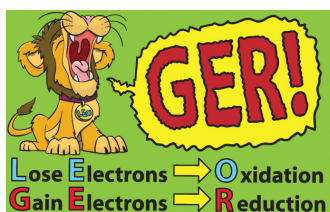
Redox Reactions

- **OXIDATION NUMBER:** Assigned charge on an atom
- **OXIDATION:** Loss of electrons (increase in oxidation number or charge... "+")
- **REDUCTION:** Gain of electrons (decrease in oxidation number or charge... "-")



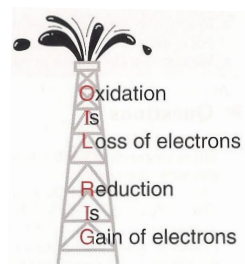
Redox Reactions

LEO THE LION GOES GER!



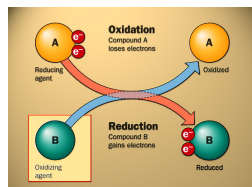
Redox Reactions

OIL RIG!



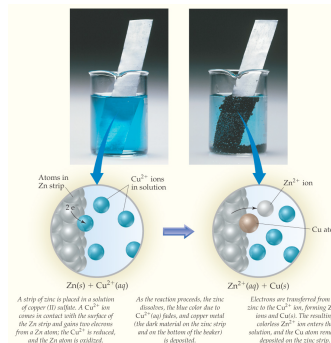
Redox Reactions

- **OXIDIZING AGENT:** electron acceptor... species that is reduced (an agent facilitates something / ex: travel agent)
- **REDUCING AGENT:** electron donor... species that is oxidized



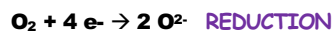
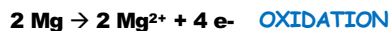
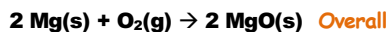
Redox Reactions

Placing a piece of Zn in a solution with Cu²⁺ ions... Make note of what is taking place at the molecular level!



Redox Reactions

- Oxidation and reduction go hand in hand... need one to have the other
- Cannot have 2 oxidations or 2 reductions in the same equation
- Written as two **HALF-REACTIONS** (one for oxidation and one for reduction)



Oxidation Numbers

Assigned charge on an atom

- 1) Elements not bonded to another different element have an oxidation number of **ZERO** (ex: Na, Fe, O₂, N₂)
- 2) In monatomic ions, oxidation number is equal to the charge on the ion (ex: Li⁺ = +1, Fe³⁺ = +3, P³⁻ = -3)
- 3) Oxidation number of oxygen is **USUALLY** -2... in H₂O₂ and O₂²⁻ it is -1

Oxidation Numbers

Assigned charge on an atom

- 4) Oxidation number of hydrogen is +1 **EXCEPT** when bonded to metals in binary compounds then it is -1 (ex: CaH₂, LiH)
- 5) Group IA metals are always +1, IIA always +2, etc... remember transition metals vary
- 6) Oxidation numbers of a molecule must add up to **ZERO** or add up to the charge on a polyatomic ion



Oxidation Numbers

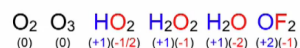
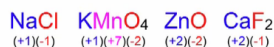
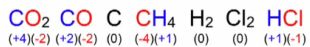
Assigned charge on an atom

+1												+3		+4		-3		-2		-1		0			
IA	IIA											IIIA	IVA	VA	VIA	VIIA	VIIIA								
1	2											13	14	15	16	17	18								
H	He											B	C	N	O	F	Ne								
3	4											5	6	7	8	9	10								
Li	Be											Al	Si	P	S	Cl	Ar								
11	12											31	32	33	34	35	36								
Na	Mg											Cu	Zn	Ga	Ge	As	Se	Br	Kr						
19	20	21	22											29	30	31	32	33	34	35	36				
K	Ca	Sc	Ti											Cu	Zn	Ga	Ge	As	Se	Br	Kr				
37	38	39	40											47	48	49	50	51	52	53	54				
Rb	Sr	Y	Zr											Ag	Cd	In	Sn	Sb	Te	I	Xe				
55	56	57	72											79	80	81	82	83	84	85	86				
Cs	Ba	La	Hf											Au	Hg	Tl	Pb	Bi	Po	At	Rn				
87	88	89	104											111	112	113	114	115	116	117	118				
Fr	Ra	Ac	Rf																						

Oxidation Numbers

Assigned charge on an atom

Examples



Practice

• EXAMPLE:

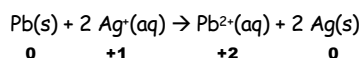
Identify which is being oxidized and which is being reduced in the following.



Writing a Redox Reaction

- 1) Write the **NET IONIC** equation
- 2) Assign oxidation numbers
- 3) Determine what is being oxidized and reduced

• **EXAMPLE:** Lead foil is immersed in silver nitrate



Balancing a Redox Reaction

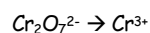
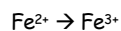
- 1) Write the half reactions
- 2) Balance the non H's and O's first
- 3) Use H_2O to balance the O's and use H^+ to balance the H's
- 4) Use e^- to balance the charges
- 5) Get common multiple for e^- and multiply
- 6) Cancel and add up the half reactions (e^- must cancel as well as all like species)...
Verify # of atoms and charges are balanced
- 7) In basic solutions, add OH^- to **BOTH** sides for every H^+ in final equation... make H_2O



Balancing a Redox Reaction

• EXAMPLE:

Write the balanced equation for the oxidation of Fe^{2+} to Fe^{3+} by $\text{Cr}_2\text{O}_7^{2-}$ to Cr^{3+} in acidic solution.

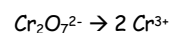
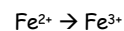


STEP #1

Balancing a Redox Reaction

• EXAMPLE:

Write the balanced equation for the oxidation of Fe^{2+} to Fe^{3+} by $\text{Cr}_2\text{O}_7^{2-}$ to Cr^{3+} in acidic solution.

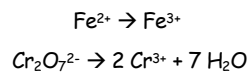


STEP #2

Balancing a Redox Reaction

• **EXAMPLE:**

Write the balanced equation for the oxidation of Fe^{2+} to Fe^{3+} by $\text{Cr}_2\text{O}_7^{2-}$ to Cr^{3+} in acidic solution.

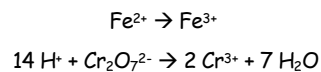


STEP #3

Balancing a Redox Reaction

• **EXAMPLE:**

Write the balanced equation for the oxidation of Fe^{2+} to Fe^{3+} by $\text{Cr}_2\text{O}_7^{2-}$ to Cr^{3+} in acidic solution.

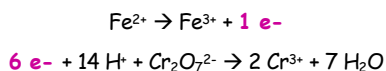


STEP #3

Balancing a Redox Reaction

• **EXAMPLE:**

Write the balanced equation for the oxidation of Fe^{2+} to Fe^{3+} by $\text{Cr}_2\text{O}_7^{2-}$ to Cr^{3+} in acidic solution.

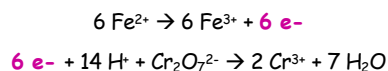


STEP #4

Balancing a Redox Reaction

• **EXAMPLE:**

Write the balanced equation for the oxidation of Fe^{2+} to Fe^{3+} by $\text{Cr}_2\text{O}_7^{2-}$ to Cr^{3+} in acidic solution.

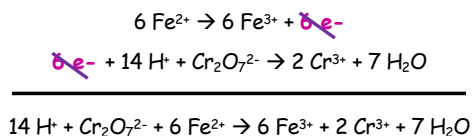


STEP #5

Balancing a Redox Reaction

• **EXAMPLE:**

Write the balanced equation for the oxidation of Fe^{2+} to Fe^{3+} by $\text{Cr}_2\text{O}_7^{2-}$ to Cr^{3+} in acidic solution.

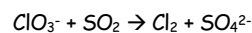


STEP #6 Are all atoms and charges **balanced**?

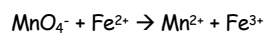
Practice

• **EXAMPLES:**

Write the balanced equation for the following reaction in **BASIC** solution:



Write the balanced equation for the following reaction in **ACIDIC** solution:



Practice

• **EXAMPLE:**

Write the balanced equation for the following reaction in **BASIC** solution:

