

Oxidation Rules		Batteries		Batteries (cont)		Writing Half Reactions	
Neutral Compound = 0 (NO -)	Ion= ion charge (w/ -)	Definition: a series of voltaic cells that produces a voltage that is the sum of the voltages of the individual cells	Types	Advantage: rechargeable	Disadvantage: heavy, expensive, takes up a lot of space	Assign oxidation numbers	Ex: $Zn + Cu^{2+} \rightarrow Zn^{2+} + Cu$
+1 w/ non-metals (Hydrogen)	Oxygen usually -2, -1 in peroxide (H ₂ O ₂)	Dry Cell Battery: Typical AA, AAA, C, & D	Lead Storage: 12 V (6 cells that each provide 2V)	Disadvantage: cost	Fuel Cells: $2H_2(g) + O_2(g) \rightarrow 2H_2O(l)$	Put the atoms with changing oxidation numbers in a separate reaction	
-1 w/ metals (H)	Group 1A: always +1	Anode: Zinc, Cathode: graphite, all immersed in KOH	Anode: Lead, Cathode: PbO ₂ , all immersed in sulfuric acid		Hydrogen is oxidized, electrons used to create electricity	Balance all atoms	
Halogens: usually -1, positive w/ oxygen	Group 2A: always +2				Used in spacecraft, too \$\$ for general use	Balance charge by adding e- to more positive side	
F always -1	Monatomic Ions: made with one atom, same as their charges				Adv: no recharge, only emission is water		
EXAMPLE:		Advantage: cheap and small	must be recycled!		Dis: cost		
Redox Equations		Disadvantage: not rechargeable		Calculating Cell Potential		Voltaic Cell	
Reduction: gain of electrons	Oxidation: loss of electrons		to keep electrodes from touching, wood or glass fiber spacers are used	Find correct half reactions on green sheet	Down reduction potential, oxidation more likely (more positive voltage)	Cathode: site of reduction (gaining e-)	Neutral atoms make solid metal
e-: electron	OIL: oxidation is loss (of electrons)			Write down half reactions on paper along with voltage		Anode: site of oxidation (losing e-)	Metal ions can usually dissolve in water
RIG: reduction is gain (of electrons)	OIL as half reaction: $Na \rightarrow Na^{+} + e^{-}$	Rechargeable Batteris: includes lithium ion, nickel-cadmium, and nickel metal hydride batteries	Voltage may vary as the H ₂ SO ₄ is used, even after recharging	higher voltage is e red, flip other half reaction to make oxidation and change sign given on green sheet (write it backwards)			
RIG as half reaction: $Cl + e^{-} \rightarrow Cl^{-}$	for oxidation: e- on right	Built in or separate charger	Advantage: large voltage, can be recharged	Add the half reactions and voltages together (e- should cancel)			
for reduction: e- is on left	If OX # ^ it is OIL						
EXAMPLE:	If OX # goes down it is RIG						

