

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)			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	Dry Cell Battery: Typical AA, AAA, C, & D	Lead Storage: 12 V (6 cells that each provide 2V)	Used in spacecraft, too \$\$ for general use	Hydrogen is oxidized, electrons used to create electricity	Balance all atoms	
Halogens: usually -1, positive w/ oxygen	Group 2A: always +2	Anode: Zinc, Cathode: graphite, all immersed in KOH	Anode: Lead, Cathode: PbO ₂ , all immersed in sulfuric acid	Adv: no recharge, only emission is water		Balance charge by adding e ⁻ to more positive side	
F always -1	Monatomic ions: made with one atom, same as their charges			Dis: cost			
EXAMPLE:							
Redox Equations				Calculating Cell Potential		Voltaic Cell	
Reduction: gain of electrons	Oxidation: loss of electrons	Advantage: cheap and small	must be recycled!	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)	Disadvantage: not rechargeable	to keep electrodes from touching, wood or glass fiber spacers are used	Write down half reactions on paper along with voltage	higher voltage is e ⁻ red, flip other half reaction to make oxidation and change sign given on green sheet (write it backwards)	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 Batteries: includes lithium ion, nickel-cadmium, and nickel metal hydride batteries	Voltage may vary as the H ₂ SO ₄ is used, even after recharging	Add the half reactions and voltages together (e ⁻ should cancel)		Definition: devices that use a chemical reaction to create electricity	Cell Notation/Diagram: two half reactions combined
RIG as half reaction: $Cl + e^{-} \rightarrow Cl^{-}$	for oxidation: e ⁻ on right						Ex: $Zn(s) Zn^{2+}(aq) Cu^{2+}(aq) Cu(s)$
for reduction: e ⁻ is on left	If OX # ^ it is OIL						
EXAMPLE:	If OX # goes down it is RIG						
		Built in or separate charger	Advantage: large voltage, can be recharged				

