SCH4U

Electrochemistry

10.2 Oxidation Numbers

Oxidation numbers are very useful for 2 main reasons: determining if a reaction is a redox reaction, and balancing complicated redox reactions. We start off by learning the rules of how to determine oxidation numbers.

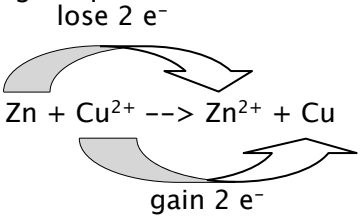
- Actual or hypothetical charges, assigned using a set of rules – Usually, but not always, integers
  - all bonded electrons owned by more electronegative element
    H_2O : O −2 [6−8=−2] 2 H +1 [(1−0=+1)x2 = +2]
  - if same electronegativity, each atom owns half of bonded electrons
    Cl_2 : Cl 0 [7−7=0]
  - oxidation numbers need to add up to overall charge of the compound
    CN^- C +2 [4−2=+2] N [5−8=−3] +2 + −3 = −1

OXIDATION NUMBER RULES

Rules	Oxidation Number	Examples
1. Pure Element	0	**Na**$_{(s)}$: 0
2. Element in Monatomic Ion	Charge of ion	**Na**$^+_{(aq)}$: +1
3. Hydrogen – most compounds – metal hydrides	+1 −1	**H**$_2$S : +1 Na**H** : −1
4. Oxygen – most compounds – peroxides – OF_2	−2 −1 +2	Li_2O : −2 H_2O_2 : −1 OF_2 : +2
5. Covalent compound without H,O	More EN element ON equals its usual ionic charge	PCl_3 : P +3, Cl −1 CS_2 : C +4, S −2
6. Sum of ON in a compound = 0		CF_4 : F −1, so C +4
7. Sum of ON of polyatomic ion = charge of ion		NO_2^- : O −2, N (+3) (+3) + 2(−2) = −1

HINTS !!!

Start with elements you know the ON for (usually this is oxygen or hydrogen in most compounds). You know the ON must add up to the total charge of the compound. Look at the remaining element. You can determine it's ON by letting it equal to "x" and writing an equation which equals the charge of the compound.



ON: 0 --> +2
Zn undergoes oxidation: increase in ON

ON: +2 --> 0
Cu^{2+} undergoes reduction: decrease in ON

For any reaction, you can determine if it is a REDOX reaction by assigning oxidation numbers and looking at if they change. If no oxidation numbers change, then it's not a redox. If oxidation numbers change (as in the above example) then you are dealing with a redox reaction.

HOMEWORK

Read 10.2 & try: p.478 Q.9−12, p.480 Q.13−16, p.480−481 Q 1−8