Class 13 Covid Chem

1) conj A & conj B notes
2) Redox #s & electronegativity
3) Metal activity series lab.

Conjugate Acid Base Pairs

In an acid-base reaction, an acid plus a base reacts to form a conjugate base plus a conjugate acid.

Acid + Base ↔ Conjugate Base + Conjugate Acid

e.g. water reacting with HCl

e.g. water reacting with ammonia

Practice Problems

Identify the **acid**, **base**, **conjugate acid** and **conjugate base** for the following reaction:

1. $HF + H_2O \rightarrow F^- + H3O^+$

2. $HSO_4^- + NH_3 \rightarrow SO_4^{2-} + NH_4^+$

3. $C_2H_3O_2^- + HCl \rightarrow HC_2H_3O_2 + Cl^-$

4. $HNO_2 + H_2O \rightarrow H_3O^+ + NO_2^-$

5. $HCN + H_2O \rightarrow H_3O^+ + CN^-$

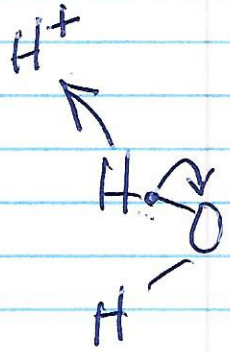
ammonia (g)

$NH_4^+(aq)$ ammonium

water + NH_3

$H_2O + NH_3 \leftrightarrow OH^- + NH_4^+$

A B CB CA



amphoteric

"bi"

H_2O / OH^-

A / CB

NH_3 / NH_4^+

B / CA

Electronegativity Table of the Elements

If you need chemistry homework help, then just click to follow the link.

	Group																	
Period	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	H 2.1																	He 0
2	Li 0.98	Be 1.57											B 2.04	C 2.55	N 3.04	O 3.44	F 3.98	Ne 0
3	Na 0.93	Mg 1.31											Al 1.61	Si 1.9	P 2.19	S 2.58	Cl 3.16	Ar 0
4	K 0.82	Ca 1	Sc 1.36	Ti 1.54	V 1.63	Cr 1.66	Mn 1.55	Fe 1.83	Co 1.88	Ni 1.91	Cu 1.9	Zn 1.65	Ga 1.81	Ge 2.01	As 2.18	Se 2.55	Br 2.96	Kr 0
5	Rb 0.82	Sr 0.95	Y 1.22	Zr 1.33	Nb 1.6	Mo 2.16	Tc 1.9	Ru 2.2	Rh 2.28	Pd 2.2	Ag 1.93	Cd 1.69	In 1.78	Sn 1.96	Sb 2.05	Te 2.1	I 2.66	Xe 2.6
6	Cs 0.79	Ba 0.89	La 1.1	Hf 1.3	Ta 1.5	W 2.36	Re 1.9	Os 2.2	Ir 2.2	Pt 2.28	Au 2.54	Hg 2	Tl 2.04	Pb 2.33	Bi 2.02	Po 2	At 2.2	Rn 0
7	Fr 0.7	Ra 0.89	Ac 1.1	Rf	Db	Sg	Bh	Hs	Mt	Uun	Uuu	Uub						
	Lanthanides				Ce 1.12	Pr 1.13	Nd 1.14	Pm 1.13	Sm 1.17	Eu 1.2	Gd 1.2	Tb 1.1	Dy 1.22	Ho 1.23	Er 1.24	Tm 1.25	Yb 1.1	Lu 1.27
	Actinides				Th 1.3	Pa 1.5	U 1.38	Np 1.36	Pu 1.28	Am 1.3	Cm 1.3	Bk 1.3	Cf 1.3	Es 1.3	Fm 1.3	Md 1.3	No 1.3	Lr

Key: White= No data 0-.66 .66-1 1-1.33 1.33-1.66 1.66-2 2-2.33 2.33-2.66 2.66-

This table is the Pauling electronegativity scale. There are other ways of measuring electronegativity, such as the Mulliken scale and the Allred-Rochow scale. Linus Pauling's electronegativity scale is the most common. Note that atoms toward the upper right are more electronegative, and those to the lower left are least electronegative. Pauling did not assign electronegativities to the noble gasses because they typically do not form covalent bonds.

In general electronegativity is the measure of an atom's ability to attract electrons to itself in a covalent bond. Because fluorine is the most electronegative element, the electrons tend to "hang out" more toward the fluorine atom when fluorine is covalently bonded to other atoms. Oxygen is the 2nd most electronegative element.

When you examine a periodic table, you will find that (excluding the noble gases) the electronegativity values tend to increase as you go to the right and up. The reverse statement is that the values tend to decrease going down and to the left. This pattern will help when you are asked to put several bonds in order from most to least ionic without using the values themselves.

Electronegativity values are useful in determining if a bond is to be classified as nonpolar covalent, polar covalent or ionic.

Oxidation- Reduction = **Redox** Ask Ms. Cormier about this word!

Oxidation = a species loses e⁻

Reduction = a species gaining e⁻

"LEO says GER"

Problem

We have to know how many electrons are being lost or gained.

Solution

We assign **oxidation numbers**.

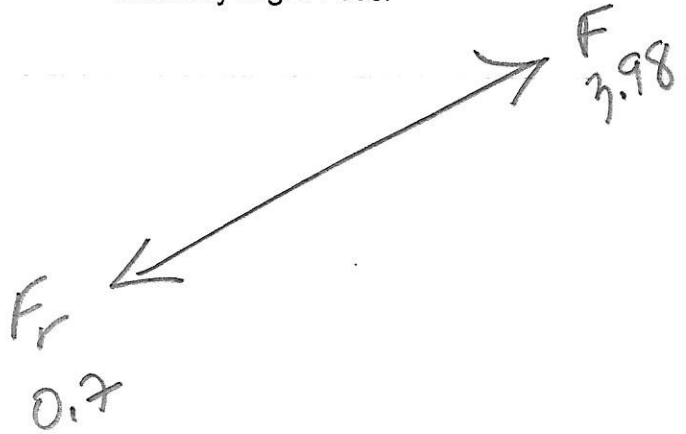
Oxidation Numbers

- indicate the number of an atom's electrons involved in bonding to an atom NOT itself
- are positive or negative numbers, but do not confuse them with positive or negative charges on ions or valences!
- the element with the greater electronegativity is assigned a negative value.

Electronegativity

- is a measure of the tendency of an atom to attract a bonding pair of electrons. The Pauling scale is the most commonly used. Fluorine (the most **electronegative** element) is assigned a value of 4.0, and values range down to caesium and francium which are the least **electronegative** at 0.7 www.chemguide.co.uk/atoms/bonding/electroneg.html

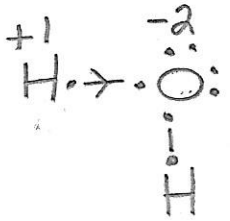
"Saturday Night Fever"



e.g. Draw the Lewis dot structure for hydrogen gas: H_2

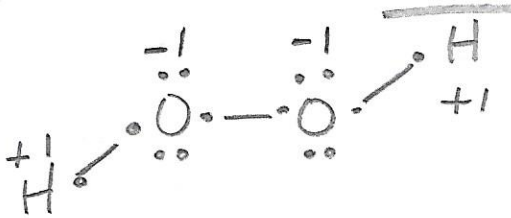
itself

Draw the Lewis dot structure for water:



$H_2O = \emptyset$

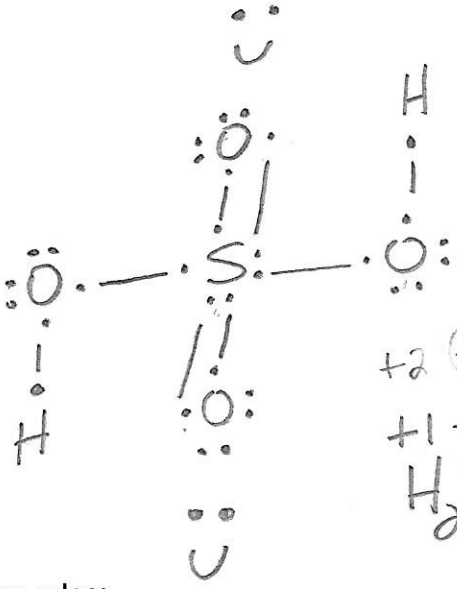
Draw the Lewis dot structure for hydrogen peroxide: H_2O_2



Draw the Lewis dot structure for H_2SO_4: $= \emptyset$

molecule

octet rule bye bye!



$+2 + 6 - 8 = \emptyset$

$+1 + 6 - 2 = \emptyset$

H_2SO_4

Rules for Assigning Oxidation Numbers

Oxidation numbers are assigned to elements using these rules:

nought = Brit zero

- **Rule 1:** The oxidation number of an element in its free (uncombined) state is zero — for example, Al(s) or Zn(s). This is also true for elements found in nature as *diatomic* (two-atom) elements

H_2, O_2, N_2, F_2, Cl_2, Br_2, or I_2 Na Au Ag Al

and for sulfur, found as:

S_8

ele

- **Rule 2:** The oxidation number of a *monatomic* (one-atom) ion is the same as the charge on the ion, for example:

  $Na^+ = +1$

  $S^{2-} = -2$

- **Rule 3:** The sum of all oxidation numbers in a neutral compound is zero. The sum of all oxidation numbers in a ***polyatomic*** (many-atom) ion is equal to the charge on the ion. This rule often allows chemists to calculate the oxidation number of an atom that may have multiple oxidation states, if the other atoms in the ion have known oxidation numbers.

- **Rule 4:** The oxidation number of an alkali metal (IA family) in a compound is +1; the oxidation number of an alkaline earth metal (IIA family) in a compound is +2.

- **Rule 5:** The oxidation number of oxygen in a compound is usually –2. If, however, the oxygen is in a class of compounds called *peroxides* (for example, hydrogen peroxide), then the oxygen has an oxidation number of –1. If the oxygen is bonded to fluorine, the number is +1.

- **Rule 6:** The oxidation state of hydrogen in a compound is usually +1. If the hydrogen is part of a *binary metal hydride* (compound of hydrogen and some metal), then the oxidation state of hydrogen is –1.

- **Rule 7:** The oxidation number of fluorine is always –1. Chlorine, bromine, and iodine usually have an oxidation number of –1, unless they're in combination with an oxygen or fluorine.

http://www.dummies.com/education/science/chemistry/rules-for-assigning-oxidation-numbers-to-elements/

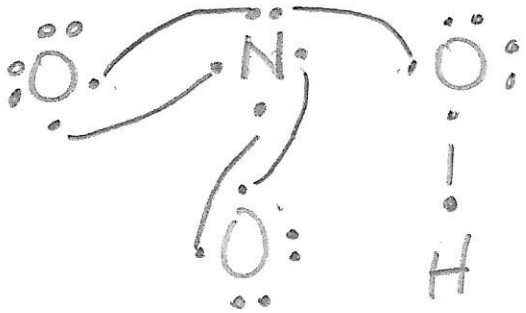
Rule 8 = PAI

$+6\ -2\ \ 2-$
SO_4

$+5\ -2\ \ 3-$
PO_4

$+5\ -2\ \ 1-$
NO_3

$+1\ +5\ -2$
HNO_3



CH_3COOH