Honors Chemistry: Rules for Significant Figures (sig figs, s.f.)

A. Read from the left and start counting sig figs when you encounter the first non-zero digit

1. All non-zero numbers are significant (meaning they count as sig figs)
   - 613 has three sig figs
   - 123456 has six sig figs

2. Zeros located between non-zero digits are significant (they count as sig figs)
   - 5004 has four sig figs
   - 602 has three sig figs
   - 6000000000000002 has 16 sig figs!

3. Trailing zeros (those at the end) are significant only if the number contains a decimal point; otherwise they are *insignificant* (they do not count)
   - 5.640 has four sig figs
   - 120000. has six sig figs
   - 120000 has two sig figs – unless you're given additional information in the problem

4. Zeros to left of the first nonzero digit are insignificant (they don't count); they are only placeholders!
   - 0.000456 has three sig figs
   - 0.052 has two sig figs
   - 0.000000000000000000000000000000000052 also has two sig figs!

B. Rules for addition/subtraction problems

Your calculated value cannot be more precise than the least precise quantity used in the calculation. The least precise quantity has the fewest digits to the right of the decimal point. **Your calculated value will have the same number of digits to the right of the decimal point as that of the least precise quantity.**

In practice, find the quantity with the fewest digits to the right of the decimal point. In the example below, this would be 11.1 (this is the least precise quantity).

7.939 + 6.26 + 11.1 = 25.299 (calculator answer)

In this case, your final answer is limited to one sig fig to the right of the decimal or 25.3 (rounded up).

C. Rules for multiplication/division problems

The number of sig figs in the final calculated value will be the same as that of the quantity with the fewest number of sig figs used in the calculation.

In practice, find the quantity with the fewest number of sig figs. In the example below, the quantity with the fewest number of sig figs is 27.2 (three sig figs). Your final answer is therefore limited to three sig figs.

(27.2 x 15.63) ÷1.846 = 230.3011918 (calculator answer)

In this case, since your final answer it limited to three sig figs, the answer is 230. (rounded down)

D. Rules for combined addition/subtraction and multiplication/division problems

First apply the rules for addition/subtraction (determine the number of sig figs for that step), then apply the rules for multiplication/division.

Honors Chemistry Periodic Table of Elements

1 H 1.008																	2 He 4.003
3 Li 6.941	4 Be 9.012											5 B 10.81	6 C 12.01	7 N 14.01	8 O 16.00	9 F 19.00	10 Ne 20.18
11 Na 22.99	12 Mg 24.31											13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.07	17 Cl 35.45	18 Ar 39.95
19 K 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.88	23 V 50.94	24 Cr 52.00	25 Mn 54.94	26 Fe 55.85	27 Co 58.93	28 Ni 58.69	29 Cu 63.55	30 Zn 65.38	31 Ga 69.72	32 Ge 72.59	33 As 74.92	34 Se 78.96	35 Br 79.90	36 Kr 83.80
37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc 98	44 Ru 101.1	45 Rh 102.9	46 Pd 106.4	47 Ag 107.9	48 Cd 112.4	49 In 114.8	50 Sn 118.7	51 Sb 121.8	52 Te 127.6	53 I 126.9	54 Xe 131.3
55 Cs 132.9	56 Ba 137.3	57 La* 138.9	72 Hf 178.5	73 Ta 180.9	74 W 183.9	75 Re 186.2	76 Os 190.2	77 Ir 192.2	78 Pt 195.1	79 Au 197.0	80 Hg 200.6	81 Tl 204.4	82 Pb 207.2	83 Bi 209.0	84 Po 209	85 At 210	86 Rn 222
87 Fr 223	88 Ra 226	89 Ac* 227	104 Rf 261	105 Db 262	106 Sg 263	107 Bh 262	108 Hs 265	109 Mt 266	110 Ds 271	111 Rg 272	112 Uub 277	113 Uut 282	114 Uuq 289	115 Uup 288	116 Uuh 292		
			58 *Ce 140.1	59 Pr 140.9	60 Nd 144.2	61 Pm 145	62 Sm 150.4	63 Eu 152.0	64 Gd 157.3	65 Tb 158.9	66 Dy 162.5	67 Ho 164.9	68 Er 167.3	69 Tm 168.9	70 Yb 173.0	71 Lu 175.0	
			90 *Th 232.0	91 Pa 231	92 U 238.0	93 Np 238	94 Pu 244	95 Am 243	96 Cm 247	97 Bk 247	98 Cf 251	99 Es 252	100 Fm 257	101 Md 258	102 No 259	103 Lr 260	

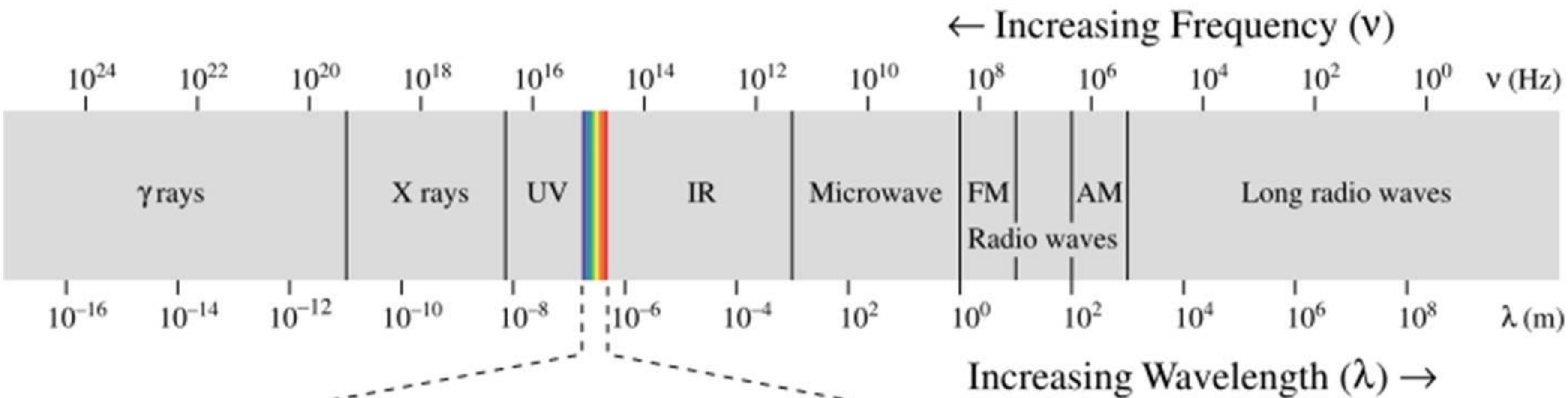
Honors Chemistry Conversion Factors, Equations and Constants

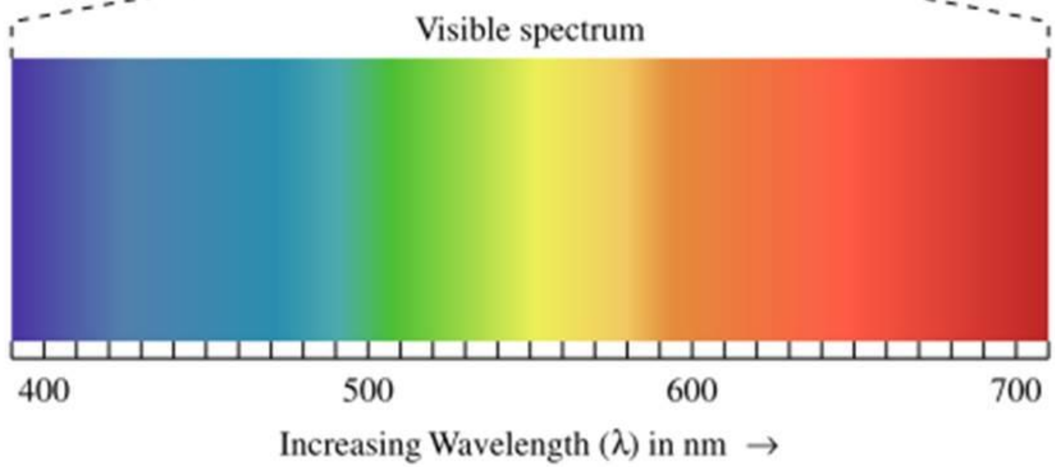
Weight/Mass	Volume	Length/Distance
16 ounces = 1 pound 1 kilogram = 2.2 pounds 454 grams = 1 pound 1 ton = 2000 pounds	1 liter = 1.0567 quarts 1 mL = 1 centimeter (cubed) 1 gallon = 3.78 liters 1 quart = 2 pints = 32 fluid ounces 1 pint = 2 cups = 16 fluid ounces	1 inch = 2.54 centimeter 1 mile = 5280 feet = 1.609 kilometers 1 yard = 3 feet = 36 inches = 0.9144 meters 1 meter = 39.37 inches = 3.281 feet = 1.094 yards 1 kilometer = 1094 yards = 0.6215 miles 1 light-year = 5.88 x 10^{12} miles = 9.46 x 10^{12} km

Density = M/V Density of water = 1.00 g/mL Density of CO_2 = 1.977 x 10^{-3} g/mL Density of gas = d = $\frac{PM}{RT}$	Energy = 1 calorie = 4.184 joules Energy of photon = hv = $\frac{hc}{\lambda}$ Potential Energy = V = k $\frac{q1q2}{r}$
Pressure and Gas Laws 1 atm = 760 mmHg = 101.325 kPa = 1.01325 bar = 29.92 inches Hg 1 torr = 133.32 Pa = 1 mmHg = 1.32 x10^{-3} atm PV = nRT R = 0.08206 $\frac{L*atm}{mol*K}$ $\frac{V1}{T1} = \frac{V2}{T2}$ $\frac{P1}{T1} = \frac{P2}{T2}$ $\frac{V1}{n1} = \frac{V2}{n2}$ $P_1V_1 = P_2V_2$	**Radioactive Decay and Planck's Equations** Amount remaining = original amount x $(\frac{1}{2})^n$ n = number of half-lives Planck's Light Equation E = hv = $\frac{hc}{\lambda}$ Planck's Constant (h) = 6.626 x 10^{-34} J*s Speed of Light (c) = 3.00 x 10^8 m/s
pH Equations pH = -log $[H^+]$ pOH = -log $[OH^-]$ $[OH^-] = 10^{-pOH}$ $[H^+][OH^-] = 1.0 \times 10^{-14}$ pH = pOH = 14 $[H^+] = 10^{-pH}$	**Avagadro's Number** (Lorenzo Romano Amedeo Carlo Avogadro) 1 mole = 6.022 x 10^{23} particles = N_A **Thermochemistry** Q = mcΔT m = mass object c = specific heat capacity $\Delta T = T_2 - T_1$ $T_K = T_c + 273$ Enthalpy: H = E + PV

May the quest continue…

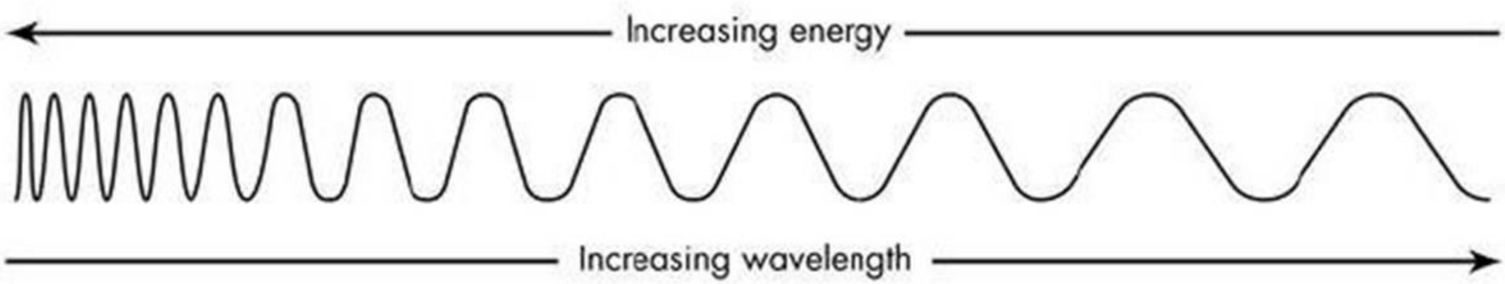
Electromagnetic Spectrum



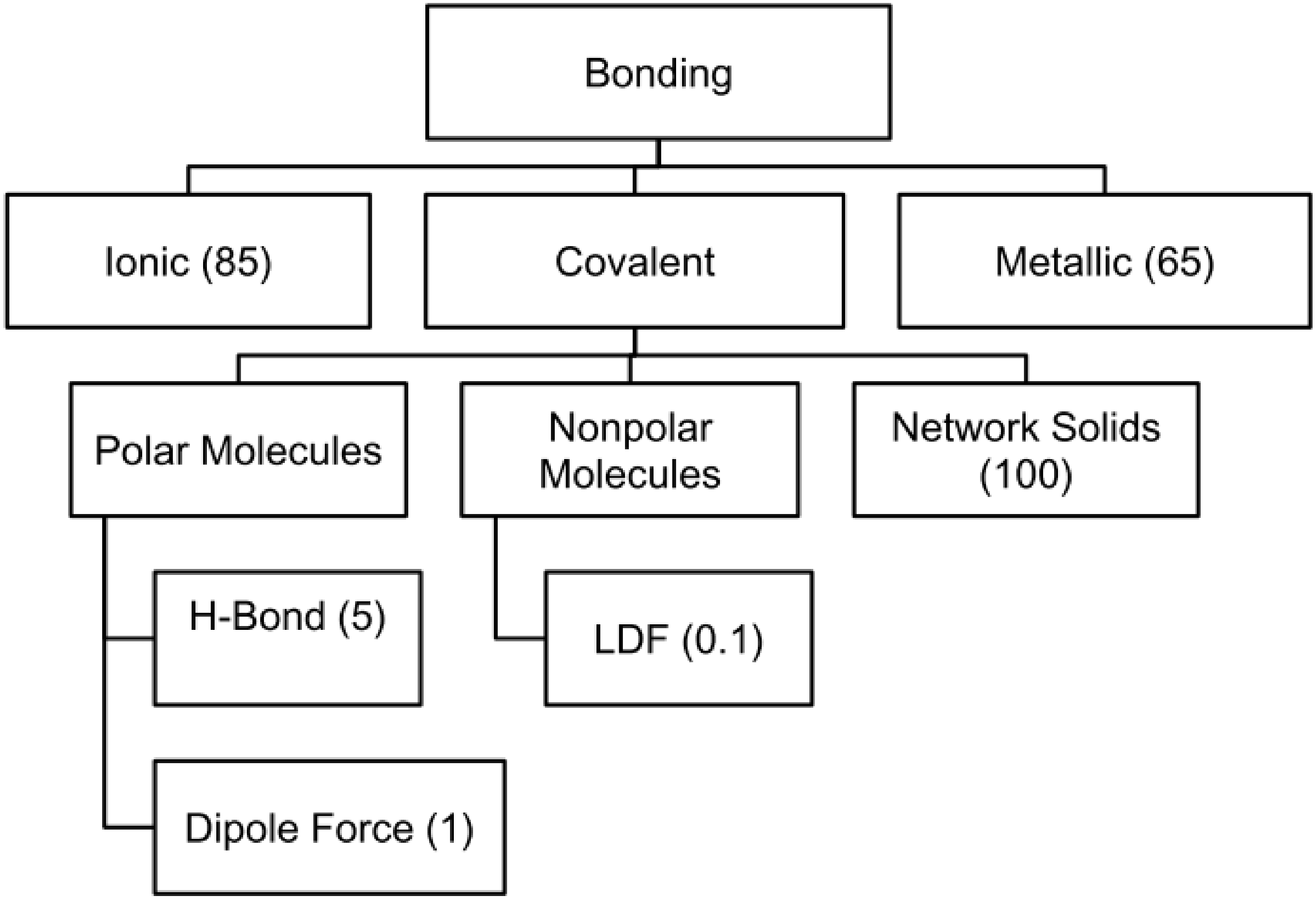


$$E = h\nu = \frac{hc}{\lambda}$$

$$h = 6.626x10^{-34}\,Js$$



Intermolecular Forces Sheet; SC1cd



SHAPE SHEET (Honors Chemistry; Molecular Geometry VSEPR Theory)

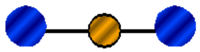
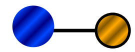
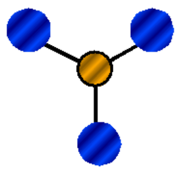
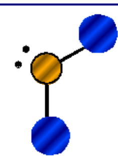
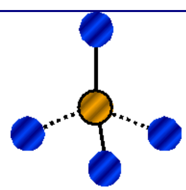
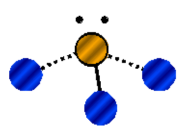
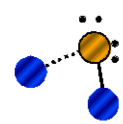
"clouds"					
2	 Linear Triatomic, Usually nonpolar CO_2		Linear Diatomic  Polarity depends upon electronegativity difference Polar if >0.5 Nonpolar if <0.5		In molecules where the outside molecules are different, shapes that tend to be nonpolar usually become polar.
3	 Trigonal Planar: BF_3, SO_3, NO_3^- 120˚ Usually nonpolar	 Bent, 12O˚ Usually polar NO_2^-		Remember to count the number of "clouds" of electrons, not the actual number of electrons. A double or triple bond counts as one effective pair.	Also: If there ever is a two molecule atom (diatomic) that molecule's polarity depends upon the electronegativity difference of the atoms
4	 Tetrahedral; 109˚: Usually nonpolar CH_4, CF_4	 Pyramidal: 107˚ Usually polar: NH_3, PCl_3	 Bent: 104.5˚ Usually polar: H_2O, OF_2		

Table of Pauling Electronegativity Values

	IA	IIA	IIIB	IVB	VB	VIB	VIIB	VIII	VIII	VIII	IB	IIB	IIIA	IVA	VA	VIA	VIIA	VIIIA
1	1 **H** 2.1																	2 **He**
2	3 **Li** 1.0	4 **Be** 1.5											5 **B** 2.0	6 **C** 2.5	7 **N** 3.0	8 **O** 3.5	9 **F** 4.0	10 **Ne**
3	11 **Na** 0.9	12 **Mg** 1.2											13 **Al** 1.5	14 **Si** 1.8	15 **P** 2.1	16 **S** 2.5	17 **Cl** 3.0	18 **Ar**
4	19 **K** 0.8	20 **Ca** 1.0	21 **Sc** 1.3	22 **Ti** 1.5	23 **V** 1.6	24 **Cr** 1.6	25 **Mn** 1.5	26 **Fe** 1.8	27 **Co** 1.8	28 **Ni** 1.8	29 **Cu** 1.9	30 **Zn** 1.6	31 **Ga** 1.6	32 **Ge** 1.8	33 **As** 2.0	34 **Se** 2.4	35 **Br** 2.8	36 **Kr**
5	37 **Rb** 0.8	38 **Sr** 1.0	39 **Y** 1.2	40 **Zr** 1.4	41 **Nb** 1.6	42 **Mo** 1.8	43 **Tc** 1.9	44 **Ru** 2.2	45 **Rh** 2.2	46 **Pd** 2.2	47 **Ag** 1.9	48 **Cd** 1.8	49 **In** 1.8	50 **Sn** 1.8	51 **Sb** 1.9	52 **Te** 2.1	53 **I** 2.5	54 **Xe**
6	55 **Cs** 0.7	56 **Ba** 0.9	57 **La**	72 **Hf**	73 **Ta**	74 **W**	75 **Re**	76 **Os**	77 **Ir**	78 **Pt**	79 **Au**	80 **Hg**	81 **Tl** 1.8	82 **Pb** 1.9	83 **Bi** 1.9	84 **Po** 2.0	85 **At** 2.2	86 **Rn**
7	87 **Fr** 0.7	88 **Ra** 0.9	89 **Ac**	104 **Rf**	105 **Db**	106 **Sg**	107 **Bh**	108 **Hs**	109 **Mt**	110	111	112		114		116		

Lanthanides	58 **Ce**	59 **Pr**	60 **Nd**	61 **Pm**	62 **Sm**	63 **Eu**	64 **Gd**	65 **Tb**	66 **Dy**	67 **Ho**	68 **Er**	69 **Tm**	70 **Yb**	71 **Lu**
Actinides	90 **Th**	91 **Pa**	92 **U**	93 **Np**	94 **Pu**	95 **Am**	96 **Cm**	97 **Bk**	98 **Cf**	99 **Es**	100 **Fm**	101 **Md**	102 **No**	103 **Lr**

2.1 0.5

Ionic	Polar Covalent	Nonpolar Covalent

Chemical Reactions Tables*- Cut out the following 2 tables and put them in the back of your composition book. These are reference tables that you will use throughout the year.*

Activity of Metals Series

Metal	**Ion Formed**
Lithium: Li	Li^{+}
Potassium: K	K^{+}
Barium: Ba	Ba^{2+}
Calcium: Ca	Ca^{2+}
Sodium: Na	Na^{+}
Magnesium: Mg	Mg^{2+}
Aluminum: Al	Al^{3+}
Manganese: Mn	Mn^{2+}
Zinc: Zn	Zn^{2+}
Chromium: Cr	Cr^{3+}
Iron: Fe	Fe^{3+}
Cadmium: Cd	Cd^{2+}
Cobalt: Co	Co^{2+}
Nickel: Ni	Ni^{2+}
Tin: Sn	Sn^{2+}
Lead: Pb	Pb^{2+}
Hydrogen: H	$2H^{+}$
Copper: Cu	Cu^{2+}
Silver: Ag	Ag^{+}
Mercury: Hg	Hg^{2+}
Platinum: Pt	Pt^{2+}
Gold: Au	Au^{3+}

Solubility Table

Key: (s) = solid, (aq)= aqueous: soluble in water, H_2O = water formed (NE)= does not exist,

	Acetate	**Bromide**	**Carbonate**	**Chlorate**	**Chloride**	**Chromate**	**Hydroxide**	**Iodide**	**Nitrate**	**Oxide**	**Phophate**	**Sulfate**	**Sulfide**
Aluminum	**(aq)**	**(aq)**	**NE**	**(aq)**	**(aq)**	**NE**	**(s)**	**(aq)**	**(aq)**	**(s)**	**(s)**	**(aq)**	**(s)**
Ammonium	**(aq)**	**(aq)**	**(aq)**	**(aq)**	**(aq)**	**(aq)**	**(aq)**	**(aq)**	**(aq)**	**NE**	**(aq)**	**(aq)**	**(aq)**
Barium	**(aq)**	**(aq)**	**(s)**	**(aq)**	**(aq)**	**(s)**	**(s)**	**(aq)**	**(aq)**	**(aq)**	**(s)**	**(s)**	**(s)**
Calcium	**(aq)**	**(aq)**	**(s)**	**(aq)**	**(aq)**	**(aq)**	**(s)**	**(aq)**	**(aq)**	**(s)**	**(s)**	**(s)**	**(s)**
Copper II	**(aq)**	**(aq)**	**(s)**	**(aq)**	**(aq)**	**NE**	**(s)**	**(aq)**	**(aq)**	**(s)**	**(s)**	**(aq)**	**(s)**
Hydrogen	**(aq)**	**(aq)**	**Gas**	**(aq)**	**(aq)**	**NE**	**H_2O**	**(aq)**	**(aq)**	**NE**	**(s)**	**(aq)**	**(s)**
Iron II	**(aq)**	**(aq)**	**(s)**	**(aq)**	**(aq)**	**NE**	**(s)**	**(aq)**	**(aq)**	**(s)**	**(s)**	**(aq)**	**(s)**
Iron III	**(aq)**	**(aq)**	**NE**	**(aq)**	**(aq)**	**(s)**	**(s)**	**(aq)**	**(aq)**	**(s)**	**(s)**	**(aq)**	**(s)**
Lead II	**(aq)**	**(s)**	**(s)**	**(aq)**	**(s)**	**(s)**	**(s)**	**(s)**	**(aq)**	**(s)**	**(s)**	**(s)**	**(s)**
Magnesium	**(aq)**	**(aq)**	**(s)**	**(aq)**	**(aq)**	**(aq)**	**(s)**	**(aq)**	**(aq)**	**(s)**	**(s)**	**(aq)**	**(s)**
Manganese II	**(aq)**	**(aq)**	**(s)**	**(aq)**	**(aq)**	**NE**	**(s)**	**(aq)**	**(aq)**	**(s)**	**(s)**	**(aq)**	**(s)**
Mercury II	**(aq)**	**(aq)**	**NE**	**(aq)**	**(aq)**	**(s)**	**(s)**	**(aq)**	**(aq)**	**(s)**	**(s)**	**(aq)**	**(s)**
Potassium	**(aq)**	**(aq)**	**(aq)**	**(aq)**	**(aq)**	**(aq)**	**(aq)**	**(aq)**	**(aq)**	**(aq)**	**(aq)**	**(aq)**	**(aq)**
Silver I	**(aq)**	**(s)**	**(s)**	**(aq)**	**(s)**	**(s)**	**(s)**	**(s)**	**(aq)**	**(s)**	**(s)**	**(aq)**	**(s)**
Sodium	**(aq)**	**(aq)**	**(aq)**	**(aq)**	**(aq)**	**(aq)**	**(aq)**	**(aq)**	**(aq)**	**(aq)**	**(aq)**	**(aq)**	**(aq)**
Strontium	**(aq)**	**(aq)**	**(s)**	**(aq)**	**(aq)**	**(s)**	**(aq)**	**(aq)**	**(aq)**	**(aq)**	**(s)**	**(aq)**	**(aq)**
Tin II	**(aq)**	**(aq)**	**NE**	**(aq)**	**(aq)**	**(s)**	**(s)**	**(aq)**	**(aq)**	**(s)**	**(s)**	**(aq)**	**(s)**
Tin IV	**(aq)**	**(aq)**	**NE**	**NE**	**(aq)**	**(aq)**	**(s)**	**(aq)**	**(aq)**	**(s)**	**NE**	**(aq)**	**(s)**
Zinc II	**(aq)**	**(aq)**	**(s)**	**(aq)**	**(aq)**	**(s)**	**(s)**	**(aq)**	**(aq)**	**(s)**	**(s)**	**(aq)**	**(s)**

The Solubility Rules

1. All common salts of the Group 1A elements and ammonium are soluble.
2. All common acetates and nitrates are soluble.
3. All binary compounds of Group VIIA elements (other than F) with metals are soluble except those of silver, mercury (I), and lead.
4. All sulfates are soluble except those of barium, strontium, lead, calcium, silver, and mercury(I).
5. Except for those in Rule 1, carbonates, hydroxides, oxides, and phosphates are insoluble.

Mole Map; SC2

Welcome to the land of the mole.

Bienvenidos a la tierra de la mole