



Present

The Super-Charged World of Chemistry (Part 3)

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I. Molecular Geometry and Bonding Theories

A. VSEPR Theory

1. polarity

B. Orbital Overlap

1. Hybrid Orbitals
 - a. hybrid orbital numbers
2. Molecular Orbitals
 - a. bond order

II. Gases

A. Kinetic Molecular Theory

1. Boyle's Law
2. Graham's Law

B. The Ideal Gas Equation

1. Dalton's Law of Partial Pressures

III. States of Matter

A. Intermolecular Forces

1. ion-dipole
2. dipole-dipole

3. London dispersion

4. hydrogen bond

B. Phase Diagrams

C. Vapor Pressure

IV. Properties of Solutions

A. Solution Formation

1. miscible vs. immiscible
2. solubility
3. saturation
4. dilution

B. Concentration

1. mass percent composition
2. mole fraction
3. molarity
4. molality

C. Colligative Properties

1. freezing point depression
2. boiling point elevation
3. osmosis

PART 3

Formulas:

Metric System Prefixes:

10^{15}	femto	one quadrillionth (f)
10^{12}	pico	one trillionth (p)
10^9	nano	one billionth (n)
10^6	micro	one millionth (u)
10^3	milli	one thousandth (m)
10^2	centi	one hundredth (c)
10^3	kilo	one thousand times
10^6	mega	one million times
10^9	giga	one billion times
10^{12}	tera	one trillion times

SI Units:

Quantity Measured	Symbol of Unit	Name of Unit
Length	m	Meter
Mass	kg	Kilogram
Time	s	Second
Temperature	K	Kelvin
Volume	L	Liters
Heat	J	Joule
Amount of a Substance	mol	Mole

Conversion of grams to moles:

long formula:

$$\text{grams to moles} = \frac{1 \text{ mole of substance}}{\text{weight in grams of 1 mole of substance}} \times \text{weight of sample in grams}$$

simple formula:

$$\text{grams to moles} = \frac{\text{weight of sample in grams}}{\text{weight in grams of 1 mole of substance}}$$

Hybrid Orbital Number chart:

hybrid orbital number	hybridization	geometry
2	sp	linear
3	sp ²	trigonal planar
4	sp ³	tetrahedral
5	dsp ³	trigonal bipyramid

Conversion from Celsius to Kelvins:

$$K = ^\circ C + 273.15$$

5 Assumptions of Kinetic Molecular Theory

1. A gas is composed of molecules that are far apart from each other in comparison with their own dimensions. Most of the volume a gas occupies is really empty space.
2. Gas molecules are in constant random motion. Each molecule continues to move in a straight line unless it collides with another molecule or with a wall of the container.
3. The molecules exert no force on each other or on the container except when they collide with each other or with the walls of the container.

4. The average kinetic energy of the molecules of a gas is proportional to the temperature.
5. Every time a molecule collides with the wall, it exerts a force on it.

Ideal Gas Equation:

$$PV = nRT$$

P = pressure in atmospheres (atm)
V = volume in liters (L)
n = number of moles (n)
R = gas constant
T = temperature in Kelvins (K)

The Gas Constant:

$$R = \frac{8.314 \text{ J}}{\text{mol}\cdot\text{K}} \text{ or } \frac{0.0821 \text{ atm}\cdot\text{L}}{\text{mol}\cdot\text{K}}$$

Dalton's Law of Partial Pressures:

$$P_{\text{total}} = P_1 + P_2 + P_3 + \dots$$

Mass Percentage Composition:

$$\frac{(\text{mass of solute})}{(\text{mass of solution})} \times 100$$

$$\text{mass of solution} = \text{mass of solvent} + \text{mass of solute}$$

Mole Fraction:

$$\text{mole fraction (X)} = \frac{\text{moles of component}}{\text{total moles of all components}}$$

Molarity:

$$M = \frac{n \text{ (moles of solute)}}{V \text{ (liters of solution)}}$$

Molality:

$$m = \frac{\text{moles of solute}}{\text{kilograms of solvent}}$$

Freezing Point Depression:

$$\text{freezing point depression} = \Delta t_f$$
$$\Delta t_f = K_f m$$

K_f is the molal freezing point depression constant.
Look this up in your text.
 m is the molality of the solution.

Boiling Point Elevation:

$$\text{boiling point elevation} = \Delta t_b$$
$$\Delta t_b = K_b m$$

Δt_b is the boiling point elevation.
 K_b is the molal boiling-point-elevation constant.
Look this up in your text.
 m is the molality of the solution.

Periodic Table of Elements

1 H Hydrogen 1.01																	2 He Helium 4.00				
3 Li Lithium 6.94	4 Be Beryllium 9.01															5 B Boron 10.81	6 C Carbon 12.01	7 N Nitrogen 14.01	8 O Oxygen 16.00	9 F Fluorine 19.00	10 Ne Neon 20.18
11 Na Sodium 22.99	12 Mg Magnesium 24.31															13 Al Aluminum 26.98	14 Si Silicon 28.09	15 P Phosphorus 30.97	16 S Sulfur 32.06	17 Cl Chlorine 35.45	18 Ar Argon 39.95
19 K Potassium 39.10	20 Ca Calcium 40.08	21 Sc Scandium 44.96	22 Ti Titanium 47.90	23 V Vanadium 50.94	24 Cr Chromium 52.00	25 Mn Manganese 54.94	26 Fe Iron 55.85	27 Co Cobalt 58.93	28 Ni Nickel 58.71	29 Cu Copper 63.55	30 Zn Zinc 65.38	31 Ga Gallium 69.72	32 Ge Germanium 72.59	33 As Arsenic 74.92	34 Se Selenium 78.96	35 Br Bromine 79.90	36 Kr Krypton 83.80				
37 Rb Rubidium 85.47	38 Sr Strontium 87.62	39 Y Yttrium 88.91	40 Zr Zirconium 91.22	41 Nb Niobium 92.91	42 Mo Molybdenum 95.94	43 Tc Technetium (99)	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.91	46 Pd Palladium 106.42	47 Ag Silver 107.87	48 Cd Cadmium 112.41	49 In Indium 114.82	50 Sn Tin 118.69	51 Sb Antimony 121.75	52 Te Tellurium 127.60	53 I Iodine 126.90	54 Xe Xenon 131.30				
55 Cs Cesium 132.91	56 Ba Barium 137.34	57 La Lanthanum 138.91	72 Hf Hafnium 178.49	73 Ta Tantalum 180.95	74 W Tungsten 183.85	75 Re Rhenium 186.21	76 Os Osmium 190.2	77 Ir Iridium 192.22	78 Pt Platinum 195.09	79 Au Gold 196.97	80 Hg Mercury 200.59	81 Tl Thallium 204.37	82 Pb Lead 207.19	83 Bi Bismuth 208.98	84 Po Polonium (210)	85 At Astatine (210)	86 Rn Radon (222)				
87 Fr Francium (223)	88 Ra Radium (226)	89 Ac Actinium (227)	104 (261)	105 (262)	106 (263)	107 (262)	108 (265)	109 (266)	Names not yet established for these elements												

Lanthanides

Actinides

58 Ce Cerium 140.12	59 Pr Praseodymium 140.91	60 Nd Neodymium 144.24	61 Pm Promethium (147)	62 Sm Samarium 150.35	63 Eu Europium 151.96	64 Gd Gadolinium 157.25	65 Tb Terbium 158.93	66 Dy Dysprosium 162.50	67 Ho Holmium 164.93	68 Er Erbium 167.26	69 Tm Thulium 168.93	70 Yb Ytterbium 173.04	71 Lu Lutetium 1.01
90 Th Thorium (232)	91 Pa Protactinium (231)	92 U Uranium (238)	93 Np Neptunium (237)	94 Pu Plutonium (242)	95 Am Americium (243)	96 Cm Curium (247)	97 Bk Berkelium (247)	98 Cf Californium (251)	99 Es Einsteinium (254)	100 Fm Fermium (257)	101 Md Mendelevium (258)	102 No Nobelium (259)	103 Lr Lawrencium (260)