



Present

# The Super-Charged World of Chemistry (Part 1)

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## I. What is Chemistry?

### A. Introduction to Matter

1. states of matter
  - a. liquid
  - b. solid
  - c. gas
2. properties of matter
  - a. physical properties
  - b. chemical properties
3. types of matter
  - a. heterogeneous
  - b. homogeneous

### B. The Elements

1. atoms
2. compounds
3. molecules
4. The Periodic Table

## II. Units of Measure

### A. The Metric System and SI Units

### B. Uncertainty in Measurement

1. precision vs. accuracy
2. significant figures
3. scientific notation

### C. Dimensional Analysis

1. unit factor method

## III. Stoichiometry

### A. Chemical Equations

1. Law of Conservation of Mass
2. balancing equations

### B. Atomic and Molecular Weights

1. mass number
2. atomic number
3. isotopes
4. atomic mass units

### C. Moles

1. molecular mass
2. molar mass

### D. Percent Composition

### E. Empirical Formulas

### F. Problems Based on

Chemical Equations

## IV. Solution Stoichiometry

### A. Molarity

### B. Titrations

### C. Limiting Reagents

### D. Yields

## PART 1

## 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:

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

### Avogadro's Constant (the magic mole number):

$$6.022 \times 10^{23}$$

### To calculate the masses of substances taking part in a chemical reaction, follow these four steps:

1. Write the balanced equation for the reaction.
2. Convert the known mass of one of the reactants to moles.
3. Use the balanced equation to set up the appropriate conversion factor(s) to find the number of moles of other reactants or products.
4. Convert from moles back to grams.

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$$\text{molecular weight} = \text{sum of masses of atoms in molecule}$$

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$$\text{formula weight} = \text{sum of masses of the atoms in a molecule's empirical formula}$$

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

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$$\text{moles to grams} = \text{moles of sample} \times \text{molecular weight}$$

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$$\begin{aligned} \text{percent composition} \\ = \frac{(\text{number of atoms of an element})(\text{atomic weight}) \times 100}{\text{molecular weight of the compound}} \end{aligned}$$

### Molarity:

$$M = \text{molarity}$$

$$n = \text{number of moles}$$

$$V = \text{volume of solution}$$

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

$$n = M \times V$$

$$V = \frac{n}{M}$$

### Concentration:

$$M_1 V_1 = M_2 V_2$$

$$M = \text{molarity}$$

$$V = \text{volume}$$

### Yield:

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$$\text{percent yield} = \frac{\text{actual yield}}{\text{theoretical yield}} \times 100$$

# 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)