CHEMISTRY

PERIODIC TABLE OF THE ELEMENTS

1 H 1.0079																	2 He 4.0026
3 Li 6.941	4 Be 9.012											5 B 10.811	6 C 12.011	7 N 14.007	8 O 16.00	9 F 19.00	10 Ne 20.179
11 Na 22.99	12 Mg 24.30											13 Al 26.98	14 Si 28.09	15 P 30.974	16 S 32.06	17 Cl 35.453	18 Ar 39.948
19 K 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.90	23 V 50.94	24 Cr 52.00	25 Mn 54.938	26 Fe 55.85	27 Co 58.93	28 Ni 58.69	29 Cu 63.55	30 Zn 65.39	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 102.91	46 Pd 106.42	47 Ag 107.87	48 Cd 112.41	49 In 114.82	50 Sn 118.71	51 Sb 121.75	52 Te 127.60	53 I 126.91	54 Xe 131.29
55 Cs 132.91	56 Ba 137.33	57 *La 138.91	72 Hf 178.49	73 Ta 180.95	74 W 183.85	75 Re 186.21	76 Os 190.2	77 Ir 192.2	78 Pt 195.08	79 Au 196.97	80 Hg 200.59	81 Tl 204.38	82 Pb 207.2	83 Bi 208.98	84 Po (209)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra 226.02	89 †Ac 227.03	104 Rf (261)	105 Db (262)	106 Sg (263)	107 Bh (262)	108 Hs (265)	109 Mt (266)	110 § (269)	111 § (272)	112 § (277)	§Not yet named					

*Lanthanide Series	58 Ce 140.12	59 Pr 140.91	60 Nd 144.24	61 Pm (145)	62 Sm 150.4	63 Eu 151.97	64 Gd 157.25	65 Tb 158.93	66 Dy 162.50	67 Ho 164.93	68 Er 167.26	69 Tm 168.93	70 Yb 173.04	71 Lu 174.97
†Actinide Series	90 Th 232.04	91 Pa 231.04	92 U 238.03	93 Np 237.05	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)

Prefix	Power	Meaning	Examples of measurements
nano (n)	10^{-9}	one-billionth	nanometer (nm): wavelength of light
micro (m)	10^{-6}	one-millionth	micrometer (*mm*): width of a hair
milli (m)	10^{-3}	one-thousandth	milliliter (mL): volume of acid in burette
centi (c)	10^{-2}	one-hundredth	centimeter (cm): length of paper
deci (d)	10^{-1}	one-tenth	deciliter (dL): amount of liquid
kilo (k)	10^{3}	one thousand times	kilogram (kg): your weight

1 gallon equals 4 quarts, 12 inches equals 1 foot,
Nomenclature 系统命名法

binary ionic compounds 二元离子化合物

Ammonium ion	NH_4^+
Acetate ion	$C_2H_3O_2^-$
Cyanide ion	CN^-

Hydroxide ion	OH^-
Nitrate ion	NO_3^-
Chlorate ion	ClO_3^-
Sulfate ion	SO_4^{2-}
Carbonate ion	CO_3^{2-}
Phosphate ion	PO_4^{3-}

$HCO_3^-$is called either the bicarbonate ion *or* the hydrogen carbonate ion

$HPO_4^{2-}$and $H_2PO_4^-$.These are named hydrogen phosphate and dihydrogen phosphate,
When the acid has *only* an element following the H, use the prefix *hydro-*, followed by the element's root name and an *-ic* ending.hydrocyanic acid.HCN

If the acid has an *-ate* polyatomic ion after the H, that makes it an *-ic* acid. H_2SO_4 is sulfuric acid.
When the acid has an *-ite* polyatomic ion after the H, that makes it an *-ous* acid

Me eat peanut butter." This corresponds to *meth-*, *eth-*, *prop-*, and *but-*, which correspond to one, two, three, and four carbons, respectively.

- *-ane* = alkane (all single bonds and saturated); C_nH_{2n+2}; *saturated*: it contains the maximum number of H's
- *-ene* = alkene (contains double bond, unsaturated); C_nH_{2n}
- *-yne* = alkyne (contains triple bond, unsaturated); C_nH_{2n-2}; *polyunsaturated*: it contains more than one double or triple bond

Naming positive ions (usually metals)

- Monatomic, metal, cation: simply the name of the metal from which it is derived. Al^{3+} is the aluminum ion (these are often referred to as group A metals).
- Transition metals form *more than one ion*; Roman numerals (in parentheses) follow the ion's name. Cu^{2+} is copper (II) ion. *Exception*: mercury (I) is Hg_2^{2+}, that is, two Hg^+ bonded together covalently.
- $NH_4^+$is ammonium.
- Roman numerals are not usually written with silver, cadmium, and zinc 银镉锌. Arrange their symbols in alphabetical order—the first one is 1+ and the other two are 2+.

Naming negative ions (usually nonmetals or polyatomic ions)

- Monatomic, nonmetal, anion: add the suffix *-ide* to the stem of the nonmetal's name. Halogens are called the *halides*. Cl^- is the chloride ion.
- Polyatomic anion: you must memorize the polyatomic ion's name. NO_2^- is the nitrite ion.

Naming Binary Molecular Compounds

a molecular compound? a combination of nonmetals, both of which lie near each other on the periodic table. Use the following set of prefixes, and don't forget the *-ide* ending to the name.

Subscript	Prefix
1	*mono-* (usually used only on the second element, such as carbon monoxide or nitrogen monoxide)
2	*di-*
3	*tri-*
4	*tetra-*
5	*penta-*
6	*hexa-*
7	*hepta-*
8	*octa-*
9	*nona-*
10	*deca-*

butane 丁烷 C4H10
propane 丙烷 C3H8

- 1–4 carbons tend to be gases at room temperature; **butane** and **propane** are among the lightest hydrocarbons and are used for fuel
- 5–10 carbons tend to be in the liquid state at room temperature; compounds that fall in this size range are used to make gasoline and solvents
- 12–18 carbons make up jet fuels and kerosene 煤油
- More than 18 carbons tend to be solids at room temperature

polymer 聚合物
monomer 单体
Amino acids 氨基酸
polypeptide 多肽
Starch 淀粉
Polyethylene 聚乙烯
Polypropylene 聚丙烯

Polyethylene—Many ethenes strung together with covalent bonds (ethylene is another name for ethene); shopping bags and plastic bottles are made of polyethylene.

- **Polypropylene**—Many propenes strung together; glues and carpets
- **Polystyrene** 聚苯乙烯—A clear, hard, brittle polymer used in CD cases; if you blow carbon dioxide into it during manufacture and you get the soft, opaque, foamy polymer used in a coffee cup.

Functional Groups 官能团
Hydroxyl group, —OH
Carboxylic acid group, —COOH
trichloroethanoic acid 三氯乙醇酸
Amine group, $-NH_2$
Isomer 同分异构体
substitution reaction 取代反应
addition reaction 加成反应
muriatic acid (HCl)
Brass: copper and zinc

Sterling silver: silver and copper

Steel: iron and carbon

Bronze: copper, tin, and other metals

Pewter 白蜡: mixture of tin, copper, bismuth, and antimony
wooden splint 小木条
burning splint 燃着的木条
colorless, odorless 无色无味
fire extinguisher 灭火器

Chlorofluorocarbons, or CFC 氟氯化碳
stratosphere 平流层
moisture 湿度
Rules for Basic Laboratory Safety

Safety goggles must be worn at all times in the laboratory.
No eating or drinking in the laboratory.
Never taste or touch the laboratory chemicals.
Always wash your hands before leaving the laboratory.
Wear proper clothing—safety glasses, closed-toed shoes, and an apron; tie long hair back and remove all jewelry.
Always follow the written directions, and never perform an unauthorized experiment.
Always add acid to water. This prevents the acid from spattering.
Point heating test tubes away from others and yourself, and heat them slowly.

Never return unused chemicals to their original containers. This prevents contamination.

Always use a pipette bulb or a pipetter to transfer when using a pipette 吸液管.

Never use your mouth.

Always use a fume hood when working with toxic substances. Never inhale fumes directly.

Never use an open flame near flammable liquids.

Dispose of chemicals in the designated disposal site—not in the sink or trash can.

fume hood 通风橱

Common Laboratory Equipment