



Reference Tables for Physical Setting/CHEMISTRY

2011 Edition

Table A
Standard Temperature and Pressure

Name	Value	Unit
Standard Pressure	101.3 kPa 1 atm	kilopascal atmosphere
Standard Temperature	273 K 0°C	kelvin degree Celsius

Table B
Physical Constants for Water

Heat of Fusion	334 J/g
Heat of Vaporization	2260 J/g
Specific Heat Capacity of H ₂ O ()	4.18 J/g°C

Table C
Selected Prefixes

Factor	Prefix	Symbol
10 ³	kilo-	k
10 ⁻¹	deci-	d
10 ⁻²	centi-	c
10 ⁻³	milli-	m
10 ⁻⁶	micro-	μ
10 ⁻⁹	nano-	n
10 ⁻¹²	pico-	p

Table D
Selected Units

Symbol	Name	Quantity
m	meter	length
g	gram	mass
Pa	pascal	pressure
K	kelvin	temperature
mol	mole	amount of substance
J	joule	energy, work, quantity of heat
s	second	time
min	minute	time
h	hour	time
d	day	time
y	year	time
L	liter	volume

Table E
Selected Polyatomic Ions

Formula	Name	Formula	Name
H_3O^+	hydronium	CrO_4^{2-}	chromate
Hg_2^{2+}	mercury(I)	$\text{Cr}_2\text{O}_7^{2-}$	dichromate
NH_4^+	ammonium	MnO_4^-	permanganate
$\left. \begin{array}{l} \text{C}_2\text{H}_3\text{O}_2^- \\ \text{CH}_3\text{COO}^- \end{array} \right\}$	acetate	NO_2^-	nitrite
CN^-	cyanide	NO_3^-	nitrate
CO_3^{2-}	carbonate	O_2^{2-}	peroxide
HCO_3^-	hydrogen carbonate	OH^-	hydroxide
$\text{C}_2\text{O}_4^{2-}$	oxalate	PO_4^{3-}	phosphate
ClO^-	hypochlorite	SCN^-	thiocyanate
ClO_2^-	chlorite	SO_3^{2-}	sulfite
ClO_3^-	chlorate	SO_4^{2-}	sulfate
ClO_4^-	perchlorate	HSO_4^-	hydrogen sulfate
		$\text{S}_2\text{O}_3^{2-}$	thiosulfate

Table F
Solubility Guidelines for Aqueous Solutions

Ions That Form Soluble Compounds	Exceptions	Ions That Form Insoluble Compounds*	Exceptions
Group 1 ions (Li^+ , Na^+ , etc.)		carbonate (CO_3^{2-})	when combined with Group 1 ions or ammonium (NH_4^+)
ammonium (NH_4^+)		chromate (CrO_4^{2-})	when combined with Group 1 ions, Ca^{2+} , Mg^{2+} , or ammonium (NH_4^+)
nitrate (NO_3^-)		phosphate (PO_4^{3-})	when combined with Group 1 ions or ammonium (NH_4^+)
acetate ($\text{C}_2\text{H}_3\text{O}_2^-$ or CH_3COO^-)		sulfide (S^{2-})	when combined with Group 1 ions or ammonium (NH_4^+)
hydrogen carbonate (HCO_3^-)		hydroxide (OH^-)	when combined with Group 1 ions, Ca^{2+} , Ba^{2+} , Sr^{2+} , or ammonium (NH_4^+)
chlorate (ClO_3^-)			
halides (Cl^- ; Br^- ; I^-)	when combined with Ag^+ , Pb^{2+} , or Hg_2^{2+}		
sulfates (SO_4^{2-})	when combined with Ag^+ , Ca^{2+} , Sr^{2+} , Ba^{2+} , or Pb^{2+}		

*compounds having very low solubility in H_2O

Table G
Solubility Curves at Standard Pressure

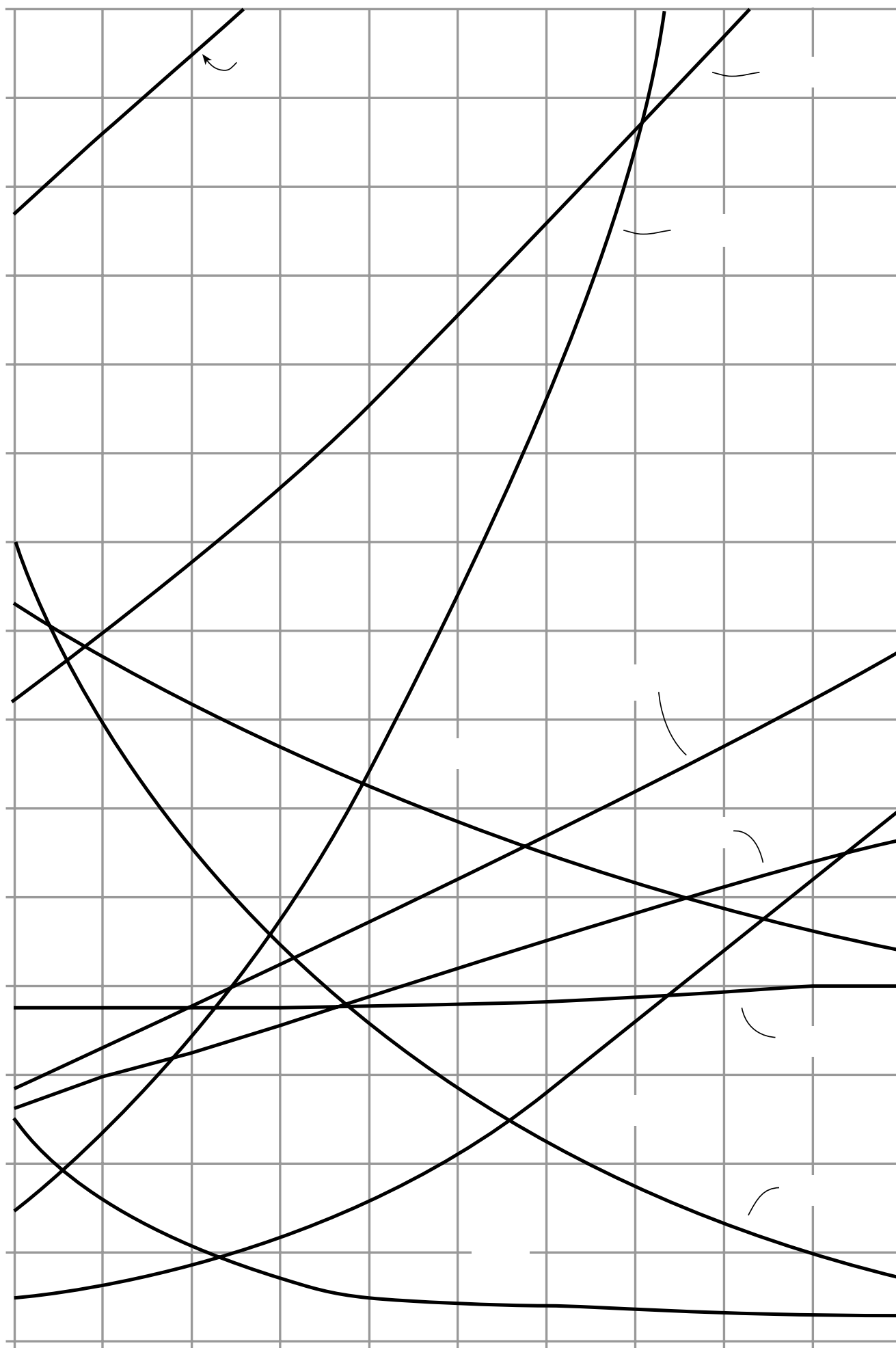


Table H
Vapor Pressure of Four Liquids

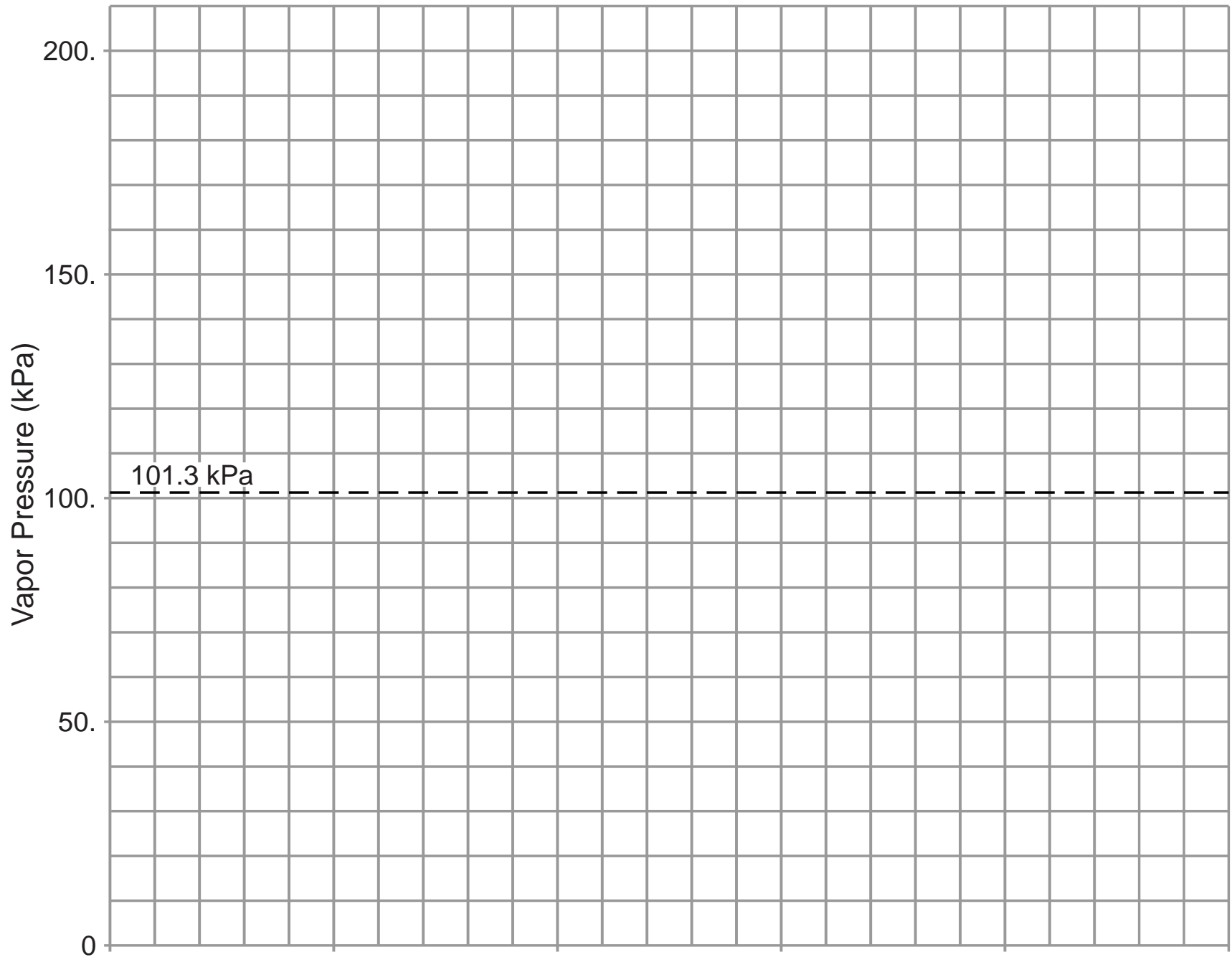


Table K
Common Acids

Formula	Name
HCl(aq)	hydrochloric acid
HNO ₂ (aq)	nitrous acid
HNO ₃ (aq)	nitric acid
H ₂ SO ₃ (aq)	sulfurous acid
H ₂ SO ₄ (aq)	sulfuric acid
H ₃ PO ₄ (aq)	phosphoric acid
H ₂ CO ₃ (aq) or CO ₂ (aq)	carbonic acid
CH ₃ COOH(aq) or HC ₂ H ₃ O ₂ (aq)	ethanoic acid (acetic acid)

Table L
Common Bases

Formula	Name
NaOH(aq)	sodium hydroxide
KOH(aq)	potassium hydroxide
Ca(OH) ₂ (aq)	calcium hydroxide
NH ₃ (aq)	aqueous ammonia

Table M
Common Acid...Base Indicators

Indicator	Approximate pH Range for Color Change	Color Change
methyl orange	3.1...4.4	red to yellow
bromthymol blue	6.0...7.6	yellow to blue
phenolphthalein	8...9	colorless to pink
litmus	4.5...8.3	red to blue
bromcresol green	3.8...5.4	yellow to blue
thymol blue	8.0...9.6	yellow to blue

Source: The Merck Index, 14th ed., 2006, Merck Publishing Group

Table N
Selected Radioisotopes

Nuclide	Half-Life	Decay Mode	Nuclide Name
¹⁹⁸ Au	2.695 d	...	gold-198
¹⁴ C	5715 y	...	carbon-14
³⁷ Ca	182 ms	+	calcium-37
⁶⁰ Co	5.271 y	...	cobalt-60
¹³⁷ Cs	30.2 y	...	cesium-137
⁵³ Fe	8.51 min	+	iron-53
²²⁰ Fr	27.4 s		francium-220
³ H	12.31 y	...	hydrogen-3
¹³¹ I	8.021 d	...	iodine-131
³⁷ K	1.23 s	+	potassium-37
⁴² K	12.36 h	...	potassium-42
⁸⁵ Kr	10.73 y	...	krypton-85
¹⁶ N	7.13 s	...	nitrogen-16
¹⁹ Ne	17.22 s	+	neon-19
³² P	14.28 d	...	phosphorus-32
²³⁹ Pu	2.410×10 ⁴ y		plutonium-239
²²⁶ Ra	1599 y		radium-226
²²² Rn	3.823 d		radon-222
⁹⁰ Sr	29.1 y	...	strontium-90
⁹⁹ Tc	2.13×10 ⁵ y	...	technetium-99
²³² Th	1.40×10 ¹⁰ y		thorium-232
²³³ U	1.592×10 ⁵ y		uranium-233
²³⁵ U	7.04×10 ⁸ y		uranium-235
²³⁸ U	4.47×10 ⁹ y		uranium-238

Source: CRC Handbook of Chemistry and Physics, 91st ed., 2010...2011, CRC Press

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Table R
Organic Functional Groups

Class of Compound	Functional Group	General Formula	Example
halide (halocarbon)	—F (fluoro-) —Cl (chloro-) —Br (bromo-) —I (iodo-)	R—X (X represents any halogen)	CH ₃ CHClCH ₃ 2-chloropropane
alcohol	—OH	R—OH	CH ₃ CH ₂ CH ₂ OH 1-propanol
ether	—O—	R—O—R	CH ₃ OCH ₂ CH ₃ methyl ethyl ether
aldehyde	$\begin{array}{c} \text{O} \\ \parallel \\ -\text{C}-\text{H} \end{array}$	$\begin{array}{c} \text{O} \\ \parallel \\ \text{R}-\text{C}-\text{H} \end{array}$	$\begin{array}{c} \text{O} \\ \parallel \\ \text{CH}_3\text{CH}_2\text{C}-\text{H} \end{array}$ propanal
ketone	$\begin{array}{c} \text{O} \\ \parallel \\ -\text{C}- \end{array}$	$\begin{array}{c} \text{O} \\ \parallel \\ \text{R}-\text{C}-\text{R} \end{array}$	$\begin{array}{c} \text{O} \\ \parallel \\ \text{CH}_3\text{CCH}_2\text{CH}_2\text{CH}_3 \end{array}$ 2-pentanone
organic acid	$\begin{array}{c} \text{O} \\ \parallel \\ -\text{C}-\text{OH} \end{array}$	$\begin{array}{c} \text{O} \\ \parallel \\ \text{R}-\text{C}-\text{OH} \end{array}$	$\begin{array}{c} \text{O} \\ \parallel \\ \text{CH}_3\text{CH}_2\text{C}-\text{OH} \end{array}$ propanoic acid
ester	$\begin{array}{c} \text{O} \\ \parallel \\ -\text{C}-\text{O}- \end{array}$	$\begin{array}{c} \text{O} \\ \parallel \\ \text{R}-\text{C}-\text{O}-\text{R} \end{array}$	$\begin{array}{c} \text{O} \\ \parallel \\ \text{CH}_3\text{CH}_2\text{C}-\text{O}-\text{CH}_3 \end{array}$ methyl propanoate
amine	$\begin{array}{c} \\ -\text{N}- \end{array}$	$\begin{array}{c} \text{R} \\ \\ \text{R}-\text{N}-\text{R} \end{array}$	CH ₃ CH ₂ CH ₂ NH ₂ 1-propanamine
amide	$\begin{array}{c} \text{O} \\ \parallel \\ -\text{C}-\text{NH} \end{array}$	$\begin{array}{c} \text{O} \quad \text{R} \\ \parallel \quad \\ \text{R}-\text{C}-\text{NH} \end{array}$	$\begin{array}{c} \text{O} \\ \parallel \\ \text{CH}_3\text{CH}_2\text{C}-\text{NH}_2 \end{array}$ propanamide

Note: R represents a bonded atom or group of atoms.

Periodic Table of the Elements

Period	1
1	1.00794 H 1

18
4.00260 He 2

KEY	Atomic Mass	Symbol	Selected Oxidation States
	12.011	C	...4 +2 +4
			Relative atomic masses are based

Group 2
1

Li

Na

19
2-8-8-1

Rb

Cs

(223) +1

Fr

+2 (227)

Ra

+3 (261)

Ac

Rf

87
-18-32-18-8-1-18-32-18-8-2-18-32-18-9-2

89

104

47.867 +2 50.9415 +2 51.996

Ti

V

Cr(+4)

Tc

0.0014

Zr

3

8

<

3

Zr

1

22

2-8-10-2

23

2-8-11-2

91.224

+4

+3

Zr

Nb

40

2-8-18-10-2

138.9055

+3

178.49

+4

La

Hf

72

2-8-18-18-9-2-18-32-10-2

39

Rb

138.9055

+3

178.49

+4

La

Hf

72

2-8-18-18-9-2-18-32-10-2

(223)

+1

Fr

+2 (227)

Ra

+3 (261)

Ac

Rf

87

-18-32-18-8-1-18-32-18-8-2-18-32-18-9-2

89

104

Pb

79

Sb

Table T
Important Formulas and Equations

Density	$d = \frac{m}{V}$ <p>d = density m = mass V = volume</p>

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