



## Massachusetts Comprehensive Assessment System Chemistry Formula and Constants Sheet

### Common Polyatomic Ions

Ion	Ionic Formula
Ammonium	$\text{NH}_4^+$
Carbonate	$\text{CO}_3^{2-}$
Hydroxide	$\text{OH}^-$
Nitrate	$\text{NO}_3^-$
Phosphate	$\text{PO}_4^{3-}$
Sulfate	$\text{SO}_4^{2-}$

**Combined Gas Law:**  $\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$

**Ideal Gas Law:**  $PV = nRT$

**Dilution Formula:**  $M_1 V_1 = M_2 V_2$

**Molar Volume of Ideal Gas at STP:** 22.4 L/mol

**Ideal Gas Constant:**  $R = 0.0821 \text{ L} \cdot \text{atm/mol} \cdot \text{K} = 8.31 \text{ L} \cdot \text{kPa/mol} \cdot \text{K}$

**STP:** 1 atm (101.3 kPa), 273 K (0°C)

**Absolute Temperature Conversion:**  $\text{K} = ^\circ\text{C} + 273$

**Definition of pH:**  $\text{pH} = -\log [\text{H}_3\text{O}^+] = -\log [\text{H}^+]$

**Avogadro's Number:**  $6.02 \times 10^{23}$  particles/mol

### Nuclear Symbols

Name	Symbol
Alpha particle	$\alpha$ or ${}^4_2\text{He}$
Beta particle	$\beta$ or ${}^0_{-1}e$
Gamma ray	$\gamma$
Neutron	${}^1_0n$



# Massachusetts Comprehensive Assessment System

## Periodic Table of the Elements

Group (Family)	1A	2A	8B										3A	4A	5A	6A	7A	8A	
Period	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
Key:	atomic weight Symbol atomic number Name																		
1	1.01 H 1 Hydrogen																	4.00 He 2 Helium	
2	6.94 Li 3 Lithium	9.01 Be 4 Beryllium																	20.18 Ne 10 Neon
3	22.99 Na 11 Sodium	24.31 Mg 12 Magnesium																	39.95 Ar 18 Argon
4	39.10 K 19 Potassium	40.08 Ca 20 Calcium	44.96 Sc 21 Scandium	47.88 Ti 22 Titanium	50.94 V 23 Vanadium	52.00 Cr 24 Chromium	54.94 Mn 25 Manganese	55.85 Fe 26 Iron	58.93 Co 27 Cobalt	58.69 Ni 28 Nickel	63.55 Cu 29 Copper	65.39 Zn 30 Zinc	69.72 Ga 31 Gallium	72.59 Ge 32 Germanium	74.92 As 33 Arsenic	78.96 Se 34 Selenium	79.90 Br 35 Bromine	83.80 Kr 36 Krypton	
5	85.47 Rb 37 Rubidium	87.62 Sr 38 Strontium	88.91 Y 39 Yttrium	91.22 Zr 40 Zirconium	92.91 Nb 41 Niobium	95.94 Mo 42 Molybdenum	98 Tc 43 Technetium	101.07 Ru 44 Ruthenium	102.91 Rh 45 Rhodium	106.42 Pd 46 Palladium	107.87 Ag 47 Silver	112.41 Cd 48 Cadmium	114.82 In 49 Indium	118.71 Sn 50 Tin	121.75 Sb 51 Antimony	127.60 Te 52 Tellurium	126.91 I 53 Iodine	131.29 Xe 54 Xenon	
6	132.91 Cs 55 Cesium	137.33 Ba 56 Barium		178.49 Hf 72 Hafnium	180.95 Ta 73 Tantalum	183.85 W 74 Tungsten	186.21 Re 75 Rhenium	190.23 Os 76 Osmium	192.22 Ir 77 Iridium	195.08 Pt 78 Platinum	196.97 Au 79 Gold	200.59 Hg 80 Mercury	204.38 Tl 81 Thallium	207.2 Pb 82 Lead	208.98 Bi 83 Bismuth	(209) Po 84 Polonium	(210) At 85 Astatine	(222) Rn 86 Radon	
7	(223) Fr 87 Francium	(226) Ra 88 Radium		(267) Rf 104 Rutherfordium	(268) Db 105 Dubnium	(271) Sg 106 Seaborgium	(272) Bh 107 Bohrium	(277) Hs 108 Hassium	(276) Mt 109 Meitnerium	(281) Ds 110 Darmstadtium	(280) Rg 111 Roentgenium								

Mass numbers in parentheses are those of the most stable or most common isotope.

Series	Element	Symbol	Atomic Number	Atomic Weight
Lanthanide Series	La	La	57	138.91
	Ce	Ce	58	140.12
	Pr	Pr	59	140.91
	Nd	Nd	60	144.24
	Pm	Pm	61	(145)
	Sm	Sm	62	150.36
	Eu	Eu	63	151.96
	Gd	Gd	64	157.25
	Tb	Tb	65	158.93
	Dy	Dy	66	162.50
	Ho	Ho	67	164.93
	Er	Er	68	167.26
	Tm	Tm	69	168.93
	Yb	Yb	70	173.04
Lu	Lu	71	174.97	
Actinide Series	Ac	Ac	89	(227)
	Th	Th	90	232.04
	Pa	Pa	91	231.04
	U	U	92	238.03
	Np	Np	93	(237)
	Pu	Pu	94	(244)
	Am	Am	95	(243)
	Cm	Cm	96	(247)
	Bk	Bk	97	(247)
	Cf	Cf	98	(251)
Es	Es	99	(252)	
Fm	Fm	100	(257)	
Md	Md	101	(258)	
No	No	102	(259)	
Lr	Lr	103	(262)	

\*Revised based on IUPAC Commission on Atomic Weights and Isotopic Abundances, "Atomic Weights of the Elements 2007."