

PERIODIC TABLE OF THE ELEMENTS

1	2	13	14	15	16	17	18
1	2	5	6	7	8	9	10
H 1.008	He 4.00	B 10.81	C 12.01	N 14.01	O 16.00	F 19.00	Ne 20.18
3	4	13	14	15	16	17	18
Li 6.94	Be 9.01	Al 13	Si 28.09	P 30.97	S 32.06	Cl 35.45	Ar 39.95
11	12	31	32	33	34	35	36
Na 22.99	Mg 24.30	Ga 69.72	Ge 72.63	As 74.92	Se 78.97	Br 79.90	Kr 83.80
19	20	49	50	51	52	53	54
K 39.10	Ca 40.08	In 114.82	Sn 118.71	Sb 121.76	Te 127.60	I 126.90	Xe 131.29
37	38	81	82	83	84	85	86
Rb 85.47	Sr 87.62	Tl 204.38	Pb 207.2	Bi 208.98	Po 209	At 210	Rn 222
55	56	80	81	82	83	84	85
Cs 132.91	Ba 137.33	Hg 200.59	Tl 204.38	Pb 207.2	Bi 208.98	Po 209	Rn 222
87	88	112	113	114	115	116	117
Fr 223	Ra 226	Cn 285	Nh 286	Fl 287	Mc 288	Lv 289	Ts 290
		101	102	103	104	105	106
		107	108	109	110	111	112
		113	114	115	116	117	118
		119	120	121	122	123	124
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		725	726	727	728	729	730
		731	732	733	734	735	736
		737	738	739	740	741	742
		743	744	745	746	747	748
		749	750	751	752	753	754
		755	756	757	758	759	760
		761	762	763	764	765	766
		767	768	769	770	771	772
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		779	780	781	782	783	784
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		839	840	841	842	843	844
		845	846	847	848	849	850
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		857	858	859	860	861	862
		863	864	865	866	867	868
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		911	912	913	914	915	916
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		953	954	955	956	957	958
		959	960	961	962	963	964
		965	966	967	968	969	970
		971	972	973	974	975	976
		977	978	979	980	981	982
		983	984	985	986	987	988
		989	990	991	992	993	994
		995	996	997	998	999	1000

*Lanthanoids

+ Actinoids

AP[®] CHEMISTRY EQUATIONS AND CONSTANTS

Throughout the exam the following symbols have the definitions specified unless otherwise noted.

L, mL = liter(s), milliliter(s)
 g = gram(s)
 nm = nanometer(s)
 atm = atmosphere(s)

mm Hg = millimeters of mercury
 J, kJ = joule(s), kilojoule(s)
 V = volt(s)
 mol = mole(s)

ATOMIC STRUCTURE

$$E = h\nu$$

$$c = \lambda\nu$$

E = energy
 ν = frequency
 λ = wavelength

Planck's constant, $h = 6.626 \times 10^{-34}$ J s

Speed of light, $c = 2.998 \times 10^8$ m s⁻¹

Avogadro's number = 6.022×10^{23} mol⁻¹

Electron charge, $e = -1.602 \times 10^{-19}$ coulomb

EQUILIBRIUM

$$K_c = \frac{[C]^c [D]^d}{[A]^a [B]^b}, \text{ where } a A + b B \rightleftharpoons c C + d D$$

$$K_p = \frac{(P_C)^c (P_D)^d}{(P_A)^a (P_B)^b}$$

$$K_a = \frac{[H^+][A^-]}{[HA]}$$

$$K_b = \frac{[OH^-][HB^+]}{[B]}$$

$$K_w = [H^+][OH^-] = 1.0 \times 10^{-14} \text{ at } 25^\circ\text{C}$$

$$= K_a \times K_b$$

$$\text{pH} = -\log[H^+], \text{ pOH} = -\log[OH^-]$$

$$14 = \text{pH} + \text{pOH}$$

$$\text{pH} = \text{p}K_a + \log \frac{[A^-]}{[HA]}$$

$$\text{p}K_a = -\log K_a, \text{ p}K_b = -\log K_b$$

Equilibrium Constants

K_c (molar concentrations)

K_p (gas pressures)

K_a (weak acid)

K_b (weak base)

K_w (water)

KINETICS

$$[A]_t - [A]_0 = -kt$$

$$\ln[A]_t - \ln[A]_0 = -kt$$

$$\frac{1}{[A]_t} - \frac{1}{[A]_0} = kt$$

$$t_{1/2} = \frac{0.693}{k}$$

k = rate constant

t = time

$t_{1/2}$ = half-life

GASES, LIQUIDS, AND SOLUTIONS

$$PV = nRT$$

$$P_A = P_{\text{total}} \times X_A, \text{ where } X_A = \frac{\text{moles A}}{\text{total moles}}$$

$$P_{\text{total}} = P_A + P_B + P_C + \dots$$

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

$$K = ^\circ\text{C} + 273$$

$$D = \frac{m}{V}$$

$$KE_{\text{molecule}} = \frac{1}{2}mv^2$$

Molarity, M = moles of solute per liter of solution

$$A = \varepsilon bc$$

P = pressure

V = volume

T = temperature

n = number of moles

m = mass

M = molar mass

D = density

KE = kinetic energy

v = velocity

A = absorbance

ε = molar absorptivity

b = path length

c = concentration

Gas constant, $R = 8.314 \text{ J mol}^{-1} \text{ K}^{-1}$
 $= 0.08206 \text{ L atm mol}^{-1} \text{ K}^{-1}$
 $= 62.36 \text{ L torr mol}^{-1} \text{ K}^{-1}$

1 atm = 760 mm Hg = 760 torr

STP = 273.15 K and 1.0 atm

Ideal gas at STP = 22.4 L mol⁻¹

THERMODYNAMICS/ELECTROCHEMISTRY

$$q = mc\Delta T$$

$$\Delta S^\circ = \sum S^\circ \text{ products} - \sum S^\circ \text{ reactants}$$

$$\Delta H^\circ = \sum \Delta H_f^\circ \text{ products} - \sum \Delta H_f^\circ \text{ reactants}$$

$$\Delta G^\circ = \sum \Delta G_f^\circ \text{ products} - \sum \Delta G_f^\circ \text{ reactants}$$

$$\Delta G^\circ = \Delta H^\circ - T\Delta S^\circ$$

$$= -RT \ln K$$

$$= -nFE^\circ$$

$$I = \frac{q}{t}$$

$$E_{\text{cell}} = E_{\text{cell}}^\circ - \frac{RT}{nF} \ln Q$$

q = heat

m = mass

c = specific heat capacity

T = temperature

S° = standard entropy

H° = standard enthalpy

G° = standard Gibbs free energy

n = number of moles

E° = standard reduction potential

I = current (amperes)

q = charge (coulombs)

t = time (seconds)

Q = reaction quotient

Faraday's constant, $F = 96,485$ coulombs per mole of electrons

$$1 \text{ volt} = \frac{1 \text{ joule}}{1 \text{ coulomb}}$$