

USEFUL INFORMATION

$$R = 0.08206 \text{ L-atm/mol-K} = 8.3145 \text{ J/mol-K}$$

$$\text{Avogadro's number} = 6.02 \times 10^{23} \text{ particles/mole}$$

$$1 \text{ \AA} = 1 \times 10^{-10} \text{ m} = 1 \times 10^{-8} \text{ cm}$$

$$\text{molar volume at STP} = 22.41 \text{ L}$$

$$\text{KE} = \frac{1}{2} mv^2, \quad \text{KE}_{\text{avg}} = \frac{1}{2} mu^2, \quad \text{total average KE per mole} = \frac{3}{2} RT$$

$$S_{\text{gas}} = k_{\text{H}} * P_{\text{gas}}$$

$$\left(P + \frac{n^2 a}{V^2}\right) (V - nb) = nRT$$

$$u = \sqrt{\frac{3RT}{M}}$$

$$\mathcal{M} = \frac{RT}{P} D$$

$$\ln\left(\frac{P_2}{P_1}\right) = \frac{\Delta H_{\text{V}}}{R} \left(\frac{1}{T_1} - \frac{1}{T_2}\right) \quad \log\left(\frac{P_2}{P_1}\right) = \frac{\Delta H_{\text{V}}}{2.303R} \left(\frac{1}{T_1} - \frac{1}{T_2}\right) \quad \ln(P) = \frac{-\Delta H_{\text{V}}}{R} \left(\frac{1}{T}\right) + C$$

$$P_{\text{A}} = X_{\text{A}} P_{\text{A}}^{\circ} \quad \Delta P = X_{\text{solute}} P_{\text{A}}^{\circ} \quad \Delta T = i K_{\text{f}} m \quad \Delta T = i K_{\text{b}} m \quad \Pi = i M R T$$

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

$$t_{\frac{1}{2}} = \frac{[A]_0}{2k} \quad t_{\frac{1}{2}} = \frac{0.693}{k} \quad t_{\frac{1}{2}} = \frac{1}{k[A]_0}$$

$$k = A e^{-E_a/RT} \quad \ln(k) = -\left(\frac{E_a}{R}\right) \left(\frac{1}{T}\right) + \ln(A)$$

$$\ln\left(\frac{k_2}{k_1}\right) = \frac{E_a}{R} \left(\frac{1}{T_1} - \frac{1}{T_2}\right) \quad \log\left(\frac{k_2}{k_1}\right) = \frac{E_a}{2.303R} \left(\frac{1}{T_1} - \frac{1}{T_2}\right)$$

	IA	IIA	IIIB	IVB	VB	VIB	VII B	VIII B			IB	II B	IIIA	IVA	VA	VIA	VIIA	VIIIA
1	1.008 H 1																	4.003 He 2
2	6.941 Li 3	9.012 Be 4											10.81 B 5	12.011 C 6	14.007 N 7	15.999 O 8	18.998 F 9	20.179 Ne 10
3	22.990 Na 11	24.305 Mg 12											26.98 Al 13	28.09 Si 14	30.974 P 15	32.06 S 16	35.453 Cl 17	39.948 Ar 18
4	39.098 K 19	40.08 Ca 20	44.96 Sc 21	47.88 Ti 22	50.94 V 23	52.00 Cr 24	54.94 Mn 25	55.85 Fe 26	58.93 Co 27	58.69 Ni 28	63.546 Cu 29	65.38 Zn 30	69.72 Ga 31	72.59 Ge 32	74.92 As 33	78.96 Se 34	79.904 Br 35	83.80 Kr 36
5	85.47 Rb 37	87.62 Sr 38	88.91 Y 39	91.22 Zr 40	92.91 Nb 41	95.94 Mo 42	98 Tc 43	101.07 Ru 44	102.91 Rh 45	106.42 Pd 46	107.87 Ag 47	112.41 Cd 48	114.82 In 49	118.69 Sn 50	121.75 Sb 51	127.60 Te 52	126.90 I 53	131.39 Xe 54
6	132.91 Cs 55	137.33 Ba 56	138.91 La 57	178.39 Hf 72	180.95 Ta 73	183.85 W 74	186.21 Re 75	190.23 Os 76	192.22 Ir 77	195.08 Pt 78	196.97 Au 79	200.59 Hg 80	204.38 Tl 81	207.2 Pb 82	208.98 Bi 83	209 Po 84	210 At 85	222 Rn 86
7	223 Fr 87	226.03 Ra 88	227.03 Ac 89	261 Rf 104	262 Ha 105	263 Sg 106	262 Ns 107	265 Hs 108	266 Mt 109	269 Uu 110	272 Uub 111	277 Uut 112						

Lanthanide Series	140.12 Ce 58	140.91 Pr 59	144.24 Nd 60	145 Pm 61	150.36 Sm 62	151.96 Eu 63	157.25 Gd 64	158.93 Tb 65	162.50 Dy 66	164.93 Ho 67	167.26 Er 68	168.93 Tm 69	173.04 Yb 70	173.04 Lu 71
Actinide Series	232.04 Th 90	231.04 Pa 91	238.03 U 92	237.05 Np 93	Pu 94	Am 95	Cm 96	Bk 97	Cf 98	Es 99	Fm 100	Md 101	No 102	Lr 103

A PERIODIC CHART OF THE ELEMENTS
(Based on ¹²C)