

**Formulas and Constants** (you may remove this page)

$$N_A = 6.022 \times 10^{23} \text{ mol}^{-1} \quad h = 6.626 \times 10^{-34} \text{ J s} \quad c = 2.998 \times 10^8 \text{ m s}^{-1}$$

$$e = 1.602 \times 10^{-19} \text{ C} \quad m_e = 9.109 \times 10^{-31} \text{ kg} \quad g = 9.81 \text{ m s}^{-2}$$

$$1 \text{ J} = 1 \text{ kg m}^2 \text{ s}^{-2} \quad 1 \text{ J} = 1 \text{ V C} \quad 1 \text{ \AA} = 1 \times 10^{-10} \text{ m}$$

$$1.00 \text{ atm} = 760 \text{ mm Hg} = 760 \text{ torr} = 101.325 \text{ kPa} = 1.01325 \text{ bar} \quad q = C \Delta T = m C_s \Delta T$$

$$\Delta E = q_v \quad \Delta H = \Delta E + P\Delta V = q_p \quad \Delta H_{\text{rxn}} = \sum m \Delta H_f(\text{products}) - \sum n \Delta H_f(\text{reactants})$$

$$E_K = \frac{1}{2} m v^2 \quad V = \frac{\kappa Q_1 Q_2}{d} \quad \kappa = 8.99 \times 10^9 \text{ J m C}^{-2} \quad E = h\nu = \frac{1}{2} m v^2 + E_b$$

$$p = mv \quad \Delta E = \frac{hc}{\lambda} \quad p = \frac{h}{\lambda} \quad \lambda = \frac{h}{mv} \quad \Delta x \Delta p \geq \frac{h}{4\pi} \quad \Delta x \Delta(mv) \geq \frac{h}{4\pi}$$

$$\frac{1}{\lambda} = R_H \left( \frac{1}{n_1^2} - \frac{1}{n_2^2} \right) \quad R_H = 1.097 \times 10^7 \text{ m}^{-1} \quad E = hcR_H \left( \frac{1}{n_1^2} - \frac{1}{n_2^2} \right) = 2.178 \times 10^{-18} \text{ J} \left( \frac{1}{n_1^2} - \frac{1}{n_2^2} \right)$$

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
IA	IIA	IIIB	IVB	VB	VIB	VIIIB	---	VIII	---	IB	IIB	IIIA	IVA	VA	VIA	VIIA	VIIIA
1A	2A	3B	4B	5B	6B	7B	---	8	---	1B	2B	3A	4A	5A	6A	7A	8A

1 <u>H</u> 1.008																	2 <u>He</u> 4.003
3 <u>Li</u> 6.941	4 <u>Be</u> 9.012											5 <u>B</u> 10.81	6 <u>C</u> 12.01	7 <u>N</u> 14.01	8 <u>O</u> 16.00	9 <u>F</u> 19.00	10 <u>Ne</u> 20.18
11 <u>Na</u> 22.99	12 <u>Mg</u> 24.31											13 <u>Al</u> 26.98	14 <u>Si</u> 28.09	15 <u>P</u> 30.97	16 <u>S</u> 32.07	17 <u>Cl</u> 35.45	18 <u>Ar</u> 39.95
19 <u>K</u> 39.10	20 <u>Ca</u> 40.08	21 <u>Sc</u> 44.96	22 <u>Ti</u> 47.88	23 <u>V</u> 50.94	24 <u>Cr</u> 52.00	25 <u>Mn</u> 54.94	26 <u>Fe</u> 55.85	27 <u>Co</u> 58.47	28 <u>Ni</u> 58.69	29 <u>Cu</u> 63.55	30 <u>Zn</u> 65.39	31 <u>Ga</u> 69.72	32 <u>Ge</u> 72.59	33 <u>As</u> 74.92	34 <u>Se</u> 78.96	35 <u>Br</u> 79.90	36 <u>Kr</u> 83.80
37 <u>Rb</u> 85.47	38 <u>Sr</u> 87.62	39 <u>Y</u> 88.91	40 <u>Zr</u> 91.22	41 <u>Nb</u> 92.91	42 <u>Mo</u> 95.94	43 <u>Tc</u> (98)	44 <u>Ru</u> 101.1	45 <u>Rh</u> 102.9	46 <u>Pd</u> 106.4	47 <u>Ag</u> 107.9	48 <u>Cd</u> 112.4	49 <u>In</u> 114.8	50 <u>Sn</u> 118.7	51 <u>Sb</u> 121.8	52 <u>Te</u> 127.6	53 <u>I</u> 126.9	54 <u>Xe</u> 131.3
55 <u>Cs</u> 132.9	56 <u>Ba</u> 137.3	57 <u>La*</u> 138.9	72 <u>Hf</u> 178.5	73 <u>Ta</u> 180.9	74 <u>W</u> 183.9	75 <u>Re</u> 186.2	76 <u>Os</u> 190.2	77 <u>Ir</u> 190.2	78 <u>Pt</u> 195.1	79 <u>Au</u> 197.0	80 <u>Hg</u> 200.5	81 <u>Tl</u> 204.4	82 <u>Pb</u> 207.2	83 <u>Bi</u> 209.0	84 <u>Po</u> (210)	85 <u>At</u> (210)	86 <u>Rn</u> (222)

Average Bond Enthalpies (Bond Dissociation Energies,  $D_0$ ) (kJ/mol)

C-H	413	N-H	391	O-H	463
C-C	348	N-N	163	O-O	146
C-N	293	N-O	201		
C=C	614	N=N	418	O <sub>2</sub>	495
C≡C	839	N≡N	941		
C=N	615	N=O	607		
C≡N	891				
C=O	799	C=O	1072		