You may remove these pages from your test.

Constants

1 atm = 101.325 kPa = 1.01325 bar = 14.696 psi $N_A = 6.022 \times 10^{23}\ mol^{-1}$ $e = 1.602 \times 10^{-19}$ C

1 eV = 1.602×10^{-19} J $\varepsilon_0 = 8.854 \times 10^{-12}\ \frac{F}{m}$ $R = 8.314\ \frac{J}{mol \cdot K} = 0.082067\ \frac{L \cdot atm}{mol \cdot K}$

$T_{(K)} = T_{(°C)} + 273.15$ $k = 8.62 \times 10^{-5}\ \frac{eV}{atom \cdot K}$ $k = 1.38 \times 10^{-23}\ \frac{J}{atom \cdot K}$ F = 96486 C·mol^{-1}

Microstructure

LD = $^{\#}/_{Length}$ $LPF = \frac{\text{length of atoms}}{\text{length of vector}}$ PD = $^{\#}/_{Area}$ $PPF = \frac{\text{area of atoms}}{\text{area of plane}}$ $V = \frac{4}{3}\pi r^3$

$A = \pi r^2$ $A_\Delta = \frac{1}{2}bh$ $\rho = \frac{n \cdot A}{V_C \cdot N_A}$ $\rho = \frac{m}{V}$ $\rho = \frac{n_A A_A + n_C A_C}{V_C N_A}$ $APF = \frac{V_S}{V_C}$

$N = \frac{N_A \rho}{A}$ $N_v = N \exp\left(-\frac{Q_v}{kT}\right)$ $a = 2\sqrt{2}R$ $a = \frac{4}{\sqrt{3}}R$

Mechanical Behaviour

$\sigma = \frac{F}{A}$ $\varepsilon = \frac{\Delta l}{l_o}$ $\sigma = E\varepsilon$ $\sigma_{3-point\ bend} = \frac{3FL}{2w \cdot h^2} x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Electrical Behaviour

$\sigma = n|e|\mu_e + h|e|\mu_h$ $\sigma = n|e|\mu_e$ $\sigma = h|e|\mu_h$

Thermodynamics

PV = nRT $\Delta U = q + w$ $\Delta U = q - P_{ext}\Delta V$ $H \equiv U + PV$ $G \equiv H - TS$ $\Delta S = \frac{q_{rev}}{T}$

For process at constant T: $\Delta G = \Delta H - T\Delta S$ $q = mc\Delta T = nC_p\Delta T$ $\Delta G = \Delta H - T\Delta S$

$W_{phase} = \frac{length\ of\ opposite\ side\ of\ lever}{total\ length\ of\ lever}$ For $aA + bB \rightarrow cC + dD$, $Q = \frac{a_C^c \cdot a_D^d}{a_A^a \cdot a_B^b}$

υ_i: stoichiometric coefficient Assuming no phase change, constant C_p:

$$\Delta H^\circ_{reaction} = (\Sigma \upsilon_i \Delta H^\circ_{f,i})_{products} - (\Sigma \upsilon_i \Delta H^\circ_{f,i})_{reactants}$$

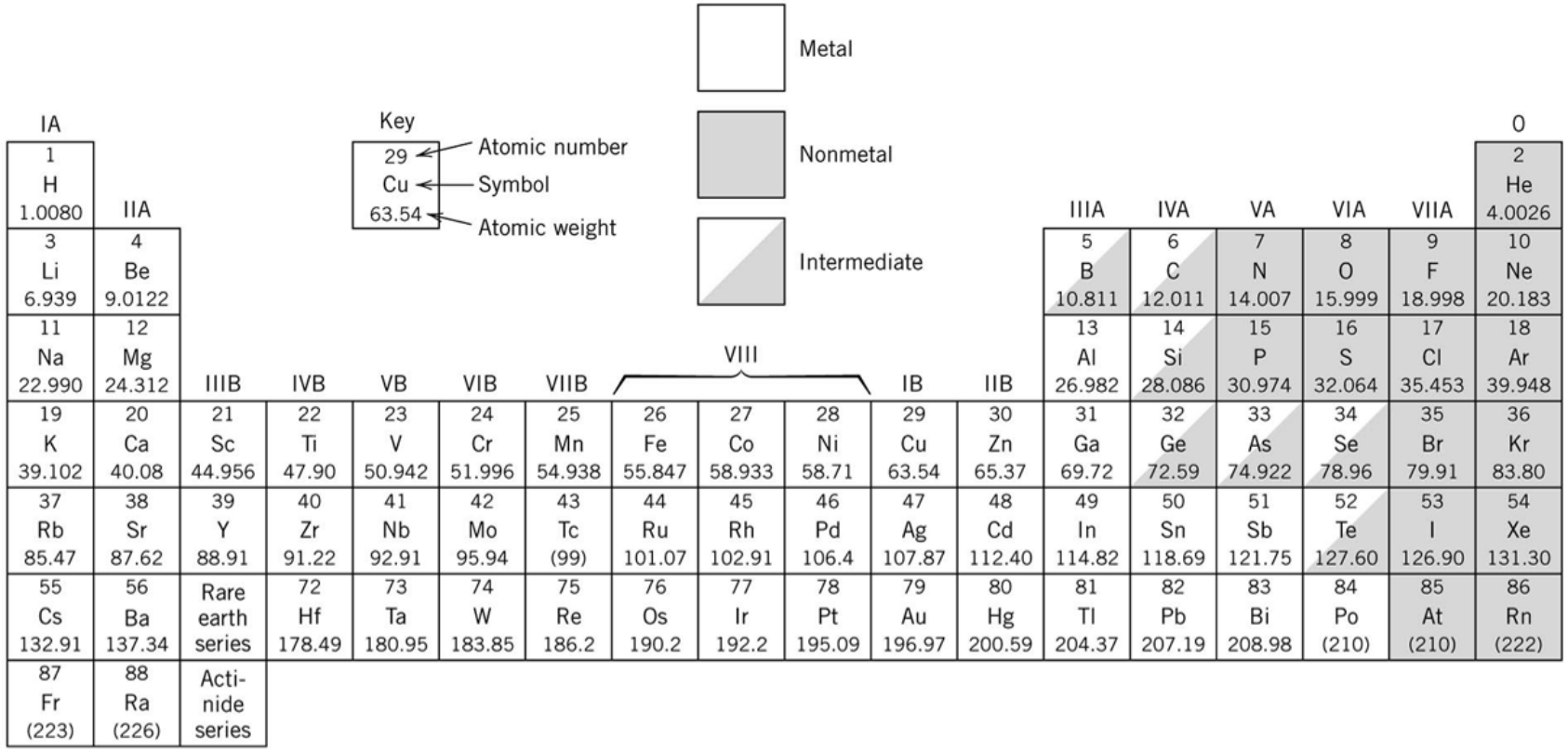
$$\Delta S^\circ_{reaction} = (\Sigma \upsilon_i \Delta S^\circ_{m,i})_{products} - (\Sigma \upsilon_i \Delta H^\circ_{m,i})_{reactants}$$

$\Delta G^\circ_{reaction} = \Delta H^\circ_{reaction} - T\Delta S^\circ_{reaction}$ $\Delta G_{reaction} = \Delta G^\circ + RTlnQ$

$$\Delta G^\circ = -RTlnK$$

Electrochemistry

$E = E^\circ - \frac{RT}{nF}lnQ$ $E = E^\circ - \frac{0.0592}{n}lnQ$, at 25°C $I = \frac{nC}{t}$ $w = nFE^\circ$



IA	IIA	IIIB	IVB	VB	VIB	VIIB	VIII			IB	IIB	IIIA	IVA	VA	VIA	VIIA	0
1 H 1.0080																	2 He 4.0026
3 Li 6.939	4 Be 9.0122											5 B 10.811	6 C 12.011	7 N 14.007	8 O 15.999	9 F 18.998	10 Ne 20.183
11 Na 22.990	12 Mg 24.312											13 Al 26.982	14 Si 28.086	15 P 30.974	16 S 32.064	17 Cl 35.453	18 Ar 39.948
19 K 39.102	20 Ca 40.08	21 Sc 44.956	22 Ti 47.90	23 V 50.942	24 Cr 51.996	25 Mn 54.938	26 Fe 55.847	27 Co 58.933	28 Ni 58.71	29 Cu 63.54	30 Zn 65.37	31 Ga 69.72	32 Ge 72.59	33 As 74.922	34 Se 78.96	35 Br 79.91	36 Kr 83.80
37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc (99)	44 Ru 101.07	45 Rh 102.91	46 Pd 106.4	47 Ag 107.87	48 Cd 112.40	49 In 114.82	50 Sn 118.69	51 Sb 121.75	52 Te 127.60	53 I 126.90	54 Xe 131.30
55 Cs 132.91	56 Ba 137.34	Rare earth series	72 Hf 178.49	73 Ta 180.95	74 W 183.85	75 Re 186.2	76 Os 190.2	77 Ir 192.2	78 Pt 195.09	79 Au 196.97	80 Hg 200.59	81 Tl 204.37	82 Pb 207.19	83 Bi 208.98	84 Po (210)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra (226)	Acti-nide series															

Rare earth series	57 La 138.91	58 Ce 140.12	59 Pr 140.91	60 Nd 144.24	61 Pm (145)	62 Sm 150.35	63 Eu 151.96	64 Gd 157.25	65 Tb 158.92	66 Dy 162.50	67 Ho 164.93	68 Er 167.26	69 Tm 168.93	70 Yb 173.04	71 Lu 174.97
Actinide series	89 Ac (227)	90 Th 232.04	91 Pa (231)	92 U 238.03	93 Np (237)	94 Pu (242)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (249)	99 Es (254)	100 Fm (253)	101 Md (256)	102 No (254)	103 Lw (257)

STANDARD FORMATION ENTHALPY, STANDARD ENTROPY AND STANDARD FORMATION GIBBS ENERGY AT 298.15 K

Species	$\Delta_f H°$ [kJ/mol]	$S°$ [J/mol·K]	$\Delta_f G°$ [kJ/mol]
C (s, graphite)	0	5.74	0
CH_4 (g)	-74.81	186.2	-50.75
C_2H_2 (g)	-83.9	200.93	
C_3H_8 (g)	-103.8	269.9	-23.49
CaC_2 (s)	-59.8	70.3	
CaF_2 (s)	-1225	68.87	-1162
CaF_2 (l)	-1186	92.6	
$Ca(OH)_2$ (s)	-987.0	83.0	
CO_2 (g)	-393.5	213.6	-394.4
Cu_2O (s)	-168.6	93.1	
Cu_2O (l)	-154.79		
Cu (s)		33.2	
Fe (s)	0	27.3	0
Fe_2O_3 (s)	-824.2	87.4	
H_2 (g)		130.68	
H_2O (g)	-241.8	188.7	-228.6
H_2O (l)	-285.8	69	
O_2 (g)	0	205.0	0

MISCELLANEOUS ENTHALPIES

Substance	Reaction	ΔH [kJ/mol]
F-F	Bond dissociation	157
F	Electron affinity $F(g) \rightarrow F^-(g)$	-328
Ca	Second Ionization energy $Ca(g) \rightarrow Ca^{2+}(g)$	1734

SPECIFIC HEATS AND HEAT CAPACITIES

Substance	Specific Heat c [J/g·K]	Molar Heat Capacity C_p [J/mol·K]
CO_2 (g)	0.843	37.1
Air (g)	1.0	
H_2O (g)	2.03	36.4
H_2O (l)	4.184	75.3
H_2O (s)	2.09	37.7

TEMPERATURES AND ENTHALPIES OF PHASE CHANGES

Substance	Melting Point [°C]	$\Delta_{fus}H°$ [kJ/mol]	Boiling Point [°C]	$\Delta_{vap}H°$ [kJ/mol]
Al	658	10.6	2467	284
Ca	851	9.33	1487	162
CH_4	-182	0.92	-164	8.18
H_2O	0	6.01	100	40.7
Fe	1530	14.9	2735	354