ELEMENTS		Atomic Number	gm/ mole	Air Water	Melt C	cal /gm	Boil	cal /gm	cal/ gm°C	watts /cm°C
Aluminum	Al	13	26.98	2.70W	659.7	93	2057	27	0.22	2.18
Antimony	Sb	51	121.8	6.69W	630.5	38	1380		0.05	0.19
Arsenic	As	33	74.9	5.73W	814		615		0.08	
Barium	Ba	56	137.4	3.6W	850		1140		0.07	
Bismuth	Bi	83	209	9.75W	271.3	12.5	1560		0.03	0.084
Boron	B	5	10.8	3.33W	2300		2550		0.31	
Bromine	Br	35	80	3.12W	-7.2	16.2	58.8		0.11	
Cadmium	Cd	48	112.4	8.64W	321	13.2			0.06	0.91
Calcium	Ca	20	40.1	1.55W	842		1240		0.15	
Carbon	C	6	12	1.7-4	3600		4200		0.17	0.24
Cesium	Cs	55	133	6.8W	640	3.8			0.05	
Chlorine	Cl	17	35.5	2.49A	-102	23	-34.6		0.23	
Chromium	Cr	24	52	7.1W	1890	75.6	2480		0.12	0.69
Cobalt	Co	27	58.9	8.9W	1495	58.4	2900		0.1	0.69
Copper	Cu	29	63.54	8.9W	1083	50.6	2336	1211	63	0.92
Fluorine	F	9	19	1.312A	-223		-187			
Gallium	Ga	31	69.7	5.91W	29.8	19.2	2403		0.08	
Germanium	Ge	32	72.6	5.36W	937.4		2830		0.07	
Gold	Au	79	197	19.3W	1063	15	2600	377	0.03	
Helium	He	2	4	.1664A	3.5K	1.25	4.2K	5		
Hydrogen	H	1	1.008	.0695A	13.4K	14	20.3K	108	3.41	
Iodine	I	53	126.9	4.93W	113.5	15.8	185		0.05	4.0E-03
Iron	Fe	26	55.85	7.86W	1535	65	3000		0.11	0.79
Lead	Pb	82	207.2	11.34	327.4	5.86	1620	208	0.03	0.35
Lithium	Li	3	6.94	.534W	186	159			0.79	0.79
Magnesium	Mg	12	24.32	1.74W	651	70	1107		0.25	1.55
Manganese	Mn	25	54.94	7.2W	1260	64.8	1900		0.11	
Mercury	Hg	80	200.6	13.6W	-38.9	2.82	357	630	0.03	0.084
Molybdenum	Mo	42	95.95	10.3W	2500	2.7			0.07	1.46
Neon	Ne	10	20.182	.8387A	-248		-245			4.0E-04
Nickel	Ni	28	58.71	8.90W	1455	73.8	2900		0.11	0.9
Nitrogen	N	7	14	.967A	63.2K	6.1	77.3K	48	0.25	
Oxygen	O	8	16	1.105A	54.4K	3.3	90K	51	0.22	
Phosphorus	P	15	30.97	2W	44.1	5	280		0.18	
Platinum	Pt	78	195.1	21.4W	1773	27.1	4300		0.03	0.69
Putonium	Pu	94	242		639		3235			
Potassium	K	19	39.1	.86W	62.23	14.5	760		0.18	0.99
Radium	Ra	88	226	5W	700		1140			
Silicon	Si	14	28.09	2.42W	1420		2355		0.18	0.84
Silver	Ag	47	107.88	10.5W	960	24.1	1950	558	0.06	4.08
Sodium	Na	11	23	.97W	97.5	27.5	880		0.3	1.35
Strontium	Sr	38	87.6	2.54W	800	25	1150			
Sulfur	S	16	32.06	2.0W	115	9.1	444	78	0.18	2.0E-03
Tantalum	Ta	73	180.9	2.0W	2800				0.04	0.036
Tin	Sn	50	118.69	7.28W	232	14.4	2270		0.05	0.64
Titanium	Ti	22	47.9	4.5W	1800		>3000		0.14	
Tungsten	W	74	183.85	19.3W	3370	44	5900		0.03	1.99
Uranium	U	92	238.06	18.7W	1132		3818		0.03	
Zinc	Zn	30	65.38	7.14	419		907			6.0E-05
Air				1A						0.004
Water				1W	0	79.7	100			0.002
Glass								539	1	0.002
Concrete										0.0015
Wood										

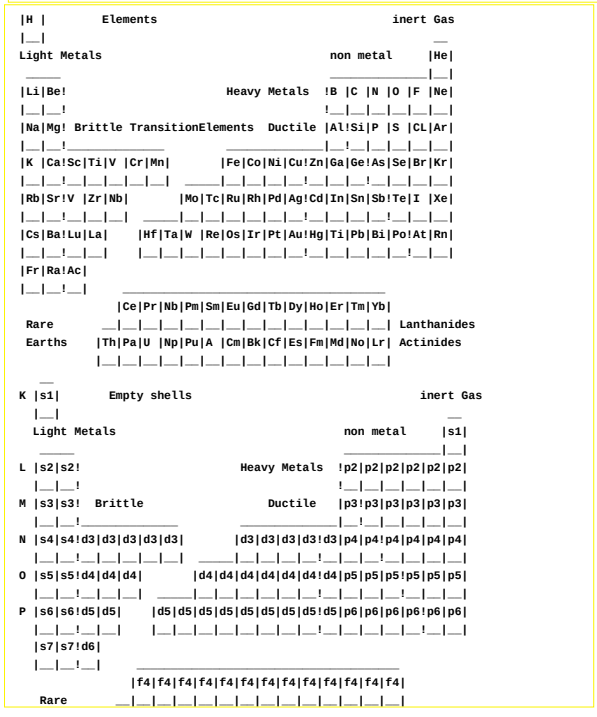
quilibrium Constant K

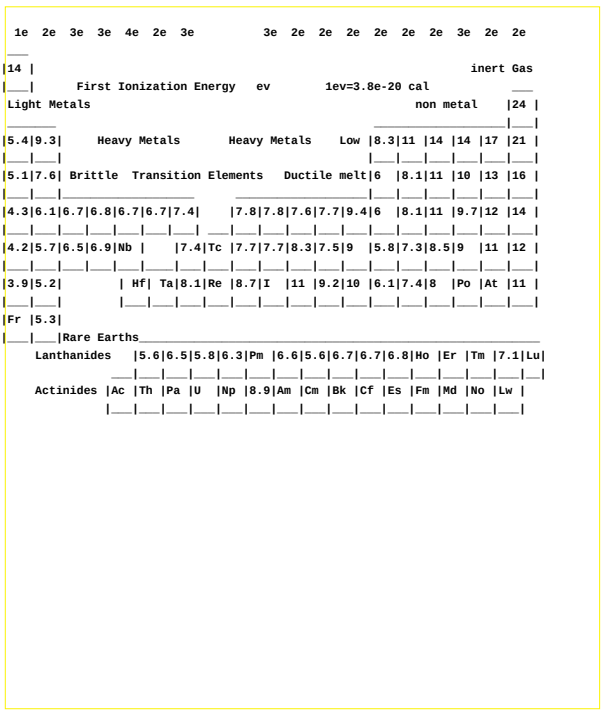
3A+B<=>2C+3D

C^2*D^3=K*A^3*B

ELEMENTS	Hardness	Δx/°C 1e^-6	Elastic Kg/mm²	Strengt Kg/mm^2	uΩ-cm	Temp Coeff	Reduce strong	Oxidize weak
Aluminum	2.9	22.9	7250	6.3	2.62	39		
Antimony	3	9	7900	1.05	39.2	0.0036	Li 3.0	Li+
Arsenic	3.5	4.7			35	0.0042	K 3.0	K+
Barium							Ca 2.9	Ca++
Beryllium	3		30000	12	4.57		Na 2.7	Na+
Bismuth	2.5	13.3	3200		115	0.004	Mg 2.4	Mg++
Boron	9.5	2			1.80E+12		H 2.1	H+
Bromine							Al 1.7	Al+++
Cadmium	2	29.8	5500	7.2	7.5	0.0038	S= .92	S
Calcium		25	2100	5.7			Zn .76	Zn++
Carbon	10	.6-4.3	500		1400	-0.0005	Cr .74	Cr+++
Cesium	0.2	97			20		Fe .44	Fe++
Chromium	9	6.2			2.6		Ni .25	Ni++
Cobalt	5	12.3	21000	24.4	9.7	0.0033	Sn .14	Sn++
Copper	3	16.5	11000	22.5	1.73	0.0039	Pb .13	Pb++
Gallium	1.5	18			53		H2 0	H3O+
Germanium	6.2				45		H2S	S
Gold	2.5	14.2	7300	11.5	2.44	0.0034	Cu -.34	Cu++
Iodine		93					I-	I2
Iridium	6.15	6.5	52500		5.3	0.0039	MnO4=	MnO4-
Iron	4	11.7	20000	20.5	9.71	0.006	Fe++	Fe+++
Lead	1.5	28.7	1800	1.33	21.9	0.004	Hg -.79	Hg+
Lithium	0.6	56			9.3	0.0005	Ag -.8	Ag+
Magnesium	2	25.2	4600	9.15	4.46	0.004	Hg	Hg++
Manganese	5	23	16000	39	5	..	NO2-	NO3-
Mercury	1.5				95.8	0.00089	Br	Br2
Molybdenum	6	4.9	3500	120	5.17		Mn++	MnO2
Nickel	5	13.3	21000	32.3	6.9	0.0047	SO2	H2SO4
Phosphorus		125					Cl- -1.3	Cl2
Platinum	4.3	8.9	15000	16	10.5	0.003	Cr+++	Cr2O7=
Putonium					150		Mn++	MnO4-
Potassium	0.5	83			7	0.006	F- -2.9	F2
Radium								
Selenium	2	37			1.2		weak	strong
Silicon	7	3->7	11000		8.50E+04		Reduce	Oxidize
Silver	2.7	18.9	72000	15.1	1.62			
Sodium	0.4	71			4.6		Oxidizing	
Strontium	1.8						Agent	
Sulfur	2	6.4					take up	
Tantalum	7	6.6	19000	50	13.1	0.003	electrons	
Tin	1.8	23	41100	1.4	11.4	0.0042		
Titanium	4	8.5	8500		47.8		Reducing	
Tungsten	7	4.3	35000	270	5.48	0.0045	Agent	
Uranium					29	0.0021	furnishes	
Zinc	2.5	17-39	8400	10.5	6	0.0037	electrons	

Brass(66 Cu 34 Zn)	3.9	0.002
Chromax(15 Cr 35 Ni 50 Fe)	100	0.00031
Constantan(55 Cu 45 Ni)	44.2	0.0002
German Silv(18 Ni)	33	0.0004
Kovar A(29 Ni 17 Co .3 Mn 46 Fe)	45-85	
Nichrome(65 Ni 12 Cr 23 Fe)	100	0.00017
Steel(.4 C)	13-22	0.003
Stainless(.1C 18 Cr 8 Ni)	90	





pH of Acids(pH<7)	COMMON Molarity	ACIDS pH			Atom Num	gm/ mole	Water/ Air Std.
Acetic	N	2.4					
Acetic	0.1N	2.9	Actinium	Ac	89	227	
Alum	0.1N	3.2	Americium	Am	95		
Ansnious	Saturated	5	Astatine	At	85		
Benzoic	0.1N	3	Berkelium	Bk	97		
Boric	0.1N	5.3	Californium	Cf	98		
Carbonic	Saturated	3.8	Cerium	Ce	58		
Citric	0.IN	2.1	Curium	Cm	96		
Formic	0.IN	2.3	Dysprosium	Dy	66	162	
Hydrochloric	N	0.1	Einsteinium	Es	99	254	
Hydrochloric	0.1N	1.1	Erbium	Er	68	167	
Hydrochloric	O.OIN	2	Europium	Eu	63	151	
Hydrocyanic	O.IN	5.1	Fermium	Fm	100	253	
Hydrogen Sulfide	0.1N	4.1	Francium	Fr	87	223	
Malic	0.1N	2.2	Gadolinium	Gd	64	157	
OrthoPhosphoric	0.1N	1.5	Hafnium	Hf	72	168	11.4
Succinic	0.1N	2.7	Holmium	Ho	67	164	
Salicylic	Saturated	2.4	Indium	In	49	114	7.3
Sulfuric	N	0.3	Lanthanum	Ir	57	139	6.15
Sulfuric	O.1N	1.2	Lutetium	La	71	175	
Sulfuric	O.01N	1.2	Mendelevium	Md	101	256	
Sulfurous	O.1N	1.5	Neodymium	Nd	60	144	
Taltaric	0.IN	2	Neptunium	Np	93	237	
Trichloracetic	0.1N	1.2	Niobium	Nb	41	92	8.57
			Osmium	Os	76	190	22.48
pH of Bases(pH>7)	COMMON Molarity	BASES pH	Palladium	Pd	46	106	12
Ammonia	N	11.6	Polonium	Po	84	210	
Ammonia	0.IN	11.1	Praseodymium	Pr	59	141	6.63
Barbital Soduim	8:09	10.6	Promethium	Pm	61	145	
Borax	O.01N	9.2	Protactinium	Pa	91	231	
CalciumCarbonate	Saturated	9.4	Rhenium	Re	75	186	20
CalciumCarbonate	Saturated	12.4	Rhodium	Rh	45	102	12.44
FerrousHydroxide	Saturated	9.5	Rubidium	Rb	37	85	1.53
Lime	Saturated	12.4	Ruthenium	Ru	44	101	12.2
Magnesia	Saturated	10.5	Samarium	Sm	62	150	7.7
Potassium Acetate	O.1N	9.7	Scandium	Sc	21	45	2.5
PotassiumBicarbonate	O.1N	8.2	Technetium	Tc	43	99	
PotassiumCarbonate	0.1	11.5	Tellurium	Te	52	127	6.24
Potassium Cyanide	0.IN	I1.O	Terbium	Tb	65	159	
PotassiumHydroxide	N	14	Thallium	Tl	81	204	11.85
PotassiumHydroxide	0.1N	13	Thorium	Th	90	232	11.5
PotassiumHydroxide	0.01N	12	Thulium	Tm	69	169	
Sodium Acetate	0.IN	8.9	Vanadium	V	23	51	5.68
Sodium Benzoate	0.IN	8	Xenon	Xe	54	131	5.49A
Sodium Bicarbonate	0.IN	8.4	Ytterbium	Yb	70	173	5.51
Sodium Carbonate	0.1N	11.6	Yttrium	Y	39	89	7.14
Sodium Hydroxide	N	14	Zirconium	Zr	40	91	6.4
Sodium Hydroxide	O.IN	13					
Sodium Hydroxide	O.OIN	12					
Sodium Metasilicate	o.IN	12.6					
Sodium Sesquicarbonat	0.1N	10.1					
Trisodium Phosphate	O.IN	12					

INSULATION VALUE OF MATERIALS

Insulation	Thickness		R
Polystyrene	1	0.28	3.57
Air Space, nonreflective	3/4	1.00	1.01
Air Space, reflective	3/4		3.48

FIREWOOD_FUEL_COMPARISONS

Fuel Type	Million BTU /Unit (1)	Available Units /million BTU(2)	Comment
#2 Fuel Oil	0.135/gallon	11.5	65% efficient
Charcoal	0.013/pound	128	60% efficient
Coal			60% efficient
Anthracite	15.2/ton	0.07	
Bituminous	22.0/ton	0.08	Low Volatile
BRuminous	28.6/ton	0.06	High Volatile
Lignite	13.8/ton	0.12	
Electricity	0.003/KWH	293	1OO% efficient
Kerosene	0.135/gallon	11.5	65% efficient
Natutal Gas	700/MCF	1.43	70% efficient
Propane	0.09/gallon	15.7	70% efficient
Wood			50% to 60% efficient
Apple	30/cord	0.047	L-smoke, L-spark
Aspen	18/cord	0.077	M-smoke, H-spark
Cottonwood	17/cord	0.082	M-smoke, L-spark
Elm, Red	28/cord	0.048	M-smoke, M-spark
Fir,Douglas	24/cord	0.058	H-smoke, M-spark
hickory	27/cord	0.052	L-smoke, L-rpark
Juniper	15/cord	0.083	M-smoke, M-spark
Maple,Silver	20/cord	0.070	L-smoke, L-spark
Oak, Red	30/cord	0.047	L-smoke, L-spark
Oak, White	32/cord	0.044	L-smoke, L-spark
Lodgepole	21/cord	0.066	M-smoke. M-spatk
Pine,Pinon	27/cord	0.052	M-smoke, M-spark
Ponderosa	20/cord	0.070	M-smoke, M-spark
Spruce	18/cord	0.077	M-smoke, H-spark

INSULATION VALUE OF MATERIALS

Insulation Material	Thickness (inches)	k	C	R Value
Ground surface			2.00	0.50
Concrete	1	12.00		0.08
Plaster	1	8.00		0.12
Face Brick	1	9.00		0.11
Brick-Low density	1	5.00		0.20
Hollow Concrete Block	8		0.90	1.11
Hollow Tile . .	4		1.00	1.00
Stucco.	1	5.00.		0.20
Metal Lath & Plaster	3/4		7.70	0.13
Rockcork .	1	0.328		3.05
Celotex	1	0.330		3.03
Corkeoard	1	0.30		3.33
Gypsum Board	1/2		2.20	0.45
Plywood .	1/2		1.60	0.82
Most sottwoods	1		0.80	1.25
Most hardwoods	1		1.10	0.91
Sawdust	1	0.410		2.44
Redwood	1	0.570		1.75
Asphalt Shingles			2.27	0.44
Built-up Roofing	3/8		3.00	0.33
Wood Shingles				
Structural Insulation Bd	1/2		0.76	1.32
Glass wool	1	0.266		3.76
Mineral Wool Bat	3-4		0.09	11.OO
Mineral Wool Bat	5-6		0.05	19.00
Mineral Wool Bat	6-7		0.05	22.00
Mineral Wool Bat	8-9		0.03	30.00
Sheep'swool	1	0.338		2.96
Balsam wool	1	0.27		3.70

SeaWater ppm	
CL	18980
Na	10561
Mg	1272
S	884
Ca	400
K	380
Au	6E-06

'k' is heat conductivity over a thickness of 1 inch and 'C' is heat conductance over the specified thickness. 'R Value' is the most common number used to compare the insulating properties of various material and is typically marked on the wrapper of container or the insulator. The 'R Value' is effectively the materials resistance to heatflow and is based on the 'k' and 'C' values. 'R Values' based on 'k' assume a thickness of 1 inch and R Values' based on 'C' are based on the thicknest indicated above. Values listed above are from the NatioM(Bureau of Slarr dards andf.

'L-' is Low,'M-' is Medium, and 'H-' is nigh

In order to calculate the actual cost of heat for each type, simply multiply the 'Available Unit/million BTU' by the current cost per unit. For example, if natural gas is currently $4 per MCF, the cost of 1 million BTU is $4 x 1.43 = $5.72. In the case of White Oak. the cost of 1 million BTU is $150/cord x 0.072 = $10.80. Note that the wood efficiency can vary greatly, depending on moisture and efficiency of the furnace you are using.

(1) Million BTU/Unit defines the average amount of heat per unit that is available for that fuel type, assuming 100%6 burning efficiency. For example, Aspen wood contains 18.000,000 BTU per dry cord.

(2) Available Units/million BTU defines the actual number of units required to produce 1,000,000 BTU. The efficiency of burning (shown in the Comment column) is considered, as well as the moisture content of woods (average 20% moisture for dry wood).

Tempering

Step 1:To harden the tool, heat tool end to bright red, quench tool end in cold water until cool to touch, then sharpen or polish tool end. At this the tool has been hardened but it is now brittle.

Step2:To temper the tool heat the tool to the temperature indicated by its color in the above table, then quench the tool in water.

TEMPERING COLOR FOR STEEL

Heated Color		Temper item or Comment
Carbon STEEL		
Faint yellow	420	Knives, hammers
Very pale yellow	430	Reamers
Light yellow	440	Lathe tools, scrapers, milling cutters, reamers
Pale straw-yellow	450	Twist drills for hard use
Straw-yellow	460	Dies, punches, bits, reamen
Deep straw-yellow	470	
Dark yellow	480	Twist drills, large taps
	485	Knurls
yellow-brown	490	
Brown-yellow	500	Axes, wood chisels, drifts
Spotted red-brown	510	
Brown-purple	520	Taps 1/4 inch and under
Light purple	530	
Full purple	540	Cold chisels, center puncher
Dark purple	550	
Full blue	560	Screwdrivers, springs, gears
Dark blue	570	
Medium blue	600	Scrapers, spokeshaves
Light blue	640	
Red-visible at night	750	
Red-visible at twilight	885	
Red-visible in daylight	975	
Red-visible in sunlight	1075	
Dark red	1290	
Dull cherry red	1475	
Cherry red	1650	
Bright cherry red	1830	
Orange-red	2010	
Orange-yellow	2190	
yellow-white	2370	
White	2550	
Brilliant while	2730	
Blue-white	2900	
Acetylenene	4080	
Induction furnace	5450	
Electric arc light	7200	