KAAVALIITE/FORMELBILAGA

$N_A = 6{,}022\,140\,76 \cdot 10^{23}\,1/\text{mol}$
$G = 6{,}674\,30 \cdot 10^{-11}\,\text{Nm}^2/\text{kg}^2$
$e = 1{,}602\,176\,634 \cdot 10^{-19}\,\text{C}$
$F = 96\,485\,\text{C/mol}$
$V_m = 24{,}055\,\text{dm}^3/\text{mol}$ (NTP)
$g = 9{,}81\,\text{m/s}^2$
$h = 6{,}626\,070\,150 \cdot 10^{-34}\,\text{Js}$
$\quad = 4{,}135\,667\,70 \cdot 10^{-15}\,\text{eVs}$
$\sigma = 5{,}670\,374 \cdot 10^{-8}\,\text{W}/(\text{m}^2 \cdot \text{K}^4)$
$\varepsilon_0 = 8{,}854 \cdot 10^{-12}\,\text{F/m}$
$\mu_0 \approx 4\pi \cdot 10^{-7}\,\text{Vs}/(\text{Am}) \approx 1{,}257 \cdot 10^{-6}\,\text{Vs}/(\text{Am})$
$c = 299\,792\,458\,\text{m/s}$
$c_a = 343\,\text{m/s}$
$R_\text{H} = 1{,}096\,8 \cdot 10^{-7}\,\text{m}^{-1}$
$c(\text{H}_2\text{O}) = 4{,}19\,\text{kJ}/(\text{kg} \cdot \text{K})$
$K_w = 1{,}008 \cdot 10^{-14}\,(\text{mol/l})^2$
$R = 8{,}314\,5\,\text{J}/(\text{mol} \cdot \text{K})$
$0\,℃ = 273{,}15\,\text{K}$
$1\,\text{atm} = 101\,325\,\text{Pa}$
$1\,\text{eV} \approx 1{,}602 \cdot 10^{-19}\,\text{J}$
$1\,\text{kWh} = 3{,}6\,\text{MJ}$
$e \approx 2{,}718\,28$
$\ln 2 \approx 0{,}693$
$\pi \approx 3{,}1416$
$360° = 2\pi\,\text{rad}$

protoni/proton:	$m_p = 1{,}672\,621\,7 \cdot 10^{-27}\,\text{kg}$
neutroni/neutron:	$m_n = 1{,}674\,927\,3 \cdot 10^{-27}\,\text{kg}$
elektroni/elektron:	$m_e = 9{,}109\,382\,6 \cdot 10^{-31}\,\text{kg}$
	$u = 1{,}660\,538\,9 \cdot 10^{-27}\,\text{kg}$
	$m_p = 1{,}007\,276\,5\,\text{u}$
	$m_n = 1{,}008\,664\,9\,\text{u}$
	$m_e = 5{,}485\,799\,0 \cdot 10^{-4}\,\text{u}$

$$p = \rho g h$$
$$A = 4\pi r^2; \quad V = \frac{4}{3}\pi r^3$$
$$ax^2 + bx + c = 0 \Rightarrow x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$
$$W = \overline{F} \cdot \overline{s}$$
$$E_p = mgh; \quad E_k = \frac{1}{2}mv^2$$
$$s = v_0 t + \frac{1}{2}at^2$$
$$v = v_0 + at$$
$$T = \frac{2\pi}{\omega};\ f_n = \frac{n}{t} = \frac{1}{T}$$
$$\varphi = \varphi_0 + \omega_0 t + \frac{1}{2}\alpha t^2$$
$$\omega = \omega_0 + \alpha t$$
$$a = \frac{v^2}{r}$$
$$F = G\frac{m_1 m_2}{r^2},\ E_p = -\frac{G m_1 m_2}{r}$$
$$y(x,t) = y_\text{max} \sin(\omega t - kx)$$
$$p(x,t) = p_\text{max} \cos(\omega t - kx)$$
$$\overline{M} = \overline{r} \times \overline{F}$$
$$\overline{p} = m\overline{v}$$
$$P = W/t$$
$$\eta = \frac{W_o}{W_i} = \frac{W_o/t}{W_i/t} = \frac{P_o}{P_i}$$
$$\frac{\sin\alpha_1}{\sin\alpha_2} = \frac{\lambda_1}{\lambda_2} = \frac{c_1}{c_2} = \frac{n_2}{n_1} = n_{12}$$
$$F = -kx; \quad \frac{F}{A} = E\frac{\Delta\ell}{\ell}$$
$$p = \frac{F}{A} = \frac{Fs}{As} = \frac{W}{V}$$
$$L = 10\lg\left(\frac{I}{I_0}\right)\,\text{dB}$$
$$f = f_0\frac{v}{v \pm v_l}; f = f_0\frac{v \pm v_h}{v}$$
$$\mu_\text{max} = 1 - \frac{T_2}{T_1}$$
$$\ell = \ell_0(1 + \alpha\Delta T); V = V_0(1 + \gamma\Delta T)$$
$$\Delta Q = c_p m \Delta T$$
$$Q = sm; Q = rm$$
$$U = RI,\ P = UI$$
$$\frac{U_1}{U_2} = \frac{N_1}{N_2} = \frac{I_2}{I_1}$$
$$M = NABI\sin\alpha$$
$$e = NAB\omega\sin(\omega t)$$
$$F = QE;\ E = U/d$$
$$\overline{F} = q(\overline{v} \times \overline{B}); F = qvB\sin\alpha$$
$$F = \frac{Q_1 Q_2}{4\pi\varepsilon_0 r^2}$$
$$F_m = I\ell B\sin\alpha$$
$$\Phi = AB\cos\alpha$$
$$E_\text{pot} = qU$$
$$C = q/U$$
$$V(x_0) = E_0/q$$
$$B = \frac{\mu_0 I}{2\pi r}$$
$$\lambda = \frac{h}{p} = \frac{h}{mv}$$
$$E = hf = \frac{hc}{\lambda}; E(\,\text{eV}) = 1240/\lambda(\,\text{nm})$$
$$\frac{1}{\lambda} = R_\text{H}\left(\frac{1}{n^2} - \frac{1}{m^2}\right)$$
$$d\sin(\theta) = n\lambda$$
$$T_{½} = \frac{\ln(2)}{\lambda}$$
$$A = \lambda N = \lambda N_0 e^{-\lambda t} = A_0 e^{-\lambda t}$$
$$A = A_1 e^{-\lambda_1 t} + A_2 e^{-\lambda_2 t}$$
$$I = I_0 e^{-\mu x}$$
$$E_B = [Zm_p + Nm_n - m_A + Zm_e]c^2$$
$$\Delta V = -\frac{RT}{\mathsf{ZF}}\ln\frac{c^s}{c^u}$$
$$J = -D\left(\frac{dc}{dx} + Zc\frac{F}{RT}\frac{dV}{dx}\right)$$
$$\frac{c^s_\text{K}}{c^u_\text{K}} = \frac{c^u_\text{Cl}}{c^s_\text{Cl}}; (c^u_\text{Cl} + |Z_p|c^u_p)c^0_\text{Cl} = c^s_\text{K}c^s_\text{Cl}$$

$$I = C\frac{dE}{dt} + g_{\mathrm{Na}}(E - E_{\mathrm{Na}}) + g_{\mathrm{K}}(E - E_{\mathrm{K}}) + g_{\ell}(E - E_{\ell})$$

$$R = \frac{\Delta p}{q_v} = \frac{8\eta L}{\pi r^4}; \quad Re = \frac{\rho v R}{\eta}$$

$$v' = \frac{2}{9}\frac{(\rho - \rho_0)gr^2}{\eta}$$

$$\mathrm{PRU} = \frac{\Delta p\,(\mathrm{mmHg})}{q_v\,(\mathrm{ml/s})}$$

$$\mathrm{PVR} = \frac{80(\mathrm{PA}_m - \mathrm{LA}_m)}{V_p}; \ \mathrm{SVR} = \frac{80(\mathrm{AO}_m - \mathrm{RA}_m)}{V_p}$$

$$It = nzF$$

$$pV = nRT$$

$$K_a = \frac{[\mathrm{A}^-][\mathrm{H_3O}^+]}{[\mathrm{HA}]}$$

$$\mathrm{pH} = \mathrm{pK}_a + \lg\frac{[\mathrm{A}^-]}{[\mathrm{HA}]}$$

Alkuaineiden jaksollinen järjestelmä / Periodiska systemet

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
H **[1]** 1,008																	**He** **[2]** 4,003
Li **[3]** 6,941	**Be** **[4]** 9,012											**B** **[5]** 10,81	**C** **[6]** 12,01	**N** **[7]** 14,01	**O** **[8]** 16,00	**F** **[9]** 19,00	**Ne** **[10]** 20,18
Na **[11]** 22,99	**Mg** **[12]** 24,31											**Al** **[13]** 26,98	**Si** **[14]** 28,09	**P** **[15]** 30,97	**S** **[16]** 32,07	**Cl** **[17]** 35,45	**Ar** **[18]** 39,95
K **[19]** 39,10	**Ca** **[20]** 40,08	**Sc** **[21]** 44,96	**Ti** **[22]** 47,87	**V** **[23]** 50,94	**Cr** **[24]** 52,00	**Mn** **[25]** 54,94	**Fe** **[26]** 55,85	**Co** **[27]** 58,93	**Ni** **[28]** 58,69	**Cu** **[29]** 63,55	**Zn** **[30]** 65,38	**Ga** **[31]** 69,72	**Ge** **[32]** 72,63	**As** **[33]** 74,92	**Se** **[34]** 78,96	**Br** **[35]** 79,90	**Kr** **[36]** 83,80
Rb **[37]** 85,47	**Sr** **[38]** 87,62	**Y** **[39]** 88,91	**Zr** **[40]** 91,22	**Nb** **[41]** 92,91	**Mo** **[42]** 95,96	**Tc** **[43]** (98)	**Ru** **[44]** 101,07	**Rh** **[45]** 102,91	**Pd** **[46]** 106,42	**Ag** **[47]** 107,87	**Cd** **[48]** 112,41	**In** **[49]** 114,82	**Sn** **[50]** 118,71	**Sb** **[51]** 121,76	**Te** **[52]** 127,60	**I** **[53]** 126,90	**Xe** **[54]** 131,29
Cs **[55]** 132,91	**Ba** **[56]** 137,32	57-71	**Hf** **[72]** 178,49	**Ta** **[73]** 180,95	**W** **[74]** 183,84	**Re** **[75]** 186,21	**Os** **[76]** 190,23	**Ir** **[77]** 192,22	**Pt** **[78]** 195,08	**Au** **[79]** 196,97	**Hg** **[80]** 200,59	**Tl** **[81]** 204,38	**Pb** **[82]** 207,2	**Bi** **[83]** 208,98	**Po** **[84]** (209)	**At** **[85]** (210)	**Rn** **[86]** (222)
Fr **[87]** (223)	**Ra** **[88]** (226)	89-103	**Rf** **[104]** (261)	**Db** **[105]** (262)	**Sg** **[106]** (266)	**Bh** **[107]** (264)	**Hs** **[108]** (277)	**Mt** **[109]** (268)	**Ds** **[110]** (281)	**Rg** **[111]** (272)	**Cn** **[112]** (285)	**Nh** **[113]** (286)	**Fl** **[114]** (289)	**Mc** **[115]** (288)	**Lv** **[116]** (293)	**Ts** **[117]** (294)	**Og** **[118]** (294)

Lantanoidit Lantanoider	**La** **[57]** 138,91	**Ce** **[58]** 140,12	**Pr** **[59]** 140,91	**Nd** **[60]** 144,24	**Pm** **[61]** (145)	**Sm** **[62]** 150,36	**Eu** **[63]** 151,96	**Gd** **[64]** 157,25	**Tb** **[65]** 158,93	**Dy** **[66]** 162,50	**Ho** **[67]** 164,93	**Er** **[68]** 167,26	**Tm** **[69]** 168,93	**Yb** **[70]** 173,05	**Lu** **[71]** 174,97
Aktinoidit Aktinoider	**Ac** **[89]** (227)	**Th** **[90]** 232,04	**Pa** **[91]** 231,04	**U** **[92]** 238,03	**Np** **[93]** (237)	**Pu** **[94]** (244)	**Am** **[95]** (243)	**Cm** **[96]** (247)	**Bk** **[97]** (247)	**Cf** **[98]** (251)	**Es** **[99]** (252)	**Fm** **[100]** (257)	**Md** **[101]** (258)	**No** **[102]** (259)	**Lr** **[103]** (262)

$\sin(x)$

°	sin()	°	sin()	°	sin()	°	sin()	°	sin()
0,0	0,000								
0,5	0,009	20,5	0,350	40,5	0,649	60,5	0,870	80,5	0,986
1,0	0,017	21,0	0,358	41,0	0,656	61,0	0,875	81,0	0,988
1,5	0,026	21,5	0,367	41,5	0,663	61,5	0,879	81,5	0,989
2,0	0,035	22,0	0,375	42,0	0,669	62,0	0,883	82,0	0,990
2,5	0,044	22,5	0,383	42,5	0,676	62,5	0,887	82,5	0,991
3,0	0,052	23,0	0,391	43,0	0,682	63,0	0,891	83,0	0,993
3,5	0,061	23,5	0,399	43,5	0,688	63,5	0,895	83,5	0,994
4,0	0,070	24,0	0,407	44,0	0,695	64,0	0,899	84,0	0,995
4,5	0,078	24,5	0,415	44,5	0,701	64,5	0,903	84,5	0,995
5,0	0,087	25,0	0,423	45,0	0,707	65,0	0,906	85,0	0,996
5,5	0,096	25,5	0,431	45,5	0,713	65,5	0,910	85,5	0,997
6,0	0,105	26,0	0,438	46,0	0,719	66,0	0,914	86,0	0,998
6,5	0,113	26,5	0,446	46,5	0,725	66,5	0,917	86,5	0,998
7,0	0,122	27,0	0,454	47,0	0,731	67,0	0,921	87,0	0,999
7,5	0,131	27,5	0,462	47,5	0,737	67,5	0,924	87,5	0,999
8,0	0,139	28,0	0,469	48,0	0,743	68,0	0,927	88,0	0,999
8,5	0,148	28,5	0,477	48,5	0,749	68,5	0,930	88,5	1,000
9,0	0,156	29,0	0,485	49,0	0,755	69,0	0,934	89,0	1,000
9,5	0,165	29,5	0,492	49,5	0,760	69,5	0,937	89,5	1,000
10,0	0,174	30,0	0,500	50,0	0,766	70,0	0,940	90,0	1,000
10,5	0,182	30,5	0,508	50,5	0,772	70,5	0,943		
11,0	0,191	31,0	0,515	51,0	0,777	71,0	0,946		
11,5	0,199	31,5	0,522	51,5	0,783	71,5	0,948		
12,0	0,208	32,0	0,530	52,0	0,788	72,0	0,951		
12,5	0,216	32,5	0,537	52,5	0,793	72,5	0,954		
13,0	0,225	33,0	0,545	53,0	0,799	73,0	0,956		
13,5	0,233	33,5	0,552	53,5	0,804	73,5	0,959		
14,0	0,242	34,0	0,559	54,0	0,809	74,0	0,961		
14,5	0,250	34,5	0,566	54,5	0,814	74,5	0,964		
15,0	0,259	35,0	0,574	55,0	0,819	75,0	0,966		
15,5	0,267	35,5	0,581	55,5	0,824	75,5	0,968		
16,0	0,276	36,0	0,588	56,0	0,829	76,0	0,970		
16,5	0,284	36,5	0,595	56,5	0,834	76,5	0,972		
17,0	0,292	37,0	0,602	57,0	0,839	77,0	0,974		
17,5	0,301	37,5	0,609	57,5	0,843	77,5	0,976		
18,0	0,309	38,0	0,616	58,0	0,848	78,0	0,978		
18,5	0,317	38,5	0,623	58,5	0,853	78,5	0,980		
19,0	0,326	39,0	0,629	59,0	0,857	79,0	0,982		
19,5	0,334	39,5	0,636	59,5	0,862	79,5	0,983		
20,0	0,342	40,0	0,643	60,0	0,866	80,0	0,985		

$\cos x = \sin(90° - x), \quad 0 \leq x \leq 90°$

$\cos^2 x + \sin^2 x = 1$

ln(x)

x	ln x	x	ln x	x	ln x
0,50	-0,693	1,30	0,262	2,10	0,742
0,52	-0,654	1,32	0,278	2,12	0,751
0,54	-0,616	1,34	0,293	2,14	0,761
0,56	-0,580	1,36	0,307	2,16	0,770
0,58	-0,545	1,38	0,322	2,18	0,779
0,60	-0,511	1,40	0,336	2,20	0,788
0,62	-0,478	1,42	0,351	2,22	0,798
0,64	-0,446	1,44	0,365	2,24	0,806
0,66	-0,416	1,46	0,378	2,26	0,815
0,68	-0,386	1,48	0,392	2,28	0,824
0,70	-0,357	1,50	0,405	2,30	0,833
0,72	-0,329	1,52	0,419	2,32	0,842
0,74	-0,301	1,54	0,432	2,34	0,850
0,76	-0,274	1,56	0,445	2,36	0,859
0,78	-0,248	1,58	0,457	2,38	0,867
0,80	-0,223	1,60	0,470	2,40	0,875
0,82	-0,198	1,62	0,482	2,42	0,884
0,84	-0,174	1,64	0,495	2,44	0,892
0,86	-0,151	1,66	0,507	2,46	0,900
0,88	-0,128	1,68	0,519	2,48	0,908
0,90	-0,105	1,70	0,531	2,50	0,916
0,92	-0,083	1,72	0,542	2,52	0,924
0,94	-0,062	1,74	0,554	2,54	0,932
0,96	-0,041	1,76	0,565	2,56	0,940
0,98	-0,020	1,78	0,577	2,58	0,948
1,00	0,000	1,80	0,588	2,60	0,956
1,02	0,020	1,82	0,599	2,62	0,963
1,04	0,039	1,84	0,610	2,64	0,971
1,06	0,058	1,86	0,621	2,66	0,978
1,08	0,077	1,88	0,631	2,68	0,986
1,10	0,095	1,90	0,642	2,70	0,993
1,12	0,113	1,92	0,652	2,72	1,001
1,14	0,131	1,94	0,663		
1,16	0,148	1,96	0,673		
1,18	0,166	1,98	0,683		
1,20	0,182	2,00	0,693		
1,22	0,199	2,02	0,703		
1,24	0,215	2,04	0,713		
1,26	0,231	2,06	0,723		
1,28	0,247	2,08	0,732		

$$\ln x = \log_e x$$

$$\log xy = \log x + \log y$$

$$\log \frac{x}{y} = \log\ x - \log \mathrm{y}$$

$$\log_a x = \frac{\log_{\mathrm{b}} x}{\log_{\mathrm{b}} a}$$