



KAAVALIITE / FORMELBILAGA

Vakioita / Konstanter

$$N_A = 6,022\,140\,76 \cdot 10^{23} \text{ 1/mol}$$

$$G = 6,674 \cdot 10^{-11} \text{ Nm}^2/\text{kg}^2$$

$$e = 1,602\,176\,634 \cdot 10^{-19} \text{ C}$$

$$F = 96\,485 \text{ C/mol}$$

$$g = 9,81 \text{ m/s}^2$$

$$h = 6,626\,070\,15 \cdot 10^{-34} \text{ J} \cdot \text{s}$$

$$h = 4,135\,7 \cdot 10^{-15} \text{ eV} \cdot \text{s}$$

$$\sigma = 5,670 \cdot 10^{-8} \text{ W}/(\text{m}^2 \cdot \text{K}^4)$$

$$b = 2,897\,771\,955 \cdot 10^{-3} \text{ m} \cdot \text{K}$$

$$\epsilon_0 = 8,85 \cdot 10^{-12} \text{ F/m}$$

$$\mu_0 \approx 4\pi \cdot 10^{-7} \text{ Vs}/(\text{Am}) \approx 1,257 \cdot 10^{-6} \text{ Vs}/(\text{Am})$$

$$c = 299\,792\,458 \text{ m/s}$$

$$c_a = 343 \text{ m/s}$$

$$R_H = 1,096\,8 \cdot 10^7 \text{ m}^{-1}$$

$$c(\text{H}_2\text{O}) = 4,19 \text{ kJ}/(\text{kg} \cdot \text{K})$$

$$K_w = 1,008 \cdot 10^{-14} (\text{mol/l})^2$$

$$I_0 = 10^{-12} \text{ W/m}^2$$

$$R = 8,314\,46 (\text{Pa} \cdot \text{m}^3) / (\text{mol} \cdot \text{K})$$

$$= 0,083\,1446 (\text{bar} \cdot \text{dm}^3) / (\text{mol} \cdot \text{K})$$

$$e \approx 2,718\,28$$

$$\pi \approx 3,1416$$

$$\text{protoni/proton: } m_p = 1,672\,621\,6 \cdot 10^{-27} \text{ kg} \\ = 1,007\,276\,5 \text{ u}$$

$$\text{neutroni/neutron: } m_n = 1,674\,927\,3 \cdot 10^{-27} \text{ kg} \\ = 1,008\,665\,0 \text{ u}$$

$$\text{elektroni/elektron: } m_e = 9,109\,382\,2 \cdot 10^{-31} \text{ kg} \\ = 5,485\,799\,1 \cdot 10^{-4} \text{ u}$$

$$u = 931,49 \text{ MeV}/c^2$$

$$= 1,660\,538\,9 \cdot 10^{-27} \text{ kg}$$

Kaavoja ja muuntokertoimia / Formler och omvandlingsfaktorer

$$0 \text{ }^\circ\text{C} = 273,15 \text{ K}$$

$$1 \text{ atm} = 101\,325 \text{ Pa}$$

$$1 \text{ eV} \approx 1,602 \cdot 10^{-19} \text{ J}$$

$$1 \text{ kWh} = 3,6 \text{ MJ}$$

$$360^\circ = 2\pi \text{ rad}$$

$$\ln 2 \approx 0,693$$

$$A = 4\pi r^2; V = \frac{4}{3}\pi r^3$$

$$ax^2 + bx + c = 0 \Rightarrow x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$\cos x = \sin(90^\circ - x), 0 \leq x \leq 90^\circ$$

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

Kemia / Kemi

$$It = nzF$$

$$pV = nRT$$

$$K_a = \frac{[\text{A}^-][\text{H}_3\text{O}^+]}{[\text{HA}]}$$

$$\text{pH} = \text{p}K_a + \lg \frac{[\text{A}^-]}{[\text{HA}]}$$

Fysiikka / Fysik

$$v = v_0 + at$$

$$x = x_0 + v_0t + \frac{1}{2}at^2$$

$$v = \omega r$$

$$T = \frac{2\pi}{\omega}; f_n = \frac{n}{t} = \frac{1}{T}$$

$$\omega = \omega_0 + \alpha t$$

$$\varphi = \varphi_0 + \omega_0 t + \frac{1}{2}\alpha t^2$$

$$a = \frac{v^2}{r}$$

$$F = G \frac{m_1 m_2}{r^2}, E_p = -\frac{G m_1 m_2}{r}$$

$$F = -kx; \frac{F}{A} = E \frac{\Delta l}{l}$$



$$T = 2\pi\sqrt{\frac{m}{k}} = 2\pi\sqrt{\frac{l}{g}}$$

$$E_{\text{pot}} = \frac{1}{2}kx^2$$

$$\bar{p} = m\bar{v}$$

$$\Delta\bar{p} = \bar{I} = \bar{F}\Delta t$$

$$W = F\Delta x \cos \alpha$$

$$l = l_0(1 + \alpha\Delta T); V = V_0(1 + \gamma\Delta T)$$

$$\eta = \frac{W_o}{W_i} = \frac{\frac{W_o}{t}}{\frac{P_o}{P_i}}$$

$$\Delta Q = cm\Delta T$$

$$Q = sm$$

$$Q = rm$$

$$\mu_{\text{max}} = 1 - \frac{T_2}{T_1}$$

$$S = \sigma T^4$$

$$\lambda_{\text{max}}T = b$$

$$F = \frac{Q_1Q_2}{4\pi\epsilon_0r^2}$$

$$F = qE$$

$$V(x_0) = E_0/q$$

$$E_{\text{pot}} = qU$$

$$E = \frac{U}{d}$$

$$C = Q/U$$

$$C = \epsilon_r\epsilon_0\frac{A}{d}$$

$$E = \frac{1}{2}QU$$

$$U = RI, P = UI, R = \rho\frac{l}{A}$$

$$E = hf = \frac{hc}{\lambda}; E(\text{eV}) = 1240/\lambda(\text{nm})$$

$$F_\mu = \mu N$$

$$P = W/t$$

$$E_p = mgh; E_k = \frac{1}{2}mv^2$$

$$\bar{M} = \bar{r} \times \bar{F}$$

$$p = \frac{F}{A} = \frac{Fs}{As} = \frac{W}{V}$$

$$p = \rho gh$$

$$f = f_0\frac{v}{v \pm v_1}; f = f_0\frac{v \pm v_h}{v}$$

$$l = \frac{P}{A}, \frac{l_1}{l_2} = \frac{r_2^2}{r_1^2}$$

$$L = 10 \lg\left(\frac{I}{I_0}\right) \text{ dB}$$

$$\frac{\sin \alpha_1}{\sin \alpha_2} = \frac{\lambda_1}{\lambda_2} = \frac{v_1}{v_2} = \frac{n_2}{n_1} = n_{12}$$

$$L = I/A$$

$$\frac{v_1}{v_2} = \sqrt{\frac{T_1}{T_2}}$$

$$\Delta Q = I \cdot \Delta t$$

$$B = \frac{\mu_0 I}{2\pi r}$$

$$\bar{F} = q(\bar{v} \times \bar{B}); F = qvB \sin \alpha$$

$$F_m = IlB \sin \alpha$$

$$e = lvB \sin \alpha$$

$$\Phi = AB \cos \alpha$$

$$e = NAB \omega \sin(\omega t)$$

$$e_k = -\frac{\Delta\Phi}{\Delta t}$$

$$M = NABI \sin \alpha$$

$$\frac{U_1}{U_2} = \frac{N_1}{N_2} \approx \frac{I_2}{I_1}$$

$$I = I_0 e^{-\mu x}$$



$$\lambda = \frac{h}{p} = \frac{h}{mv}$$

$$2d \sin \theta = n\lambda$$

$$\frac{1}{\lambda} = R_H \left(\frac{1}{n^2} - \frac{1}{m^2} \right)$$

$$N = \frac{m}{M} N_A$$

$$T_{1/2} = \frac{\ln 2}{\lambda}$$

$$E_k^{max} = hf - W_0$$

$$E = \sum (w_T H_T)$$

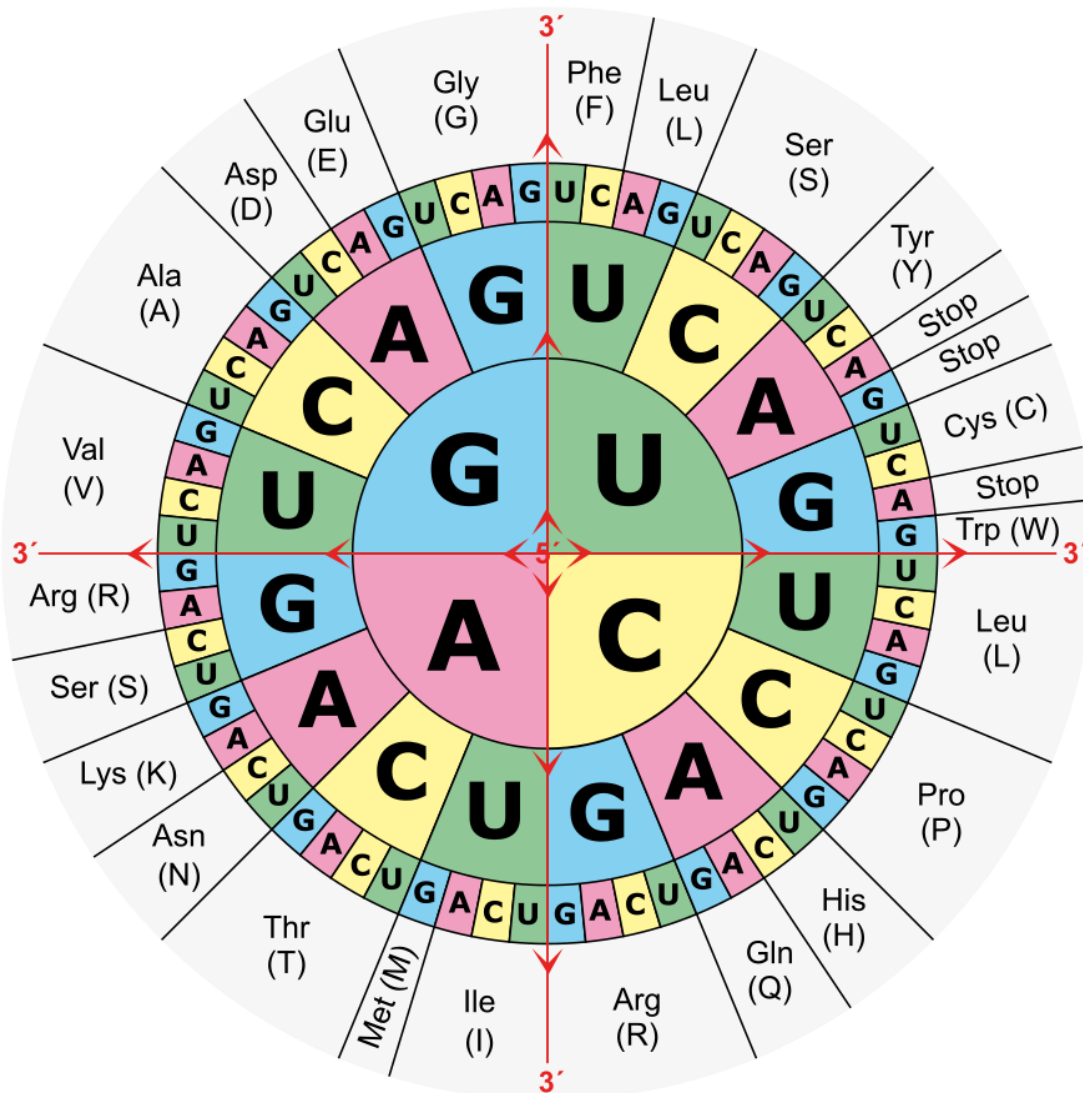
$$E = \frac{\phi}{A}$$

$$\Delta E_k = W = QU$$

$$A = \lambda N = \lambda N_0 e^{-\lambda t} = A_0 e^{-\lambda t}$$

$$H_T = w_R D$$

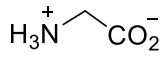
**Lähettilä-RNA:n kodoneja vastaavat aminohapot
Aminosyror som motsvarar kodon i budbärar-RNA**



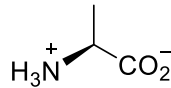


Luonnon aminohapot / Aminosyrorna i naturen

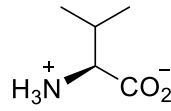
Aminohapot on esitetty siinä muodossa, jossa ne pääosin esiintyvät fysiologisessa pH-arvossa 7,4. Aminosyrorna presenteras i den form som mest förekommer vid det fysiologiska pH-värdet 7,4.



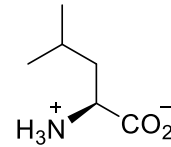
**glysiini /
glycin**
Gly, G



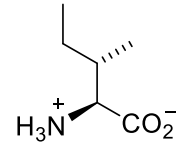
**alaniini /
alanin**
Ala, A



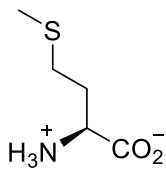
**valliini /
valin**
Val, V



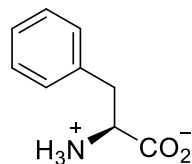
**leusiini /
leucin**
Leu, L



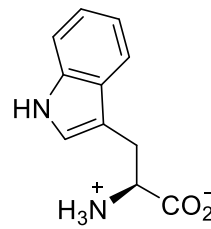
**isoleusiini /
isoleucin**
Ile, I



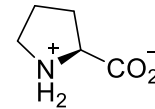
**metioniini /
metionin**
Met, M



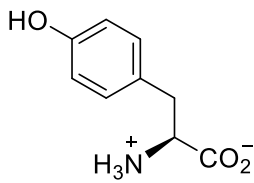
**fenyylialaniini /
fenylalanin**
Phe, F



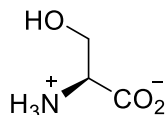
**tryptofaani /
tryptofan**
Trp, W



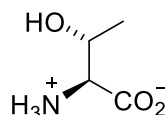
**proliini /
prolin**
Pro, P



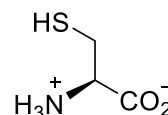
**tyrosiini /
tyrosin**
Tyr, Y



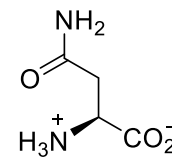
**seriini /
serin**
Ser, S



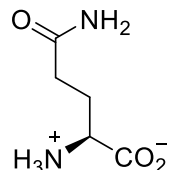
**treoniini /
treonin**
Thr, T



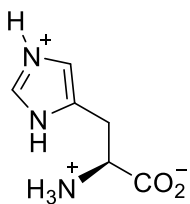
**kysteiini /
cystein**
Cys, C



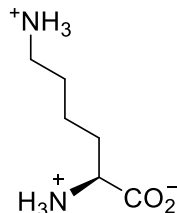
**asparagiini /
asparagin**
Asn, N



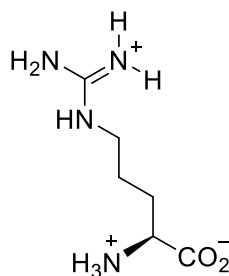
**glutamiini /
glutamin**
Gln, Q



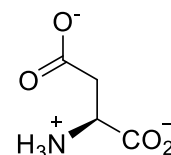
**histidiini /
histidin**
His, H



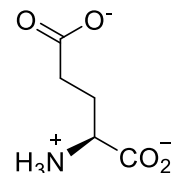
**lyysiini /
lysin**
Lys, K



**arginiini /
arginin**
Arg, R



**asparagiinihappo /
asparaginsyra**
Asp, D



**glutamiinihappo /
glutaminsyra**
Glu, E



Alkuaineiden jaksollinen järjestelmä / Grundämnenas periodiska system

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

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