

## KAAVALIITE / FORMELBILAGA 2024

## Vakioita / Konstanter

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$$\pi \approx 3,1416$$

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

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

$$\text{elektroni/elektron: } m_e = 9,109\,382\,2 \cdot 10^{-31} \text{ kg}$$

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

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

$$m_p = 1,007\,276\,5 \text{ u}$$

$$m_n = 1,008\,665\,0 \text{ u}$$

$$m_e = 5,485\,799\,1 \cdot 10^{-4} \text{ u}$$

## Kaavoja ja muuntokertoimia / Formler och omvandlingsfaktorer

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

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

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

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

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

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

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

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

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

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

## Kemia / Kemi

$$It = nzF$$

$$pV = nRT$$

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

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

## Fysiikka / Fysik

$$v = v_0 + at$$

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

$$v = \omega r$$

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

$$\omega = \omega_0 + at$$

$$\varphi = \varphi_0 + \omega_0t + \frac{1}{2}\alpha t^2$$

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

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

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

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

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

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

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

$$W = \bar{F} \cdot \bar{s}$$

$$F_{\mu} = \mu N$$

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

$$\eta = \frac{W_0}{W_i} = \frac{\frac{W_0}{t}}{\frac{W_i}{t}} = \frac{P_0}{P_i}$$

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

$$Q = sm$$

$$Q = rm$$

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

$$S = \sigma T^4$$

$$F = \frac{Q_1 Q_2}{4\pi\epsilon_0 r^2}$$

$$F = qE$$

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

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

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

$$C = Q/U$$

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

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

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

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

$$P = W/t$$

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

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

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

$$p = \rho gh$$

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

$$I = \frac{P}{A}, \frac{I_1}{I_2} = \frac{r_2^2}{r_1^2}$$

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

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

$$L = I/A$$

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

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

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

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

$$F_m = IlB \sin \alpha$$

$$e = lvB \sin \alpha$$

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

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

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

$$M = NABI \sin \alpha$$

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

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

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

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

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

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

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

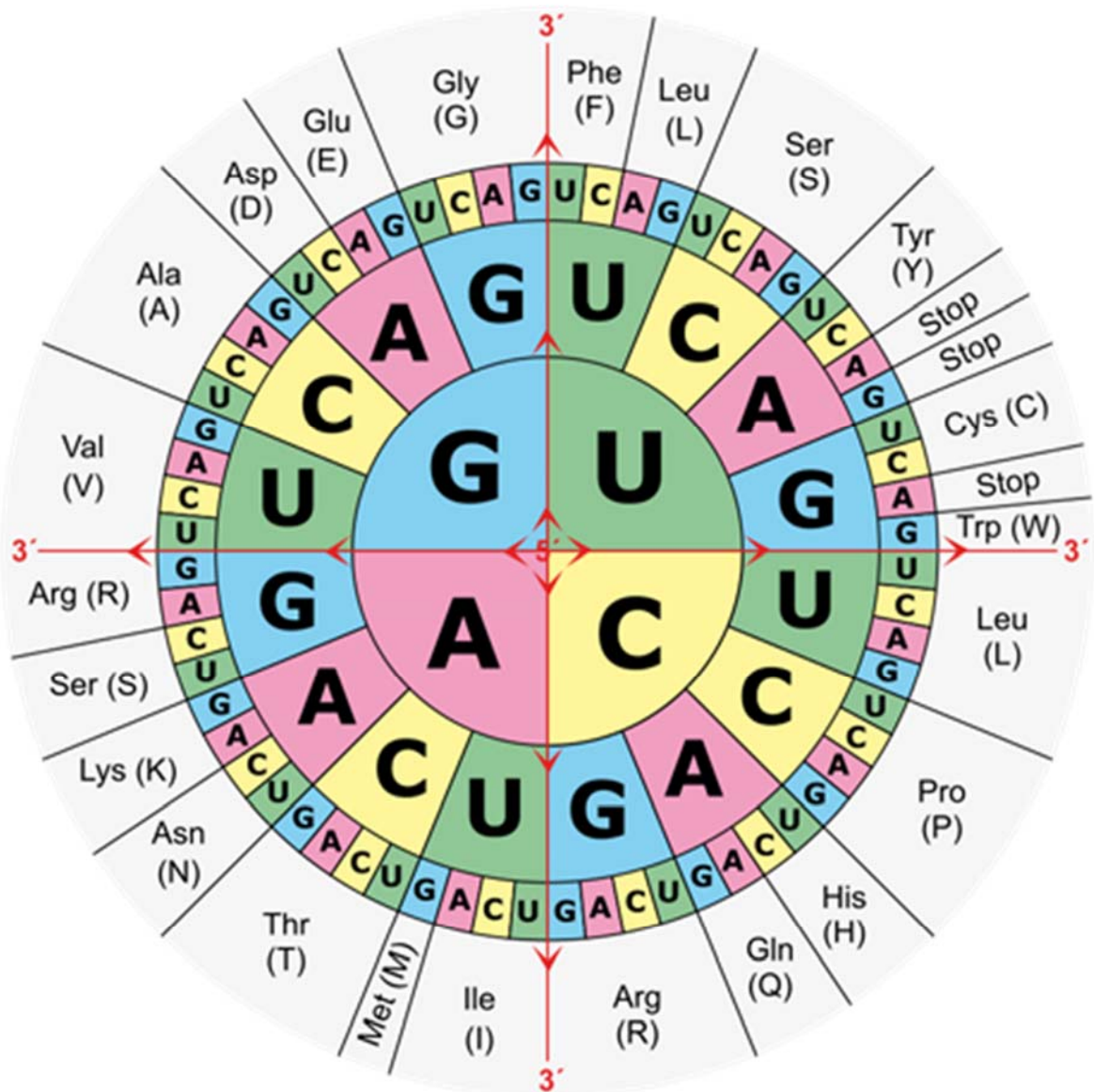
$$E = \frac{\phi}{A}$$

$$\Delta E_k = W = QU$$

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

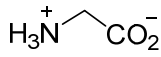
$$H_T = w_R D$$

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

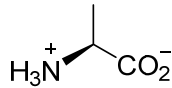


## Luonnon aminohapot / Aminosyrorna i naturen

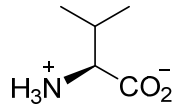
Aminohapot on esitetty siinä muodossa, jossa ne pääosin esiintyvät fysiologisessa pH-arvossa 7,4. Aminosyrorna presenteras i den form som mest förekommer vid det fysiologiska pH-värdet 7,4.



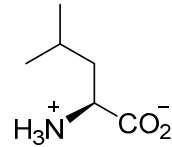
**glysiini /  
glycin**  
Gly, G



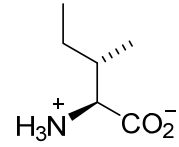
**alaniini /  
alanin**  
Ala, A



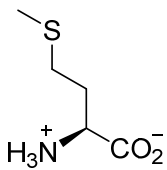
**valiini /  
valin**  
Val, V



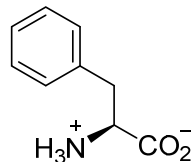
**leusiini /  
leucin**  
Leu, L



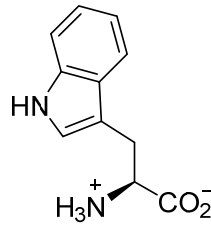
**isoleusiini /  
isoleucin**  
Ile, I



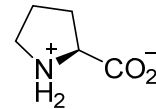
**metioniini /  
metionin**  
Met, M



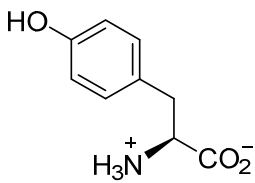
**fenyylialaniini /  
fenylalanin**  
Phe, F



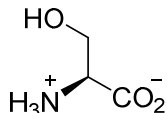
**tryptofaani /  
tryptofan**  
Trp, W



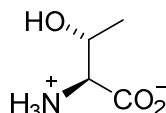
**proliini /  
prolin**  
Pro, P



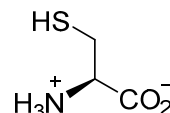
**tyrosiini /  
tyrosin**  
Tyr, Y



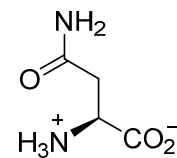
**seriini /  
serin**  
Ser, S



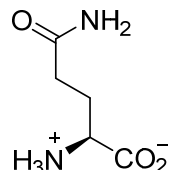
**treoniini /  
treonin**  
Thr, T



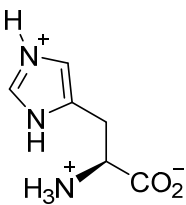
**kysteiini /  
cystein**  
Cys, C



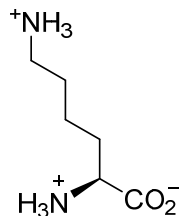
**asparagiini /  
asparagin**  
Asn, N



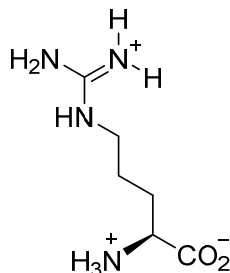
**glutamiini /  
glutamin**  
Gln, Q



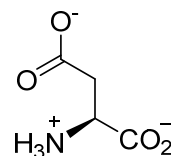
**histidiini /  
histidin**  
His, H



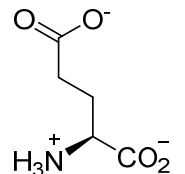
**lysiini /  
lysin**  
Lys, K



**arginiini /  
arginin**  
Arg, R



**asparagiinihappo /  
asparaginsyra**  
Asp, D



**glutamiinihappo /  
glutaminsyra**  
Glu, E

