

**KAAVALIITE / FORMELBILAGA**
**Vakioita ja muuntokertoimia / Konstanter och omvandlingsfaktorer**

$$a_0 = 5,291772105 \cdot 10^{-11} \text{ m}$$

$$\mu_0 = 4\pi \cdot 10^{-7} \text{ H m}^{-1}$$

$$c = 299792458 \text{ m s}^{-1}$$

$$m_e = 9,1093837139 \cdot 10^{-31} \text{ kg}$$

$$e = 1,6021766346 \cdot 10^{-19} \text{ C}$$

$$m_n = 1,6749275006 \cdot 10^{-27} \text{ kg}$$

$$\epsilon_0 = 8,8541878188 \cdot 10^{-12} \text{ F m}^{-1}$$

$$m_p = 1,6726219259 \cdot 10^{-27} \text{ kg}$$

$$F = 96485 \text{ C mol}^{-1}$$

$$N_A = 6,02214076 \cdot 10^{23} \text{ mol}^{-1}$$

$$g = 9,80665 \text{ m s}^{-2}$$

$$R = 8,314462618 \text{ J mol}^{-1}\text{K}^{-1}$$

$$G = 6,67430 \cdot 10^{-11} \text{ N m}^2\text{kg}^{-2}$$

$$= 0,08314462618 \text{ bar dm}^3 \text{ mol}^{-1}\text{K}^{-1}$$

$$h = 6,62607015 \cdot 10^{-34} \text{ J s}$$

$$R_H = 1,09678 \cdot 10^7 \text{ m}^{-1}$$

$$k_B = 1,380649 \cdot 10^{-23} \text{ J K}^{-1}$$

$$\sigma = 5,670374 \cdot 10^{-8} \text{ W m}^{-2}\text{K}^{-4}$$

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

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

$$1 \text{ atm} = 101325 \text{ Pa} = 1,01325 \text{ bar}$$

**Matematiikka / Matematik**

$$a_n = a_1 + (n - 1)d, \quad \sum_{i=1}^n a_i = n \cdot \frac{a_1 + a_n}{2}$$

$$D \cos x = -\sin x$$

$$a_n = a_1 q^{n-1}, \quad \sum_{i=1}^n a_i = a_1 \cdot \frac{1 - q^n}{1 - q}, \quad q \neq 1$$

$$D(f(x) + g(x)) = f'(x) + g'(x)$$

$$c^2 = a^2 + b^2 - 2ab \cos \gamma$$

$$D(f(x)g(x)) = f'(x)g(x) + f(x)g'(x)$$

$$\vec{a} \cdot \vec{b} = |\vec{a}| |\vec{b}| \cdot \cos(\vec{a}, \vec{b})$$

$$D(f(g(x))) = f'(g(x))g'(x)$$

$$\cos(\pi - \alpha) = -\cos \alpha, \quad \sin(-\alpha) = -\sin \alpha$$

$$\cos(-\alpha) = \cos \alpha, \quad \sin(\pi - \alpha) = \sin(\alpha)$$

$$K_n = Kq^n$$

$$P(X = r) = \binom{n}{r} p^r (1 - p)^{n-r}$$

$$Dx^n = nx^{n-1}$$

$$De^x = e^x$$

$$D \sin x = \cos x$$

$\alpha$	$\sin \alpha$	$\cos \alpha$
0	0	1
$\frac{\pi}{4}$	$\frac{1}{\sqrt{2}}$	$\frac{1}{\sqrt{2}}$
$\frac{\pi}{3}$	$\frac{\sqrt{3}}{2}$	$\frac{1}{2}$
$\frac{\pi}{2}$	1	0
$\pi$	0	-1

## Fysiikka / Fysik

$$A = \lambda N$$

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

$$B = \mu_0 H$$

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

$$c = \frac{1}{\sqrt{\epsilon_0 \mu_0}}$$

$$C = \frac{1}{\Sigma \frac{1}{C_i}}$$

$$C = \Sigma C_i$$

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

$$C = \frac{Q}{U}$$

$$d \sin \alpha = k\lambda$$

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

$$e = -\frac{\Delta\phi}{\Delta t}$$

$$E = \frac{1}{2} C U^2$$

$$E = \frac{1}{2} k x^2$$

$$E = \frac{1}{2} m v^2$$

$$E = \frac{F}{q}$$

$$E = \gamma m c^2$$

$$E = hf$$

$$E = mgh$$

$$E = qU$$

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

$$\epsilon = \epsilon_r \epsilon_0$$

$$\eta = \frac{E_a}{E_0}$$

$$\eta = \frac{W}{Q}$$

$$f = \frac{1}{T}$$

$$F = \gamma \frac{m_1 m_2}{r^2}$$

$$F = -kx$$

$$F = \frac{\mu_0 I_1 I_2}{2\pi r} \ell$$

$$F = \mu N$$

$$F = \frac{q_1 q_2}{4\pi \epsilon_0 r^2}$$

$$\vec{F} = q(\vec{v} \times \vec{B})$$

$$\Phi = \vec{A} \cdot \vec{B}$$

$$I = F\Delta t$$

$$I = \frac{P}{A}$$

$$I = \frac{\Delta Q}{\Delta t}$$

$$I = \sigma T^4$$

$$\ell = \ell_0(1 + \alpha\Delta T)$$

$$\lambda = \frac{b}{T}$$

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

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

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

$$\mu = \mu_r \mu_0$$

$$n = \frac{c}{v}$$

$$n = \frac{m}{M}$$

$$n = \frac{N}{N_A}$$

$$n_1 \sin \alpha_1 = n_2 \sin \alpha_2$$

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

$$N = \rho g V$$

$$p = \frac{F}{A}$$

$$p = \frac{nRT}{V}$$

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

$$p = \rho gh$$

$$P = UI$$

$$P = \frac{W}{t}$$

$$Q = cm\Delta T$$

$$Q = rm$$

$$Q = sm$$

$$R = \rho \frac{l}{A}$$

$$R = \Sigma R_i$$

$$R = \frac{1}{\Sigma \frac{1}{R_i}}$$

$$\rho = \frac{m}{V}$$

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

$$T = \frac{2\pi}{\omega}$$

$$\Delta U = Q + W$$

$$U = RI$$

$$V = \frac{E}{q}$$

$$v = f\lambda$$

$$v = v_0 + at$$

$$V = V_0(1 + \gamma\Delta T)$$

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

$$W = p\Delta V$$

$$x = x_0 + v_0 t + \frac{1}{2}at^2$$

## Kemia / Kemi

$$n = \frac{m}{M}$$

$$It = nzF$$

$$n = \frac{N}{N_A}$$

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

$$\rho = \frac{m}{V}$$

$$K_W = 1,008 \cdot 10^{-14} \text{ (mol}^2 \text{ dm}^{-6}\text{)}, \text{ kun/när } T = 25 \text{ }^\circ\text{C}$$

$$pV = nRT$$

## Alkuaineiden jaksollinen järjestelmä / Grundämnenas periodiska system

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

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