Umstellung von Formeln

1. Stelle die folgenden Formeln um.

a) $F = ma$ $a =$

b) $pV = NRT$ $T =$

c) $qU = h \cdot \frac{c}{\lambda_{\min}}$ $\lambda_{\min} =$

d) $E_{\text{pot}} = mg\Delta h$ $\Delta h =$

e) $F_{\text{e}} = k_{\text{e}} \cdot \frac{q_1 \cdot q_2}{r^2}$ $q_2 =$

f) $P_{\text{total}} = c_{\text{Rtg}} \cdot U^2 IZ$ $I =$

g) $\frac{1}{2}mv^2 = \frac{3}{2}kT$ $T =$

h) $\frac{\Delta V}{\Delta t} = -\frac{\pi \cdot r^4}{8 \cdot \eta} \cdot \frac{\Delta p}{\Delta l}$ $\Delta p =$

$\eta =$

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2. Stelle die folgenden Formeln um.

a) $M = \sigma \cdot T^4$ $T =$

b) $E_{\text{kin}} = \frac{1}{2}mv^2$ $v =$

c) $\Delta E = \sigma \cdot \left({T_1}^4 - {T_2}^4\right) \cdot A \cdot t$ $T_1 =$

$T_2 =$

d) $P_{\text{total}} = c_{\text{Rtg}} \cdot U^2 IZ$ $U =$

e) $\frac{1}{2}mv^2 = \frac{3}{2}kT$ $v =$

f) $mg\Delta h = \frac{1}{2}mv^2$ $v =$

g) $F_{\text{e}} = k_{\text{e}} \cdot \frac{q_1 \cdot q_2}{r^2}$ $r =$

h) $\frac{\Delta V}{\Delta t} = -\frac{\pi \cdot r^4}{8 \cdot \eta} \cdot \frac{\Delta p}{\Delta l}$ $r =$

i) $f_0 = \frac{1}{2\pi} \cdot \sqrt{\frac{D}{m}}$ $D =$

$m =$

j) $f_0 = \frac{1}{2\pi} \cdot \sqrt{\frac{g}{l}}$ $l =$

k) $f_0 = \frac{1}{2\pi} \cdot \sqrt{\frac{1}{LC}}$ $L =$

$C =$

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3. Stelle die folgenden Formeln um.

a) $\delta = \frac{\lambda_v}{n \cdot \sin(\omega)}$ $\sin(\omega) =$

$\omega =$

b) $\frac{\sin(\alpha_1)}{\sin(\alpha_2)} = \frac{c_1}{c_2}$ $\sin(\alpha_2) =$

$\alpha_2 =$

c) $y = y_{\max} \cdot \sin(2\pi f \cdot t + \varphi_0)$ $f =$

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4. Stelle die folgenden Formeln um.

a) $J = J_0 \cdot e^{-\mu x}$ $x =$

$\mu =$

b) $J = J_0 \cdot e^{-\frac{\ln(2)}{D}x}$ $x =$

$D =$

c) $U = U_0 \cdot e^{-t/(RC)}$ $t =$

$C =$

d) $n_i = n_0 \cdot e^{-\frac{Mg\Delta h}{RT}}$ $\Delta h =$

$T =$

e) $\Lambda = \Lambda_0 \cdot 2^{-\frac{t}{T}}$ $t =$

$T =$

f) $U = U_{\max} \cdot \left(1 - e^{-t/(RC)}\right)$ $t =$

$R =$

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5. Stelle die folgenden Formeln um.

a) $\mathrm{pH} = -\log\left[\frac{\mathrm{H^+}}{1\mathrm{M}}\right]$ $[\mathrm{H^+}] =$

b) $E = \log\left(\frac{J_0}{J}\right)$ $J =$

c) $S = k_B \cdot \ln(\Omega)$ $\Omega =$

d) $n_{\mathrm{dB}} = 10 \cdot \log\left(\frac{J}{J_0}\right)$ $J =$

e) $\mathrm{pH} = \mathrm{p}K + \log\left(\frac{[\mathrm{Basis}]}{[\mathrm{Säure}]}\right)$ [Basis] =

[Säure] =

f) $\mathrm{pH} = \mathrm{p}K + \log\left(\frac{[\mathrm{Basis}]}{c-[\mathrm{Basis}]}\right)$ [Basis] =

g) $E = E^0 + \frac{RT}{z_\mathrm{e}F} \cdot \ln\left(\frac{c_\mathrm{ox}}{c_\mathrm{red}}\right)$ c_ox =

c_red =

h) $E = E^0 + \frac{0{,}059\,\mathrm{V}}{z_\mathrm{e}} \cdot \log\left(\frac{c_\mathrm{ox}}{c_\mathrm{red}}\right)$ c_ox =

c_red =

Lösungen

1.

a) $F = ma$ $\quad a = \frac{F}{m}$

b) $pV = NRT$ $\quad T = \frac{pV}{NR}$

c) $qU = h \cdot \frac{c}{\lambda_{\min}}$ $\quad \lambda_{\min} = \frac{hc}{qU}$

d) $E_{\text{pot}} = mg\Delta h$ $\quad \Delta h = \frac{E_{\text{pot}}}{mg}$

e) $F_{\text{e}} = k_{\text{e}} \cdot \frac{q_1 \cdot q_2}{r^2}$ $\quad q_2 = \frac{F_{\text{e}} \cdot r^2}{k_{\text{e}} \cdot q_1}$

f) $P_{\text{total}} = c_{\text{Rtg}} \cdot U^2 IZ$ $\quad I = \frac{P_{\text{total}}}{c_{\text{Rtg}} \cdot U^2 \cdot Z}$

g) $\frac{1}{2}mv^2 = \frac{3}{2}kT$ $\quad T = \frac{mv^2}{3k}$

h) $\frac{\Delta V}{\Delta t} = -\frac{\pi \cdot r^4}{8 \cdot \eta} \cdot \frac{\Delta p}{\Delta l}$ $\quad \Delta p = -\frac{\Delta V \cdot 8 \cdot \eta \cdot \Delta l}{\Delta t \cdot \pi \cdot r^4}$

$\eta = -\frac{\pi \cdot r^4 \cdot \Delta p \cdot \Delta t}{8 \cdot \Delta l \cdot \Delta V}$

2.

a) $M = \sigma \cdot T^4$ $\quad T = \sqrt[4]{\frac{M}{\sigma}}$

b) $E_{\text{kin}} = \frac{1}{2}mv^2$ $\quad v = \sqrt{\frac{2 \cdot E_{\text{kin}}}{m}}$

c) $\Delta E = \sigma \cdot \left({T_1}^4 - {T_2}^4\right) \cdot A \cdot t$ $\quad T_1 = \sqrt[4]{\frac{\Delta E}{\sigma \cdot A \cdot t} + {T_2}^4}$

$T_2 = \sqrt[4]{{T_1}^4 - \frac{\Delta E}{\sigma \cdot A \cdot t}}$

d) $P_{\text{total}} = c_{\text{Rtg}} \cdot U^2 IZ$ $\quad U = \sqrt{\frac{P_{\text{total}}}{c_{\text{Rtg}} \cdot I \cdot Z}}$

e) $\frac{1}{2}mv^2 = \frac{3}{2}kT$ $\quad v = \sqrt{\frac{3kT}{m}}$

f) $mg\Delta h = \frac{1}{2}mv^2$ $\quad v = \sqrt{2g\Delta h}$

g) $F_{\text{e}} = k_{\text{e}} \cdot \frac{q_1 \cdot q_2}{r^2}$ $\quad r = \sqrt{\frac{k_{\text{e}} \cdot q_1 \cdot q_2}{F_{\text{e}}}}$

h) $\frac{\Delta V}{\Delta t} = -\frac{\pi \cdot r^4}{8 \cdot \eta} \cdot \frac{\Delta p}{\Delta l}$ $\quad r = \sqrt[4]{-\frac{\Delta V \cdot 8 \cdot \eta \cdot \Delta l}{\Delta t \cdot \pi \cdot \Delta p}}$

i) $f_0 = \frac{1}{2\pi} \cdot \sqrt{\frac{D}{m}}$ $\quad D = (f_0 \cdot 2\pi)^2 \cdot m$

$m = \frac{D}{(f_0 \cdot 2\pi)^2}$

j) $f_0 = \frac{1}{2\pi} \cdot \sqrt{\frac{g}{l}}$ $\quad l = \frac{g}{(f_0 \cdot 2\pi)^2}$

k) $f_0 = \frac{1}{2\pi} \cdot \sqrt{\frac{1}{LC}}$ $\quad L = \frac{1}{C \cdot (f_0 \cdot 2\pi)^2}$

$C = \frac{1}{L \cdot (f_0 \cdot 2\pi)^2}$

3.

a) $\delta = \frac{\lambda_v}{n \cdot \sin(\omega)}$ $\quad \sin(\omega) = \frac{\lambda_v}{n \cdot \delta}$

$\omega = \arcsin\left(\frac{\lambda_v}{n \cdot \delta}\right)$ (**arcsin( )** oder **sin^{-1}( )**)

b) $\frac{\sin(\alpha_1)}{\sin(\alpha_2)} = \frac{c_1}{c_2}$ $\quad \sin(\alpha_2) = \frac{\sin(\alpha_1) \cdot c_2}{c_1}$

$\alpha_2 = \arcsin\left(\frac{\sin(\alpha_1) \cdot c_2}{c_1}\right)$

c) $y = y_{\max} \cdot \sin(2\pi f \cdot t + \varphi_0)$ $\quad f = \frac{\arcsin\left(\frac{y}{y_{\max}}\right) - \varphi_0}{2\pi \cdot t}$

4.

a) $J = J_0 \cdot e^{-\mu x}$ $\quad x = -\frac{\ln\left(\frac{J}{J_0}\right)}{\mu} = \frac{\ln\left(\frac{J_0}{J}\right)}{\mu} = \frac{\log\left(\frac{J_0}{J}\right)}{\mu \cdot \log(e)}$

$\mu = \frac{\ln\left(\frac{J_0}{J}\right)}{x}$

b) $J = J_0 \cdot e^{-\frac{\ln(2)}{D}x}$ $\quad x = \frac{D \cdot \ln\left(\frac{J_0}{J}\right)}{\ln(2)} = D \cdot \log_2\left(\frac{J_0}{J}\right)$

$D = \frac{x \cdot \ln(2)}{\ln\left(\frac{J_0}{J}\right)} = \frac{x}{\log_2\left(\frac{J_0}{J}\right)}$

c) $U = U_0 \cdot e^{-t/(RC)}$ $\quad t = RC \cdot \ln\left(\frac{U_0}{U}\right)$

$C = \frac{t}{R \cdot \ln\left(\frac{U_0}{U}\right)}$

d) $n_i = n_0 \cdot e^{-\frac{Mg\Delta h}{RT}}$ $\quad \Delta h = \frac{RT}{Mg} \cdot \ln\left(\frac{n_0}{n_i}\right)$

$T = \frac{Mg\Delta h}{R \cdot \ln\left(\frac{n_0}{n_i}\right)}$

e) $\Lambda = \Lambda_0 \cdot 2^{-\frac{t}{T}}$ $\quad t = T \cdot \log_2\left(\frac{\Lambda_0}{\Lambda}\right) = \frac{T \cdot \ln\left(\frac{\Lambda_0}{\Lambda}\right)}{\ln(2)}$

$T = \frac{t}{\log_2\left(\frac{\Lambda_0}{\Lambda}\right)} = \frac{t \cdot \ln(2)}{\ln\left(\frac{\Lambda_0}{\Lambda}\right)}$

f) $U = U_{\max} \cdot \left(1 - e^{-t/(RC)}\right)$ $\quad t = -RC \cdot \ln\left(1 - \frac{U}{U_{\max}}\right)$

$R = -\frac{t}{C \cdot \ln\left(1 - \frac{U}{U_{\max}}\right)}$

5.

a) $\mathrm{pH} = -\log\left[\frac{\mathrm{H^+}}{1\mathrm{M}}\right]$ $\quad [\mathrm{H^+}] = (10^{-\mathrm{pH}})\mathrm{M}$

b) $E = \log\left(\frac{J_0}{J}\right)$ $\quad J = J_0 \cdot 10^{-E}$

c) $S = k_\mathrm{B} \cdot \ln(\Omega)$ $\quad \Omega = e^{\frac{S}{k_\mathrm{B}}}$

d) $n_\mathrm{dB} = 10 \cdot \log\left(\frac{J}{J_0}\right)$ $\quad J = J_0 \cdot 10^{\frac{n_\mathrm{dB}}{10}}$

e) $\mathrm{pH} = \mathrm{p}K + \log\left(\frac{[\mathrm{Basis}]}{[\mathrm{Säure}]}\right)$ $\quad [\mathrm{Basis}] = [\mathrm{Säure}] \cdot 10^{(\mathrm{pH}-\mathrm{p}K)}$

$[\mathrm{Säure}] = \frac{[\mathrm{Basis}]}{10^{(\mathrm{pH}-\mathrm{p}K)}}$

f) $\mathrm{pH} = \mathrm{p}K + \log\left(\frac{[\mathrm{Basis}]}{c - [\mathrm{Basis}]}\right)$ $\quad [\mathrm{Basis}] = \frac{c \cdot 10^{(\mathrm{pH}-\mathrm{p}K)}}{1 + 10^{(\mathrm{pH}-\mathrm{p}K)}}$

g) $E = E^0 + \frac{RT}{z_\mathrm{e}F} \cdot \ln\left(\frac{c_\mathrm{ox}}{c_\mathrm{red}}\right)$ $\quad c_\mathrm{ox} = c_\mathrm{red} \cdot e^{\frac{(E-E^0) \cdot z_\mathrm{e}F}{RT}}$

$c_\mathrm{red} = \frac{c_\mathrm{ox}}{e^{\frac{(E-E^0) \cdot z_\mathrm{e}F}{RT}}}$

h) $E = E^0 + \frac{0{,}059\,\mathrm{V}}{z_\mathrm{e}} \cdot \log\left(\frac{c_\mathrm{ox}}{c_\mathrm{red}}\right)$ $\quad c_\mathrm{ox} = c_\mathrm{red} \cdot 10^{\frac{(E-E^0) \cdot z_\mathrm{e}}{0{,}059\,\mathrm{V}}}$

$c_\mathrm{red} = \frac{c_\mathrm{ox}}{10^{\frac{(E-E^0) \cdot z_\mathrm{e}}{0{,}059\,\mathrm{V}}}}$