$R = 8{,}314\ J\ K^{-1}\ mol^{-1}$;
$k_B = 1{,}381\ 10^{-23}\ J\ K^{-1}$;
$h = 6{,}626\ 10^{-34}\ J\ s$;

$F = 96500\ C\ mol^{-1}$;
$c = 3 \cdot 10^{8}\ m\ s^{-1}$;
$N_A = 6{,}022\ 10^{23}\ mol^{-1}$;

Table C.6 Standard Electrode Potentials at 25 °C[a]

Reduction Reaction	*E°/V*
$Ag^+ + e^- = Ag$	+0.80
$Ag^{2+} + e^- = Ag^+$	+1.98
$AgCl + e^- = Ag + Cl^-$	+0.22
$Al^{3+} + 3e^- = Al$	−1.68
$Au^+ + e^- = Au$	+1.83
$Au^{3+} + 3e^- = Au$	+1.52
$Ba^{2+} + 2e^- = Ba$	−2.92
$Be^{2+} + 2e^- = Be$	−1.97
$BrO^- + H_2O + 2e^- = Br^- + 2OH^-$	+0.76
$2HOBr + 2H^+ + 2e^- = Br_2 + 2H_2O$	+1.60
$2BrO_3^- + 12H^+ + 10e^- = Br_2 + 6H_2O$	+1.48
$CO_2 + 2H^+ + 2e^- = CO + H_2O$	−0.11
$Ca^{2+} + 2e^- = Ca$	−2.84
$Cd(OH)_2 + 2e^- = Cd + 2OH^-$	−0.82
$Cd^{2+} + 2e^- = Cd$	−0.40
$Ce^{3+} + 3e^- = Ce$	−2.34
$Ce^{4+} + e^- = Ce^{3+}$	+1.72
$Cl_2 + 2e^- = 2Cl^-$	+1.36
$ClO^- + H_2O + 2e^- = Cl^- + 2OH^-$	+0.89
$Co^{2+} + 2e^- = Co$	−0.28
$Co^{3+} + e^- = Co^{2+}$	+1.92
$Cr^{2+} + 2e^- = Cr$	−0.90
$Cr_2O_7^{2-} + 14H^+ + 6e^- = 2Cr^{3+} + 7H_2O$	+1.38
$Cr^{3+} + 3e^- = Cr$	−0.74

(*continued*)

[a] From C. M. A. Brett and A. M. O. Brett, *Electrochemistry*. Oxford, UK: Oxford University Press, 1993. Much more detailed information is available in A. J. Bard, R. Parsons, and J. Jordan (Eds.). *Standard Potentials in Aqueous Solution*. New York: Dekker, 1985.

Table C.6 (*continued*)

Reduction Reaction	*E°/V*
$Cu^+ + e^- = Cu$	+0.52
$Cu^{2+} + 2e^- = Cu$	+0.34
$Cu^{2+} + e^- = Cu^+$	+0.16
$Cu(NH_3)_4^{2+} + 2e^- = Cu + 4NH_3$	0.00
$F_2 + 2e^- = 2F^-$	+2.87
$Fe^{2+} + 2e^- = Fe$	−0.44
$Fe^{3+} + 3e^- = Fe$	−0.04
$Fe^{3+} + e^- = Fe^{2+}$	+0.77
$Fe(CN)_6^{3-} + e^- = Fe(CN)_6^{4-}$	+0.36
$Fe(CN)_6^{4-} + 2e^- = Fe + 6CN^-$	−1.16
$2H^+ + 2e^- = H_2$	0.00
$2H_2O + 2e^- = H_2 + 2OH^-$	−0.83
$H_2O_2 + 2H^+ + 2e^- = 2H_2O$	+1.76
$Hg_2^{2+} + 2e^- = 2Hg$	+0.80
$Hg_2Cl_2 + 2e^- = 2Hg + 2Cl^-$	+0.27
$Hg^{2+} + 2e^- = Hg$	+0.86
$2Hg^{2+} + 2e^- = Hg_2^{2+}$	+0.91
$I_2 + 2e^- = 2I^-$	+0.54
$K^+ + e^- = K$	−2.93
$Li^+ + e^- = Li$	−3.04
$Mg^{2+} + 2e^- = Mg$	−2.36
$Mn^{2+} + 2e^- = Mn$	−1.18
$Mn^{3+} + e^- = Mn^{2+}$	+1.51
$MnO_2 + 4H^+ + 2e^- = Mn^{2+} + 2H_2O$	+1.23
$NO_3^- + 2H^+ + e^- = NO_2 + H_2O$	+0.80
$NO_3^- + 4H^+ + 3e^- = NO + 2H_2O$	+0.96
$Na^+ + e^- = Na$	−2.71
$Ni^{2+} + 2e^- = Ni$	−0.26
$O_2 + 2H_2O + 4e^- = 4OH^-$	+0.40
$O_2 + 4H^+ + 4e^- = 2H_2O$	+1.23
$O_2 + 2H^+ + 2e^- = H_2O_2$	+0.70
$Pb^{2+} + 2e^- = Pb$	−0.13
$PbO_2 + 4H^+ + 2e^- = Pb^{2+} + 2H_2O$	+1.70
$PbSO_4 + 2e^- = Pb + SO_4^{2-}$	−0.36
$Pt^{2+} + 2e^- = Pt$	+1.19
$Rb^+ + e^- = Rb$	−2.93
$Sn^{2+} + 2e^- = Sn$	−0.14
$Sn^{4+} + 2e^- = Sn^{2+}$	+0.15
$Zn^{2+} + 2e^- = Zn$	−0.76

1. $\left(p+\frac{a}{V_m^2}\right)(V_m-b)=RT$

$pV^{\kappa}=p_0V_0^{\kappa}, \qquad \kappa=\frac{C_{P,m}}{C_{V,m}}, \qquad \frac{T_0}{T}=\left(\frac{V}{V_0}\right)^{\frac{R}{C_{V,m}}}$

2. $dW=F\cdot ds, \quad dW=c_v dT$

3. $E=\bar{\varepsilon}\,N_A=U-U_0=N_A\left(\bar{\varepsilon}_{kin}+\bar{\varepsilon}_{pot}\right), \qquad k_B=\frac{R}{N_A}$

$f(v_x)=\left(\frac{M}{2\pi RT}\right)^{\frac{1}{2}}\cdot\exp\left(-\frac{Mv_x^2}{2RT}\right), \qquad f(v)=4\pi\cdot\left(\frac{M}{2\pi RT}\right)^{\frac{3}{2}}\cdot v^2\cdot\exp\left(-\frac{Mv^2}{2RT}\right)$

$\sqrt{\overline{v_A^2}}=\sqrt{\frac{3\,RT}{M_A}}\,,\ \bar{v}_{relativ}=\sqrt{\frac{8\,RT}{\pi\mu}}, \quad \mu=\frac{M_AM_B}{M_A+M_B}$

$\sigma_{AB}=\pi\left(r_A+r_B\right)^2, \qquad Z_{AB}=\frac{N(A)}{V}\frac{N(B)}{V}\sigma_{AB}\bar{v}_{relativ}$

4. $\Delta_rH=\sum_i\nu_iH_i=\sum\nu_i\Delta_fH_i$
$\Delta_rS=\sum_i\nu_iS_i$
$\Delta_rG=\sum_i\nu_i\mu_i=\sum\nu_i\Delta_fG_i$

Tabellen: $\Delta_fH^{\ominus}_{298}$, $S^{\ominus}_{298}$, $\Delta_fG^{\ominus}_{298}$

$\Delta_rC_p=\sum\nu_iC_{pi}$

$d\xi=\frac{dn_i}{\nu_i}$

$\Delta_rG=\sum_i\nu_i\mu_i=\sum_i\nu_i\mu^{\ominus}+RT\ln\prod_i a_i^{\nu_i}=\Delta_rG^{\ominus}+RT\ln Q$

↑ keine Glgew.konz. ↑

a_i → c_i, x_i, p_r

$\Delta_rG^{\ominus}=-RT\ln\prod_i\left(x^{\nu_i}\right)_{Gl}=-RT\ln K^{\ominus}$

5. Phasengleichgewichte (Mehrstoffsystem, Index Lösungsmittel:1, Index gelöster Stoff: 2, T = konstant):

Dampfdruck-erniedrigung	Siedepunkts-erhöhung	Gefrierpunkts-erniedrigung	Osmotischer Druck
Henry: $p_1=K_Hx_1$ $K_H=$ Henry-Konstante	$\Delta T=E_em_2$ $E_e=\frac{RT_{Sdp}^2M}{\Delta_VH_m}$	$\Delta T=-E_km_2$ $E_k=\frac{RT_{Sm}^2M}{\Delta_{Sm}H_m}$	Virialentwicklung: $\pi=cRT(1+A_2c+A_3c^2+\cdots)$

6. Elektrisches Potential:

$$\phi = \frac{E_{pot}}{Q_1}, \qquad E_{pot} = \frac{1}{4\pi\varepsilon_0}\frac{Q_1 Q_2}{r}$$

$$W = Q_1\left(\phi_2 - \phi_1\right) = Q_1 U = U\ I\ t$$

$$Q_1 = I\ t = \frac{m_i}{M_i} z_i F$$

$$\frac{U}{I} = R = \sigma\frac{\ell}{A}, \qquad \kappa = \frac{1}{\sigma}, \qquad \frac{\kappa}{c} = \Lambda = \nu_+\Lambda_+ + \nu_-\Lambda_-, \qquad \Lambda = \Lambda_0 - k\sqrt{c}$$

7. Spektroskopie:

Lichtintensität: $I = \frac{dQ}{dt\ A} = \frac{\sum \varepsilon_i dN_i}{dt\ A}$

Wenn nur Photonen einer Frequenz(Wellenlänge) vorhanden sind, gilt:

$$I = \frac{\varepsilon N}{t\,A}$$

$\varepsilon = h\nu, \qquad c = \nu\lambda$