

Appendice G

Potenziali standard di riduzione in soluzione acquosa a 25,0 °C*

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Elemento	Semireazione	$E_{\text{red}}^{\circ} / \text{V}$
alluminio	$\text{Al}^{3+}(aq) + 3e^{-} \rightleftharpoons \text{Al}(s)$ $\text{Al(OH)}_4^-(aq) + 3e^{-} \rightleftharpoons \text{Al}(s) + 4\text{OH}^-(aq)$	-1,662 -2,328
argento	$\text{Ag}^+(aq) + e^{-} \rightleftharpoons \text{Ag}(s)$ $\text{Ag}_2\text{O}(s) + \text{H}_2\text{O}(l) + 2e^{-} \rightleftharpoons 2\text{Ag}(s) + 2\text{OH}^-(aq)$ $\text{AgCl}(s) + e^{-} \rightleftharpoons \text{Ag}(s) + \text{Cl}^-(aq)$ $\text{AgBr}(s) + e^{-} \rightleftharpoons \text{Ag}(s) + \text{Br}^-(aq)$ $\text{AgI}(s) + e^{-} \rightleftharpoons \text{Ag}(s) + \text{I}^-(aq)$ $\text{Ag}_2\text{S}(s) + 2e^{-} \rightleftharpoons 2\text{Ag}(s) + \text{S}^{2-}(aq)$	0,7996 0,342 0,2223 0,0713 -0,152 -0,691
azoto	$\text{N}_2\text{O}(g) + 2\text{H}^+(aq) + 2e^{-} \rightleftharpoons \text{N}_2(g) + \text{H}_2\text{O}(l)$ $2\text{NO}(aq) + 2\text{H}^+(aq) + 2e^{-} \rightleftharpoons \text{N}_2\text{O}(g) + \text{H}_2\text{O}(l)$ $\text{HNO}_2(aq) + \text{H}^+(aq) + e^{-} \rightleftharpoons \text{NO}(g) + \text{H}_2\text{O}(l)$ $\text{NO}_3^-(aq) + 4\text{H}^+(aq) + 3e^{-} \rightleftharpoons \text{NO}(g) + 2\text{H}_2\text{O}(l)$ $\text{NO}_3^-(aq) + 3\text{H}^+(aq) + 2e^{-} \rightleftharpoons \text{HNO}_2(aq) + \text{H}_2\text{O}(l)$ $\text{NO}_3^-(aq) + 2\text{H}^+(aq) + e^{-} \rightleftharpoons \frac{1}{2}\text{N}_2\text{O}_4(g) + \text{H}_2\text{O}(l)$	1,766 1,591 0,983 0,957 0,934 0,803
bario	$\text{Ba}^{2+}(aq) + 2e^{-} \rightleftharpoons \text{Ba}(s)$	-2,912
berillio	$\text{Be}^{2+}(aq) + 2e^{-} \rightleftharpoons \text{Be}(s)$	-1,847
bromo	$\text{BrO}_3^-(aq) + 6\text{H}^+(aq) + 5e^{-} \rightleftharpoons \frac{1}{2}\text{Br}_2(l) + 3\text{H}_2\text{O}(l)$ $\text{Br}_2(l) + 2e^{-} \rightleftharpoons 2\text{Br}^-(aq)$ $\text{BrO}^-(aq) + \text{H}_2\text{O}(l) + 2e^{-} \rightleftharpoons \text{Br}^-(aq) + 2\text{OH}^-(aq)$ $\text{BrO}_3^-(aq) + 3\text{H}_2\text{O}(l) + 6e^{-} \rightleftharpoons \text{Br}^-(aq) + 6\text{OH}^-(aq)$	1,482 1,066 0,761 0,61
cadmio	$\text{Cd}^{2+}(aq) + 2e^{-} \rightleftharpoons \text{Cd}(s)$	-0,403
calcio	$\text{Ca}^{2+}(aq) + 2e^{-} \rightleftharpoons \text{Ca}(s)$ $\text{CaSO}_4(s) + 2e^{-} \rightleftharpoons \text{Ca}(s) + \text{SO}_4^{2-}(aq)$	-2,868 -2,936
cerio	$\text{Ce}^{4+}(aq) + e^{-} \rightleftharpoons \text{Ce}^{3+}(aq)$ $\text{Ce}^{3+}(aq) + 3e^{-} \rightleftharpoons \text{Ce}(s)$	1,72 -2,336
cesio	$\text{Cs}^+(aq) + e^{-} \rightleftharpoons \text{Cs}(s)$	-3,026
cloro	$\text{HClO}(aq) + \text{H}^+(aq) + e^{-} \rightleftharpoons \frac{1}{2}\text{Cl}_2(g) + \text{H}_2\text{O}(l)$ $\text{ClO}_3^-(aq) + 6\text{H}^+(aq) + 5e^{-} \rightleftharpoons \frac{1}{2}\text{Cl}_2(g) + 3\text{H}_2\text{O}(l)$ $\text{Cl}_2(g) + 2e^{-} \rightleftharpoons 2\text{Cl}^-(aq)$ $\text{ClO}_4^-(aq) + 2\text{H}^+(aq) + 2e^{-} \rightleftharpoons \text{ClO}_3^-(aq) + \text{H}_2\text{O}(l)$ $\text{ClO}^-(aq) + \text{H}_2\text{O}(l) + 2e^{-} \rightleftharpoons \text{Cl}^-(aq) + 2\text{OH}^-(aq)$	1,611 1,47 1,358 1,189 0,81
cobalto	$\text{Co}^{3+}(aq) + e^{-} \rightleftharpoons \text{Co}^{2+}(aq)$ $[\text{Co}(\text{NH}_3)_6]^{3+}(aq) + e^{-} \rightleftharpoons [\text{Co}(\text{NH}_3)_6]^{2+}(aq)$ $\text{Co}^{2+}(aq) + 2e^{-} \rightleftharpoons \text{Co}(s)$ $\text{Co(OH)}_2(s) + 2e^{-} \rightleftharpoons \text{Co}(s) + 2\text{OH}^-(aq)$	1,92 0,108 -0,28 -0,73
cromo	$\text{Cr}_2\text{O}_7^{2-}(aq) + 14\text{H}^+(aq) + 6e^{-} \rightleftharpoons 2\text{Cr}^{3+}(aq) + 7\text{H}_2\text{O}(l)$ $\text{CrO}_4^{2-}(aq) + 4\text{H}_2\text{O}(l) + 3e^{-} \rightleftharpoons \text{Cr}(\text{OH})_3(aq) + 5\text{OH}^-(aq)$ $\text{Cr}^{3+}(aq) + e^{-} \rightleftharpoons \text{Cr}^{2+}(aq)$ $\text{Cr}^{3+}(aq) + 3e^{-} \rightleftharpoons \text{Cr}(s)$ $\text{Cr}^{2+}(aq) + 2e^{-} \rightleftharpoons \text{Cr}(s)$	1,232 -0,13 -0,407 -0,744 -0,913

Elemento	Semireazione	$E^\circ_{\text{red}}/\text{V}$
ferro	$\text{Fe}^{3+}(aq) + e^- \rightleftharpoons \text{Fe}^{2+}(aq)$ $[\text{Fe}(\text{CN})_6]^{3-}(aq) + e^- \rightleftharpoons [\text{Fe}(\text{CN})_6]^{4-}(aq)$ $\text{Fe}^{3+}(aq) + 3 e^- \rightleftharpoons \text{Fe}(s)$ $\text{Fe}^{2+}(aq) + 2 e^- \rightleftharpoons \text{Fe}(s)$ $\text{Fe(OH)}_3(s) + e^- \rightleftharpoons \text{Fe(OH)}_2(s) + \text{OH}^-(aq)$	0,771 0,358 -0,037 -0,447 -0,56
fluoro	$\text{F}_2(g) + 2 e^- \rightleftharpoons 2 \text{F}^-(aq)$	2,866
fosforo	$\text{H}_3\text{PO}_4(aq) + 2 \text{H}^+(aq) + 2 e^- \rightleftharpoons \text{H}_3\text{PO}_3(aq) + \text{H}_2\text{O}(l)$ $\text{H}_3\text{PO}_3(aq) + 2 \text{H}^+(aq) + 2 e^- \rightleftharpoons \text{H}_3\text{PO}_2(aq) + \text{H}_2\text{O}(l)$	-0,276 -0,499
gadolino	$\text{Gd}^{3+}(aq) + 3 e^- \rightleftharpoons \text{Gd}(s)$	-2,279
gallio	$\text{Ga}^{3+}(aq) + 3 e^- \rightleftharpoons \text{Ga}(s)$	-0,549
idrogeno	$\text{H}_2\text{O}_2(aq) + 2 \text{H}^+(aq) + 2 e^- \rightleftharpoons 2 \text{H}_2\text{O}(l)$ $2 \text{H}^+(aq) + 2 e^- \rightleftharpoons \text{H}_2(g)$ $\text{H}_2\text{O}(l) + e^- \rightleftharpoons \frac{1}{2}\text{H}_2(g) + \text{OH}^-(aq)$ $\text{H}_2(g) + 2 e^- \rightleftharpoons \text{H}^-(aq)$	1,776 0,0000 -0,828 -2,23
indio	$\text{In(OH)}_3(s) + 3 e^- \rightleftharpoons \text{In}(s) + 3 \text{OH}^-(aq)$	-0,99
iodio	$\text{IO}_3^-(aq) + 6 \text{H}^+(aq) + 5 e^- \rightleftharpoons \frac{1}{2}\text{I}_2(l) + 3 \text{H}_2\text{O}(l)$ $\text{I}_2(s) + 2 e^- \rightleftharpoons 2 \text{I}^-(aq)$ $\text{I}_3^-(aq) + 2 e^- \rightleftharpoons 3 \text{I}^-(aq)$	1,195 0,536 0,536
lantanio	$\text{La}^{3+}(aq) + 3 e^- \rightleftharpoons \text{La}(s)$	-2,379
litio	$\text{Li}^+(aq) + e^- \rightleftharpoons \text{Li}(s)$	-3,040
magnesio	$\text{Mg}^{2+}(aq) + 2 e^- \rightleftharpoons \text{Mg}(s)$	-2,372
manganese	$\text{MnO}_4^-(aq) + 4 \text{H}^+(aq) + 3 e^- \rightleftharpoons \text{MnO}_2(s) + 2 \text{H}_2\text{O}(l)$ $\text{Mn}^{3+}(aq) + e^- \rightleftharpoons \text{Mn}^{2+}(aq)$ $\text{MnO}_4^-(aq) + 8 \text{H}^+(aq) + 5 e^- \rightleftharpoons \text{Mn}^{2+}(aq) + 4 \text{H}_2\text{O}(l)$ $\text{MnO}_2(s) + 4 \text{H}^+(aq) + 2 e^- \rightleftharpoons \text{Mn}^{2+}(aq) + 2 \text{H}_2\text{O}(l)$ $\text{MnO}_4^-(aq) + e^- \rightleftharpoons \text{MnO}_4^{2-}(aq)$ $2 \text{MnO}_2(s) + \text{H}_2\text{O}(l) + e^- \rightleftharpoons \text{Mn}_2\text{O}_3(s) + 2 \text{OH}^-(aq)$ $\text{Mn}^{2+}(aq) + 2 e^- \rightleftharpoons \text{Mn}(s)$ $\text{Mn(OH)}_2(s) + 2 e^- \rightleftharpoons \text{Mn}(s) + 2 \text{OH}^-(aq)$	1,679 1,542 1,507 1,224 0,558 0,118 -1,185 -1,56
mercurio	$2 \text{Hg}^{2+}(aq) + 2 e^- \rightleftharpoons \text{Hg}_2^{2+}(aq)$ $\text{Hg}^{2+}(aq) + 2 e^- \rightleftharpoons \text{Hg}(l)$ $\text{Hg}_2^{2+}(aq) + 2 e^- \rightleftharpoons 2 \text{Hg}(l)$ $\text{Hg}_2\text{SO}_4(s) + 2 e^- \rightleftharpoons 2 \text{Hg}(l) + \text{SO}_4^{2-}(aq)$ $\text{Hg}_2\text{Cl}_2(s) + 2 e^- \rightleftharpoons 2 \text{Hg}(l) + 2 \text{Cl}^-(aq)$ $\text{Hg}_2\text{Br}_2(s) + 2 e^- \rightleftharpoons 2 \text{Hg}(l) + 2 \text{Br}^-(aq)$ $\text{HgO}(s) + \text{H}_2\text{O}(l) + 2 e^- \rightleftharpoons \text{Hg}(l) + 2 \text{OH}^-(aq)$	0,920 0,851 0,797 0,613 0,268 0,139 0,0977
nichel	$\text{Ni}^{2+}(aq) + 2 e^- \rightleftharpoons \text{Ni}(s)$ $\text{Ni(OH)}_2(s) + 2 e^- \rightleftharpoons \text{Ni}(s) + 2 \text{OH}^-(aq)$	-0,257 -0,72
oro	$\text{Au}^+(aq) + e^- \rightleftharpoons \text{Au}(s)$ $\text{Au}^{3+}(aq) + 2 e^- \rightleftharpoons \text{Au}^+(aq)$ $\text{AuCl}_2^-(aq) + e^- \rightleftharpoons \text{Au}(s) + 2 \text{Cl}^-(aq)$ $\text{AuCl}_4^-(aq) + 2 e^- \rightleftharpoons \text{AuCl}_2^-(aq) + 2 \text{Cl}^-(aq)$	1,692 1,401 1,154 0,926
ossigeno	$\text{O}_3(g) + 2 \text{H}^+(aq) + 2 e^- \rightleftharpoons \text{O}_2(g) + \text{H}_2\text{O}(l)$ $\text{O}_3(g) + \text{H}_2\text{O}(l) + 2 e^- \rightleftharpoons \text{O}_2(g) + 2 \text{OH}^-(aq)$ $\text{O}_2(g) + 4 \text{H}^+(aq) + 4 e^- \rightleftharpoons 2 \text{H}_2\text{O}(l)$ $\text{O}_2(g) + 2 \text{H}^+(aq) + 2 e^- \rightleftharpoons \text{H}_2\text{O}_2(l)$ $\text{O}_2(g) + 2 \text{H}_2\text{O}(l) + 4 e^- \rightleftharpoons 4 \text{OH}^-(aq)$	2,076 1,24 1,229 0,695 0,401
palladio	$\text{Pd}^{2+}(aq) + 2 e^- \rightleftharpoons \text{Pd}(s)$	0,951
piombo	$\text{PbO}_2(s) + 4 \text{H}^+(aq) + \text{SO}_4^{2-}(aq) + 2 e^- \rightleftharpoons \text{PbSO}_4(s) + 2 \text{H}_2\text{O}(l)$ $\text{PbO}_2(s) + 4 \text{H}^+(aq) + 2 e^- \rightleftharpoons \text{Pb}^{2+}(s) + 2 \text{H}_2\text{O}(l)$ $\text{Pb}^{2+}(aq) + 2 e^- \rightleftharpoons \text{Pb}(s)$ $\text{PbF}_2(s) + 2 e^- \rightleftharpoons \text{Pb}(s) + 2 \text{F}^-(aq)$ $\text{PbSO}_4(s) + 2 e^- \rightleftharpoons \text{Pb}(s) + \text{SO}_4^{2-}(aq)$	1,691 1,455 -0,126 -0,344 -0,359

Elemento	Semireazione	$E^\circ_{\text{red}}/\text{V}$
platino	$\text{Pt}^{2+}(aq) + 2e^- \rightleftharpoons \text{Pt}(s)$	1,18
potassio	$\text{K}^+(aq) + e^- \rightleftharpoons \text{K}(s)$	-2,931
rame	$\text{Cu}^+(aq) + e^- \rightleftharpoons \text{Cu}(s)$ $\text{Cu}^{2+}(aq) + 2e^- \rightleftharpoons \text{Cu}(s)$ $\text{Cu}^{2+}(aq) + e^- \rightleftharpoons \text{Cu}^+(aq)$ $\text{Cu(OH)}_2(s) + 2e^- \rightleftharpoons \text{Cu}(s) + 2\text{OH}^-(aq)$	0,521 0,342 0,153 -0,222
rubidio	$\text{Rb}^+(aq) + e^- \rightleftharpoons \text{Rb}(s)$	-2,98
scandio	$\text{Sc}^{3+}(aq) + 3e^- \rightleftharpoons \text{Sc}(s)$	-2,077
sodio	$\text{Na}^+(aq) + e^- \rightleftharpoons \text{Na}(s)$	-2,71
stagno	$\text{Sn}^{4+}(aq) + 2e^- \rightleftharpoons \text{Sn}^{2+}(aq)$ $\text{Sn}^{2+}(aq) + 2e^- \rightleftharpoons \text{Sn}(s)$	0,151 -0,138
stronzio	$\text{Sr}^{2+}(aq) + 2e^- \rightleftharpoons \text{Sr}(s)$	-2,899
tallio	$\text{Tl}^{3+}(aq) + 2e^- \rightleftharpoons \text{Tl}^+(aq)$ $\text{Tl}^+(aq) + e^- \rightleftharpoons \text{Tl}(s)$ $\text{TlCl}(s) + e^- \rightleftharpoons \text{Tl}(s) + \text{Cl}^-(aq)$	1,252 -0,336 -0,557
vanadio	$\text{VO}_2^+(aq) + 2\text{H}^+(aq) + e^- \rightleftharpoons \text{VO}^{2+}(aq) + \text{H}_2\text{O}(l)$ $\text{VO}^{2+}(aq) + 2\text{H}^+(aq) + e^- \rightleftharpoons \text{V}^{3+}(aq) + \text{H}_2\text{O}(l)$ $\text{V}^{3+}(aq) + e^- \rightleftharpoons \text{V}^{2+}(aq)$ $\text{V}^{2+}(aq) + 2e^- \rightleftharpoons \text{V}(s)$	0,991 0,337 -0,255 -1,175
zinco	$\text{Zn}^{2+}(aq) + 2e^- \rightleftharpoons \text{Zn}(s)$ $\text{Zn(OH)}_4^{2-}(aq) + 2e^- \rightleftharpoons \text{Zn}(s) + 4\text{OH}^-(aq)$ $\text{Zn(OH)}_2(s) + 2e^- \rightleftharpoons \text{Zn}(s) + 2\text{OH}^-(aq)$ $\text{ZnO}(s) + \text{H}_2\text{O}(l) + 2e^- \rightleftharpoons \text{Zn}(s) + 2\text{OH}^-(aq)$	-0,762 -1,199 -1,249 -1,260
zolfo	$\text{S}_2\text{O}_8^{2-}(aq) + 2e^- \rightleftharpoons 2\text{SO}_4^{2-}(aq)$ $\text{S}_2\text{O}_6^{2-}(aq) + 4\text{H}^+(aq) + 2e^- \rightleftharpoons 2\text{H}_2\text{SO}_3(aq)$ $\text{SO}_4^{2-}(aq) + 4\text{H}^+(aq) + 2e^- \rightleftharpoons \text{H}_2\text{SO}_3(aq) + \text{H}_2\text{O}(l)$ $\text{S}_4\text{O}_6^{2-}(aq) + 2e^- \rightleftharpoons 2\text{S}_2\text{O}_3^{2-}(aq)$ $2\text{SO}_4^{2-}(aq) + 4\text{H}^+(aq) + 2e^- \rightleftharpoons \text{S}_2\text{O}_6^{2-}(aq) + \text{H}_2\text{O}(l)$ $\text{SO}_4^{2-}(aq) + \text{H}_2\text{O}(l) + 2e^- \rightleftharpoons \text{SO}_3^{2-}(aq) + 2\text{OH}^-(aq)$ $2\text{SO}_3^{2-}(aq) + 2\text{H}_2\text{O}(l) + 2e^- \rightleftharpoons \text{S}_2\text{O}_4^{2-}(aq) + 4\text{OH}^-(aq)$	2,010 0,564 0,172 0,08 -0,22 -0,93 -1,12

*I dati sono tratti da CRC Handbook of Chemistry and Physics, 87th ed., 2006-2007.