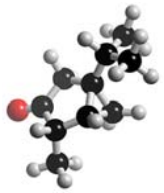
A2.CHEM5.3.003

ELECTRODE POTENTIALS



Name …… Form ……

1) Calculate the standard electrode potential of the Na^+/Na electrode given that when it was joined to the standard hydrogen electrode, the cell emf was -2.71 volts.

2) Calculate the emf of a cell with the standard AgCl/Ag electrode (Eê = +0.22 V) as the left hand electrode and the Fe^{2+}/Fe (Eê = -0.44 V) electrode as the right hand one.

3) Calculate the emf of a standard cell: $Zn(s) \mid Zn^{2+}(aq) \parallel Pb^{2+}(aq) \mid Pb(s)$

given that:

$Zn^{2+}(aq) + 2\,e^- \rightleftharpoons Zn(s)$	Eê = -0.76 V
$Pb^{2+}(aq) + 2\,e^- \rightleftharpoons Pb(s)$	Eê = -0.13 V

4) Calculate $E\hat{e}_{cell}$ of the following cells using the Eê values that follow.

a) $Ni(s) \mid Ni^{2+}(aq) \mid\mid Sn^{4+}(aq), Sn^{2+}(aq) \mid Pt(s)$

b) $Pt(s) \mid I^-(aq) \mid I_2(s) \mid\mid Ag^+(aq) \mid Ag(s)$

c) $Pt(s) \mid Cl^-(aq) \mid Cl_2(g) \mid\mid Br_2(l), Br^-(aq) \mid Pt(s)$

$Ni^{2+}(aq) + 2\,e^- \rightleftharpoons Ni(s)$	Eê = -0.25 V
$Sn^{4+}(aq) + 2\,e^- \rightleftharpoons Sn^{2+}(aq)$	Eê = +0.15 V
$I_2(s) + 2\,e^- \rightleftharpoons 2\,I^-(aq)$	Eê = +0.54 V
$Ag^+(aq) + e^- \rightleftharpoons Ag(s)$	Eê = +0.80 V
$Br_2(l) + 2\,e^- \rightleftharpoons 2\,Br^-(aq)$	Eê = +1.07 V
$Cl_2(g) + 2\,e^- \rightleftharpoons 2\,Cl^-(aq)$	Eê = +1.36 V

5) Calculate the E° of the Cu^{2+}/Cu couple given:

$Cu(s) \mid Cu^{2+}(aq) \parallel Cl_2(g) \mid Cl^-(aq) \mid Pt(s)$	$E\hat{e}_{cell}$ = +1.02 V
$Cl_2(g) + 2\,e^- \rightleftharpoons 2\,Cl^-(aq)$	Eê = +1.36 V

6) Calculate the standard electrode potentials of the half-cells for which the potential is not given. Write your answer by writing the half equation with its potential.

a) $Mg(s) \mid Mg^{2+}(aq) \mid\mid Ti^{3+}(aq), Ti^{2+}(aq) \mid Pt(s)$ — $E\hat{e}_{cell}$ = +2.00 V

$Mg^{2+}(aq) + 2\,e^- \rightleftharpoons Mg(s)$ — Eê = -2.38 V

b) $K(s) \mid K^+(aq) \mid\mid Mg^{2+}(aq) \mid Mg(s)$ — $E\hat{e}_{cell}$ = +0.54 V

$Mg^{2+}(aq) + 2\,e^- \rightleftharpoons Mg(s)$ — Eê = -2.38 V

c) $Pt(s) \mid Hg(l) \mid Hg_2Cl_2(aq), KCl(aq) \mid\mid Rb^+(aq) \mid Rb(s)$ — $E\hat{e}_{cell}$ = -3.19 V

$Hg_2Cl_{2(aq)} + 2\,e^- \rightleftharpoons 2\,Hg_{(l)} + 2\,Cl^-_{(aq)}$ — Eê =+0.27 V

7) For each of the following questions,

i) Draw the cell notation for the cell produced when the two half cells are joined via a salt bridge.

ii) Calculate the cell emf.

Remember the cell emf should be positive, although it may not be if the SHE is involved.

a) $Cr^{2+}(aq) + 2\,e^- \rightleftharpoons Cr(s)$ — Eê = -0.91 V

$Zn^{2+}(aq) + 2\,e^- \rightleftharpoons Zn(s)$ — Eê = -0.76 V

b) $Cu^{2+}(aq) + 2\,e^- \rightleftharpoons Cu(s)$ — Eê = +0.34 V

$Fe^{3+}(aq) + e^- \rightleftharpoons Fe^{2+}(aq)$ — Eê = +0.77 V

c) $MnO_4^-(aq) + 8\,H^+(aq) + 5\,e^- \rightleftharpoons Mn^{2+}(aq) + 4\,H_2O(l)$ — Eê = +1.51 V

$Cl_2(g) + 2\,e^- \rightleftharpoons 2\,Cl^-(aq)$ — Eê = +1.36 V