Examples using $E^o_{cell} = E^o_{(right\ hand\ electrode)} - E^o_{(left\ hand\ electrode)}$

1. Find the e.m.f. of the cell

$$Fe \mid Fe^{2+} \mid\mid Pb^{2+} \mid Pb$$

LHS   **RHS**
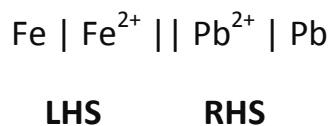
Electrode			E^o/ V
Fe^{2+}	$+ 2e^-$ $\rightleftharpoons$	Fe	-0.44
Pb^{2+}	$+ 2e^-$ $\rightleftharpoons$	Pb	-0.13

$E^o_{cell} = E^o_{(right\ hand\ electrode)} - E^o_{(left\ hand\ electrode)}$

$\quad = E^o_{(Pb,\ Pb^{2+})} - E^o_{(Fe,\ Fe^{2+})}$

$\quad = -0.13 + 0.44$

$\quad = \underline{+0.31V}$

2. Find the e.m.f. of the cell

$$Cu \mid Cu^{2+} \mid\mid Mg^{2+} \mid Mg$$

LHS   **RHS**
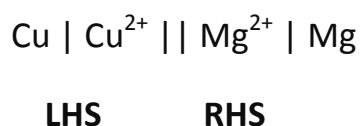
Electrode			E^o/ V
Mg^{2+}	$+ 2e^-$ $\rightleftharpoons$	Mg	-2.37
Cu^{2+}	$+ 2e^-$ $\rightleftharpoons$	Cu	$+0.34$

$E^o_{cell} = E^o_{(right\ hand\ electrode)} - E^o_{(left\ hand\ electrode)}$

$\quad = E^o_{(Mg,\ Mg^{2+})} - E^o_{(Cu,\ Cu^{2+})}$

$\quad = -2.37 - 0.34$

$\quad = \underline{-2.71V}$

3. Find E^o for Sn^{2+}, Sn if

$Ag \mid Ag^+ \parallel Sn^{2+} \mid Sn$ $\qquad E^o_{cell} = -0.94V$

$H_2 \mid H^+ \parallel Ag^+ \mid Ag$ $\qquad E^o_{cell} = +0.80V$
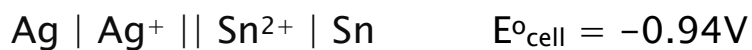
re-writing the question

$Ag \mid Ag^+ \parallel Sn^{2+} \mid Sn$

LHS $\qquad$ **RHS**

UNKNOWN

Electrode				E^o/ V
Sn^{2+}	$+ 2e^-$	$\rightleftharpoons$	Sn	UNKNOWN
Ag^+	$+ e^-$	$\rightleftharpoons$	Ag	$+0.80$

$E^o_{cell} = E^o_{(right\ hand\ electrode)} - E^o_{(left\ hand\ electrode)}$

$E^o_{cell} = E^o_{(Sn,\ Sn^{2+})} - E^o_{(Ag,\ Ag^+)}$

$E^o_{cell} + E^o_{(Ag,\ Ag^+)} = E^o_{(Sn,\ Sn^{2+})}$

$E^o_{(Sn,\ Sn^{2+})} = -0.94 + 0.80$

$\qquad = \underline{-0.14V}$

4. Given:

$$Pt \mid Cr^{2+}, Cr^{3+} \parallel Cu^{2+} \mid Cu \qquad E^o_{cell} = +0.75V$$

$$Cu^{2+} + 2e^- \quad \rightleftharpoons \quad Cu \qquad E^o = +0.34V$$

Find:

$$E^o \text{ for} \quad Cr^{3+} + e- \rightleftharpoons Cr^{2+}$$

re-writing the question

$$Pt \mid Cr^{2+}, Cr^{3+} \parallel Cu^{2+} \mid Cu$$

LHS   **RHS**
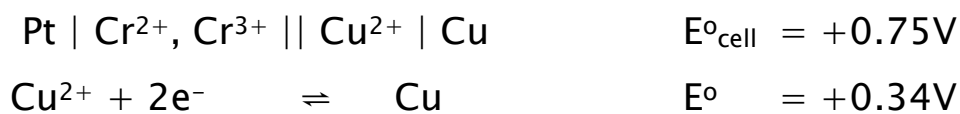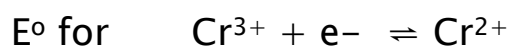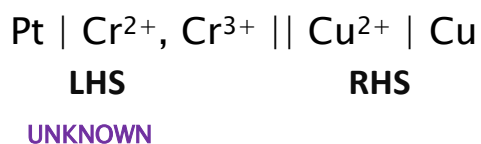
UNKNOWN

Electrode			E^o/ V
Cr^{3+} + e^- $\rightleftharpoons$	Cr^{2+}		UNKNOWN
Cu^{2+} + $2e^-$ $\rightleftharpoons$	Cu		+0.34

$$E^o_{cell} = E^o_{(right\ hand\ electrode)} - E^o_{(left\ hand\ electrode)}$$

$$E^o_{cell} = E^o_{(Cu,\ Cu^{2+})} - E^o_{(Cr^{3+},\ Cr^{2+})}$$

$$E^o_{(Cr^{3+},\ Cr^{2+})} = E^o_{(Cu,\ Cu^{2+})} - E^o_{cell}$$

$$E^o_{(Cr^{3+},\ Cr^{2+})} = +0.34 - 0.75$$

$$= \underline{-0.41V}$$

examples taken from

Jim Clark, *Calculations in AS/A Level Chemistry* (2000). Pearson Education.