

Electro Practice Problems

1. $\text{MnO}_4^- (\text{aq}) + \text{Br}^- (\text{aq}) + \text{H}^+ (\text{aq}) \rightarrow \text{Mn}^{+2} (\text{aq}) + \text{Br}_2 (\text{l}) + \text{H}_2\text{O} (\text{l})$
- After balancing the above reaction with the $\frac{1}{2}$ box method how many electrons are transferred in the reaction represented by the balanced eq'n above?
A) 2 B) 4 C) 5 D) 8 E) 10
 - Write the 2 half reaction equations.
 - If **$E^\circ_{\text{red}} + E^\circ_{\text{ox}} = E^\circ_{\text{cell}}$** then find the **$E^\circ_{\text{cell}}$** for the redox reaction above.
 - If **$\Delta G^\circ_{\text{rxn}} = -nF E^\circ_{\text{cell}}$** then what is the $\Delta G^\circ_{\text{rxn}}$ for the above reaction. Compare and Contrast the signs of the $\Delta G^\circ_{\text{rxn}}$ and E°_{cell} and come up with a plan for spontaneity and signs.
(F= 96500 J/mol*V and n=moles of electrons transferred)
 - Now find the Keq and again compare and contrast signs of $\Delta G^\circ_{\text{rxn}}$, E°_{cell} and Keq and then comment on product/reactant favored!!

2. $\text{Cr}_2\text{O}_7^{2-} (\text{aq}) + \text{Zn} (\text{s}) + \text{H}^+ (\text{aq}) \rightarrow \text{Zn}^{+2} (\text{aq}) + \text{Cr}^{+3} (\text{aq}) + \text{H}_2\text{O} (\text{l})$
- After balancing the above rxn with the $\frac{1}{2}$ box method, how many electrons are transferred?
 - Write the 2 half reaction equations.
 - Find the **E°_{cell}** for the redox reaction above.
 - Find $\Delta G^\circ_{\text{rxn}}$ for the above reaction. Compare and Contrast the signs of the $\Delta G^\circ_{\text{rxn}}$ and E°_{cell} .
(F= 96500 J/mol*V and n=moles of electrons transferred)
 - Now find the Keq and again compare and contrast signs of $\Delta G^\circ_{\text{rxn}}$ & E°_{cell} with the size of Keq.
 - E°_{cell} is the potential of the reaction as long as **all solutions** are 1.0 Molar and **all gases** (if the reaction has gases) are at 1.0 atm. If even one of these values changes then the E°_{cell} changes to E_{cell} . What is the difference in those two symbols (compare and contrast the symbols)?
The equation for finding E_{cell} is **$E_{\text{cell}} = E^\circ_{\text{cell}} - (RT/nF)(\ln(Q))$** where $R = 8.31 \text{ J/mol}\cdot\text{K}$
 $T = 298\text{K}$ $n = \text{moles of electrons transferred}$ $F = 96500 \text{ J/V}\cdot\text{mol}$; $Q = (P/R)$ where (aq) = [] and (g) = atm for example: $\text{Ni} (\text{s}) + 2\text{H}^+ (\text{aq}) \rightarrow \text{Ni}^{+2} (\text{aq}) + \text{H}_2 (\text{g})$ $Q = \frac{[\text{Ni}^{+2}](P_{\text{H}_2})}{[\text{H}^{+}]^2}$
- Find E_{cell} for the reaction in part A if $[\text{Zn}^{+2}] = 0.100\text{M}$ when everything else is standard.

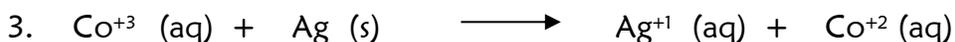


3. Write the balanced redox reaction, find the E°_{cell} , draw a picture of this cell with a salt bridge of KNO_3 and then predict how the voltage would change with each of the following:
- the products are less than standard molarity? More than standard molarity?
 - the reactants are less than standard molarity? More than standard molarity?

Electro #2

I. Balance the following redox reactions and then use your standard reduction potentials in aqueous solution sheet to find the E°_{cell} .

$E^\circ_{\text{cell}} = E^\circ_{\text{ox}} + E^\circ_{\text{red}}$: Remember E°_{ox} values are the negative of the E°_{red} values found on the sheet. Read the $\frac{1}{2}$ reactions backwards to make them be E°_{ox} $\frac{1}{2}$ reactions.



II. For each of the reactions in Part I, find the ΔG° and the K_{eq} . Relate the signs of the ΔG° and E°_{cell} to the magnitude of the K_{eq} .

III. For each of the reactions in Part I, find the E_{cell} at nonstandard conditions if the following conditions are changed:

For 1 the $[\text{Co}^{+2}] = .10\text{M}$ while all other solutions are standard.

For 2 the $[\text{Ni}^{+2}] = .20\text{M}$ while all other solutions are standard.

For 3 the $[\text{Co}^{+2}] = 1.10\text{M}$ while all other solutions are standard.

For 4 the $[\text{Sn}^{+2}] = 0.10\text{M}$, $[\text{Sn}^{+4}] = 0.40\text{M}$, & $[\text{Cu}^{+2}] = 0.30\text{M}$.

IV. Of the reactions in Part I which one could you look at the states and say for sure that the ΔS° is a positive number? Explain your answer.

V. If 3.67 g of sodium chloride is dissolved in 100.0 mL of water in a coffee cup calorimeter causing the temperature of the water to decrease from 25.00°C to 24.43 °C,

a. What is the molar heat of dissolving for sodium chloride?

b. Write a thermochemical equation for the dissolving of sodium chloride. If 40.0 g of sodium chloride dissolves how many kJ of heat are absorbed?

c. Using your charts find the $\Delta S^\circ_{\text{rxn}}$. Then using the Gibbs Free energy equation find the $\Delta G^\circ_{\text{rxn}}$. From the $\Delta G^\circ_{\text{rxn}}$ find K_{eq} for the reaction.