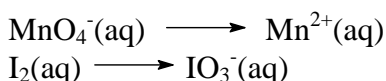


Electrochemistry

*Note: Some of these problems will require you to look up necessary information from your textbook. All the information you need **will** be there.*

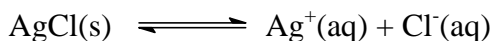
- Predict whether or not the following chemicals will react under standard conditions at 25°C. In each case where a reaction occurs, provide the balanced equation and ϵ° .
 - Chlorine gas and aqueous sodium bromide [$\epsilon^\circ = 0.293 \text{ v}$]
 - Iron(II) chloride and acidified potassium dichromate [$\epsilon^\circ = 0.559 \text{ v}$]
 - Iodine and hydrogen peroxide [$\epsilon^\circ = 1.068 \text{ v}$]
 - silver nitrate and hydrogen peroxide [$\epsilon^\circ = 1.068 \text{ v}$]

- Calculate ϵ° (at 25°C) for a galvanic cell based on the following half-reactions (in acidic solution):



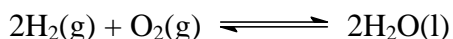
Calculate the voltage for a cell with a pH = 2.0, Mn^{2+} and IO_3^- are each 0.50 M, and I_2 and MnO_4^- are each 0.0010 M. Give the full cell notation for the reaction using the conditions given. [$\epsilon^\circ = 0.31 \text{ v}$, $\epsilon = 0.2166 \text{ v}$]

- Find the EMF of a cell in which a standard hydrogen electrode is coupled to an electrode with 0.1 M acetic acid and hydrogen gas at 1.0 atm pressure. (*Hint: acetic acid is a weak acid with a $K_a = 1.8 \times 10^{-5}$.*) [$\epsilon = 0.1699 \text{ v}$]
- Find ϵ° and K (at 25°C) for the equilibrium



Will the EMF increase or decrease if the Ag^+ concentration is raised above 1 M? Explain your answer. [$\epsilon^\circ = -0.5777 \text{ v}$, $K = 1.72 \times 10^{-10}$, **decrease**]

- A hydrogen/oxygen fuel cell has the net reaction



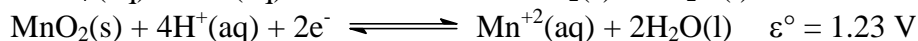
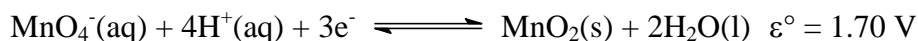
and the cell is operated under acidic conditions. The cell is constructed with $P_{\text{H}_2} = 2.00 \text{ atm}$ and $P_{\text{O}_2} = 0.20 \text{ atm}$ and run at a temperature of 25°C. What voltage will be produced by the fuel cell? Is it possible to vary the pressure of hydrogen only (with the pressure of O_2 fixed at 0.20 atm) so that the battery produces 10.0 volts at 25°C? If so, what would the pressure of H_2 have to be to obtain this voltage? Do you think it would be possible to build such a battery? [$\epsilon = 1.228 \text{ v}$, $7.37 \times 10^{296} \text{ atm}$, **NO**]

6. Using the following half-reactions (which occur in acidic solution):

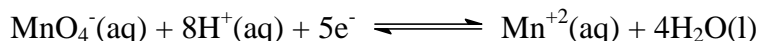


Determine whether the chlorate (ClO_3^-) ion disproportionates spontaneously in acidic solution under standard conditions at 25°C . What are ε° and K for the disproportionation?
[$\varepsilon^\circ = 0.261 \text{ v}$, $K = 2.96 \times 10^{26}$]

7. Given the half-reactions



Determine ε° for the half reaction



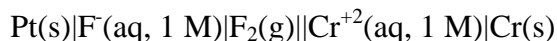
[$\varepsilon^\circ = 1.512 \text{ v}$]

8. A concentration cell is set up as follows:



0.500 litre beakers are used. A current of 2.0 A is drawn from the cell.

- What voltage will be initially produced by the cell? [**0.2114 v**]
 - What voltage will the cell produce after ten minutes of operation? [**0.08583 v**]
 - How many minutes may the cell be run before it produces no voltage? [**33 min 52 sec**]
9. When the cell



is run, what will be produced at the anode and what at the cathode?

[**O₂ at anode, H₂ at cathode**]