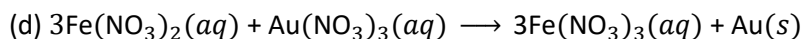
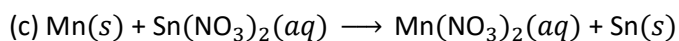
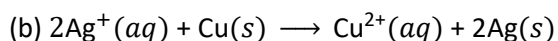
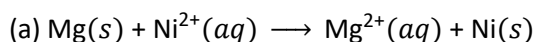


Electrochemistry

Section 106 – Electrode and Cell Potentials

106-1 Calculate the standard cell potential for each reaction below, and note whether the reaction is spontaneous under standard state conditions.



Solution

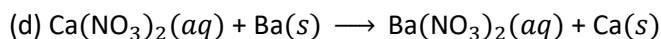
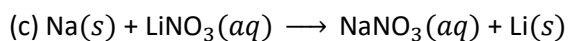
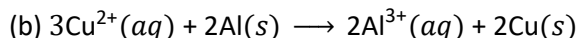
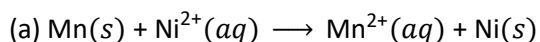
(a) $E_{\text{cell}}^{\circ} = E_{\text{cathode}}^{\circ} - E_{\text{anode}}^{\circ} = -0.257 \text{ V} - (-2.372 \text{ V}) = +2.115 \text{ V}$ (spontaneous);

(b) $E_{\text{cell}}^{\circ} = E_{\text{cathode}}^{\circ} - E_{\text{anode}}^{\circ} = 0.7996 \text{ V} - (+0.337 \text{ V}) = +0.4626 \text{ V}$ (spontaneous);

(c) $E_{\text{cell}}^{\circ} = E_{\text{cathode}}^{\circ} - E_{\text{anode}}^{\circ} = -0.1375 \text{ V} - (-1.185 \text{ V}) = +1.048 \text{ V}$ (spontaneous);

(d) $E_{\text{cell}}^{\circ} = E_{\text{cathode}}^{\circ} - E_{\text{anode}}^{\circ} = 1.498 \text{ V} - (+0.771 \text{ V}) = +0.727 \text{ V}$ (spontaneous)

106-2 Calculate the standard cell potential for each reaction below, and note whether the reaction is spontaneous under standard state conditions.



Solution

(a) $E_{\text{cell}}^{\circ} = E_{\text{cathode}}^{\circ} - E_{\text{anode}}^{\circ} = -0.257 \text{ V} - (-1.185 \text{ V}) = +0.928 \text{ V}$ (spontaneous);

(b) $E_{\text{cell}}^{\circ} = E_{\text{cathode}}^{\circ} - E_{\text{anode}}^{\circ} = 0.337 \text{ V} - (-1.662 \text{ V}) = +1.999 \text{ V}$ (spontaneous);

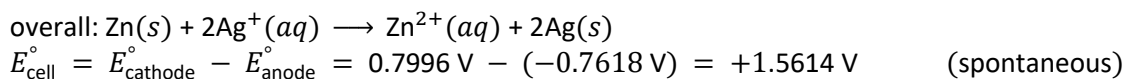
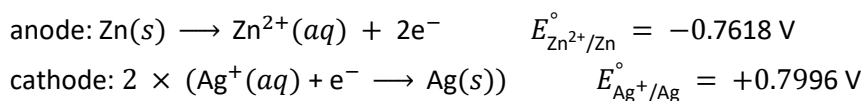
(c) $E_{\text{cell}}^{\circ} = E_{\text{cathode}}^{\circ} - E_{\text{anode}}^{\circ} = -3.04 \text{ V} - (-2.71 \text{ V}) = -0.33 \text{ V}$ (non-spontaneous);

(d) $E_{\text{cell}}^{\circ} = E_{\text{cathode}}^{\circ} - E_{\text{anode}}^{\circ} = -2.868 \text{ V} - (-2.912 \text{ V}) = +0.044 \text{ V}$ (spontaneous)

106-3 Determine the cell reaction and standard cell potential at 25 °C for a cell made from a cathode half-cell consisting of a silver electrode in 1 M silver nitrate solution and an anode half-cell consisting of a zinc electrode in 1 M zinc nitrate. Is the reaction spontaneous at standard conditions?

Solution

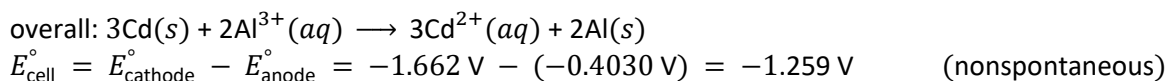
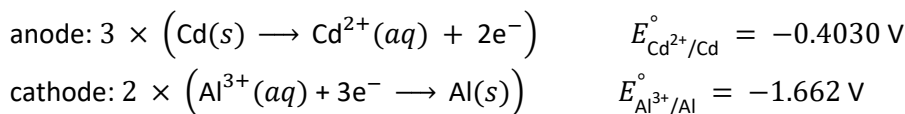
Galvanic cells have positive cell potentials, so the anode must have the least positive (or most negative) standard reduction potential



- 106-4 Determine the cell reaction and standard cell potential at 25 °C for a cell made from an anode half-cell containing a cadmium electrode in 1 M cadmium nitrate and a cathode half-cell consisting of an aluminum electrode in 1 M aluminum nitrate solution. Is the reaction spontaneous at standard conditions?

Solution

Oxidation occurs at the anode and reduction at the cathode:

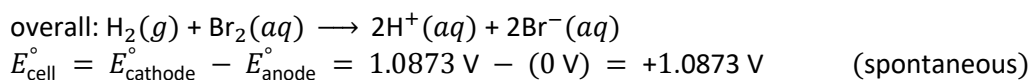
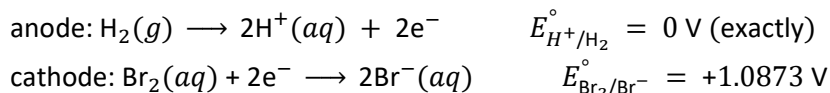


- 106-5 Write the balanced cell reaction for the cell schematic below, calculate the standard cell potential, and note whether the reaction is spontaneous under standard state conditions.



Solution

Both half-cells are using inert Pt electrodes, which do not participate in the oxidation-reduction reaction:



- 106-6 Write the balanced cell reaction for the cell schematic below, calculate the standard cell potential, and note whether the reaction is spontaneous under standard state conditions.



Solution

