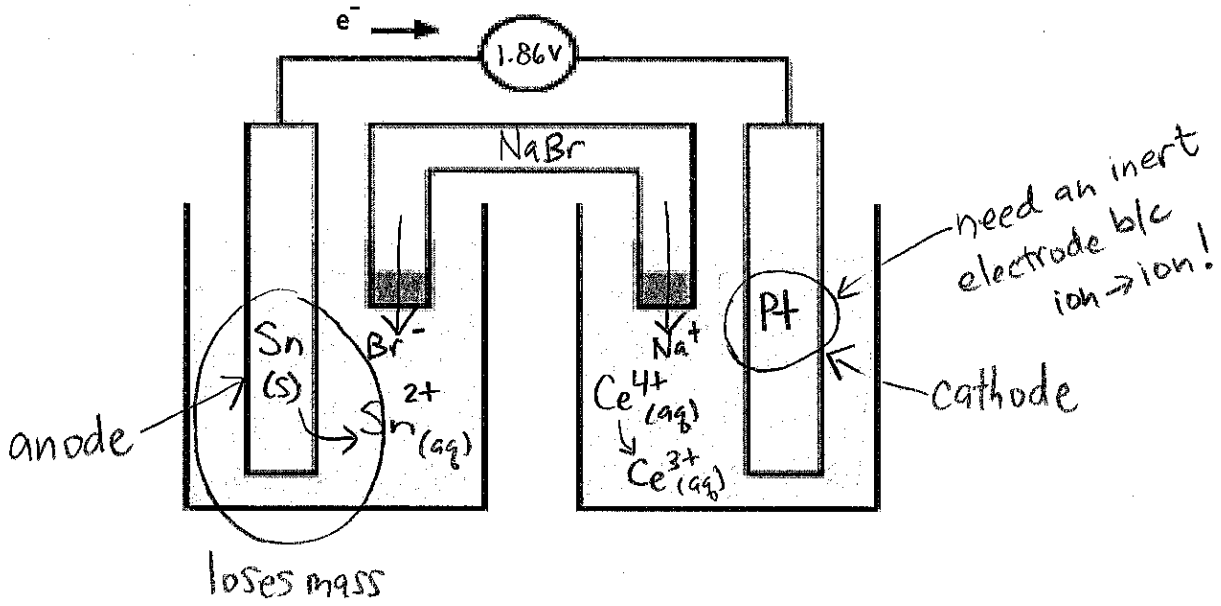
red ox 28

$$2\,Ce^{4+}(aq) + Sn(s) \rightarrow Sn^{2+}(aq) + 2\,Ce^{3+}(aq)$$

2. The diagram below shows a galvanic cell based on the reaction represented above.



a. Label the anode and cathode in the diagram.

b. Label each electrode with an appropriate metal.

c. What ions will be found in solution in each half-cell? Fill them in on the diagram.

d. The diagram includes a salt bridge that is filled with a saturated solution of NaBr. Draw what happens in the salt bridge as the cell operates on the diagram above.

e. Circle the electrode that will lose mass as the reaction progresses. As the mass is "lost", where does it go? the anode loses mass as $Sn_{(s)}$ is oxidized + moves into solution, so the mass of the anode electrode moves into the solution!

f. Put a rectangle around the electrode that will gain mass as the reaction progresses. Where does this mass come from? Trick question! Normally the cathode gains mass (from soln as the cation is reduced to a solid), but in this cell the reduction doesn't create a solid, so the mass of the cathode electrode won't change!

g. Use the following reduction potentials to calculate the voltage measured on the voltmeter shown above.

$Sn^{2+}(aq) + 2\,e^- \rightarrow Sn(s)$ $\quad E^\circ_{red} = -0.14\,V$] $\Rightarrow E^\circ_{ox} = +0.14V$

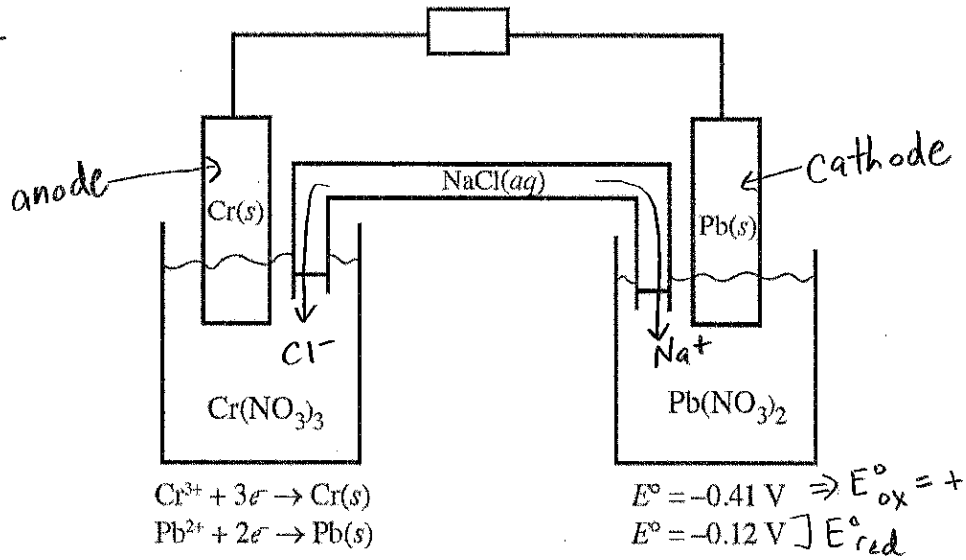
$Ce^{4+}(aq) + 4\,e^- \rightarrow Ce(s)$ $\quad E^\circ_{red} = -2.34\,V$ → don't need (this ½ rxn doesn't happen here!)

$Ce^{4+}(aq) + e^- \rightarrow Ce^{3+}(aq)$ $\quad E^\circ_{red} = +1.72\,V$

$$E^\circ_{cell} = E^\circ_{ox} + E^\circ_{red} = 1.72 + 0.14 = \boxed{1.86V}$$

A voltaic cell is created using the half-cells shown below. The concentrations of the solutions in each half-cell are 1.0 M.

$\Rightarrow E^\circ_{cell} = +$



$Cr^{3+} + 3e^- \rightarrow Cr(s)$ $\quad E^\circ = -0.41\ V \Rightarrow E^\circ_{ox} = +0.41$

$Pb^{2+} + 2e^- \rightarrow Pb(s)$ $\quad E^\circ = -0.12\ V \rightarrow E^\circ_{red}$

3. Which of the following occurs at the cathode? red cat

   a. Cr^{3+} is reduced to Cr(s).
   b. Pb^{2+} is reduced to Pb(s).
   c. Cr(s) is oxidized to Cr^{3+}.
   d. Pb(s) is oxidized to Pb^{2+}.

4. Which of the following best describes the activity in the salt bridge as the reaction progresses?

   a. Electrons flow through the salt bridge from the Pb/Pb^{2+} half-cell to the Cr/Cr^{3+} half-cell. never!
   b. Pb^{2+} flows to the Cr/Cr^{3+} half-cell, and Cr^{3+} flows to the Pb/Pb^{2+} half-cell.
   c. Na^+ flows to the Cr/Cr^{3+} half-cell, and Cl^- flows to the Pb/Pb^{2+} half-cell.
   d. Na^+ flows to the Pb/Pb^{2+} half-cell, and Cl^- flows to the Cr/Cr^{3+} half-cell.

5. Based on the given reduction potentials, which of the following would lead to a reaction?

   a. Placing some Cr(s) in a solution containing Pb^{2+} ions.
   b. Placing some Pb(s) in a solution containing Cr^{3+} ions.
   c. Placing some Cr(s) in a solution containing Cr^{3+} ions.
   d. Placing some Pb(s) in a solution containing Pb^{2+} ions.

6. Which of the following statements applies to the change in mass of the electrodes involved in this electrochemical cell?

   a. Cr(s) is the cathode and it gains mass since metal ions are being converted to metal atoms which often adhere to the electrode.
   b. Pb(s) is the cathode and it gains mass since metal ions are being converted to metal atoms which often adhere to the electrode. Fat cat!
   c. Cr(s) is the anode and it gains mass since metal ions are being converted to metal atoms which often adhere to the electrode.
   d. Pb(s) is the anode and it gains mass since metal ions are being converted to metal atoms which often adhere to the electrode.