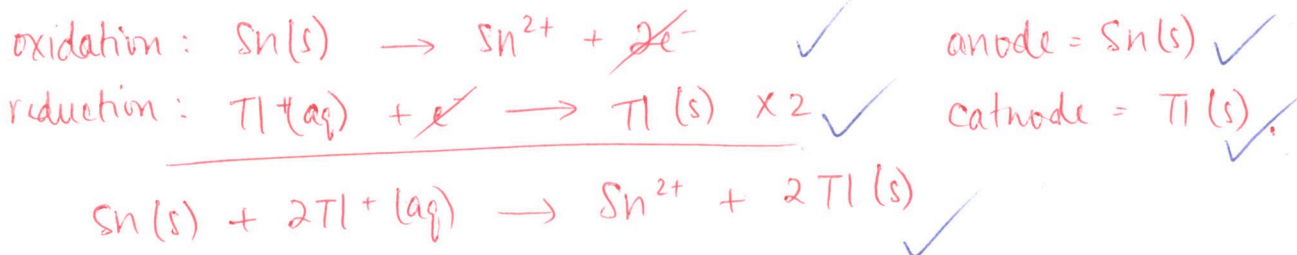


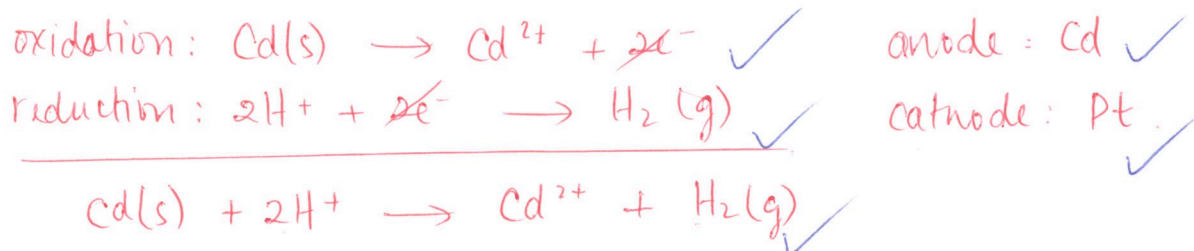
G12 Chemistry: Class 16 Homework

1. Write the oxidation half-reaction, the reduction half-reaction, and the overall cell reaction for each of the following galvanic cells. Identify the anode and the cathode in each case. In part(b) platinum is present as an inert electrode.

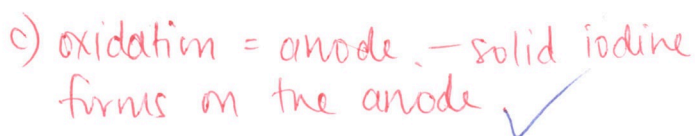
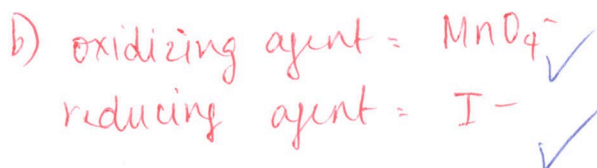
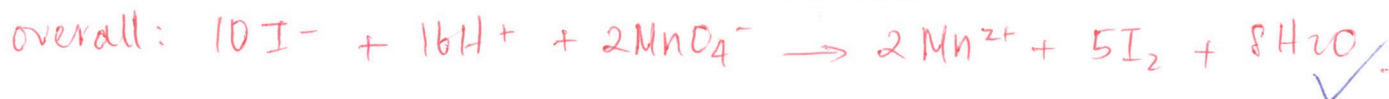
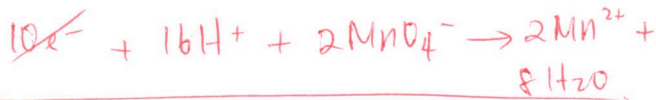
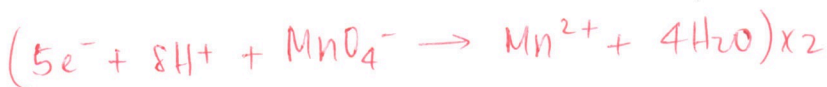
a. $\text{Sn(s)} \mid \text{Sn}^{2+}(\text{aq}) \parallel \text{Tl}^+(\text{aq}) \mid \text{Tl(s)}$ [5 marks]



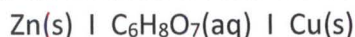
b. $\text{Cd(s)} \mid \text{Cd}^{2+}(\text{aq}) \parallel \text{H}^+(\text{aq}) \mid \text{H}_2(\text{g}) \mid \text{Pt(s)}$ [5 marks]



2. A galvanic cell involves the overall reaction of iodide ions with acidified permanganate ions to form manganese (II) ions and iodine. The salt bridge contains potassium nitrate.
- Write the half-reactions and the overall cell reaction [1 mark]
 - Identify the oxidizing agent and the reducing agent [2 marks]
 - The inert anode and the cathode are both made of graphite. Solid iodine forms on one of them. Which one? [1 mark]

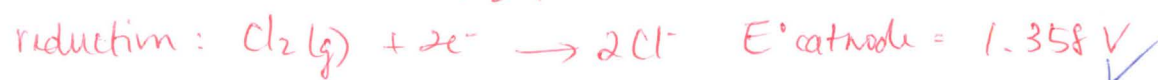
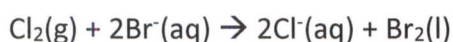


3. Pushing a zinc electrode and a copper electrode into a lemon makes a "lemon cell". In the following representation of the cell $\text{C}_6\text{H}_8\text{O}_7$ is the formula of citric acid. Explain why the representation does not include a double vertical line. [2 marks]



- double vertical line represents a porous barrier or a salt bridge. ✓
- both reactions occur in the same lemon with no barrier. ✓

4. Write the two half-reactions for the following redox reaction. Subtract the two reduction potentials to find the standard cell potential for a galvanic cell in which this reaction occurs. [3 marks]



$$E^\circ_{\text{cell}} = E^\circ_{\text{cathode}} - E^\circ_{\text{anode}} \\ = 1.358 - 1.066 = 0.292\text{V} \quad \checkmark$$

5. Write the two half-reactions for the following redox reaction. Subtract the two standard reduction potentials to find the standard cell potential for the reaction. [3 marks]



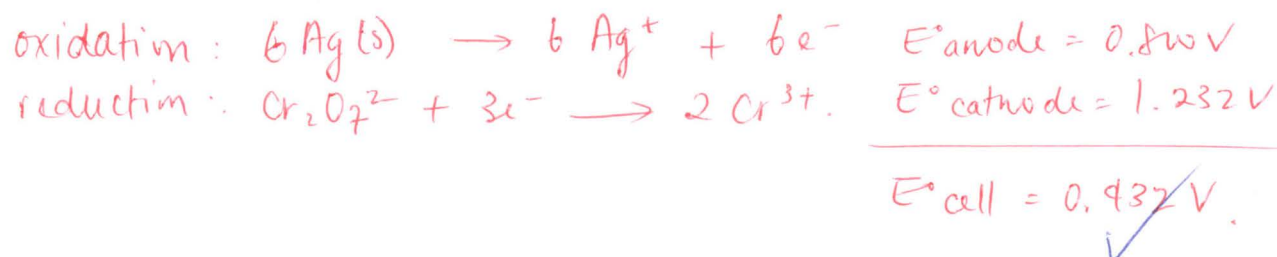
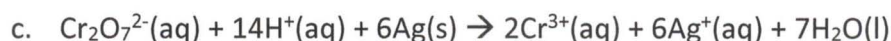
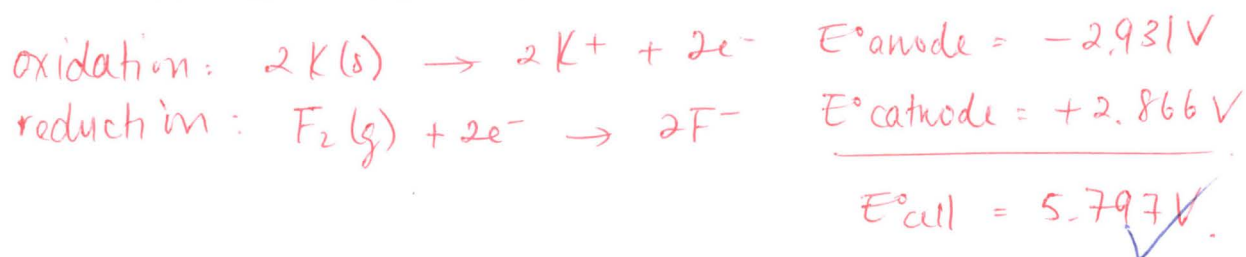
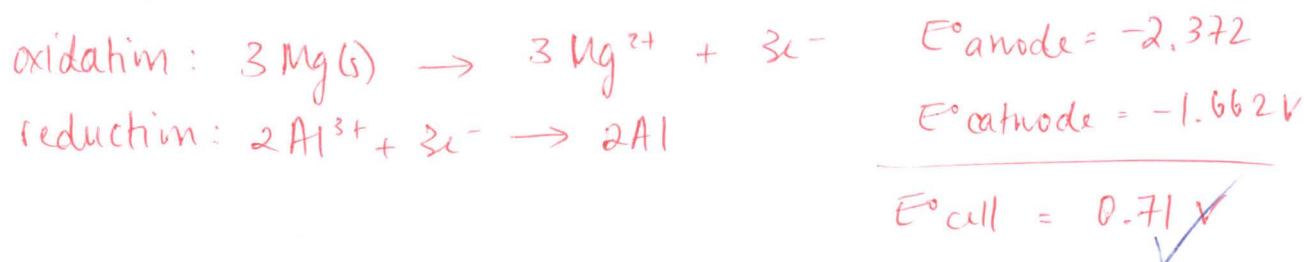
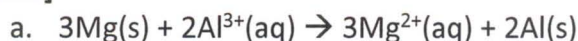
$$E^\circ_{\text{cell}} = 0 - (-0.138) = +0.138\text{V} \quad \checkmark$$

6. Write the two half-reactions for the following redox reaction. Add the standard reduction potential and the standard oxidation potential to find the standard cell potential for the reaction. [3 marks]

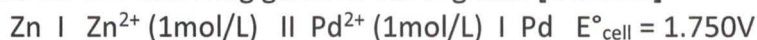


$$E^\circ_{\text{cell}} = 0.222 - (-0.744) \\ = 0.966\text{V} \quad \checkmark$$

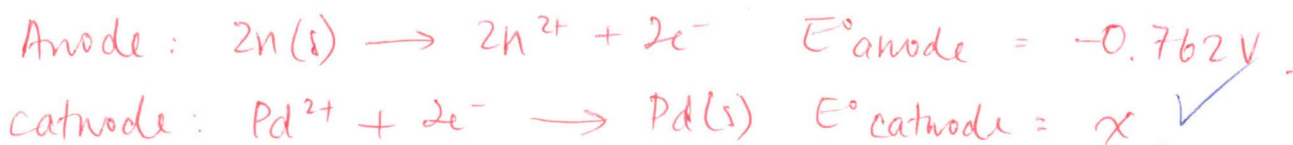
7. Determine the standard cell potential for each of the following redox reactions. [3 marks]



8. The cell potential for the following galvanic cell is given. [2 marks]



Determine the standard reduction potential for the following half-reaction.



$$E^{\circ}_{\text{cathode}} = E^{\circ}_{\text{cell}} + E^{\circ}_{\text{anode}}$$

$$= 1.750\text{V} + (-0.762)$$

$$= 0.988\text{V}$$
 ✓

9. Calculate the mass of zinc plated onto the cathode of an electrolytic cell by a current of 750mA in 3.25h. [4 marks]

$$750 \text{ mA} \rightarrow 0.750 \text{ A}$$

$$3.25 \text{ h} \times 3600 = 11700 \text{ sec}$$

$$q = It$$

$$= 0.750 \times 11700$$

$$= 8775 \text{ C}$$

$$n = \frac{q}{F}$$

$$= \frac{8775 \text{ C}}{96500 \text{ C/mol}}$$

$$= 0.091 \text{ mol/e}^-$$

$$= 0.045 \text{ mol}$$

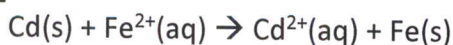


$$n = 0.045 \text{ mol}$$

$$M = 65.39 \text{ g/mol}$$

$$m = \underline{2.97 \text{ g}}$$

10. Will the following reaction occur spontaneously at 25°C, given that $[\text{Fe}^{2+}] = 0.60\text{M}$ and $[\text{Cd}^{2+}] = 0.010\text{M}$? [5 marks]



$$E = E^\circ - \frac{0.0257}{n} \ln Q$$



$$E = -0.044 - \frac{0.0257}{2} \ln \frac{[0.010]}{[0.60]}$$

$$E^\circ_{\text{cell}} = -0.447 - (-0.403) = -0.044 \text{ V}$$

$$E = 0.00861 \text{ V}$$

$$n = 2 \text{ mol of e}^-$$

\therefore spontaneous because E is \oplus