

- In the electrolytic production of Al, what mass of Al can be deposited in 2.00 hours by a current of 1.8 A?

2

Answer:

- What products would you expect at the anode and the cathode on electrolysis of a 1 M aqueous solution of NiI_2 ? Explain your answers.

2

Marks
8

- An electrochemical cell is consists of 1.0 L half-cells of Fe/Fe²⁺ and Cd/Cd²⁺ with the following initial concentrations: [Fe²⁺] = 0.800 M, [Cd²⁺] = 0.200 M.

What is the initial E_{cell} at 25 °C?

Answer:

What is E_{cell} when [Cd²⁺] reaches 0.15 M?

Answer:

What is [Cd²⁺] when E_{cell} reaches 0.015 V?

Answer:

What are the equilibrium concentrations of both ions?

[Cd²⁺] =

[Fe²⁺] =

<ul style="list-style-type: none">What is the electrochemical potential of the following cell at 25 °C? $\text{Fe} \mid \text{FeSO}_4 (0.010 \text{ M}) \parallel (\text{FeSO}_4 (0.100 \text{ M}) \mid \text{Fe}$	Marks 3
<div>Answer:</div>	2
<ul style="list-style-type: none">Calculate the mass of aluminium which can be produced with the same quantity of electricity that is used to produce 1.00 kg of copper metal.	2

Marks
6

- A galvanic cell consists of a Cr^{3+}/Cr half-cell with unknown $[\text{Cr}^{3+}]$ and a Ni^{2+}/Ni half-cell with $[\text{Ni}^{2+}] = 1.20 \text{ M}$. The electromotive force of the cell at 25°C was measured to be 0.55 V . What is the concentration of Cr^{3+} in the Cr^{3+}/Cr half-cell?

Answer:

Calculate the equilibrium constant of the reaction at 25°C .

Answer:

Calculate the standard Gibbs free energy of the reaction at 25°C .

Answer:

Express the overall reaction in the shorthand voltaic cell notation.

Marks
3

- A strip of copper and a strip of zinc are embedded in a lemon, and are connected by wires to a voltmeter; a voltage is generated and can be read at the voltmeter. What chemical reactions are occurring that lead to the generation of current?

Assuming there are no losses in the circuit and the conditions are similar to standard, what voltage can be read at the voltmeter?

Marks
4

- A 20.0 mL sample of 0.121 M Fe^{2+} in an acid solution was used to titrate 23.5 mL of a KMnO_4 solution of unknown concentration. Write the balanced redox reaction that occurs in solution upon titration, and calculate the molarity of the KMnO_4 solution.

Answer:

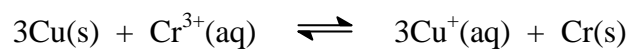
- How many minutes would be required to obtain 10.0 g of liquid mercury by passing a constant current of 0.17 A through a solution containing $\text{Hg}_2(\text{NO}_3)_2(\text{aq})$?

2

Answer:

Marks
3

- Calculate ΔG° for the following reaction:



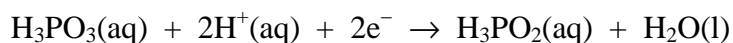
Answer:

Is the reaction spontaneous under standard conditions? Give a reason for your answer.

THE REMAINDER OF THIS PAGE IS FOR ROUGH WORKING ONLY.

Marks
3

- The standard reduction potential of phosphorous acid to hypophosphorous acid is -0.499 V , with the following half-reaction:

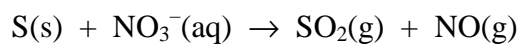


What would the reduction potential be for this half reaction at a temperature of $25\text{ }^\circ\text{C}$ in an aqueous solution with pH of 2.3 and concentrations of $[\text{H}_3\text{PO}_3(\text{aq})] = 0.37\text{ M}$ and $[\text{H}_3\text{PO}_2(\text{aq})] = 0.00025\text{ M}$?

Answer:

2

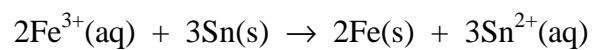
- A number of bacteria can reduce the nitrate ion in the presence of sulfur. A simplified unbalanced redox reaction can be written as:



Balance this redox equation for acidic conditions.

Marks
3

- What is the value of the equilibrium constant for the following reaction at 298 K?



Relevant electrode potentials can be found on the data page.

Answer:

Marks
5

- A galvanic cell is made of a Zn^{2+}/Zn half cell with $[\text{Zn}^{2+}] = 2.0 \text{ M}$ and an Ag^+/Ag half cell with $[\text{Ag}^+] = 0.050 \text{ M}$. Calculate the electromotive force of the cell at 25°C .

Answer:

Calculate the equilibrium constant of the reaction at 25°C .

Answer:

Calculate the standard Gibbs free energy of the reaction at 25°C .

Answer:

Indicate whether the reaction is spontaneous or not. Give a reason for your answer.

Express the overall reaction in the shorthand voltaic cell notation.

- A melt of NaCl is electrolysed for 35 minutes with a current of 3.50 A. Calculate the mass of sodium and volume of chlorine at 40 °C and 1.00 atm that are formed.

4

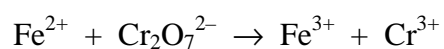
Marks
2

- A concentration cell containing aqueous solutions of $\text{Cu}(\text{NO}_3)_2$ and solid copper metal is constructed so that the Cu^{2+} ion concentration in the cathode half-cell is 0.66 M. Calculate the concentration of the Cu^{2+} ion in the anode half-cell if the cell potential for the concentration cell at 25 °C is 0.03 V.

Answer:

3

- In **acid solution**, dichromate ion oxidises iron(II) to iron(III) as illustrated in the partial equation:



Write a balanced equation for this reaction.

What would happen to the cell potential if the concentration of Cr^{3+} were increased?

Marks
2

- How many minutes would be required to electroplate 25.0 g of manganese by passing a constant current of 4.8 A through a solution containing MnO_4^- ?

Answer:

Marks
6

- The solubility product constant of AgCl is $K_{sp} = 1.8 \times 10^{-10} \text{ M}^2$. Using the relevant electrode potentials found on the data page, calculate the reduction potential at 298 K of a half-cell formed by:
(a) an Ag electrode immersed in a saturated solution of AgCl.

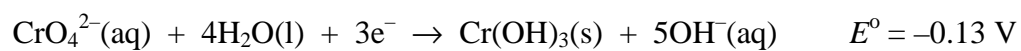
Answer:

- (b) an Ag electrode immersed in a 0.5 M solution of KCl containing some AgCl precipitate.

Answer:

Each of these half-cells is connected to a standard $\text{Cu}^{2+}(1 \text{ M})/\text{Cu(s)}$ half-cell. In which half-cell, (a) or (b), will clear evidence of a reaction be seen? Describe the change(s) observed.

- The physiological properties of chromium depend on its oxidation state. Consider the half reaction in which Cr(VI) is reduced to Cr(III).

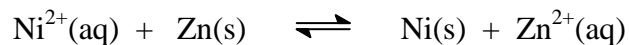


Calculate the potential for this half reaction at 25 °C, where pH = 7.40 and $[\text{CrO}_4^{2-}(\text{aq})] = 1.0 \times 10^{-6} \text{ M}$.

Answer:

Marks
5

- Consider the following reaction at 298 K.



Calculate ΔG° for the cell. (Relevant electrode potentials can be found on the data page.)

Answer:

What is the value of the equilibrium constant for the reaction at 298 K?

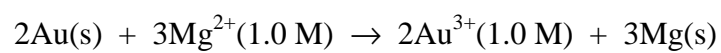
Answer:

Express the overall reaction in voltaic cell notation.

2

- Using a current of 2.00 A, how long (in minutes) will it take to plate out all of the silver from 0.250 L of a $1.14 \times 10^{-2} \text{ M Ag}^+(\text{aq})$ solution?

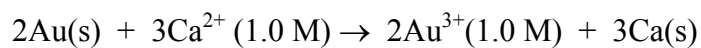
- Calculate the standard free-energy change for the following reaction at 298 K.



Answer:

Marks
2

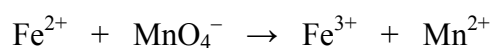
- Calculate the standard free-energy change for the following reaction at 298 K.



Answer:

2

Complete and balance the following equation for the reaction between iron(II) ions and permanganate ions in an acidic solution.

**2**

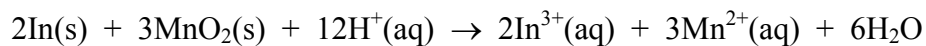
- What is the value of the equilibrium constant for the following reaction at 298 K?



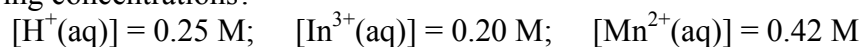
Answer:

Marks
2

- Consider the following balanced redox reaction.



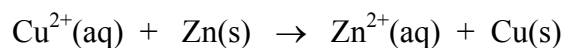
If $E^\circ = 1.568\text{ V}$, what would be the measured potential of this cell at 298 K at the following concentrations?



Answer:

2

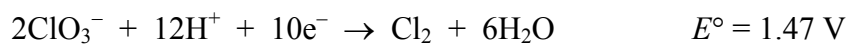
- What is the value of the equilibrium constant for the following reaction at 298 K?



Relevant electrode potentials can be found on the data page.

Answer:

- Consider the following half-reactions and their standard reduction potentials.



Give the overall cell reaction.

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Calculate ΔG° and hence the value of K_c for the cell reaction at 298 K.

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$\Delta G^\circ =$	$K_c =$
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