CHEMISTRY

NCERT - FULL MARKS CHEMISTRY(TAMIL)

ELECTROCHEMISTRY - II

Example

1. Predict whether the reaction

$$2Ag_{(s)} + Zn^{2+}_{(aq)} \rightarrow 2Ag^{+}_{(aq)} + Zn_{(s)}$$

is feasible or not.

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2. Determine the feasibility of the reaction

$$2Al_{(s)} + 3Sn^{4+}_{(aq)} \rightarrow 2Al^{3+} + 3Sn^{2+}_{(aq)}$$

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3. What is the potential of a half-cell consisting of zinc electrode in $0.01MZnSO_4$ solution $25^\circ C$. $E^\circ = 0.763V$.

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4. Calculate the emf of the cell.

$Zn|Zn^{2+}(0.001M)||Ag^+(0.1M)|Ag$

The standard potential of Ag/Ag^+ half - cell is $+0.80V$ and Zn/Zn^{2+} is $-0.76V$.

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5. Calculate the equilibrium constant for the reaction between silver nitrate and metallic zinc.

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6. Calculate the E.M.F. of the zinc - silver cell at $25^{\circ}C$ when $\left[Zn^{2+}\right] = 0.10M$ and $\left[Ag^{+}\right] = 10M$. $[E^{\circ}$ cell at $25^{\circ}C = 1.56$ volt$]$

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7. Write the cell reactions for the following cells.

(i) $Zn\left|ZnO_2^{2-}, OH^{-}\right|HgO \mid Hg$

(ii) $Pb|PbSO_4|H_2SO_4|PbSO_4|PbO_2 \mid Pt$

(iii) $Pt|H_2|HCl|Hg_2Cl_2|Hg \mid Pt$

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8. Calculate the potential of the following cell at 298 K

$Zn\,/\,Zn^{2+}(a = 0.1)\,/\,Cu^{2+}(a = 0.01)\,/\,Cu$

$E^{\circ}_{Zn^{2+}\,/\,Zn} = -0.762V$

$E^{\circ}_{Cu^{2+}\,/\,Cu} = +0.337V$

Compare the free energy change for this cell with the free enegy of the cell in the standard state.

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9. Calculate the standard e.m.f. of the reaction

$Fe^{3+} + 3e^- \rightarrow Fe_{(s)}$. Given the e.m.f. values of

$Fe^{3+} + e \rightarrow Fe^{2+}$ and $Fe^{2+} + 2e \rightarrow Fe_{(s)}$ as $+0.771V$ and $= 0.44$

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10. The standard electrode potantials of the half cells Ag^+ / Ag and $Fe^{3+}, Fe^{2+} / Pt$ are $0.7991V$ and $0.771V$ respectively. Calculate the equilibrium constant of the reaction :

$Ag_{(s)} + Fe^{3+} \Leftrightarrow Ag^+ + Fe^{2+}$

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Self Evaluation A Choose The Correct Answer

1. What is single electrode potential ?

A. Reduction potential

B. Half-wave potential

C. Single electrode potential

D. cell potential

Answer:

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2. Calculate the standard emf of the cell having the standard free energy change of the cell reaction is -64.84 kJ for 2 electrons transfer.

A. $\Delta G = -nFE$

B. $\Delta H = -nFE$

C. $\Delta E = nFG$

D. $\Delta F = nEG$

Answer:

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3. How to predict the feasibility of a cell reaction ?

A. Electronegativity

B. Electrochemical series

C. Electron affinity

D. Equivalent conductance

Answer:

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4. ..... first introduced the electrochemical battery

A. strong reducing agents

B. strong oxidising agents

C. weak reducing agents

D. weak oxidising agents

Answer:

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5. The emf of a cell with 1 M solutions of reactants and products in solution at $25^{\circ} C$ is called

A. Half cell potential

B. Standard emf

C. Single electrode potential

D. Redox potential

Answer:

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6. Write the relationship between equilibrium constant and enthapy.

A. $E^\circ = 0.0591 \log K$

B. $0.0591 E^\circ = \log K$

C. $nE^\circ = 0.0951 \log K$

D. $nE^\circ = 0.0591 \log K$

Answer:

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Self Evaluation B Answer In One Or Two Sentences

1. The standard reduction potentials of Fe^{3+}/Fe and Fe^{2+}/Fe electrode systems are $-0.035V$ and $-0.44V$ respectively. Predict which of the two oxidations is easy : Fe^{3+}/Fe and Fe^{2+}/Fe.

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2. What are the types of changes in the cathode and anode in electrolytic and electrochemical cells.

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3. Write the electrochemical cell for the overall cell reaction

$Zn_{(s)} + 2AgNO_3 \rightarrow 2Ag_{(s)} + Zn(NO_3)_2$.

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4. The standard reduction potential of $Fe^{3+}, Fe^{2+} / Pt$ is $+0.771V$. This half cell is connected with another half cell such that e.m.f. of the cell is 0.771V. What is the other half cell ?

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5. Write the cell reaction for the half cell $Cl^{-}_{(aq)} / AgCl_{(s)} Ag$.

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6. What is single electrode potential ?

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7. Define standard emf of a cell.

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8. How to predict the feasibility of a cell reaction ?

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9. Write the Nernst equation.

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Self Evaluation C Answer Not Exceeding Sixty Words

1. What are the types of changes in the cathode and anode in electrolytic and electrochemical cells.

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2. How the climate of an area is determined?

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Self Evaluation D Solve The Problems

1. The standard reduction potential for the reaction $Sn^{4+} + 2e^- \rightarrow Sn^{2+}$ is + 0.15V. Calculate the free energy change of the

reaction.

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2. Write the Nernst equation for the half cell $Zn^{2+}{}_{(aq)} / Zn_{(s)}$.

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3. The emf of the cell $Cd / CdCl_2, \quad 25H_2O \quad / AgCl_{(s)} Ag$ is 0.675 V. Calculate of the cell reaction.

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4. The standard free energy change of the reaction $M^{+}{}_{(aq)} + e^{-} \rightarrow M_{(s)}$ is -23.125 kJ. Calculate the standard emf of the half cell.

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5. The emf of the half cell $Cu^{2+}{}_{(aq)}/Cu_{(s)}$ containing 0.01 M Cu^{2+} solution is +0.301 V. Calculate the standard emf of the half cell.

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6. If $E_1 = 0.5V$ corresponds to $Cr^{3+} + 3e^- \rightarrow Cr_{(s)}$ and $E_2 = 0.41V$ corresponds to $Cr^{3+} + e^- \rightarrow Cr^{2+}$ reactions, calculate the emf (E_3) of the reaction $Cr^{2+} + 2e^- \rightarrow Cr_{(s)}$.

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7. Calculate the standard emf of the cell having the standard free energy change of the cell reaction is -64.84 kJ for 2 electrons transfer.

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8. Calculate the emf of the cell $Zn/ZnO_2, OH^-{}_{aq}, -HgO/Hg$ given that E° values of OH^-, ZnO and $OH^-, HgO/Hg$ half cells are -1.216 V and 0.098 V respectively.

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9. The equilibrium constant of cell reaction: $Ag_{(s)} + Fe^{3+} \Leftrightarrow Fe^{2+} + Ag^+$ is 0.335 at $25^\circ C$. Calculate the standard emf of the cell $Ag/Ag^+, Fe^{3+}, Fe^{2+}/Pt$. Calculate E° of the half cell $Fe^{3+}, Fe^{2+}/Pt$ is 0.7791 V Calculate E° of $Fe^{3+}, Fe^{2+}/Pt$ half cell.

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10. Calculate the emf of the cell having the cell reaction $2Ag^+ + Zn \Leftrightarrow 2Ag + Zn^{2+}$ and $E^\circ{}_{cell} = 1.56V$ at $25^\circ C$ when

concentration of $Zn^{2+} = 0.1M$ and $Ag^{+} = 10M$ in the solution.

$$\left[\text{Hint}: E_{cell} = E^{\circ}{}_{cell} - \frac{RT}{nF} In \frac{[Zn^{2+}]}{[Ag]^2}\right]$$

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11. The emf values of the cell reactions $Fe^{3+} + e^{-} \rightarrow Fe^{2+}$ and $Ce^{2+} \rightarrow Ce^{3+} e^{-}$ are 0.61 V and -0.85 V respectively. Construct the cell such that the free energy of the cell is negative. Calculate the emf of the cell.

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12. A zinc rod is placed in 0.095 M zinc chloride solution at $25^{\circ} C$. EmF of this half cell is -0.79V. Calculate $E^{\circ}{}_{Zn2+/Zn}$.

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