CHEMISTRY

NCERT - NCERT CHEMISTRY(GUJRATI)

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

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Self Evaluation D Solve The Problems

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

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2. The emf of the cell : $Cd/CdCl_2.25H_2O/AgCl_{(s)}Ag$ is 0.675V. Calculate ΔG of the cell reaction.

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

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

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5. 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 $Cr^{2+} + e \rightarrow Cr^{2+}$ reactions, calculate the emf (E_3) of the reaction $Cr^{2+} + 2e \rightarrow Cr_{(s)}$

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

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

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8. 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 $Fe^{3+}, Fe^{2+}/Pt$ half cell.

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9. Calculate the emf of the cell having the cell reaction $2Ag^{+} + Zn \Leftrightarrow 2Ag + Zn^{2+}$ and $E^{\circ}_{\text{cell}} = 1.56V$ at $25^{\circ}C$ when concentration of $Zn^{2+} = 0.1M$ and $Ag^{+} = 10M$ in the solution.

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10. 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 $-0.85V$ respectively. Construct the cell such that the free energy change of the cell is negative. Calculate the emf of the cell.

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11. 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 $E^{\circ}_{Zn^{2+}/Zn}$.

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