Parishram (2025)

Physical Chemsitry

Electrochemistry

DPP : 5

Q1 The equilibrium constant of the following redox reaction at $298\ \mathrm{K}$ is 1×10^{8}

$$2\mathrm{Fe}^{3+}\ (\mathrm{aq.}) + 2\mathrm{I}^{-}(\mathrm{aq.}) \rightleftharpoons 2\mathrm{Fe}^{2+}\ (\mathrm{aq.}) + \mathrm{I}_2\ (\mathrm{s})$$

If the standard reduction potential of iodine becoming iodide is $+0.54\ \mathrm{V}$. What is the standard reduction potential of $\mathrm{Fe}^{3+}/\mathrm{Fe}^{2+}$?

(A) $+1.006\ \mathrm{V}$
(B) $-1.006\ \mathrm{V}$
(C) $+0.77\ \mathrm{V}$
(D) $-0.77\ \mathrm{V}$

Q2 The equilibrium constant for the following general reaction is 10^{30}. Calculate E° for the cell at $298\ \mathrm{K}$.

$2\mathrm{X}_2(\ \mathrm{s}) + 3\mathrm{Y}^{2+}(\mathrm{aq}) \rightleftharpoons 2\mathrm{X}_2^{3+}(\mathrm{aq}) + 3\mathrm{Y}(\mathrm{s})$

(A) $+0.105\ \mathrm{V}$
(B) $+0.2955\ \mathrm{V}$
(C) $0.0985\ \mathrm{V}$
(D) $-0.2955\ \mathrm{V}$

Q3 The potential of the cell containing two hydrogen electrodes as represented below

$\mathrm{Pt};\ \frac{1}{2}\mathrm{H}_2\ (\mathrm{g})\ |\ \mathrm{H}^{+}\left(10^{-8}\ \mathrm{M}\right)\|$ is

$\mathrm{H}^{+}\left(0.001\ \mathrm{M}\ \right)\ |\ \frac{1}{2}\mathrm{H}_2\ (\mathrm{g})\ ;\ \mathrm{Pt}$

(A) $0.296\ \mathrm{V}$
(B) $-0.295\ \mathrm{V}$
(C) $0.13\ \mathrm{V}$
(D) $-0.13\ \mathrm{V}$

Q4 The equilibrium constant of the reaction $\mathrm{Cu}(\mathrm{s}) + 2\mathrm{Ag}^{+}(\mathrm{aq}) \rightarrow \mathrm{Cu}^{2+}(\mathrm{aq}) + 2\mathrm{Ag}(\mathrm{s})$ $\mathrm{E}^{0} = 0.46\ \mathrm{V}$ at $298\ \mathrm{K}$ is

(A) 2.4×10^{10}
(B) 2.0×10^{10}
(C) 4.0×10^{10}
(D) 4.0×10^{15}

Q5 Which one is the wrong statement about electrochemical series?

(A) Active metals have negative reduction potentials.
(B) Active non-metals have positive reduction potentials.
(C) Metals above hydrogen liberate hydrogen from acids.
(D) Metals below hydrogen are strong reducing agents.

Q6 Determine the equilibrium constant of the following reaction at $298\ \mathrm{K}$

$2\mathrm{Fe}^{3+} + \mathrm{Sn}^{2+} \rightarrow 2\mathrm{Fe}^{2+} + \mathrm{Sn}^{4+}$

(Given: $E^{\circ}_{\mathrm{sn}^{4+}/\mathrm{Sin}^{2+}} = 0.15$ volt, $E^{\circ}_{\mathrm{Fe}^{3+}/}\mathrm{Fe}^{2+} = 0.771$ volt)

(A) 1.0×10^{10}
(B) 1.0×10^{21}
(C) 2.0×10^{21}
(D) 2.0×10^{11}

Q7 The standard reduction potentials in acidic conditions are $0.77\ \mathrm{V}$ and $0.53\ \mathrm{V}$, respectively, for $\mathrm{Fe}^{3+}\ |\ \mathrm{Fe}^{2+}$ and $I_3^{-}\ |\ I^{-}$ couples. The equilibrium constant for the reaction:

$2\mathrm{Fe}^{3+} + 3\mathrm{I}^{-} \rightleftharpoons 2\mathrm{Fe}^{2+} + I_3^{-}$, is

$(2.303\mathrm{RT}/\mathrm{F} = 0.06)$

(A) 2×10^{8}
(B) 10^{8}
(C) 10^{4}
(D) 10^{-8}

Q8 The nature of curve of E° cell vs. $\log \mathrm{K}_{\mathrm{c}}$ is:

(A) Straight line
(B) Parabola
(C) Hyperbola

(D) Elliptical current

Q9 The Nernst equation $\mathrm{E}=\mathrm{E}^{\circ}-\mathrm{RT}/\mathrm{nF}\,\mathrm{lnQ}$ indicates that the Q will be equal to equilibrium constant K_c when

(A) $E=E^{\circ}$

(B) $\mathrm{RT}/\mathrm{nF}=1$

(C) $\mathrm{E}=$ zero

(D) $E^{\circ}=1$

Q10 The E° at $25^{\circ}\mathrm{C}$ for the following reaction is $0.22\ \mathrm{V}$. Calculate the equilibrium constant at $25^{\circ}\mathrm{C}$.

$\mathrm{H_2(\,g)+2AgCl(s)\rightarrow 2Ag(s)+2HCl(aq)}$

(A) 2.8×10^{7}

(B) 5.2×10^{8}

(C) 5.2×10^{6}

(D) 5.2×10^{3}

Q11 The standard EMF of a galvanic cell involving two moles of electrons in its redox reaction is $0.59\ \mathrm{V}$. The equilibrium constant for a redox reaction of the cell is

(A) 10^{20} (B) 10^{5}

(C) 10 (D) 10^{10}

Q12 The oxidation potential of hydrogen electrode at $\mathrm{pH}=10$ and $\mathrm{P_{H_2}}=1$ atm is

(A) $0.51\ \mathrm{V}$

(B) $0.00\ \mathrm{V}$

(C) $+0.59\ \mathrm{V}$

(D) $0.059\ \mathrm{V}$

Q13 From the electrochemical series, it can be concluded that:

(A) $\mathrm{Zn^{2+}}$ will liberate $\mathrm{H_2}$ from $1\mathrm{MHCl}$

(B) Ag metal reacts spontaneously with $\mathrm{Zn^{2+}}$.

(C) Zn metal will liberate $\mathrm{H_2}$ from $1\mathrm{MHCl}$

(D) Ag metal will liberate $\mathrm{H_2}$ from $1\mathrm{MHCl}$

Q14 At equilibrium:

(A) $\mathrm{E^{\circ}_{cell}}=0,\Delta\mathrm{G}^{\circ}=0$

(B) $\mathrm{E_{cell}}=0,\Delta\mathrm{G}=0$

(C) Both are correct

(D) None is correct

Answer Key

Q1	(C)	Q8	(A)
Q2	(B)	Q9	(C)
Q3	(A)	Q10	(A)
Q4	(D)	Q11	(A)
Q5	(D)	Q12	(C)
Q6	(B)	Q13	(C)
Q7	(B)	Q14	(B)

Hints & Solutions

Note: scan the QR code to watch video solution

Q1 Video Solution:

Q2 Video Solution:

Q3 Video Solution:

Q4 Video Solution:

Q5 Video Solution:

Q6 Video Solution:

Q7 Video Solution:

Q8 Video Solution:

Q9 Video Solution:

Q10 Video Solution:

Q11 Video Solution:

Q12 Video Solution:

Q13 Video Solution:

Q14 Video Solution: