

JEE MAIN ELECTROCHEMISTRY — NERNST EQUATION AND ITS APPLICATION — PYQS

Max. Marks: 48
Questions: 12

Section A (MCQ) — 3 questions

Q.1 One half cell in a voltaic cell is constructed by dipping silver rod in AgNO_3 solution of unknown concentration, other half cell is Zn rod dipped in 1 molar solution of ZnSO_4 .

A voltage of 1.60 V is measured at 298 K for this cell. What is the concentration of Ag^+ ions used in terms of log x ($x = [\text{Ag}^+]$)?

$$E_{\text{Zn}^{2+}/\text{Zn}}^\ominus = -0.76 \text{ V}, E_{\text{Ag}^+/\text{Ag}}^\ominus = +0.80 \text{ V}, \frac{2.303RT}{F} = 0.059 \text{ V} \quad [\text{JEE Main 2026 (Online) 5th April Evening Shift}]$$

- (1) $\frac{2}{3.9}$ (2) $\frac{4}{5.9}$ (3) $\frac{2.9}{2}$ (4) $\frac{5.9}{4}$

Scan or tap for the full solution



Q.2 In the given electrochemical cell, $\text{Ag(s)}|\text{AgCl(s)}|\text{FeCl}_2(\text{aq}), \text{FeCl}_3(\text{aq})|\text{Pt(s)}$ at 298 K, the cell potential (E_{cell}) will increase when :

- A. Concentration of Fe^{2+} is increased.
 B. Concentration of Fe^{3+} is decreased.
 C. Concentration of Fe^{2+} is decreased.
 D. Concentration of Fe^{3+} is increased.
 E. Concentration of Cl^- is increased.

Choose the correct answer from the options given below :

[JEE Main 2026 (Online) 23rd January Morning Shift]

- (1) C, D and E Only (2) A and B Only
 (3) B Only (4) A and E Only

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Q.3 For a $\text{Mg}|\text{Mg}^{2+}(\text{aq})||\text{Ag}^+(\text{aq})|\text{Ag}$ the correct Nernst Equation is :

[JEE Main 2025 (Online) 29th January Morning Shift]

- (1) $E_{\text{cell}} = E_{\text{cell}}^\ominus - \frac{RT}{2F} \ln \frac{[\text{Ag}^+]^2}{[\text{Mg}^{2+}]}$
 (2) $E_{\text{cell}} = E_{\text{cell}}^\ominus - \frac{RT}{2F} \ln \frac{[\text{Mg}^{2+}]}{[\text{Ag}^+]}$
 (3) $E_{\text{cell}} = E_{\text{cell}}^\ominus - \frac{RT}{2F} \ln \frac{[\text{Ag}^+]}{[\text{Mg}^{2+}]}$
 (4) $E_{\text{cell}} = E_{\text{cell}}^\ominus + \frac{RT}{2F} \ln \frac{[\text{Ag}^+]^2}{[\text{Mg}^{2+}]}$

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Section B (Numerical) — 9 questions

Q.4 An electrochemical cell consists of the following two redox couples, $\text{M}^{x+}(\text{aq})/\text{M(s)}$ [$E_{\text{red}}^\ominus = +0.15 \text{ V}$] and $\text{Fe}^{3+}(\text{aq})/\text{Fe(s)}$ [$E_{\text{red}}^\ominus = -0.036 \text{ V}$]. The cell EMF (E_{cell}) is recorded to be 0.2057 V. If the reaction quotient of the electrochemical reaction is found to be 10^{-2} , then the value of x is _____. (Nearest integer)

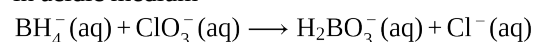
[Given : M is a p-block metal and $\frac{2.303RT}{F} = 0.059 \text{ V}$]

[JEE Main 2026 (Online) 4th April Evening Shift]

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Q.5 Consider the following redox reaction taking place in acidic medium



If the Nernst equation for the above balanced reaction is

$$E_{\text{cell}} = E_{\text{cell}}^\ominus - \frac{RT}{nF} \ln Q,$$

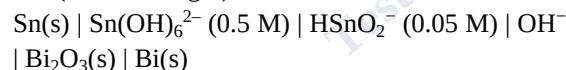
then the value of n is _____. (Nearest integer)

[JEE Main 2026 (Online) 28th January Morning Shift]

Scan or tap for the full solution



Q.6 A volume of x mL of 5 M NaHCO_3 solution was mixed with 10 mL of 2 M H_2CO_3 solution to make an electrolytic buffer. If the same buffer was used in the following electrochemical cell to record a cell potential of 235.3 mV, then the value of x = _____ mL (nearest integer).



Consider up to one place of decimal for intermediate calculations

Given : $E_{\text{Sn(OH)}_6^{2-}|\text{HSnO}_2^-}^\ominus = -0.9 \text{ V}$

$E_{\text{Bi}_2\text{O}_3|\text{Bi}}^\ominus = -0.44 \text{ V}$

$\text{p}K_{\text{a}}(\text{H}_2\text{CO}_3) = 6.11$

[$\frac{2.303RT}{F} = 0.059 \text{ V}$]

Antilog (1.29) = 19.5

[JEE Main 2026 (Online) 28th January Evening Shift]

Scan or tap for the full solution



Q.7 Consider the following electrochemical cell at 298 K
 $\text{Pt} \mid \text{HSnO}_2^-(\text{aq}) \mid \text{Sn}(\text{OH})_6^{2-}(\text{aq}) \mid \text{OH}^-(\text{aq}) \mid \text{Bi}_2\text{O}_3(\text{s}) \mid \text{Bi}(\text{s})$

If the reaction quotient at a given time is 10^6 , then the cell EMF (E_{cell}) is _____ $\times 10^{-1}$ V (Nearest integer).

Given the standard half-cell reduction potential as

$$E^\circ_{\text{Bi}_2\text{O}_3/\text{Bi}, \text{OH}^-} = -0.44 \text{ V and}$$

$$E^\circ_{\text{Sn}(\text{OH})_6^{2-}/\text{HSnO}_2^-, \text{OH}^-} = -0.90 \text{ V}$$

[JEE Main 2026 (Online) 22nd January Morning Shift]

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Q.8 Consider the following electrochemical cell :
 $\text{Pt} \mid \text{O}_2(\text{g})(1 \text{ bar}) \mid \text{HCl}(\text{aq}) \parallel \text{M}^{2+}(\text{aq}, 1.0 \text{ M}) \mid \text{M}(\text{s})$
 The pH above which, oxygen gas would start to evolve at anode is _____ (nearest integer).

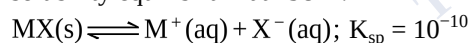
[Given : $E^\circ_{\text{M}^{2+}/\text{M}} = 0.994 \text{ V}$
 $E^\circ_{\text{O}_2/\text{H}_2\text{O}} = 1.23 \text{ V}$ } standard reduction

potential and $\frac{RT}{F}(2.303) = 0.059 \text{ V}$ at the given condition]

[JEE Main 2026 (Online) 22nd January Evening Shift]

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Q.9 MX is a sparingly soluble salt that follows the given solubility equilibrium at 298 K.



If the standard reduction potential for $\text{M}^+(\text{aq}) + \text{e}^- \rightarrow \text{M}(\text{s})$ is $(E^\circ_{\text{M}^+/\text{M}}) = 0.79 \text{ V}$, then the value of the standard reduction potential for the metal/metal insoluble salt electrode $E^\circ_{\text{X}^-/\text{MX}(\text{s})/\text{M}}$ is _____ mV. (nearest integer)

[Given: $\frac{2.303RT}{F} = 0.059 \text{ V}$]

[JEE Main 2026 (Online) 21st January Evening Shift]

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Q.10 Consider the following half cell reaction
 $\text{Cr}_2\text{O}_7^{2-}(\text{aq}) + 6\text{e}^- + 14\text{H}^+(\text{aq}) \rightarrow 2\text{Cr}^{3+}(\text{aq}) + 7\text{H}_2\text{O}(\ell)$
 The reaction was conducted with the ratio of $\frac{[\text{Cr}^{3+}]^2}{[\text{Cr}_2\text{O}_7^{2-}]} = 10^{-6}$. The pH value at which the EMF of the half cell will become zero is _____.

(nearest integer value)

[Given: standard half cell reduction potential

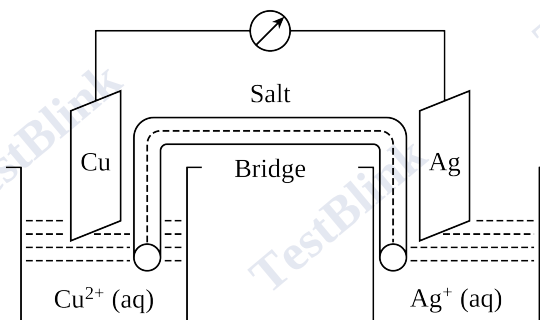
$$E^\circ_{\text{Cr}_2\text{O}_7^{2-}, \text{H}^+/\text{Cr}^{3+}} = 1.33 \text{ V}, \frac{2.303RT}{F} = 0.059 \text{ V}.]$$

[JEE Main 2025 (Online) 8th April Evening Shift]

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Q.11 1 Faraday of electricity was passed through $\text{Cu}^{2+}(1.5 \text{ M}, 1 \text{ L})/\text{Cu}$ and 0.1 Faraday was passed through $\text{Ag}^+(0.2 \text{ M}, 1 \text{ L})/\text{Ag}$ electrolytic cells. After this the two cells were connected as shown below to make an electrochemical cell. The emf of the cell thus formed at 298 K is _____ mV (nearest integer)



$$\text{Given : } E^\circ_{\text{Cu}^{2+}/\text{Cu}} = 0.34 \text{ V}$$

$$E^\circ_{\text{Ag}^+/\text{Ag}} = 0.8 \text{ V}$$

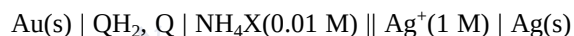
$$\frac{2.303RT}{F} = 0.06 \text{ V}$$

[JEE Main 2025 (Online) 7th April Morning Shift]

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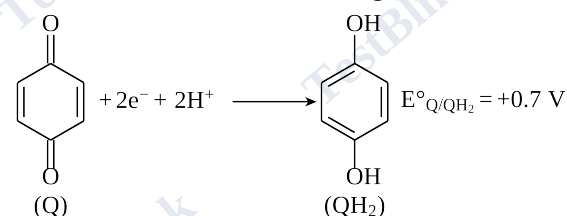


Q.12 Consider the following electrochemical cell at standard condition.



$$E_{\text{cell}} = +0.4 \text{ V}$$

The couple QH_2/Q represents quinhydrone electrode, the half cell reaction is given below:



$$[\text{Given : } E^\circ_{\text{Ag}^+/\text{Ag}} = +0.8 \text{ V and } \frac{2.303RT}{F} = 0.06 \text{ V}]$$

The pK_b value of the ammonium halide salt (NH_4X) used here is _____ . (nearest integer)

[JEE Main 2025 (Online) 2nd April Morning Shift]

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ANSWER KEY

Section A (MCQ) — 3 questions

Ques.	1	2	3						
Ans.	2	1	4						

Section B (Numerical) — 9 questions

Ques.	4	5	6	7	8	9	10
Ans.	2	24	78	4	4	200	10

Ques.	11	12					
Ans.	400	6					