

YAKEEN NEET 2.0

2026

Electrochemistry

Physical Chemistry

Lecture -4

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Topics to be covered

- 1 Medics Test, Revision of Last Class
- 2 Gibbs free energy
- 3 Nernst equation
- 4 Home work from modules



Rule to Attend Class




- 1. Always sit in a peaceful environment with headphone and be ready with your copy and pen.**
- 2. Never ever attend a class from in between or don't join a live class in the middle of the chapter.**
- 3. Make sure to revise the last class before attending the next class & always complete your home work along with DPP.**
- 4. Never ever engage in chat whether live or recorded on the topic which is not being discussed in current class as by doing so u can be blocked by the admin team or your subscription can be cancelled.**



Rule to Attend Class



- 5. Try to make maximum notes during the class if something is left then u can use the notes pdf after the class to complete the remaining class.**
- 6. Always ask your doubts in doubt section to get answer from faculty. Before asking any doubt please check whether same doubt has been asked by someone or not.**
- 7. Don't watch the videos in high speed if you want to understand better.**



There is one big flaw in your Preparation that's name is Backlog ? What do we say to Backlog ?



NOT TODAY !!!

MEDICS



Mastery

Checks your grasp over
NEET-level concepts

Evaluation

Judging both knowledge
and test-smartness

Decision Making

Testing your speed + accuracy under pressure

Intuition

Some answers need gut + logic –
can you spot the trick?

Concepts

It's all about strong basics –
no shortcuts here

Strategy

The MEDICS test – built
for those who heal,
hustle, and hope.

QUESTION

$$\underline{6 \times 6 \times 6 \times 6 \times 6 \times 6} =$$

$$\begin{array}{r} 216 \\ \times 6 \\ \hline \end{array}$$

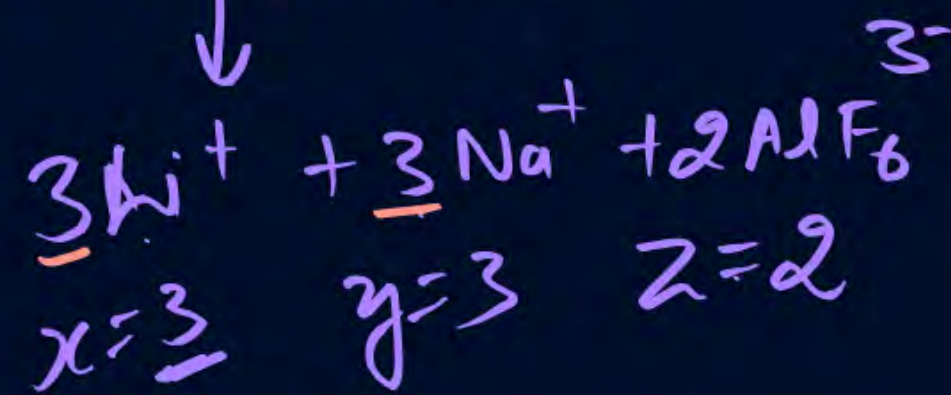
$$\begin{array}{r} 1296 \\ \times 6 \\ \hline \end{array}$$

$$\begin{array}{r} 3 \times 3 \times 3 \\ \times 3 \times 3 \times 3 \\ \hline \end{array}$$



If the solubility of lithium sodium hexafluorido aluminate, $\text{Li}_3\text{Na}_3(\text{AlF}_6)_2$ is 's' mol lt^{-1} , its solubility product is equal to :

$$\begin{aligned} K_{sp} &= x^x y^y z^z (s)^{x+y+z} \\ &= (\underline{3})^3 (\underline{3})^3 (\underline{2})^2 (s)^8 \\ &= 2916 s^8 \end{aligned}$$

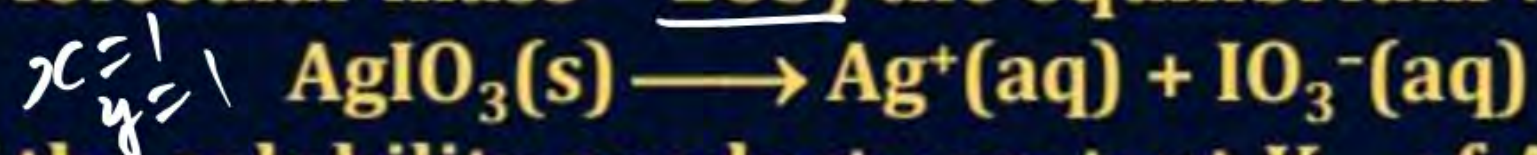


- ☐ A 729 s^8
- ☐ B 12 s^8
- ☐ C 3900 s^8
- ☒ D 2916 s^8

QUESTION



In a saturated solution of the sparingly soluble strong electrolyte AgIO_3 (Molecular mass = 283) the equilibrium which sets in is :



If the solubility product constant K_{sp} of AgIO_3 at a given temperature is 1×10^{-8} ; what is the mass of AgIO_3 contained in 100 mL of its saturated solution?

$$\begin{aligned} K_{sp} &= 10^{-8} = (1)(1)(s)^{1+1} \\ &= s^2 = 10^{-8} \text{ M} \\ s &= 10^{-4} \text{ moles/L} \\ &= 10^{-4} \times 283 \text{ g/L} \\ 1000 \text{ ml} &= 10^{-4} \times 283 \text{ g} \\ 100 \text{ ml} &= \frac{10^{-4} \times 283 \times 100}{1000} \\ &= 2.83 \times 10^{-3} \end{aligned}$$

- ☐ A $1 \times 10^{-7} \text{ g}$
- ☐ B $1 \times 10^{-4} \text{ g}$
- ☐ C $28.3 \times 10^{-2} \text{ g}$
- ☒ D $2.83 \times 10^{-3} \text{ g}$

QUESTION



$M(OH)_x$ has $K_{sp} = 4 \times 10^{-12}$ and solubility $10^{-4} M$. The value of x is:

$$y=1 \quad x=\underline{x}$$

A 1

B 2

C 3

D 4

$$4 \times 10^{-12} = x^x y^y (s)^{x+y}$$

$$4 \times 10^{-12} = x^x (s)^{x+1}$$

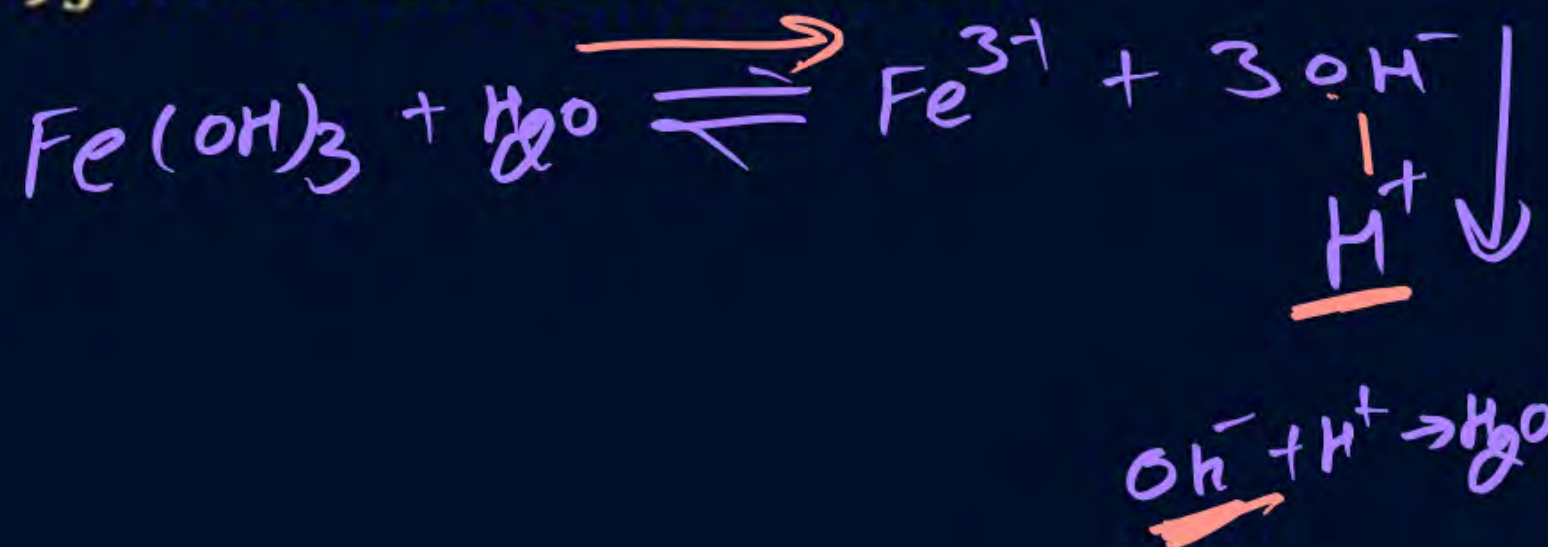
$$= 2^2 (10^{-4})^{2+1}$$

$$4 \times 10^{-12} = 4 \times 10^{-12}$$

QUESTION



The solubility of $\text{Fe}(\text{OH})_3$ would be maximum in :



A 0.1 M NaOH X

B 0.1 M HCl

C 0.1 M KOH X

D 0.1 M $\text{H}_2\text{SO}_4 \rightarrow 2\text{H}^+$
 2×0.1
 $= 0.2$

QUESTION



pH when solution containing HA ($K_a = 10^{-6}$) and NaA show maximum buffer action will be :

$$\uparrow pK_a = 6$$

\downarrow
W.A.

\downarrow
Salt.

$$[HA] = [A^-]$$

$$pH = pK_a + \log \frac{[A^-]}{[HA]}$$

$$pH = pK_a$$

☒ A 6

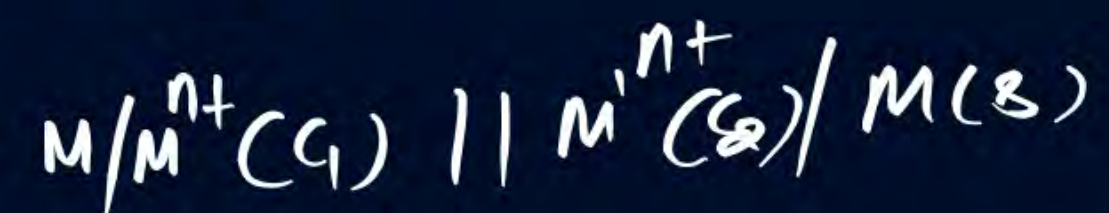
☐ B 7

☐ C < 6

☐ D > 7



Revision of Last Class

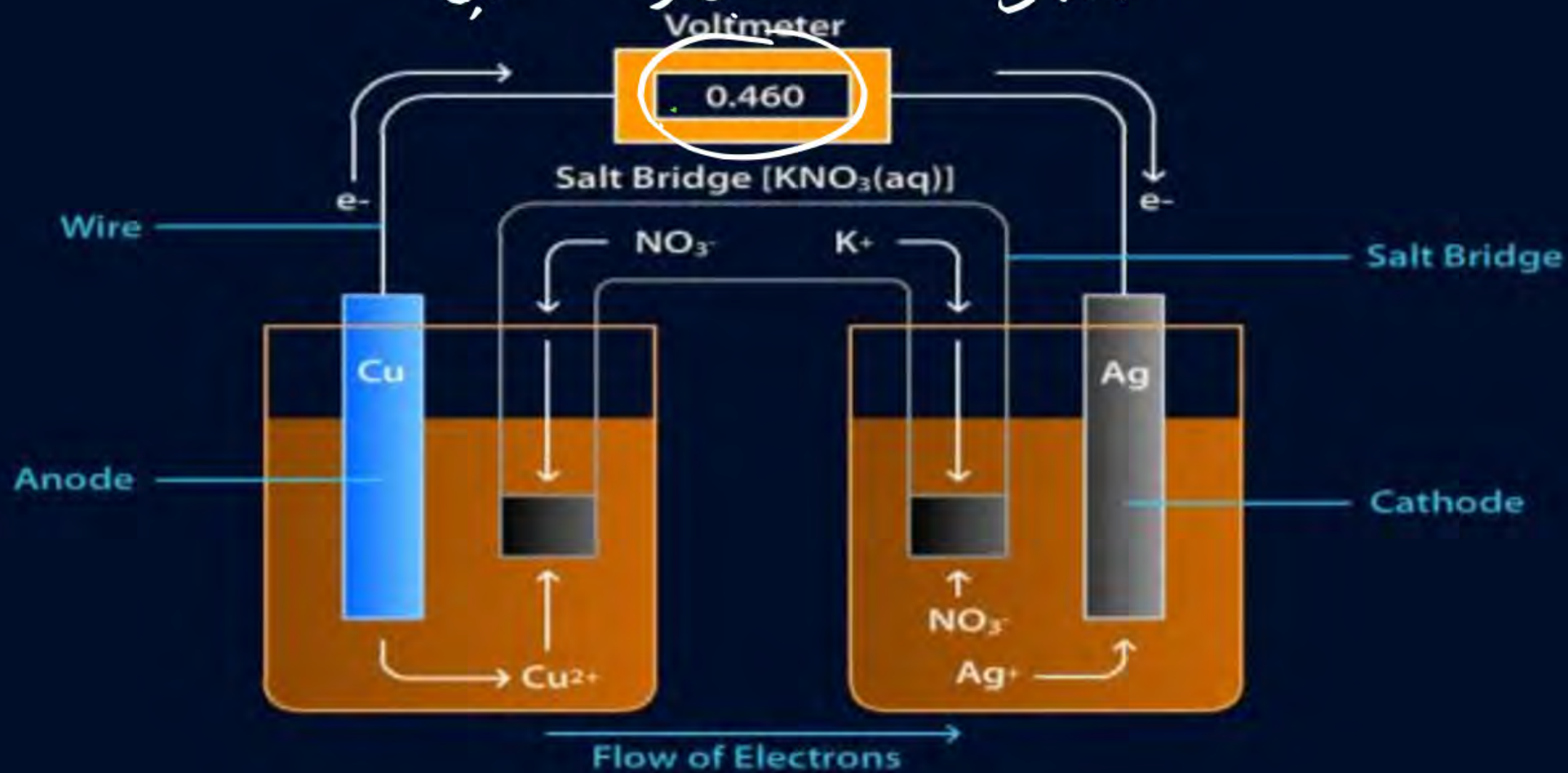


$$E^{\circ}_{cell} = E^{\circ}_{Cathode} - E^{\circ}_{Anode}$$

\downarrow S.R.P. \downarrow S.R.P.

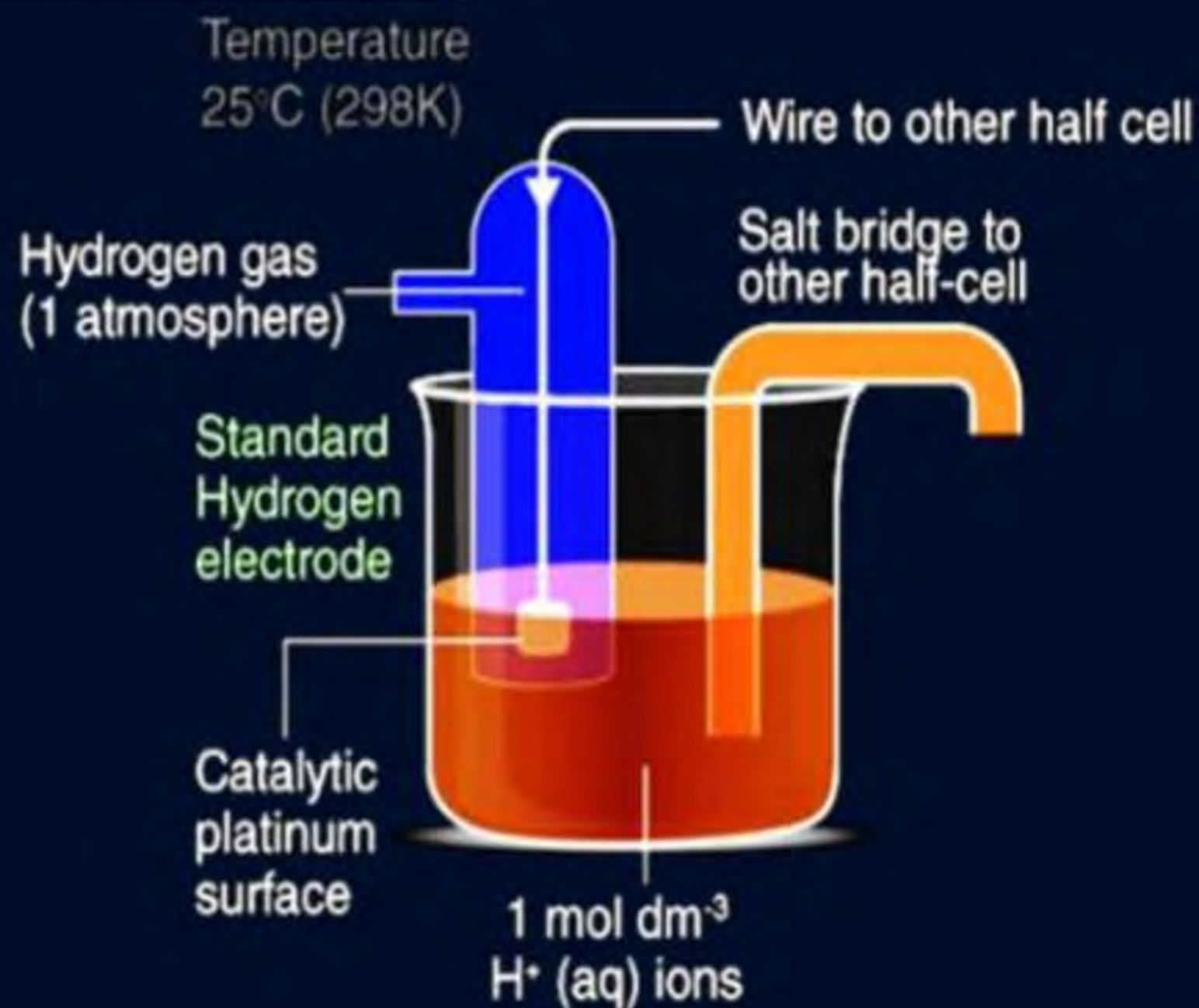
$$E^{\circ}_{cell} = E^{\circ}_{Anode} + E^{\circ}_{Cathode}$$

\downarrow S.R.P. \downarrow S.R.P.





Standard Hydrogen Electrode (S.H.E.)



MEDICS test \rightarrow lec-1 + lec-2 \rightarrow Electrochem.
 \downarrow
Tomorrow.

Ionic eq. Complete

QUESTION



Given the following half-cell reactions and corresponding standard (reduction) electrode potentials.



$$E^\circ_{\text{Cell}} = E^\circ_{\text{Cathode}} - E^\circ_{\text{Anode}} \\ = 1.25 - (-1.25) \\ = +2.5V$$

Which combination of two half-cells would result in a cell with the largest potential?

~~$$E^\circ_{\text{Cell}} = 0.38 - (-0.24) \\ = 0.62V$$~~

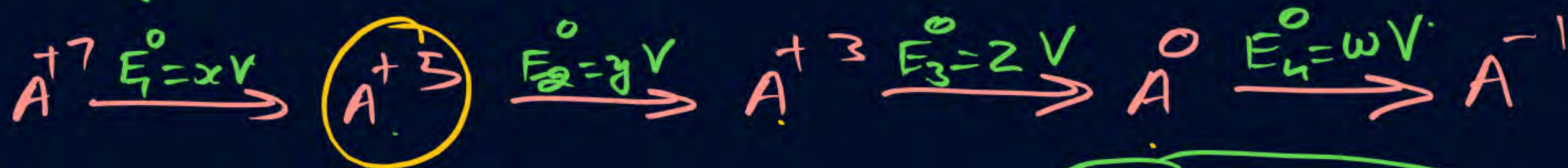
↓
Smallest
 $E^\circ_{\text{Cell}} = (+)ve$



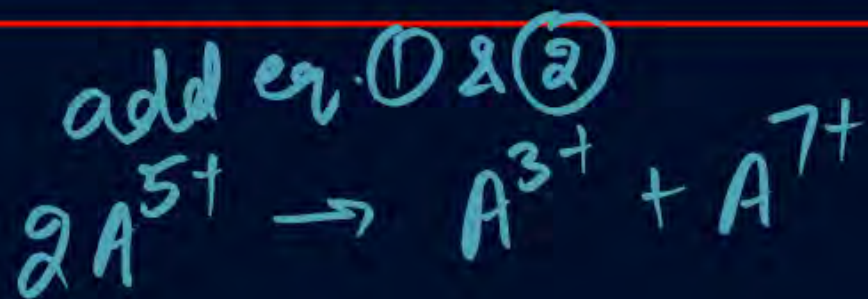
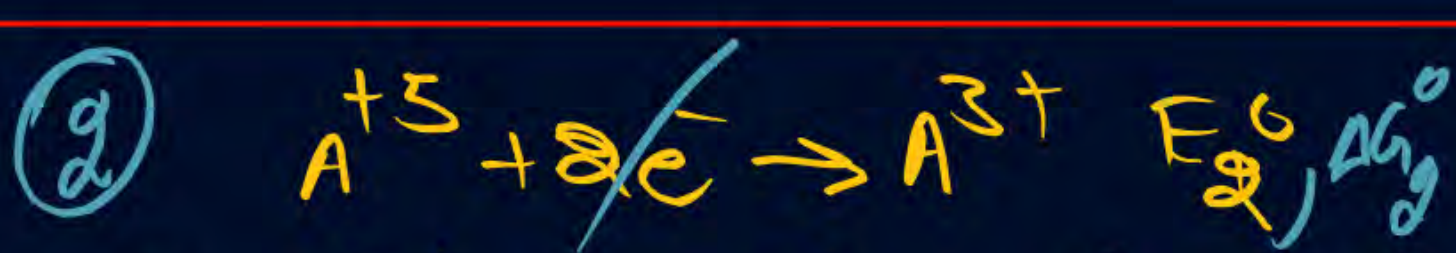
Latimer diagram

MIT

diagram \rightarrow elements diff oxidⁿ stt series in dec. oxidⁿ no.



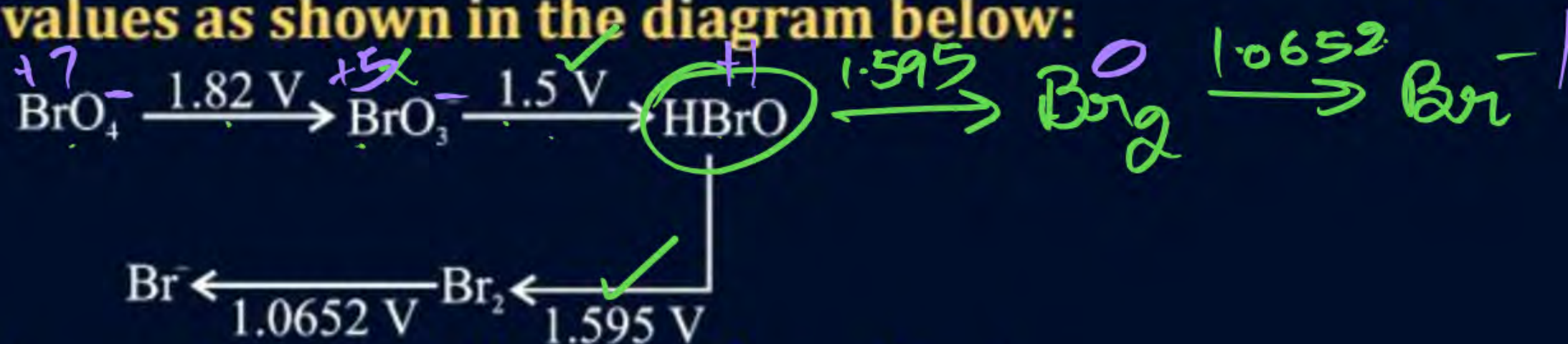
species disproportionation occurs $\rightarrow E_{L.H.S}^0 < E_{R.H.S}^0 \Rightarrow \Delta G^0 = (-)VE$
 \downarrow
 spontaneuous



$$\Delta G_3^0 = \Delta G_1^0 + \Delta G_2^0$$

$\rightarrow = (-)VE$

Consider the change in oxidation state of Bromine corresponding to different emf values as shown in the diagram below:



Then the species undergoing disproportionation is:





Gibbs Free Energy and E.M.F. of Cell



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$$\textcircled{1} \Delta G^\circ = -nFE^\circ_{\text{cell}}$$

n = no. of e^- lost or gained in balanced Chem. rxn

F = Faraday Constant $\approx 96500 \text{ C}$

$$\textcircled{2} \Delta G^\circ = -RT \ln K \quad \ln = 2.303 \log_{10}$$

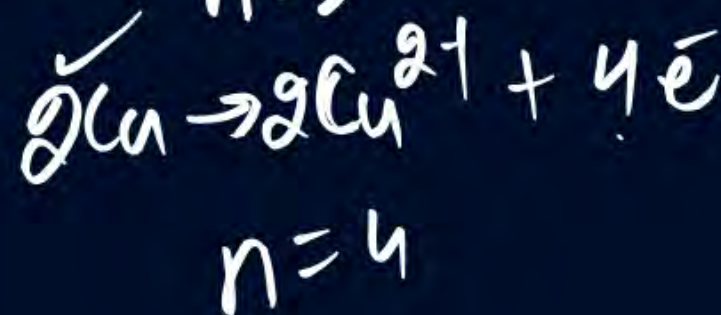
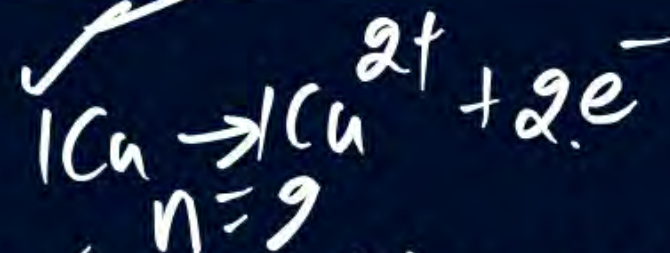
$K > 1 \Rightarrow \Delta G^\circ = (-)ve \Rightarrow \text{rxn spontaneous}$

$K < 1 \Rightarrow \Delta G^\circ = (+)ve \Rightarrow \text{rxn non-spontaneous}$

$E^\circ_{\text{S.O.P. on S.R.P. on Cell}}$

$\frac{\text{ext.}}{\text{ext.}} = \text{Int.}$

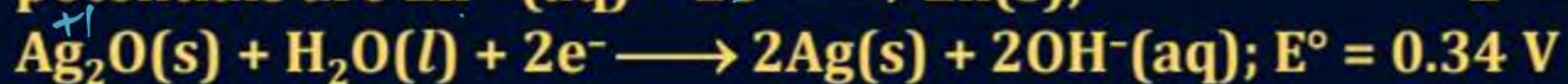
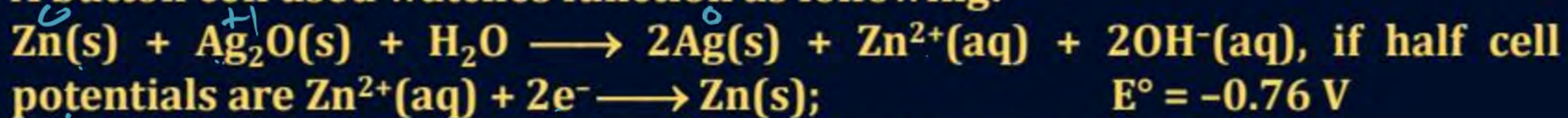
$\frac{\Delta G^\circ}{n} = E^\circ_{\text{ext.}} \rightarrow \text{Int.}$



QUESTION



A button cell used watches function as following:



The Cell potential will be:

$$E_{\text{cell}}^{\circ} = 0.34 - (-0.76) = 1.1 \text{ V}$$

A 1.34 V

B 1.10 V

C 0.42 V

D 0.84 V

QUESTION (NEET 2019)



For the cell reaction: $2\text{Fe}^{3+}(\text{aq}) + 2\text{I}^{-}(\text{aq}) \longrightarrow 2\text{Fe}^{2+}(\text{aq}) + \text{I}_2(\text{aq})$ $E^{\circ} = 0.24 \text{ V}$ at 298 K. The standard Gibbs energy ($\Delta_r G^{\circ}$) of the cell reaction is: [Given that Faraday constant $F = 96500 \text{ C mol}^{-1}$]

$$n=2 \quad \frac{1}{-1} \quad \frac{1}{0}$$

$$\Delta G^{\circ} = -nFE^{\circ}_{\text{cell}}$$

$$= \frac{-2 \times 96500 \times 0.24}{1000} = -46.32 \text{ KJ/mol}$$

(A) 23.16 kJ mol⁻¹

(B) -46.32 kJ mol⁻¹

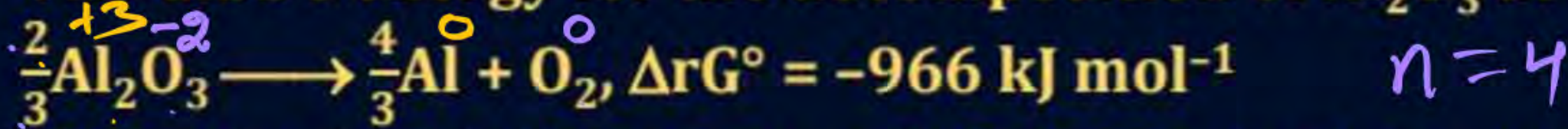
(C) -23.16 kJ mol⁻¹

(D) 46.32 kJ mol⁻¹

QUESTION (AIPMT (Mains) 2012)



The Gibb's energy for the decomposition of Al_2O_3 at 500°C is as follows:



The potential difference needed for electrolytic reduction of Al_2O_3 at 500°C is at least the

(A) 5.0 V

(B) 4.5 V

(C) 3.0 V

(D) 2.5 V

$$\Delta G^\circ = -nFE^\circ$$

$$+966000 = +4 \times 96500 E^\circ$$

$$E^\circ = \frac{10}{4} = 2.5 \text{ V}$$

$$1 \text{ kJ} = 1000 \text{ J}$$

$$2 \times \frac{2}{3} \times 3 = 4$$

$$3 \times \frac{4}{3} = 4$$

$$3 \times \frac{2}{3} \times 2$$

If the E°_{cell} for a given reaction has a negative value, which of the following gives the correct relationship for the values of ΔG° and K_{eq} ?

☒ **A** $\Delta G^\circ > 0; K_{\text{eq}} < 1$

☐ **B** $\Delta G^\circ > 0; K_{\text{eq}} > 1$

☐ **C** $\Delta G^\circ < 0; K_{\text{eq}} > 1$

☐ **D** $\Delta G^\circ < 0; K_{\text{eq}} < 1$

QUESTION



Consider the following equations for a cell reaction:



$$\begin{aligned} E^\circ &= x \text{ volt, } K_{\text{eq}} = K_1 \\ E^\circ &= y \text{ volt, } K_{\text{eq}} = K_2 = (K_1)^2 \end{aligned}$$

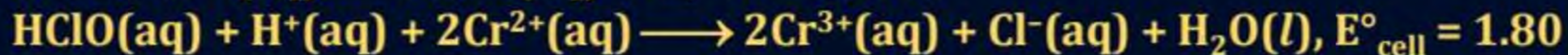
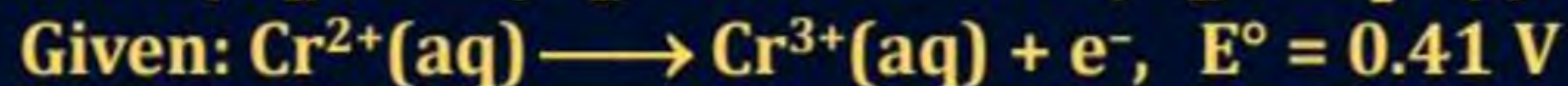
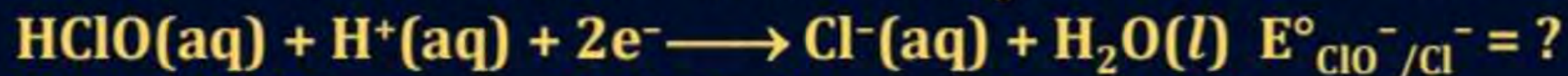
Then:

- ☐ A $x = y, K_1 = K_2$
- ☒ B $x = 2y, K_1 = 2K_2$
- ☒ C $x = y, K_1^2 = K_2$
- ☒ D $x^2 = y, K_1^2 = K_2$

QUESTION



What is the standard electrode potential for the reduction of HClO ?



A 1.39

B 1.54

C 1.22

D 0.90

QUESTION



Standard electrode potential of SHE at 298 K is:

A 0.05 V

B 0.10 V

C 0.50 V

D 0.00 V



The nature of curve of E°_{cell} vs $\log K_c$ is:

- ☒ A Straight line
- ☐ B Parabola
- ☐ C Hyperbola
- ☐ D Elliptical curve

$$\Delta G^\circ = -nFE^\circ = -2.303RT \log K_c$$

$$E^\circ = \frac{2.303RT}{nF} \log K_c + 0$$

Diagram showing the relationship between E° and $\log K_c$. The equation is written as $E^\circ = \frac{2.303RT}{nF} \log K_c + 0$. The term $\frac{2.303RT}{nF}$ is circled and labeled with a downward arrow pointing to m . The term $\log K_c$ is circled and labeled with a downward arrow pointing to x . The constant term $+0$ is also circled.



QUESTION



The cell reaction $\overset{\text{Cathode}}{2\text{Ag}^+(\text{aq})} + \overset{\text{anode}}{\text{H}_2(\text{g})} \longrightarrow 2\text{H}^+(\text{aq}) + 2\text{Ag}(\text{s})$, is best represented by:

- A** $\text{Ag}(\text{s}) \mid \text{Ag}^+(\text{aq}) \parallel \text{H}^+(\text{aq}) \mid \text{H}_2(\text{g}) \mid \text{Pt}(\text{s})$ *Pt, H₂(g) / H⁺ || Ag⁺(aq) / Ag(s)*
- B** $\text{Pt}(\text{s}) \mid \text{H}_2(\text{g}) \mid \text{H}^+(\text{aq}) \parallel \text{Ag}^+(\text{aq}) \mid \text{Ag}(\text{s})$
- C** $\text{Ag}(\text{s}) \mid \text{Ag}^+(\text{aq}) \parallel \text{H}_2(\text{g}) \mid \text{H}^+(\text{aq}) \mid \text{Pt}(\text{s})$
- D** $\text{Ag}^+(\text{aq}) \mid \text{Ag}(\text{s}) \parallel \text{H}_2(\text{g}) \mid \text{H}^+(\text{aq})$



Salt Bridge & its Functions

Both cation & anion should have same ionic velocity, or ionic mobility or transport no.

(K⁺Cl⁻)

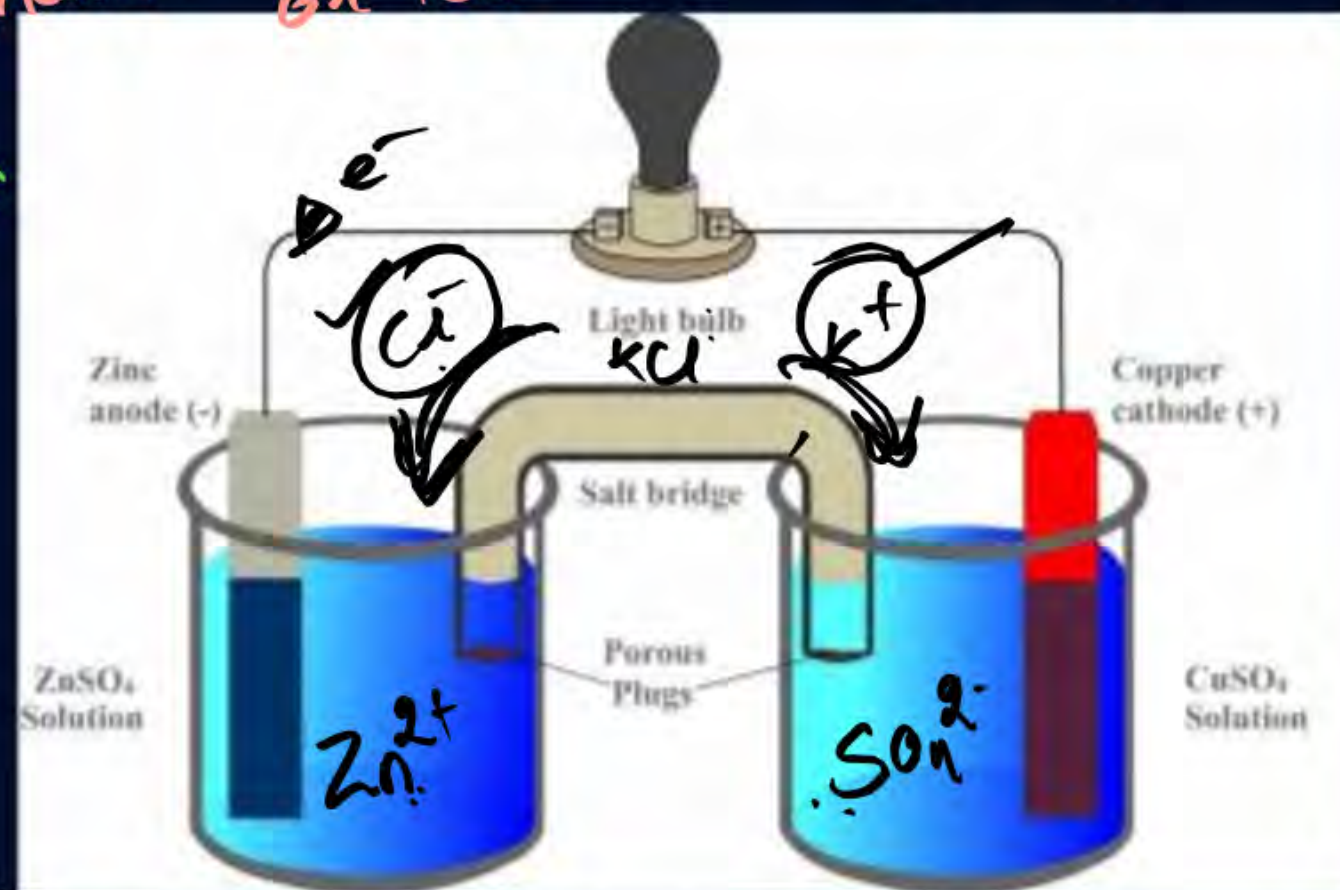
MIT

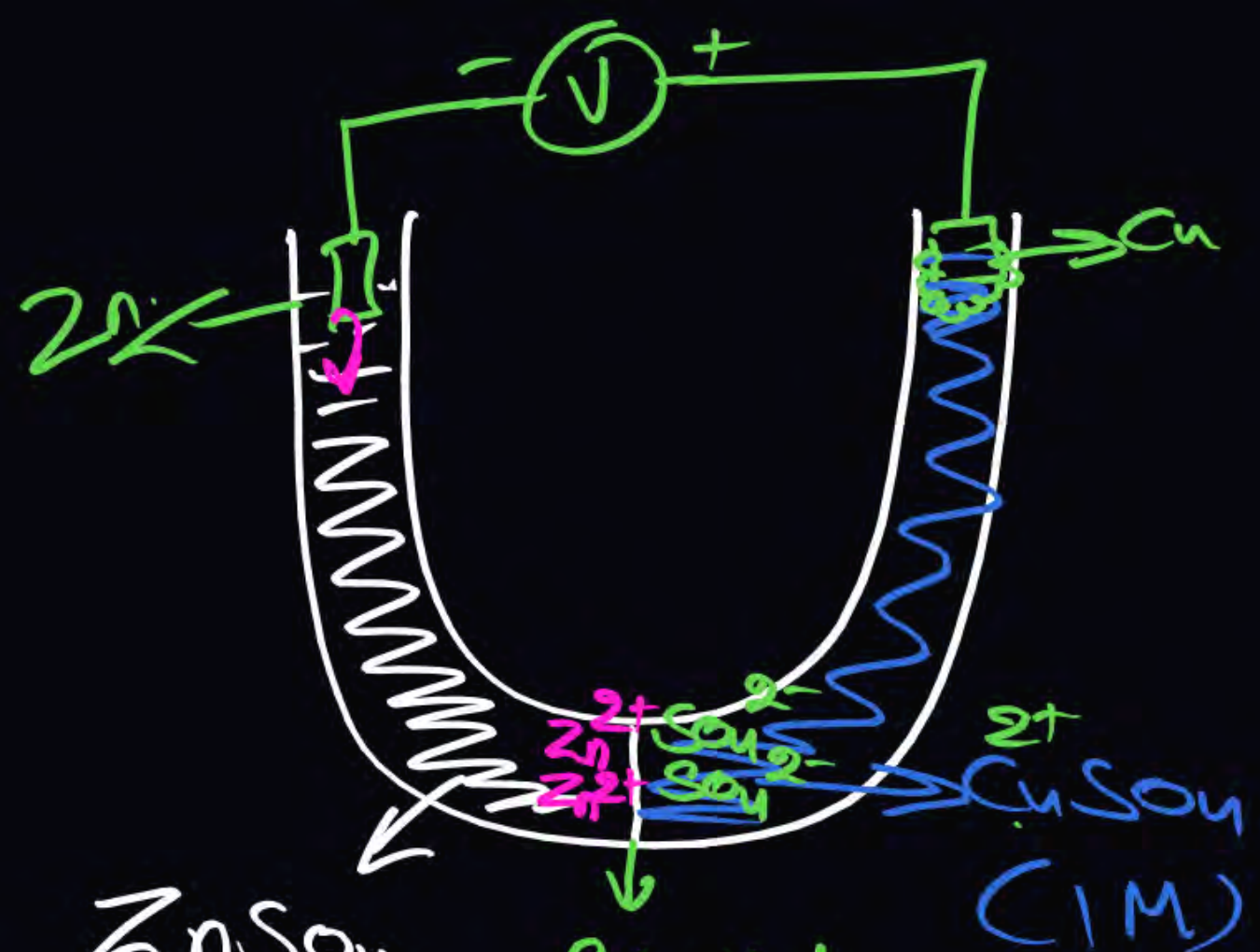
Salt bridge → Agar-agar gel + Inert electrolyte.

① Completes the circuit to get continuous supply of current.

② remove charges by movement of ions.

③ removes LJP (Liquid Junction potential)





ZnSO_4
(1M)

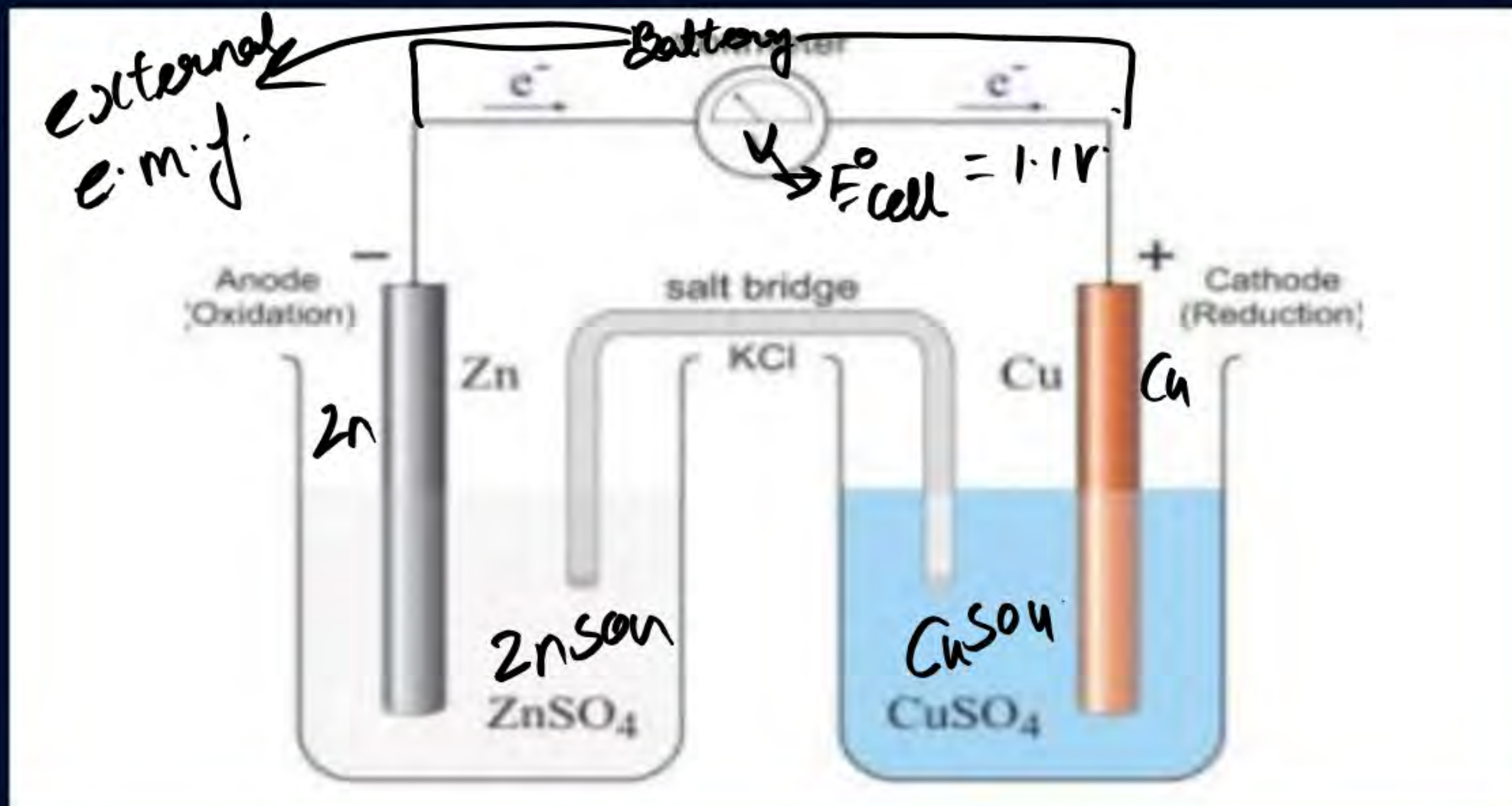
Potential
develop

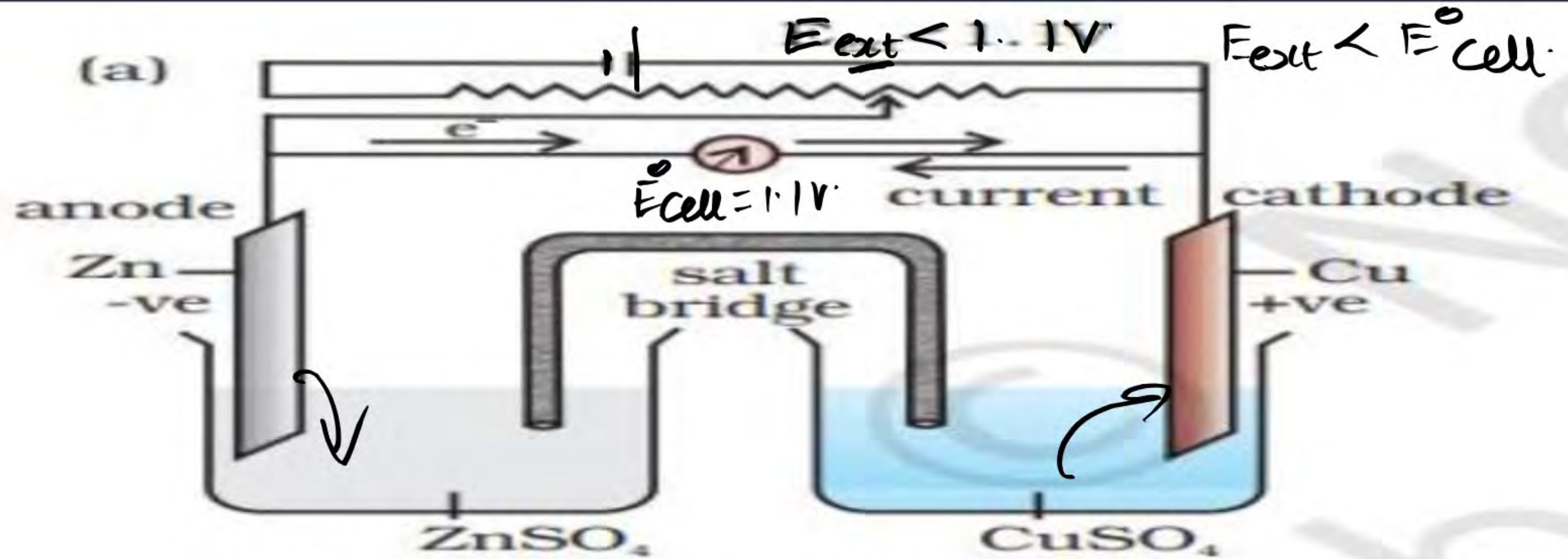
CuSO_4
(1M)

Liquid Junction potential



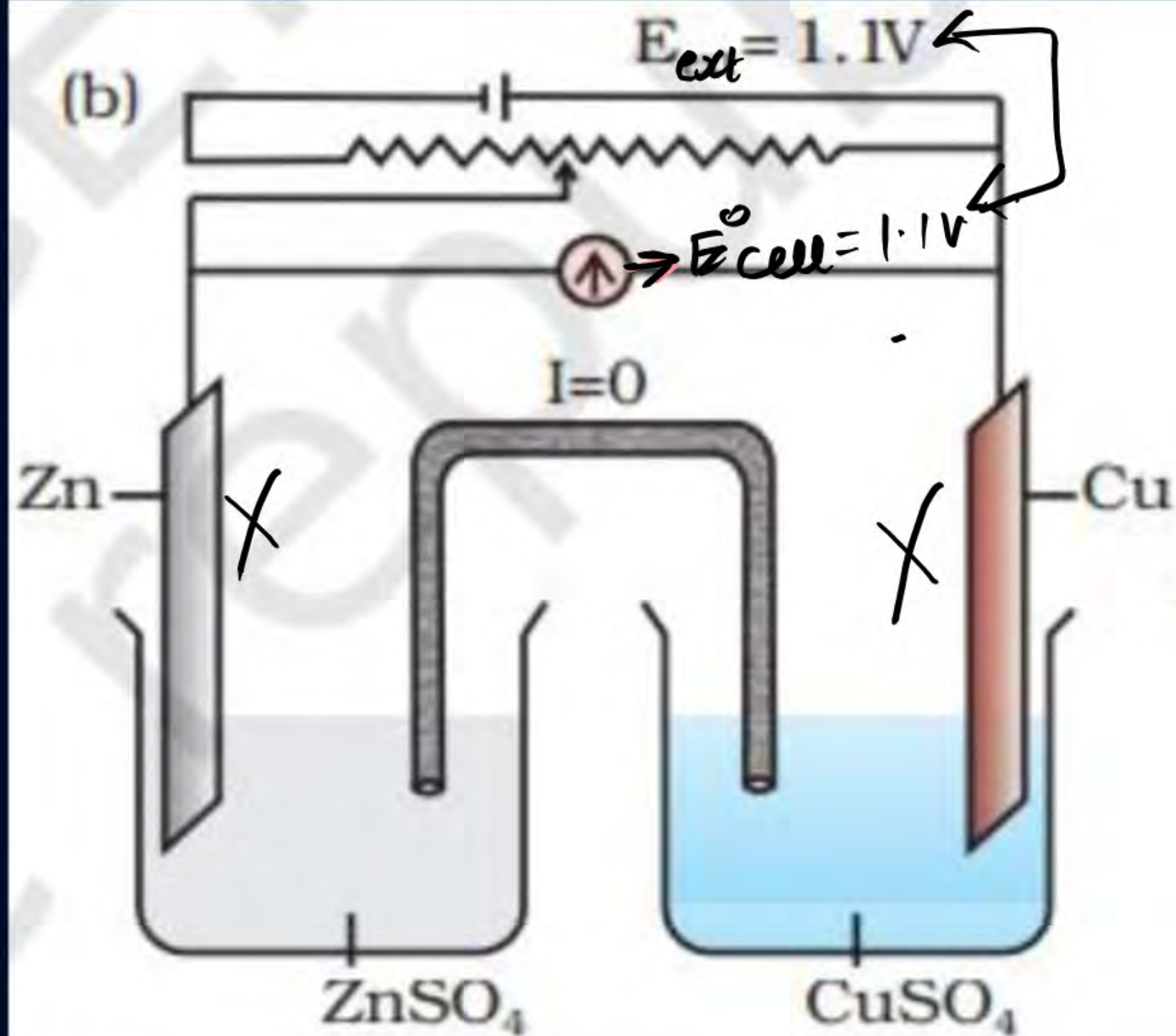
Effect on external E.M.F. of cell





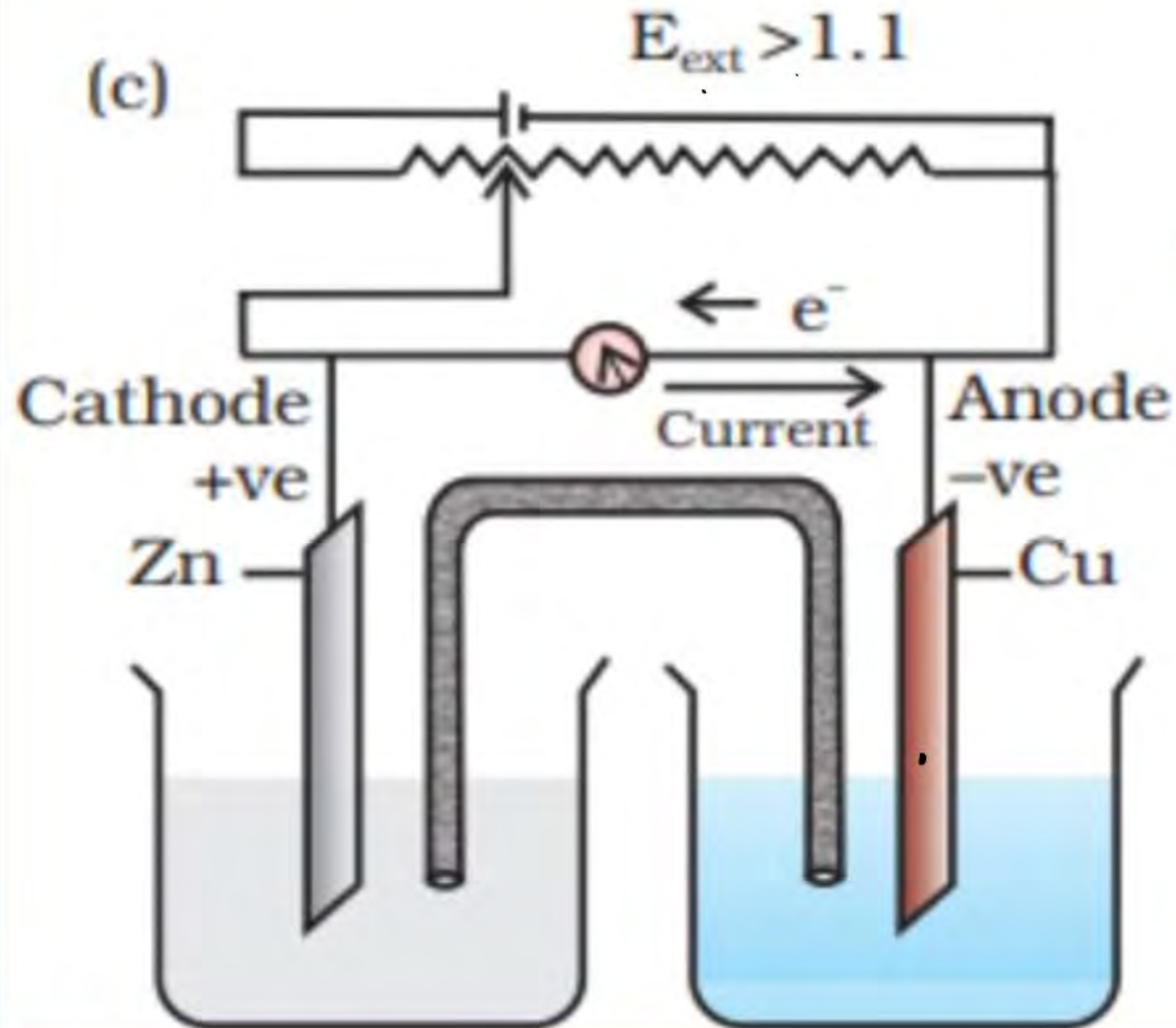
When $E_{\text{ext}} < 1.1 \text{ V}$

- (i) Electrons flow from Zn rod to Cu rod hence current flows from Cu to Zn.
- (ii) Zn dissolves at anode and copper deposits at cathode.



When $E_{ext} = 1.1 V$

- (i) No flow of electrons or current.
- (ii) No chemical reaction.



When $E_{\text{ext}} > 1.1 \text{ V}$

- (i) Electrons flow from Cu to Zn and current flows from Zn to Cu.
- (ii) Zinc is deposited at the zinc electrode and copper dissolves at copper electrode.

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effect of external e.m.f. of Cell.

- ① $E_{\text{cell}} > E_{\text{external}} \Rightarrow$ electrochemical cell work \rightarrow Zn \rightarrow anode \rightarrow oxidⁿ
Cu \rightarrow Cathode \rightarrow redⁿ
- ② $E_{\text{cell}} = E_{\text{external}} \Rightarrow$ No cell $\hat{=}$ ($I=0$)
- ③ $E_{\text{cell}} < \underline{E_{\text{external}}}$ \Rightarrow electrolytic cell work \Rightarrow Cu \rightarrow anode \rightarrow oxidⁿ
Zn \rightarrow Cathode \rightarrow redⁿ

QUESTION – (NCERT Exemplar)

An electrochemical cell can behave like an electrolytic cell when _____.

A $E_{\text{cell}} = 0$

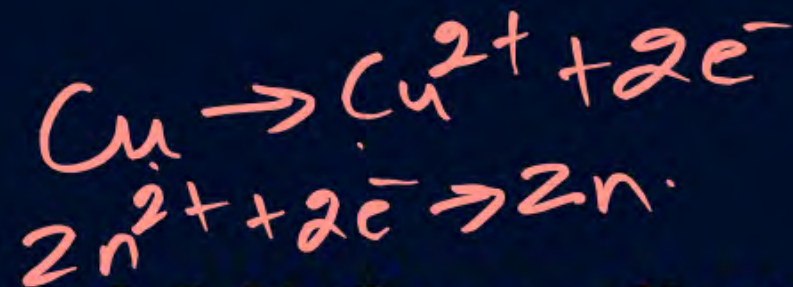
B $E_{\text{cell}} > E_{\text{ext}}$

C $E_{\text{ext}} > E_{\text{cell}}$

D $E_{\text{cell}} = E_{\text{ext}}$

QUESTION – (AIIMS 2006)

$$E_{\text{ext}} > E_{\text{cell}}$$



Assertion: For the Daniel cell, $\text{Zn}|\text{Zn}^{2+}||\text{Cu}^{2+}|\text{Cu}$ with, $E_{\text{cell}} = 1.1 \text{ V}$, the application of opposite potential greater than 1.1 V results into flow of electron from cathode of anode.

Reason: Zn is deposited at anode and Cu is deposited at cathode. ~~X~~

- A** If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.
- B** If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.
- C** If the Assertion is correct but Reason is incorrect.
- D** If both the Assertion and Reason are incorrect.
- E** If the Assertion is incorrect but the Reason is correct.



Nernst Equation

(Effect of temperature and concentration on electrode potential or e.m.f. of cell)

QUESTION



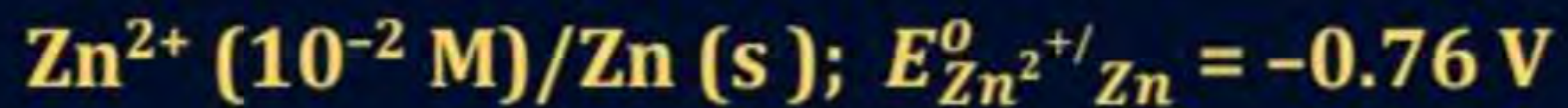
Find electrode potential of following:

$\text{Cu}/\text{Cu}^{2+} (0.1 \text{ M}) ; E_{\text{Cu}^{2+}/\text{Cu}}^0 = +0.34 \text{ V}$

QUESTION



Find electrode potential of following:

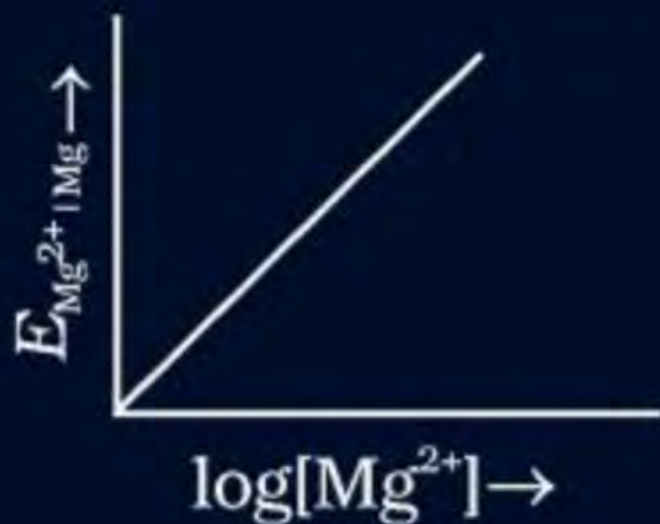


QUESTION – (NCERT Exemplar)

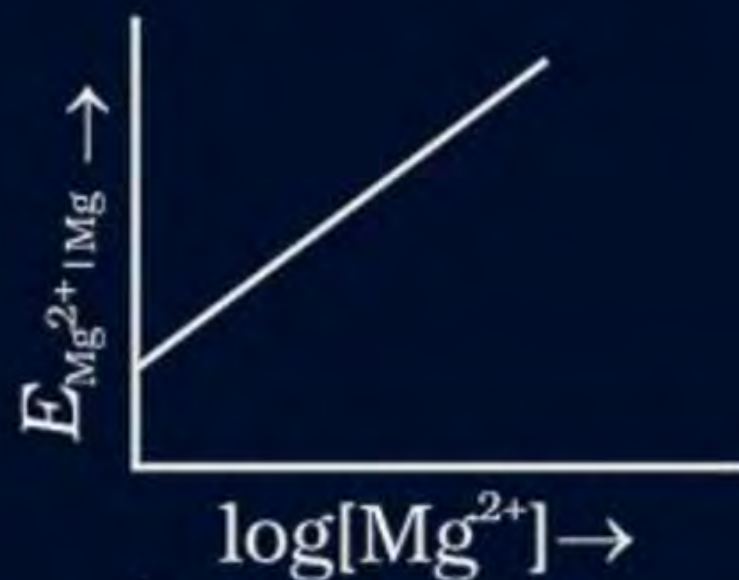
Electrode potential for Mg electrode varies according to the equation

$$E_{\text{Mg}^{2+}|\text{Mg}} = E_{\text{Mg}^{2+}|\text{Mg}}^{\ominus} - \frac{0.059}{2} \log \frac{1}{[\text{Mg}^{2+}]} \quad \text{The graph of } E_{\text{Mg}^{2+}|\text{Mg}} \text{ vs } \log[\text{Mg}^{2+}] \text{ is:}$$

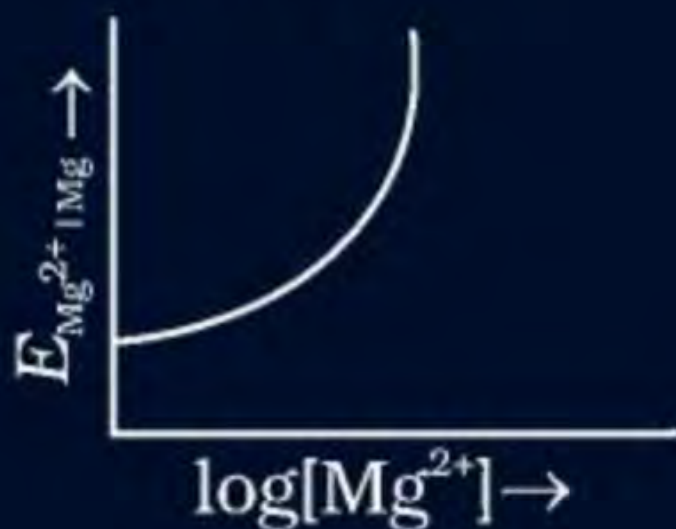
A



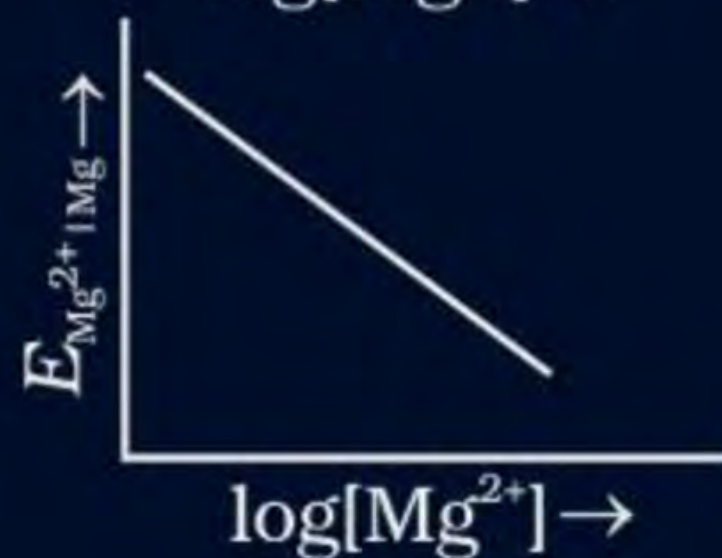
B



C



D



QUESTION



Find Oxidation potential of the following:

Pt, H_2 (1 atm)/ H^+ (10^{-3} M)

QUESTION



Find Reduction potential of the following:

Pt, H_2 (1 atm)/ H^+ (10^{-2} M)

The pressure of H_2 required to make potential of H_2 electrode. Zero in pure water at 298 K.

- A** 10^{-10} atm
- B** 10^{-4} atm
- C** 10^{-14} atm
- D** 10^{-12} atm

QUESTION (AIIMS-2019)

At 298 K temperature, a hydrogen gas electrode is made by dipping platinum wire in a solution of HCl of pH = 10 and by passing hydrogen gas around the platinum wire at one atm pressure. The potential of electrode would be

- A** 0.59 V
- B** 0.118 V
- C** 1.18 V
- D** 0.059 V



trick :-

THANK
YOU