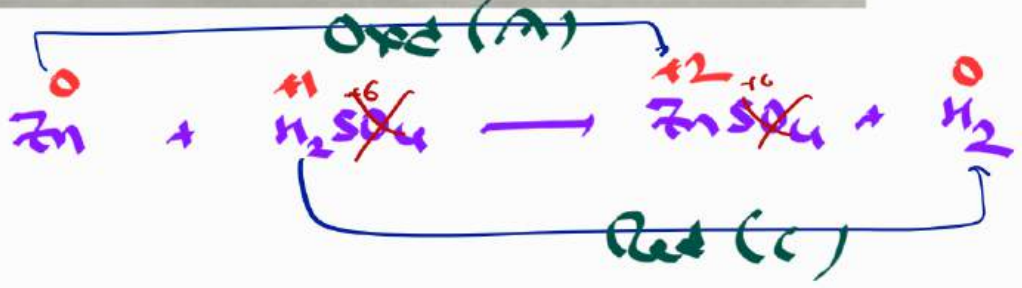
6. Which of the following is the correct cell representation for the given cell reaction?

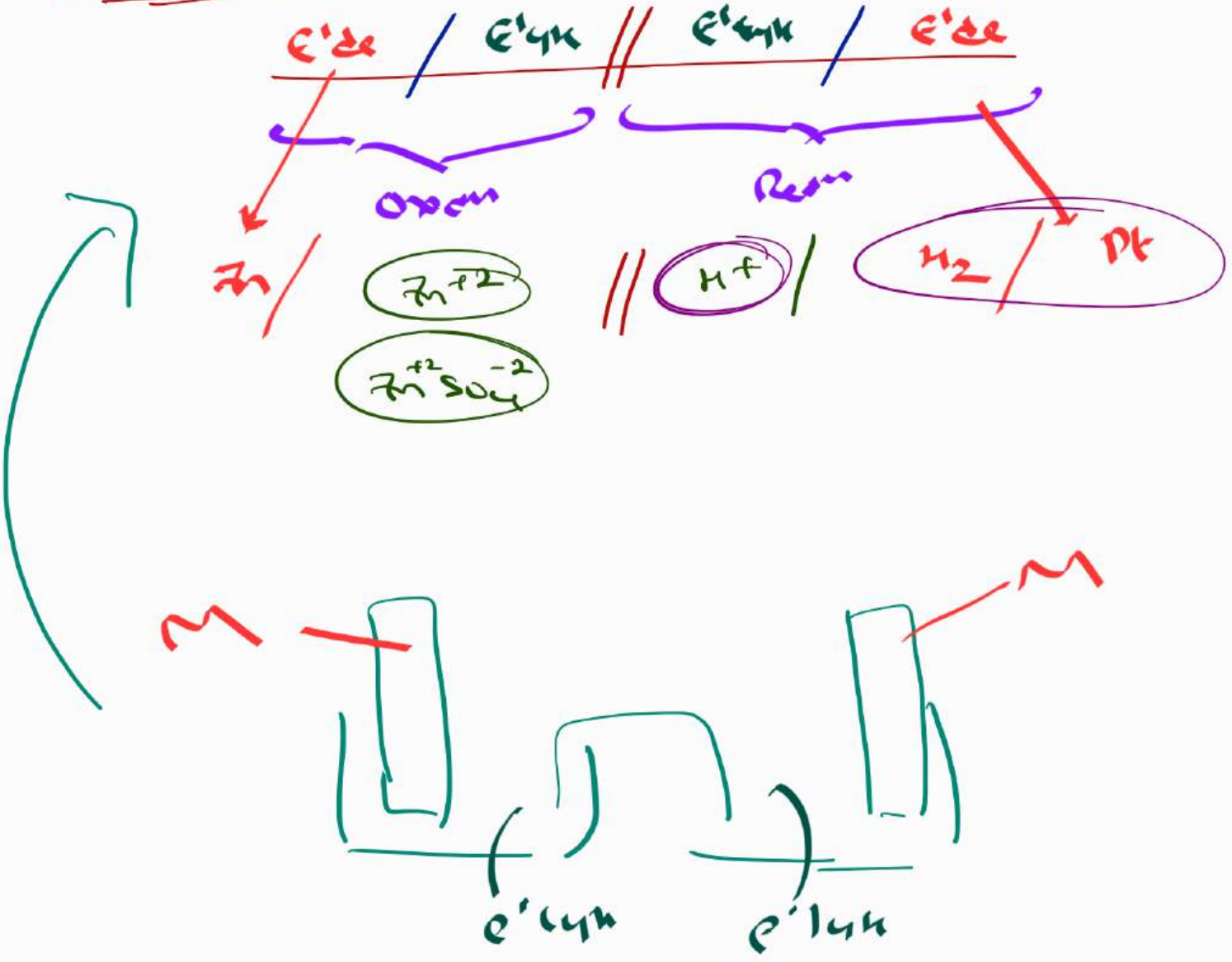
$$Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2$$



A:- (Oxdn) : $Zn \longrightarrow Zn^{+2} + 2e^-$

C:- (Redn) $2H^+ + 2e^- \longrightarrow H_2$

Cell representation:



8. Which of the following reactions is possible at anode?

(a) $2Cr^{3+} + 7H_2O \rightarrow Cr_2O_7^{2-} + 14H^+$

(b) $F_2 \rightarrow 2F^-$

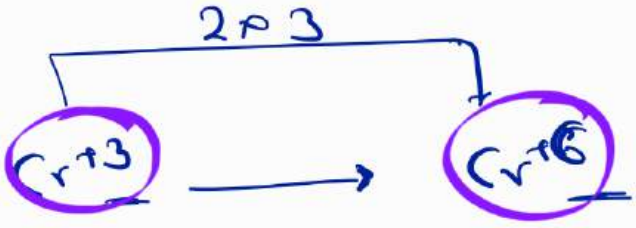
(c) $1/2O_2 + 2H^+ \rightarrow H_2O$

(d) None of these

$2x - 14 = -2$

$2x = 12$

$x = +6$



11. Which of the following is the cell reaction that occurs when the following half-cells are combined?

A $I_2 + 2e^- \rightarrow 2I^-$ (1 M); $E^\circ = +0.54$ V

C $Br_2 + 2e^- \rightarrow 2Br^-$ (1 M); $E^\circ = +1.09$ V

(a) $2Br^- + I_2 \rightarrow Br_2 + 2I^-$

(b) $I_2 + Br_2 \rightarrow 2I^- + 2Br^-$

(c) $2I^- + Br_2 \rightarrow I_2 + 2Br^-$

(d) $2I^- + 2Br^- \rightarrow I_2 + Br_2$

red^n / oxd^n

A :- $E_0 = 0.54$

C :- $E_0 = +1.09$ ↑ red^n

↓

Red^n

↓

C

C :- $Br_2 + 2e^- \rightarrow 2Br^-$

A :- $2I^- \rightarrow I_2 + 2e^-$

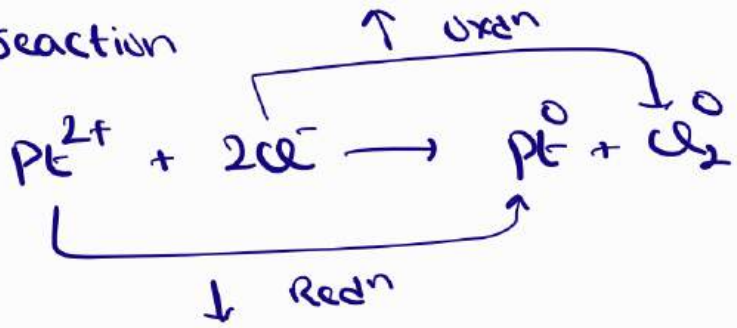
$Br_2 + 2I^- \rightarrow I_2 + 2Br^-$

---

13. The standard reduction potential for the half-cell reaction, $Cl_2 + 2e^- \rightarrow 2Cl^-$ will be
($Pt^{2+} + 2Cl^- \rightarrow Pt + Cl_2$, $E^\circ_{cell} = -0.15$ V;
$Pt^{2+} + 2e \rightarrow Pt$, $E^\circ = 1.20$ V)

(a) −1.35 V (b) +1.35 V
(c) −1.05 V (d) +1.05 V

Given reaction



A:- $Cl^- \rightarrow Cl_2$ (E_A) ← −1.35

C:- $Pt^{+2} \rightarrow Pt$ (E_C)

$E_{cell} = E_C - E_A$

$-0.15 \quad 1.2 \quad x$

$-0.15 = 1.2 - x$

$-0.15 - 1.2 = x$

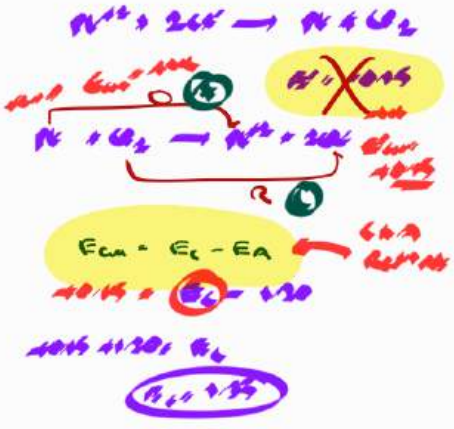
$-1.35 = x$

$Cl^- \rightarrow Cl_2$

but in question they are asking

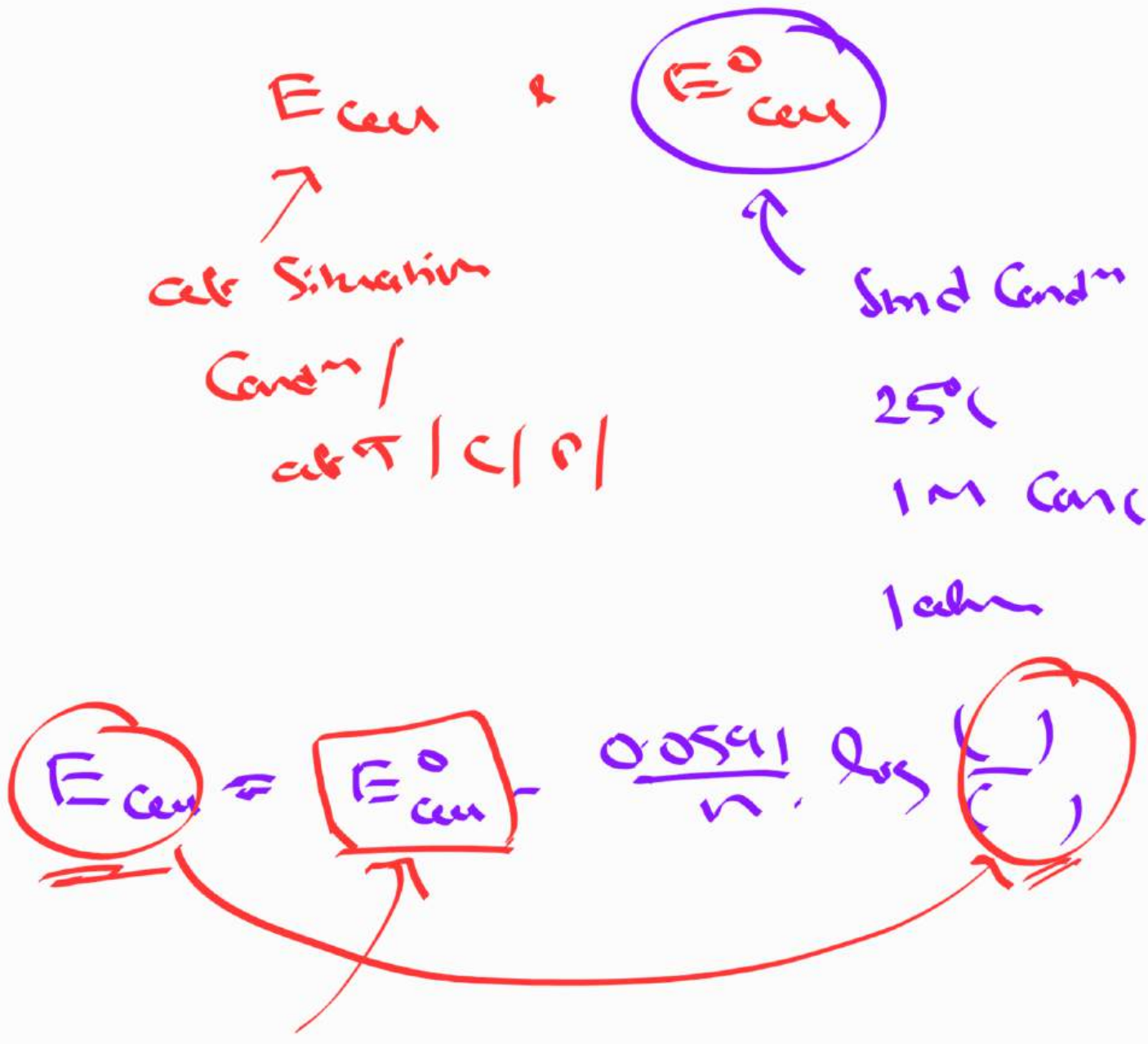
$Cl_2 \rightarrow Cl^- \Rightarrow -(-1.35)$

$\Rightarrow +1.35$



14. In a cell reaction, $Cu_{(s)} + 2Ag^{+}_{(aq)} \rightarrow Cu^{2+}_{(aq)} + 2Ag_{(s)}$ $E^{\circ}_{cell} = +0.46$ V. If the concentration of Cu^{2+} ions is doubled then E°_{cell} will be

(a) doubled
(b) halved
(c) increased by four times
(d) unchanged.



(c)

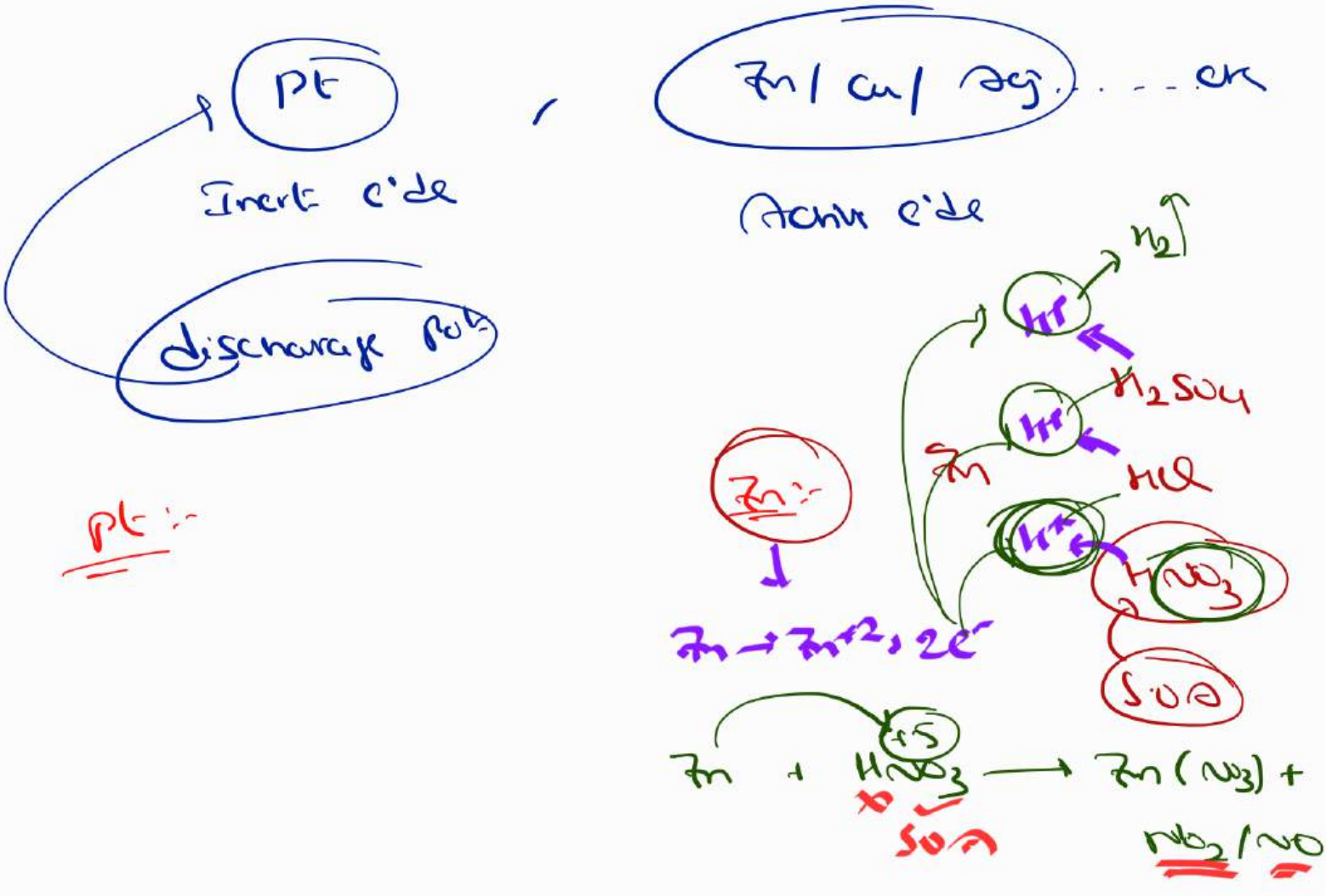
21. Zn gives hydrogen with H_2SO_4 and HCl but not with HNO_3 because

(a) Zn acts as oxidising agent when reacts with HNO_3

(b) HNO_3 is weaker acid than H_2SO_4 and HCl

(c) Zn is above the hydrogen in electrochemical series

(d) NO_3^- is reduced in preference to H^+ ion.



(d)

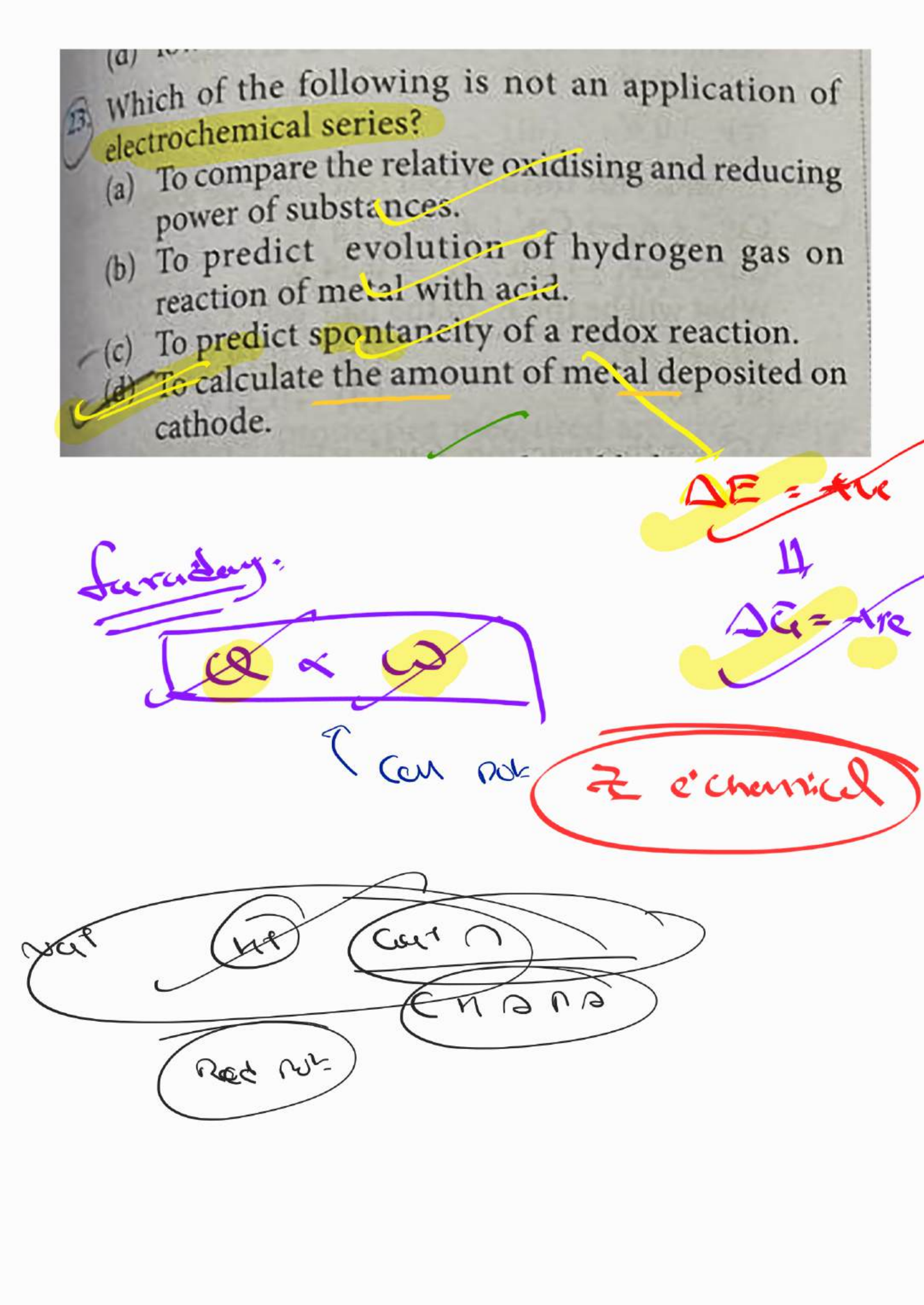
23. Which of the following is not an application of electrochemical series?

(a) To compare the relative oxidising and reducing power of substances.

(b) To predict evolution of hydrogen gas on reaction of metal with acid.

(c) To predict spontaneity of a redox reaction.

(d) To calculate the amount of metal deposited on cathode.



24. E° values of three metals are listed below.

$Zn^{2+}_{(aq)} + 2e^- \rightarrow Zn_{(s)}$; $E^\circ = -0.76$ V

$Fe^{2+}_{(aq)} + 2e^- \rightarrow 2Fe_{(s)}$; $E^\circ = -0.44$ V

$Sn^{2+}_{(aq)} + 2e^- \rightarrow Sn_{(s)}$; $E^\circ = -0.14$ V

Which of the following statements are correct on the basis of the above information?

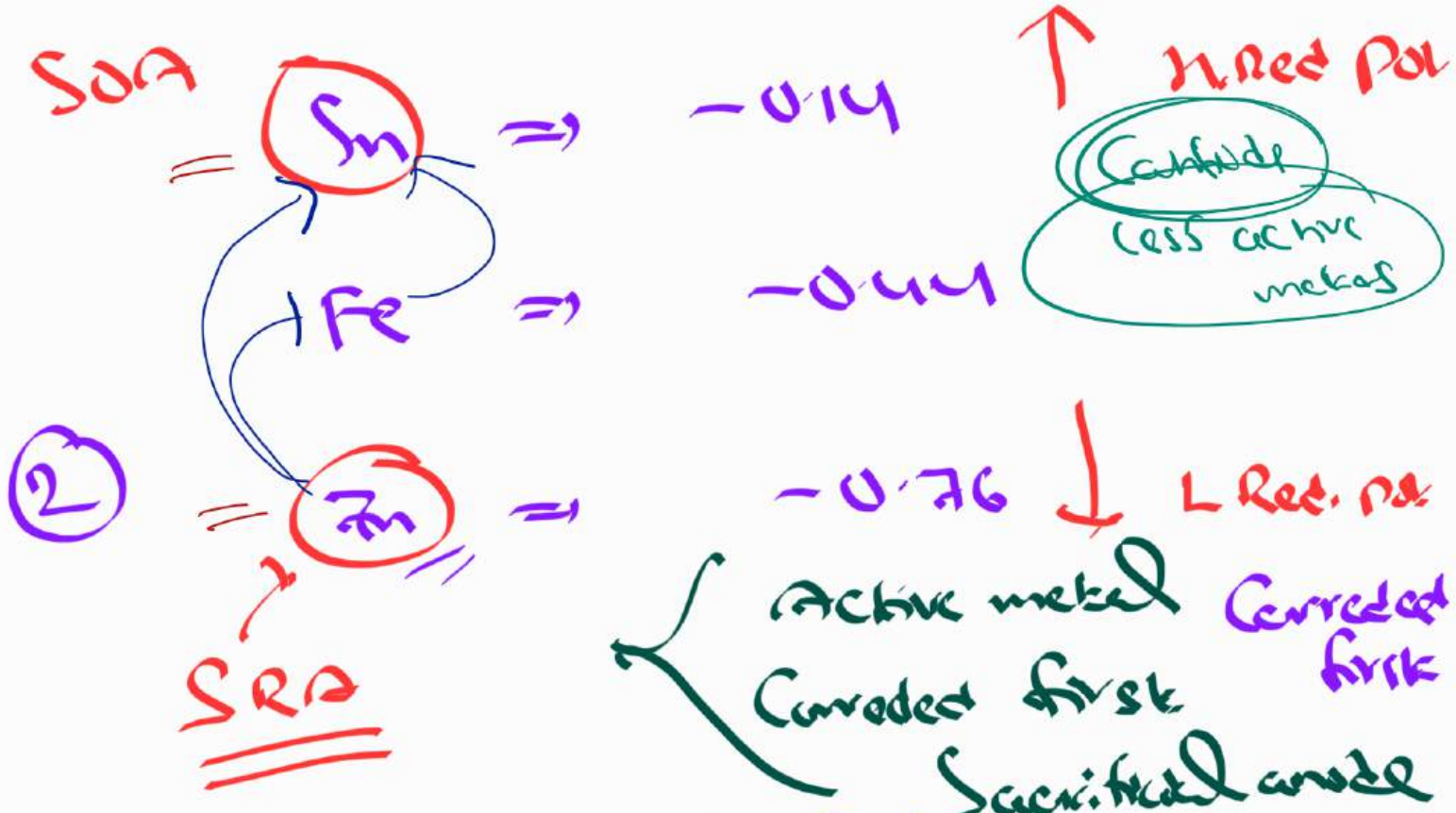
(i) Zinc will be corroded in preference to iron if zinc coating is broken on the surface.

(ii) If iron is coated with tin and the coating is broken on the surface then iron will be corroded.

(iii) Zinc is more reactive than iron but tin is less reactive than iron.

(a) (i) and (ii) only (b) (ii) and (iii) only

(c) (i), (ii) and (iii) (d) (i) and (iii) only



for protection of Tin (Sn)

Zinc can be used as Sacrificial Anode

(c) (i), (ii) and (iii) (d)

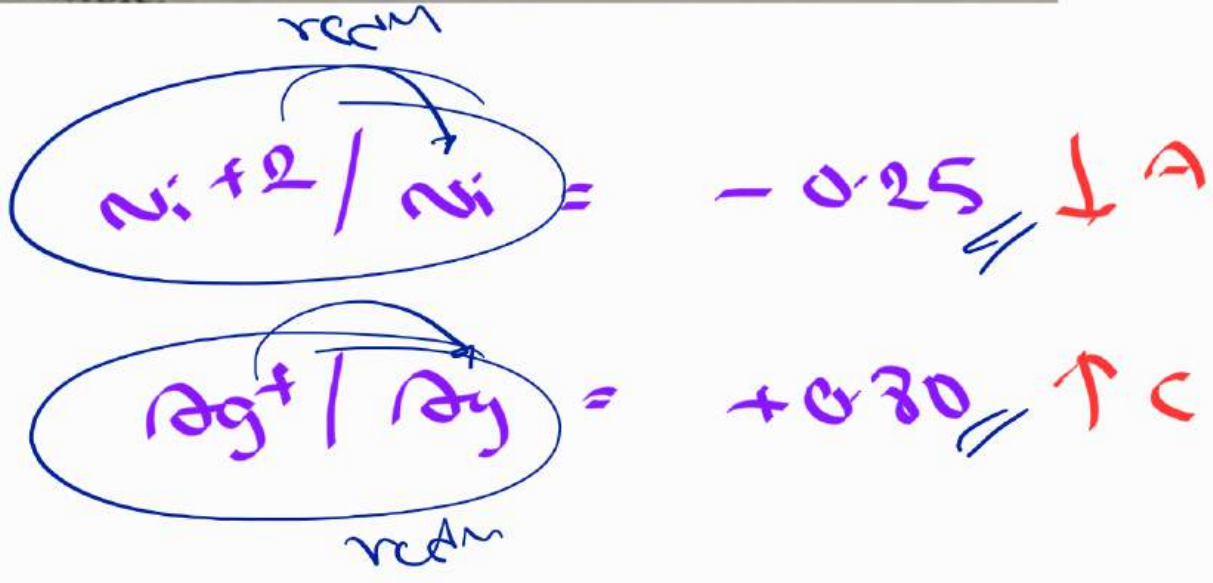
25. E° value of Ni^{2+}/Ni is -0.25 V and Ag^+/Ag is $+0.80$ V. If a cell is made by taking the two electrodes what is the feasibility of the reaction?

(a) Since E° value for the cell will be positive, redox reaction is feasible.

(b) Since E° value for the cell will be negative, redox reaction is not feasible.

(c) Ni cannot reduce Ag^+ to Ag hence reaction is not feasible.

(d) Ag can reduce Ni^{2+} to Ni hence reaction is feasible.



28. Mark the correct Nernst equation for the given cell.

$Fe_{(s)} \mid Fe^{2+}(0.001\ M) \mid\mid H^+(1\ M) \mid H_{2(g)}(1\ bar) \mid Pt_{(s)}$

(a) $E_{cell} = E^\circ_{cell} - \frac{0.591}{2} \log \frac{[Fe^{2+}][H^+]^2}{[Fe][H_2]}$

(b) $E_{cell} = E^\circ_{cell} - \frac{0.591}{2} \log \frac{[Fe][H^+]^2}{[Fe^{2+}][H_2]}$

(c) $E_{cell} = E^\circ_{cell} - \frac{0.0591}{2} \log \frac{[Fe^{2+}][H_2]}{[Fe][H^+]^2}$

(d) $E_{cell} = E^\circ_{cell} - \frac{0.0591}{2} \log \frac{[Fe][H_2]}{[Fe^{2+}][H^+]^2}$

29. The correct Nernst equation for the given cell $Pt_{(s)} \mid Br_{2(l)} \mid Br^-(M) \,||\, H^+(M) \mid H_{2(g)}(1\ bar) \mid Pt_{(s)}$ is

(a) $E_{cell} = E^\circ_{cell} - \frac{0.0591}{2} \log \frac{[Br_{2(l)}][H_2]}{[H^+]^2[Br^-]^2}$

(b) $E_{cell} = E^\circ_{cell} - \frac{0.0591}{2} \log \frac{[H^+]^2[Br^-]^2}{[Br_{2(l)}][H_2]}$

(c) $E_{cell} = E^\circ_{cell} - \frac{0.0591}{2} \log \frac{[H^+]^2[H_2]}{[Br_{2(l)}][Br^-]^2}$

(d) $E_{cell} = E^\circ_{cell} - \frac{0.0591}{2} \log \frac{[Br_{2(l)}][Br^-]^2}{[H^+]^2[H_2]}$

A :- $2Br^- \longrightarrow Br_2 + 2e^-$

C :- $2H^+ + 2e^- \longrightarrow H_2$

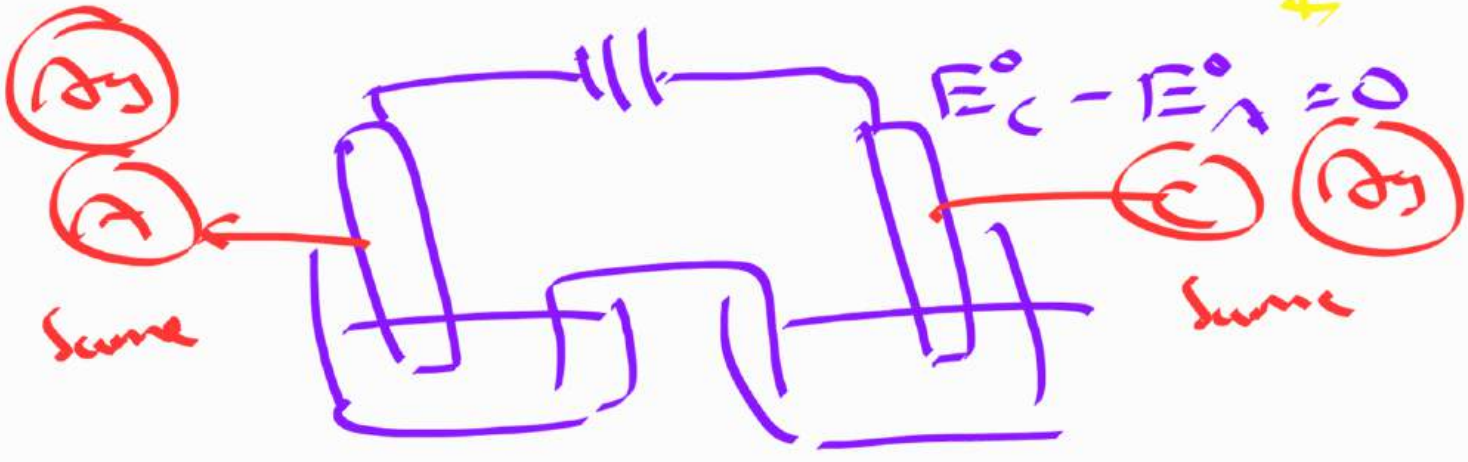
$2H^+ + 2Br^- \longrightarrow H_2 + Br_2$

31. What will be the emf of the following concentration cell at 25°C?

$Ag_{(s)} \mid AgNO_3(0.01\ M) \mid\mid AgNO_3\ (0.05\ M) \mid Ag_{(s)}$

(a) 0.828 V (b) 0.0413 V

(c) −0.0413 V (d) −0.828 V



$E_{cell} = E^\circ_{cell} -$

$= (E_C - E_A)$

32. The standard reduction potential for Cu^{2+}/Cu is +0.34 V. What will be the reduction potential at pH = 14? [Given : K_{sp} of $Cu(OH)_2$ is 1.0×10^{-19}]

(a) 2.2 V (b) 3.4 V

(c) −0.22 V (d) −2.2 V

Sol^n $Cu^{+2}/Cu = +0.34$

$Cu^{+2} + 2e^- \longrightarrow Cu$

$E_{cell} = E^\circ_{cell} - \frac{0.059}{n} \log \frac{[Cu]}{[Cu^{+2}]}$ 1×10^{-19}

$E^\circ = +0.34$, $n = 2$

K_{sp} $Cu(OH)_2 \rightleftharpoons Cu^{+2} + 2OH^-$

s 0 0

0 s 2s + 1M

Very Small

$\simeq 1M$

$K_{sp} = [Cu^{+2}][OH^-]^2$

$K_{sp} = [S][2S]^2$

$= 4S^3$

$Cu^{+2} \leftarrow S = \left(\frac{K_{sp}}{3}\right)^{1/3}$

$K_{sp} = [Cu^{+2}][1M]$

$\frac{1 \times 10^{-19}}{1} = [Cu^{+2}]$

in presence of pH = 14

$pOH = 0$

$-\log[OH^-] = 0$

$= \log 1$

$[OH^-] = 1$

Big value

36. E°_{cell} for the reaction, $2H_2O \rightarrow H_3O^+ + OH^-$ at 25 °C is − 0.8277 V. The equilibrium constant of the reaction is

(a) 10^{-14} (b) 10^{-23} (c) 10^{-7} (d)

37. Cell reaction is spontaneous, when

at eqm
both half cells
have same net
⇓
No flow of current

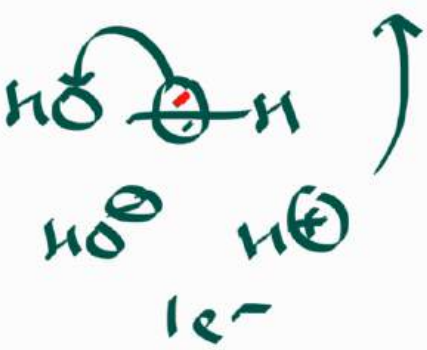
$E = E^\circ - \frac{0.0591}{n} \log$ ( ) K_{eq}

$0 = E^\circ - \frac{0.0591}{n} \log K_{eq}$

$\frac{0.0591}{n} \log K_{eq} = E^\circ$

$\log K_{eq} = \frac{nE^\circ}{0.0591}$

$H_2O + H_2O \rightarrow H_3O^+ + OH^-$ (1e⁻)



$\log K_{eq} = \frac{1 \times (-0.8277)}{0.0591}$

≈ -14

$K_{eq} = 10^{-14}$

39. The Gibbs energy for the decomposition of Al_2O_3 at 500 °C is as follows :

$2/3Al_2O_3 \rightarrow 4/3Al + O_2$; $\Delta_rG = +966$ kJ/mol

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

(a) 5.0 V (b) 4.5 V

(c) 3.0 V (d) − 2.5 V

$\Delta G^\circ = -nFE_{cell}$

$E_{cell} = \frac{-\Delta G}{nF}$

$= \frac{+966 \times 10^3}{4 \times 96500}$

$= \frac{9660}{4 \times 965}$

$\frac{2}{3}Al_2O_3 \rightarrow \frac{4}{3}Al + O_2$

+3 −2 0 0

$\left(\frac{2}{3} \times 3\right) \times 2$ = 4

$\left(\frac{2}{3} \times 3\right) \times 2$ = 4 OR

40. E° values for the half cell reactions are given below

$Cu^{2+} + e^- \rightarrow Cu^+$; $E^\circ = 0.15$ V

$Cu^{2+} + 2e^- \rightarrow Cu$; $E^\circ = 0.34$ V

What will be the E° of the half-cell : $Cu^+ + e^- \rightarrow Cu$

(a) +0.49 V (b) +0.19 V

(c) +0.53 V (d) +0.30 V

42. The specific conductivity of N/10 KCl solution at 20 °C is 0.0212 ohm^{-1} cm^{-1} and the resistance of the cell containing this solution at 20 °C is 55 ohm. The cell constant is

(a) 3.324 cm^{-1} (b) 1.166 cm^{-1}

(c) 2.372 cm^{-1} (d) 3.682 cm^{-1}

$K = 0.0212$

$C = \frac{12}{10} = 0.12$

$R = 55$

$\rho_A = ?$

$R = \frac{1}{K} \cdot \frac{\ell}{A}$

$\frac{\ell}{A} = R.K$

(c) 2.372 cm (d) 3.062 cm

43. Electrical conductance through metals is called metallic or electronic conductance and is due to the movement of electrons. The electronic conductance depends on
(a) the nature and structure of the metal
(b) the number of valence electrons per atom
(c) change in temperature
(d) all of these.

a) Al, Cu, Au, Fe

"nature of metallic bond"

b) M-1 ve

M-2 ve

c) temp ↑ → Cond ↓ metal

(c) 0.005 M

50 The specific conductance of a saturated solution of AgCl at 25 °C is 1.821×10^{-5} mho (m^{-1}). What is the solubility of AgCl in water (in $g\,L^{-1}$), if limiting molar conductivity of AgCl is 130.26 mho cm^2 mol^{-1}?

(a) $1.89 \times 10^{-3}\ g\,L^{-1}$ (b) $2.78 \times 10^{-2}\ g\,L^{-1}$

(c) $2.004 \times 10^{-2}\ g\,L^{-1}$ (d) $1.43 \times 10^{-3}\ g\,L^{-1}$

...Cl solution is

1.821×10^{-5}

$\Lambda = \frac{K \times 1000}{M}$ S = Molarity / mol/lit / gm/lit

130.26

$S = \frac{K \times 1000}{\Lambda}$

$= \frac{1.821 \times 10^{-5} \times 1000}{130.26}$

AgCl

dil HCl

$\frac{35.5}{143.5}$

= ◯ mol/lit

= ◯ × 143.5 × ◯ gm/lit

...lyte in the solution. ...produced on dissociation of

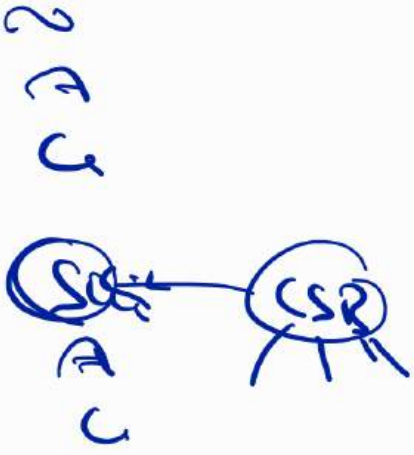
52. $NaCl$, $MgCl_2$ and $CaSO_4$ are known as
(a) 1 – 1, 2 – 1, and 2 – 2 type electrolytes respectively
(b) strong, weak and strong electrolytes respectively
(c) electrolytes with different values of Λ_m°
(d) electrolytes with same molar conductivity.

53. Which of ...

NaCl — SE

$MgCl_2$ — SE

$CaSO_4$ — WE



NaCl 1:1

$MgCl_2$ 1:2

$Al_2(SO_4)_3$

2:3

A_3B_2

2:3 / 3:2

(c)

70. How much electricity in terms of Faraday is required to produce 100 g of Ca from molten $CaCl_2$?

(a) 1 F (b) 2 F (c) 3 F (d) 5 F

... of 1.5 ampere flows through ...

Faraday 1st law:

20 Ca

$CaCl_2$: 20 equiv

$w = \frac{\text{Eq.wt}}{96500} \times i \times t$

$w = \text{Eq.wt} \times \frac{i \times t}{96500}$

no. of many faradays

$\frac{100}{20} \Leftarrow \frac{w}{\text{Eq.wt}}$ = no of faradays

5 5F

Shortcut

2F- Ca^{+2}

1F- $\Rightarrow$ $\frac{1}{2}$ Ca^{+2}

20g

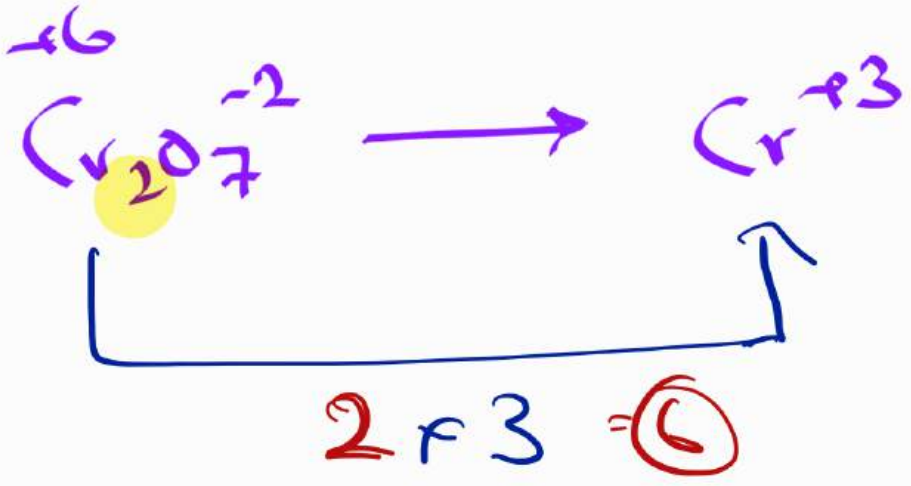
100g $\Leftarrow$ 5F

w

(d)

(21) How many coulombs of electricity is required to reduce 1 mole of $Cr_2O_7^{2-}$ in acidic medium?

(a) 4×96500 C
(b) 6×96500 C
(c) 2×96500 C
(d) 1×96500 C

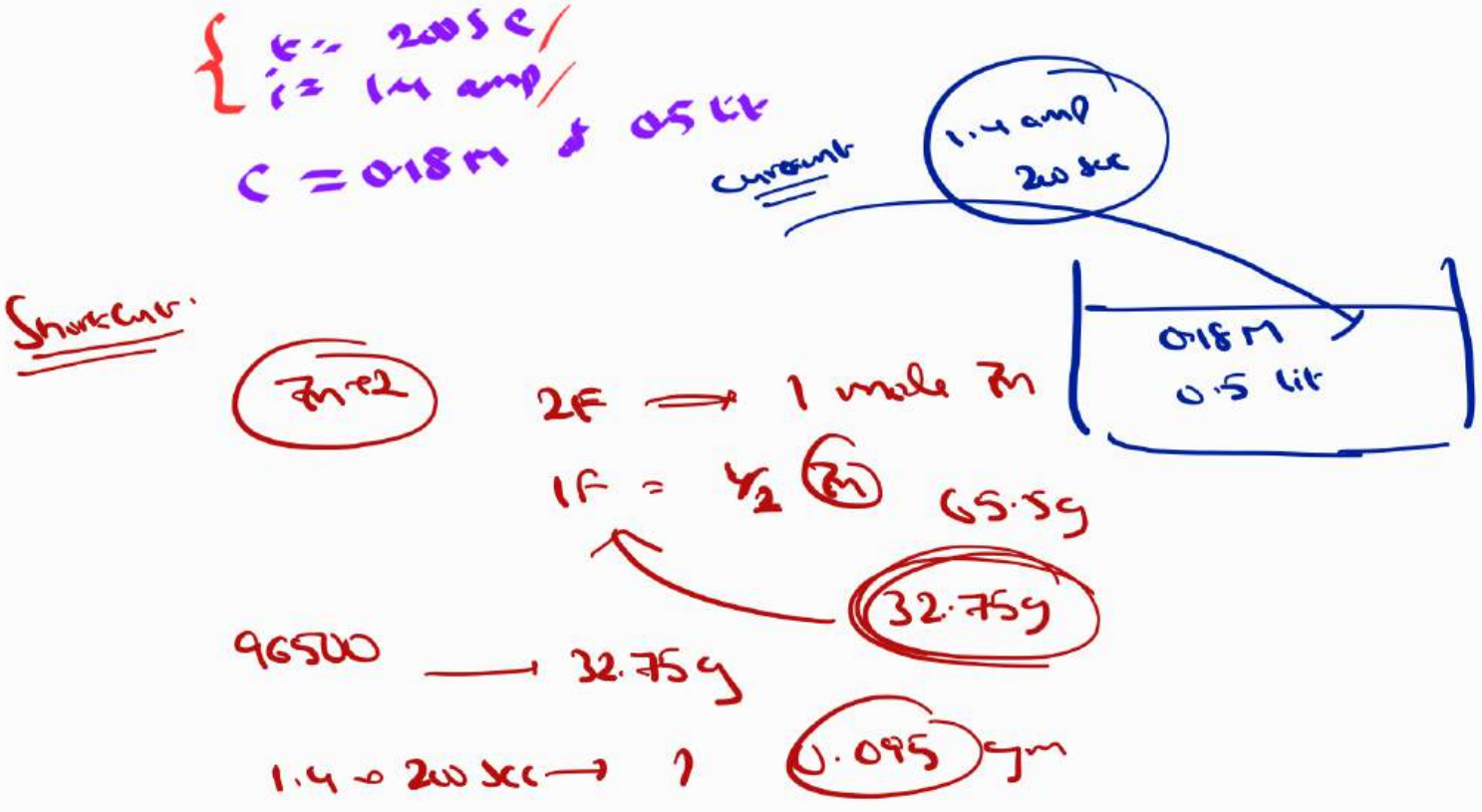


74. A current of 1.40 ampere is passed through 500 mL of 0.180 M solution of zinc sulphate for 200 seconds. What will be the molarity of Zn^{2+} ions after deposition of zinc?

(a) 0.154 M (b) 0.177 M

(c) 2 M (d) 0.180 M

left



C = 0.18 M / 0.5 lit

n = M × V

= 0.18 × 0.5

n = 0.09 mole

taken

wt. 0.095 gm

n = w / g mol wt

= 0.095 / 65.5

n = 0.0014

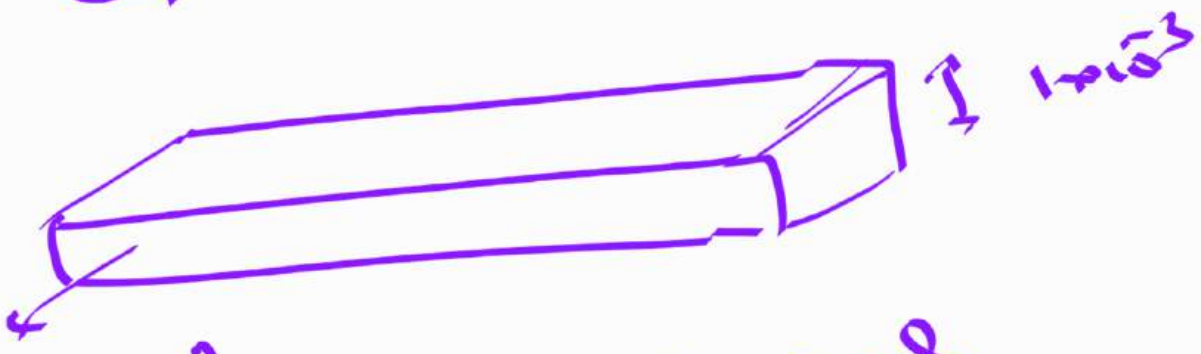
deposited

$M = \frac{n_{left}}{V} = \frac{0.09 - 0.0014}{0.5}$

= 0.177 M

75. How much time is required to deposit 1×10^{-3} cm thick layer of silver (density is 1.05 g cm^{-3}) on a surface of area 100 cm^2 by passing a current of 5 A through $AgNO_3$ solution?
(a) 125 s (b) 115 s (c) 18.7 s (d) 27.25 s

deposit $\ell =$



$V = a \cdot \ell$

$= 100 \times 10^{-3}\ cm^3$

$= 0.1\ cm^3$

$d = 1.05\ g/cm^3$ $= 0.1\ cm^3$

$1\ cm^3 \Rightarrow 1.05$ gm of Ag

$0.1\ cm^3 \Rightarrow 0.105$ g of Ag

S.K

96500 → 108g Ag

Ok ? —— 0.105

S

76. How much metal will be deposited when a current of 12 ampere with 75% efficiency is passed through the cell for 3 h? (Given : $Z = 4 \times 10^{-4}$)

(a) 32.4 g (b) 38. 8 g (c) 36.0 g (d) 22.4 g

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

$\frac{Eq}{96500} = 4 \times 10^{-4}$

$Eq.wt = 4 \times 96500 \times 10^{-4}$

$= 38.6$ gm

$i =$ (12) amp

(only 75% eff)

$= 12 \times \frac{75}{100}$

$= 9$ amp

96500 → 38.6

$9 \times 3 \times 60 \times 60 = ?$

81. An electric current is passed through silver nitrate solution using silver electrodes. 15.28 g of silver was found to be deposited on cathode. What will be the weight of copper deposited on cathode if same amount of electricity is passed through copper sulphate solution using copper electrodes?

(a) 4.49 g (b) 6.4 g

(c) 12.8 g (d) 3.2 g

S.C

1 F → 1 Ag → 108 g

1/2 Cu → 31.75 g

108 g of Ag → 31.75 g

15.28 → ?

(84) An acidic solution of Cu^{2+} containing 0.4 g of Cu^{2+} ions is electrolysed until all the copper is deposited. What is the volume of oxygen evolved at NTP?

(a) 141 cc (b) 31.75 cc

(c) 64 cc (d) 32 cc

...correct words to fill in the

Cu^{+2} O_2

$\frac{1}{2}$ mole = $\frac{1}{4}$ mole O_2

31.75 g Cu = $\frac{22.4}{4}$ = 5.6 L

5600 ml

0.4 g = ?

86. Which of the following statements is true?

(a) When an aqueous solution of NaCl is electrolysed, sodium metal is deposited at cathode.

(b) There is no difference between specific conductivity and molar conductivity.

(c) Silver nitrate solution can be stored in a copper container.

(d) The addition of liquid bromine to iodide solution turns it violet.

in electrolyte.

90. Electrolysis of an aqueous solution of $AgNO_3$ with silver electrodes produces (i) at cathode while (ii) ions are dissolved from anode. When Pt electrodes are used (iii) is produced at anode and (iv) at cathode.

	(i)	(ii)	(iii)	(iv)
(a)	H_2	NO_3^-	OH^-	H_2
(b)	Ag	H^+	O_2	H_2
(c)	Ag	Ag^+	O_2	Ag
(d)	Ag	H^+	Ag^+	O_2

$AgNO_3$

$Ag^+ \; NO_3^-$

$H^+ \; OH^-$