Electrode potential, E_{Cell}, Nernt equation and ECS

1. (b) Reduction potential of hydrogen electrode,

$$E_H = \frac{-2.303\ RT}{F} \log \frac{1}{[H^+]}$$

$$= -0.059\ pH = -0.059 \times 3 = -0.177\ V.$$

2. (a) $E^o_{\text{cell}} = E^o_{\text{cathode}} - E^o_{\text{anode}} = 0.799 - (-0.763) = 1.562\ V$

3. (a) More negative is the reduction potential, higher will be the reducing property, *i.e.* the power to give up electrons.

4. (b) Standard potential of Zinc < Copper.

5. **Answer:** (d) Ag

Explanation:

- A metal reacts with $CuSO_4$ solution if it is **more reactive than copper**.
- Mg, Fe, and Zn are more reactive than Cu → they displace copper from $CuSO_4$.
- Silver (Ag) is **less reactive than copper** → no reaction occurs.

6. (c) A cation having highest reduction potential will be reduced first and so on. However, Mg^{2+} in aqueous solution will not be reduced $\left(E^0_{Mg^{2+}/Mg} < E_{H_2O/\frac{1}{2}H_2+OH^-}\right)$. Instead water would be reduced in preference.

7. (c) A is displace from *D* because *D* have a $E^o = -0.402\ V$.

8. (a)

Reduction

$$\overset{o}{Zn}_{(s)} + 2Ag^{+}_{(aq)} \rightarrow Zn^{2+}_{(aq)} + 2\overset{o}{Ag}_{(s)}$$

Oxidation

In this reaction zinc act as a anode and Ag act as a cathode.

9. (a) No doubt Be is placed above Mg in the second group of periodic table but it is below Mg in electrochemical series.

10. (b) Nernst's equation shows relation between E and E^o.

11. (a) $E = E^o - \frac{RT}{nF} \ln \frac{1}{[M^{n+}]}$; $E = E^o + \frac{RT}{nF} \ln [M^{n+}]$

$$E = E^o + \frac{2.303\,RT}{nF} \log [M^{n+}]$$

Substituting the value of *R*, *T* (298*K*) and *F* we get

$$E = E^o + \frac{0.0591}{n} \log (M^{n+}).$$

12. (c) At 298 *K* standard electrode potential of NHE electrode is 0.00 *V*.

13. (a) Since, Ag^+ ions are reduced to *Ag* and $E^o_{Ag^+/Ag} > E^o_{Cu^{++}/Cu}$ *Cu* is oxidized to Cu^{++}.

14. (d) The reducing power decreases as the reduction potential increase (becomes less negative).

15. (c) Actually the equation is derived from Nerst equation assuming equilibrium condition in a cell reaction, when $E = 0$.

16. (a) More negative is the standard reduction potential, greater is the tendency to lose electrons and hence greater reactivity.

17. (a) Hg has greater reduction potential than that of H^+ and hence cannot displace hydrogen from acid.

18. (c) Brown layer is deposited on iron rod because Cu has greater reduction potential than that of Fe^{2+}.

19. (b) Since $E^o_{A^{2+}/A} < E^o_{B^{2+}/B}$. A has greater tendency to be oxidized.

$A + B^{2+} \rightarrow A^{2+} + B$.

20. (b) Since $E^o_{Zn^{++}/Zn}$ is negative, so *Zn* has greater tendency to be oxidized than hydrogen. Hence it can act as reducing agent.

21. (a) Standard electrode potential of Hydrogen is zero.

22. (b) According to electrochemical series.

23. (a) The standard reduction potential of K^+, Mg^{2+}, Zn^{+2} Cu^{2+} increase in this order.

24. (c) $E_{\text{cell}} = E^o_{Au^{3+}/Au} - E^o_{Ni^{2+}/Ni} = 1.50 - (-0.25) = 1.75$ *V*.

25. (a) Electromotive force is *+ve* if oxidation and reduction both takes place in a cell.