Faraday's law of electrolysis

1. (c) $Ag^{+} + e^{-} \rightarrow Ag;\ E_{Ag} = \frac{Atomic\ \ Mass}{1} = 108$

Number of faraday $= \frac{W_{Ag}}{E_{Ag}} = \frac{108}{108} = 1$.

2. (a) $W_{Ag} = \frac{E_{Ag} \times Q}{96500} = \frac{108 \times 9.65}{96500}$ $= 1.08 \times 10^{-2}\, gm = 10.8\, mg$

3. (b) $Fe^{2+} + 2e^{-} \rightarrow Fe;\ E_{Fe} = \frac{56}{2} = 28$

$W_{Fe} = E_{Fe}$ × Number of faraday $= 28 \times 3 = 84\ \ gm$.

4. (c) $W_{Ag} = \frac{E_{Ag} \times Q}{96500} = \frac{107.87 \times 965}{96500} = 1.0787\ \ gm$.

5. (c) $Al^{3+} + 3e^{-} \rightarrow Al$

$E_{Al} = \frac{27}{3} = 9$

$W_{Al} = E_{Al} \times \text{No. of faradays} = 9 \times 5 = 45\ \ gm$.

6. (c) *Cu* voltameter or *Cu* or *Ag* coulometer are used to detect the amount deposited on an electrode during passage of know charge through solution.

7. **Answer:** (c) Gram/coulomb

Explanation:

Electrochemical equivalent (Z) is defined as the mass of a substance deposited or liberated per unit charge passed through the electrolyte. Its formula is:

$$Z = \frac{m}{Q} = \frac{m}{It}$$

where mmm = mass deposited, I = current, t = time, and Q=ItQ total charge. Hence, the unit of Z is **gram per coulomb (g/C)**.

8. (b) $\frac{\text{Weight of } Cu}{\text{Weight of } H_2} = \frac{\text{Eq. weight of } Cu}{\text{Eq. weight. of } H}$

$$\frac{\text{Weight of } Cu}{0.50} = \frac{63.6/2}{1}$$

Weight of $Cu = 15.9$ *gm*.

9. (c) $Cu^{2+} + 2e^- \rightarrow Cu$

2 Faradays will deposit $= 1\, g\,\text{atom of } Cu = 63.5\, g$.

10. **Answer:** (a) Anions move towards anode, cations towards cathode

Explanation:
During electrolysis:

- **Cations** (positive ions) move toward the **cathode** (negative electrode) to gain electrons (reduction).
- **Anions** (negative ions) move toward the **anode** (positive electrode) to lose electrons (oxidation).

11. **Answer:** (c) Coulomb mole^{-1}

Explanation:
One Faraday is the charge of one mole of electrons. Its value is approximately 96500 C/mol. Hence, the unit of Faraday is **Coulomb per mole (C/mol)**.

12. (a) At cathode; $Al^{3+} + 3e^- \rightarrow Al$

$$E_{Al} = \frac{27}{3} = 9$$

$$W_{Al} = E_{Al} \times \text{No. of faradays} = 9 \times 0.1 = 0.9\, gm.$$

13. **Answer:** (c) m = Z × Q = Z × I × t

Explanation:

The **first law of electrolysis** (Faraday's First Law) states:

The mass (m) of a substance deposited or liberated at an electrode is directly proportional to the total charge (Q) passed through the electrolyte.

Mathematically:

$$\boldsymbol{m = Z \cdot Q = Z \cdot I \cdot t}$$

Where:

- mmm = mass of substance deposited
- Z = electrochemical equivalent
- $\boldsymbol{Q} = total\ charge = current \times time$

14. (b) $W = zit$; $W = \dfrac{32.69 \times 5 \times 60 \times 40}{96500} = 4.065\ gm$.

15. (b) $m = Z \times 4 \times 120$; $M = Z \times 6 \times 40$

$$\frac{M}{m} = \frac{6 \times 40}{4 \times 120} = \frac{1}{2}; \quad M = m/2.$$

16. (c) $W_{\text{metal}} = \dfrac{E \times I \times t}{96500} = \dfrac{E \times 3 \times 50 \times 60}{96500}$

$$E = \frac{96500 \times w}{3 \times 50 \times 60} = \frac{96500 \times 1.8}{3 \times 50 \times 60} = 19.3 \ .$$

17. (a) $Al \to Al^{3+} + 3e^{-}$.
The charged obtained is $3 \times 96500\ C$.

18. (a) Wt. of Ag deposited $= Eq.wt\ of\ Ag = 108\ gm$
Wt. of Ni deposited $= Eq.wt.of\ Ni = 29.5\ gm$
Wt. $of\ Cr$ deposited $= Eq.wt.of\ Cr = 17.3\ gm$.

19. (d) One Faraday $= 1\ gm$ of equivalent of Cu.

20. (c) $W = Zit\ ;\ Z = \frac{E}{96500}$.

21. (d) During electrolysis of $CuSO_4$. Cu^{2+} gets discharged at cathode and OH^{-} at anode. Thus solution becomes acidic due to excess of H^{+} and SO_4^{2-} or H_2SO_4.

23. (b) 1 mole of electrons $= 1$ faraday
$Mg^{++} + 2e^{-} \to Mg$; 2 moles of electrons $= 2$ faraday.

24. (d) $Cu^{++} + 2e^{-} \to Cu$

$$E_{Cu} = \frac{63.54}{2} = 31.77$$

Amount of electricity required to deposit .6354 *gm* of *Cu* $= \frac{96500 \times 0.6354}{31.77} = 1930\ Coulombs$.

25. (a) The amount deposited is directly proportional to current intensity, electrochemical equivalent of ions and the time for electrolysis and is independent of the temperature.