What are Faraday's Laws of Electrolysis?

Worksheet

Faraday's first law: mass = (Q M) / (n F), where F = 96,485 C/mol of electrons. The mass of substance deposited is proportional to charge passed and inversely proportional to the number of electrons.

$$m = \frac{Q \cdot M}{n \cdot F}$$

Questions

1. 12,500 C deposits 1.5 g of metal. If n = 2, what is the molar mass?

A) 40 g/mol
B) 60 g/mol
C) 80 g/mol
D) 120 g/mol

2. What is the Faraday constant?

A) 6.02 10 C/mol
B) 9.65 10 C/mol
C) 1.60 10 C
D) 3.37 10 C/mol

3. If 48,242.5 C deposits 54 g of Ag, what is n?

A) 0.5
B) 1
C) 2
D) 3

4. Does increasing charge increase or decrease mass deposited?

A) Decreases
B) Increases proportionally
C) No effect
D) Depends on temperature

5. How much copper is deposited when 9,648.5 C of charge passes through a CuSO solution? (Cu: M = 64 g/mol, n = 2)

6. Silver is plated when 48,242.5 C passes through AgNO. (Ag: M = 108 g/mol, n = 1). Mass of Ag?

7. How many coulombs deposit 1 g of copper? (n = 2, M = 64)

8. Define: What does Faraday's first law state?

9. Define: What is the Faraday constant (F)?

10. Define: How does n (number of electrons) affect mass?

Answer Key

1. B) 60 g/mol - M = (Q n F) / (m F) ... rearranging m = (QM)/(nF): 1.5 = (12500M)/(296485). Solving: M 60 g/mol
2. B) 9.65 10 C/mol - F = 96,485 C/mol (or ~9.65 10).
3. B) 1 - Using m = (QM)/(nF): 54 = (48242.5108)/(n96485). Solving: n = 1
4. B) Increases proportionally - m Q; more charge deposits more mass.
5. m = (Q M) / (n F) m = (9648.5 64) / (2 96485) m = (617,504) / (192,970) = 3.2 g
6. m = (Q M) / (n F) m = (48242.5 108) / (1 96485) m = (5,210,190) / (96,485) = 54 g
7. Q = (m n F) / M Q = (1 2 96485) / 64 Q = 192,970 / 64 = 3,015.5 C
8. Mass of substance deposited = (Q M) / (n F). Mass is proportional to charge passed.
9. The charge on one mole of electrons: 96,485 coulombs/mol.
10. More electrons (higher n) = less mass for the same charge (inversely proportional).