What is the Nernst Equation?

Worksheet

E = E (RT/nF)ln(Q), where E is actual potential, E is standard potential, R is gas constant, T is temperature (K), n is electrons transferred, F is Faraday constant, and Q is reaction quotient.

E = E @frac{RT}{nF}@ln(Q)

Questions

1. Nernst equation: E = E (RT/nF)ln(Q). At Q=1, E equals:
A) 0 V
B) E
C) E + RT/nF
D) cannot determine

2. As Q increases (reaction progresses), E:
A) increases
B) decreases to zero
C) stays constant
D) becomes negative

3. What is ln(Q) at equilibrium?
A) 0
B) 1
C) ln(K)
D) infinity

4. Doubling temperature T at Q=1 does what to E?
A) increases by 2
B) decreases
C) stays same as E
D) halves

5. Zn-Cu cell at 25C, n=2, E=1.10 V. If Q=4, what is E?

6. At equilibrium (Q=K), what is E?

7. Temperature doubles from 298 K to 596 K, Q=1, n=1, E=0.5 V. New E?

8. Define: What does the Nernst equation calculate?

9. Define: At what condition is E = E?

10. Define: What happens to E as Q increases toward K?

Answer Key

1. B) E - ln(1)=0, so E = E 0 = E.
2. B) decreases to zero - ln(Q) increases, so E (positive number) = decreases.
3. C) ln(K) - At equilibrium Q=K, so ln(Q)=ln(K).
4. C) stays same as E - At Q=1, ln(Q)=0, so E = E regardless of T.
5. E = 1.10 (8.314298)/(296485)ln(4) E = 1.10 0.025691.386 E = 1.10 0.0356 = 1.064 V
6. When Q=K: ln(Q) = ln(K) E = E (RT/nF)ln(K) = 0 V (The cell voltage is zero at equilibrium.)
7. E = 0.5 (8.314596)/(196485)ln(1) ln(1)=0 so E = 0.5 V (At Q=1, E=E regardless of T.)
8. The actual cell potential E when concentrations (Q) differ from standard conditions.
9. When all concentrations are 1 M (Q = 1), so ln(Q) = 0.
10. E decreases toward zero (less voltage available as the reaction approaches equilibrium).