What are Oxidation-Reduction Potentials?

Worksheet

Standard reduction potential (E) in volts shows the tendency of a species to gain electrons. Ecell = Ecathode Eanode; a positive Ecell indicates a spontaneous reaction.

$$E_{cell} = E_{cathode} - E_{anode}$$

Questions

1. For a cell with Cathode E = +1.50 V and Anode E = +0.62 V, what is Ecell?

A) +0.88 V
B) +2.12 V
C) +1.50 V
D) +0.62 V

2. Which species is the strongest oxidising agent (most likely to be reduced)?

A) Li / Li: 3.04 V
B) Cl / Cl: +1.36 V
C) Zn / Zn: 0.76 V
D) H / H: 0.00 V

3. If Ecell = 0.25 V, is the reaction spontaneous?

A) Yes, it's always spontaneous
B) No, energy must be applied
C) Yes, negative means reduction
D) Needs more information

4. What does the cathode reduction potential represent?

A) The tendency to be oxidised
B) The tendency to be reduced
C) The rate of reaction
D) The energy released

5. Calculate Ecell for a cell with Cu/Cu cathode (E = +0.34 V) and Zn/Zn anode (E = 0.76 V).

6. Is the reaction Ag + Fe Ag + Fe spontaneous? (Ag/Ag: E = +0.80 V; Fe/Fe: E = 0.44 V).

7. A cell has Ecathode = +1.36 V and Eanode = +0.80 V. Calculate Ecell.

8. Define: What does standard reduction potential (E) measure?

9. Define: Formula for cell potential using E?

10. Define: When is a redox reaction spontaneous?

Answer Key

1. A) +0.88 V - Ecell = 1.50 0.62 = +0.88 V
2. B) Cl / Cl: +1.36 V - Highest E = strongest oxidising agent. Cl has the highest value shown.
3. B) No, energy must be applied - Negative Ecell means non-spontaneous under standard conditions.
4. B) The tendency to be reduced - Ecathode is the tendency of that half-reaction to be reduced.
5. Ecell = Ecathode Eanode Ecell = (+0.34) (0.76) Ecell = +0.34 + 0.76 = +1.10 V (spontaneous)
6. Cathode: Ag + e Ag (E = +0.80 V) Anode: Fe Fe + 2e (E = 0.44 V) Ecell = 0.80 (0.44) = +1.24 V (positive, spontaneous)
7. Ecell = Ecathode Eanode Ecell = 1.36 0.80 = +0.56 V (spontaneous)
8. The tendency of a species to be reduced (gain electrons), measured in volts (V).
9. Ecell = Ecathode Eanode
10. When Ecell > 0 (positive cell potential).