

[TP] Based on the balanced reduction half-reaction, how many moles of electrons are consumed when 1 mole of $O_2(g)$ is reduced to hydrogen peroxide, $H_2O_2(aq)$?

20% 1. 1
20% 2. 2
20% 3. 3
20% 4. 4
20% 5. 6

Response Counter 10

Lecture 23 CH102 A2 (MWF 11:15 am)

Friday, March 23, 2018

Begin ch16: Electron transfer reactions and electrochemistry

- Balancing redox equations
- Electrochemistry in a nutshell
- Electrochemical cells harness spontaneous electron flow
- Cell line notation

Next lecture: Continue ch16. Cell voltage, E_{cell}, and electrical energy; Calculating standard cell voltage, $E°_{cell}$; Cell voltage versus spontaneity.

For oxidation numbers and balancing redox equations, please work through http://goo.gl/MMEUCs

A long time ago …

… my chemistry teacher ended a lecture by asking us to balance a chemical equation like the following.

$$O_2(g) + NO(g) \rightarrow H_2O_2(aq) + NO_3^-(aq)$$

I tried by inspection, but could not do it.

[TP] Based on the balanced reduction half-reaction, how many moles of electrons are consumed when 1 mole of $O_2(g)$ is reduced to hydrogen peroxide, $H_2O_2(aq)$?

20% 1. 1
20% 2. 2
20% 3. 3
20% 4. 4
20% 5. 6

Response Counter 10

[Quiz] Based on the balanced oxidation half-reaction, how many moles of electrons are released when 1 mole of $NO(g)$ is oxidized to $NO_3^-(aq)$?

20% 1. 1
20% 2. 2
20% 3. 3
20% 4. 4
20% 5. 6

Response Counter 10

Balancing redox equations

Combine balanced half-reactions for $O_2(g)$ reduced to hydrogen peroxide and $NO(g)$ oxidized to $NO_3^-(aq)$, to balance the redox equation

$$O_2(g) + NO(g) \rightarrow H_2O_2(aq) + NO_3^-(aq)$$

Balancing redox equations

For oxidation numbers and balancing redox equations, please work through http://goo.gl/MMEUCs.

$$NO_3^-(aq) + H_2C_2O_4(aq) \rightarrow CO_2(g) + NO(g)$$

Electrochemistry in a nutshell

- Redox processes transfer electrons
- Redox processes evolve spontaneously to equilibrium
- Electron transfer can be harnessed as an electric current

$Cu^{2+}(aq)$ oxidizes Zn(s)

Spontaneous flow of electrons from Zn to Cu

$Cu^{2+}(aq) + 2\,e^- \rightarrow Cu(s)$

$Zn(s) \rightarrow Zn^{2+}(aq) + 2\,e^-$

Harness in an electrochemical cell

$Zn(s)|\,Zn^{2+}(aq)\,||Cu^{2+}(aq)|\,Cu(s)$

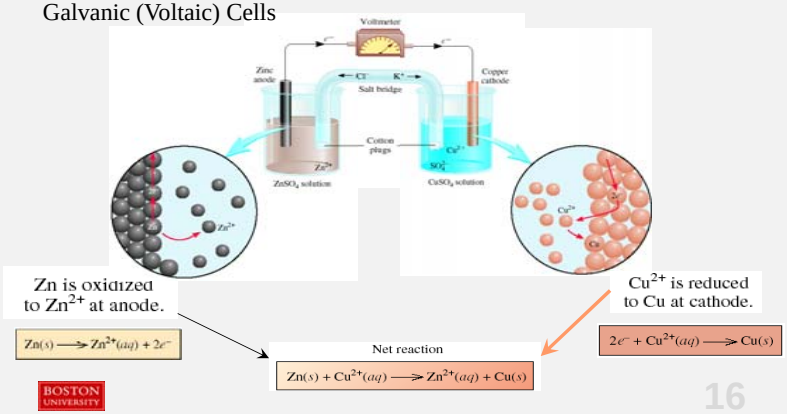
$Cu^{2+}(aq)$ oxidizes Zn(s) spontaneously

Sketch an electrochemical cell to harness the spontaneity of

$Cu^{2+}(aq) + Zn(s) \rightarrow Cu(s) + Zn^{2+}(aq)$

$Zn(s)|\,Zn^{2+}(aq)\,||Cu^{2+}(aq)|\,Cu(s)$

Galvanic (Voltaic) Cells



Cell line notation (Tro, 4e, p 897)

$Zn(s)|\,Zn^{2+}(aq)\,||Cu^{2+}(aq)|\,Cu(s)$

- Oxidation on left, "||" is salt bridge, reduction on right
- Phases separated by "|", same phases separated by ","
- If no solid, inert electrode (Pt or graphite)
- Left to right order matches flow of electrons

Cell line notation (Tro, 4e, p 897)

$Fe(s)|\ Fe^{2+}(aq)\ ||MnO_4^-(aq), Mn^{2+}(aq)|\ Pt(s)$

Write the half reactions ...

$Fe(s) \rightarrow Fe^{2+}(aq) + 2\ e^-$

$MnO_4^-(aq) + 5\ e^- + 8\ H^+(aq) \rightarrow Mn^{2+}(aq) + 4\ H_2O(l)$

Sketch the cell (on your own).

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