① $Cd^{2+} + Fe \rightarrow Cd + Fe^{2+}$

$Cd^{2+} + 2e^- \rightarrow Cd$

$Fe \rightarrow Fe^{2+} + 2e^-$

$Cd^{2+} + Fe \rightarrow Cd + Fe^{2+}$ (Already balanced)

②

$NH_4^+ + O_2 \rightarrow NO_3^- + H_2O$

$NH_4^+ \rightarrow NO_3^-$: Balance N

$NH_4^+ + 3H_2O \rightarrow NO_3^-$: Balance O

$NH_4^+ + 3H_2O \rightarrow NO_3^- + 10H^+$: Balance H

$NH_4^+ + 3H_2O \rightarrow NO_3^- + 10H^+ + 8e^-$: Balance charges

$O_2 \rightarrow 2H_2O$: Balance O

$O_2 + 4H^+ \rightarrow 2H_2O$: Balance H

$O_2 + 4H^+ + 4e^- \rightarrow 2H_2O$: Balance charge

Combine (need 8 e^- on each side):

$NH_4^+ + 3H_2O \rightarrow NO_3^- + 10H^+ + 8e^-$

$2\times(O_2 + 4H^+ + 4e^- \rightarrow 2H_2O)$

$NH_4^+ + 3H_2O + 2O_2 + 8H^+ + 8e^- \rightarrow NO_3^- + 2(10H^+) + 8e^- + 4H_2O$

$NH_4^+ + 2O_2 \rightarrow NO_3^- + 2H^+ + H_2O$

(3) $CH_2O + O_2 \rightarrow CO_2 + H_2O$

$CH_2O \rightarrow CO_2$: Balance C

$CH_2O + H_2O \rightarrow CO_2$: Balance O

$CH_2O + H_2O \rightarrow CO_2 + 4H^+$: Balance H

$CH_2O + H_2O \rightarrow CO_2 + 4H^+ + 4e^-$: Balance charge

$O_2 \rightarrow 2H_2O$: Balance O

$4H^+ + O_2 \rightarrow 2H_2O$: Balance H

$4H^+ + 4e^- + O_2 \rightarrow 2H_2O$: Balance charge

Combine

$CH_2O + H_2O + 4H^+ + 4e^- + O_2 \rightarrow CO_2 + 4H^+ + 4e^- + 2H_2O$

$CH_2O + O_2 \rightarrow CO_2 + H_2O$

(4) $Fe^{2+} + H_2O + O_2 \rightarrow Fe(OH)_3 + H^+$

$Fe^{2+} + \rightarrow Fe(OH)_3$: Fe

$Fe^{2+} + 3H_2O \rightarrow Fe(OH)_3$: O

$Fe^{2+} + 3H_2O \rightarrow Fe(OH)_3 + 3H^+$: H

$Fe^{2+} + 3H_2O \rightarrow Fe(OH)_3 + 3H^+ + e^-$: charge

$O_2 \rightarrow ?$

$O_2 \rightarrow 2H_2O$: O

$4H^+ + O_2 \rightarrow 2H_2O$: H

$4e^- + 4H^+ + O_2 \rightarrow 2H_2O$: charge

* Multiply Fe equation by 4 to get $4e^-$ and combine *

* $4Fe^{2+} + 12\,(10)\,H_2O + 4e^- + 4H^+ + O_2 \rightarrow 4Fe(OH)_3 + 12\,(8)\,H^+ + 4e^- + 2H_2O$

$4Fe^{2+} + 10H_2O + O_2 \rightarrow 4Fe(OH)_3 + 8H^+$

(5)

$H^+ + Fe(OH)_3 + H_2 \rightarrow Fe^{2+} + H_2O$ *

$Fe(OH)_3 \rightarrow Fe^{2+}$: Fe

$Fe(OH)_3 \rightarrow Fe^{2+} + 3H_2O$: O

$3H^+ + Fe(OH)_3 \rightarrow Fe^{2+} + 3H_2O$: H

$e^- + 3H^+ + Fe(OH)_3 \rightarrow Fe^{2+} + 3H_2O$: charge

$H_2 \rightarrow 2H^+$: H

$H_2 \rightarrow 2H^+ + 2e^-$: charge

* multiply Fe equation by 2 to balance e^- and combine *

$2e^- + 6H^+ + 2Fe(OH)_3 + H_2 \rightarrow 2Fe^{2+} + 6H_2O + 2H^+ + 2e^-$

$4H^+ + 2Fe(OH)_3 + H_2 \rightarrow 2Fe^{2+} + 6H_2O$