Oxidation-Reduction (Redox) Reactions

Essential Question

How do electrons move in a reaction?

Oxidation and Reduction

- Oxidation: loss of electrons
- Reduction: gain of electrons

Oxidation **I**s **L**oss
Reduction **I**s **G**ain

$$Na \rightarrow Na^+ + e^-$$ *oxidized*

$$Cl_2 + 2e^- \rightarrow 2Cl^-$$ *reduced*

Assigning Oxidation Numbers

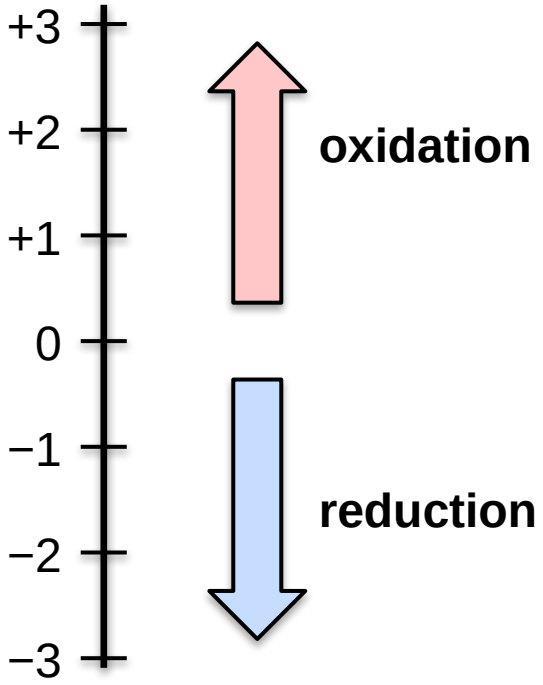
- Element alone: 0
- Monatomic ion: its charge
- O is usually −2; H is usually +1
- Total = overall charge

?

$$K\ Mn\ O_4$$

Up or Down?

- Number goes up: oxidized
- Number goes down: reduced



Half-Reactions

- Split redox into two halves
- Oxidation: e^- are products
- Reduction: e^- are reactants

Oxidation: $Zn \rightarrow Zn^{2+} + 2e^-$

Reduction: $Cu^{2+} + 2e^- \rightarrow Cu$

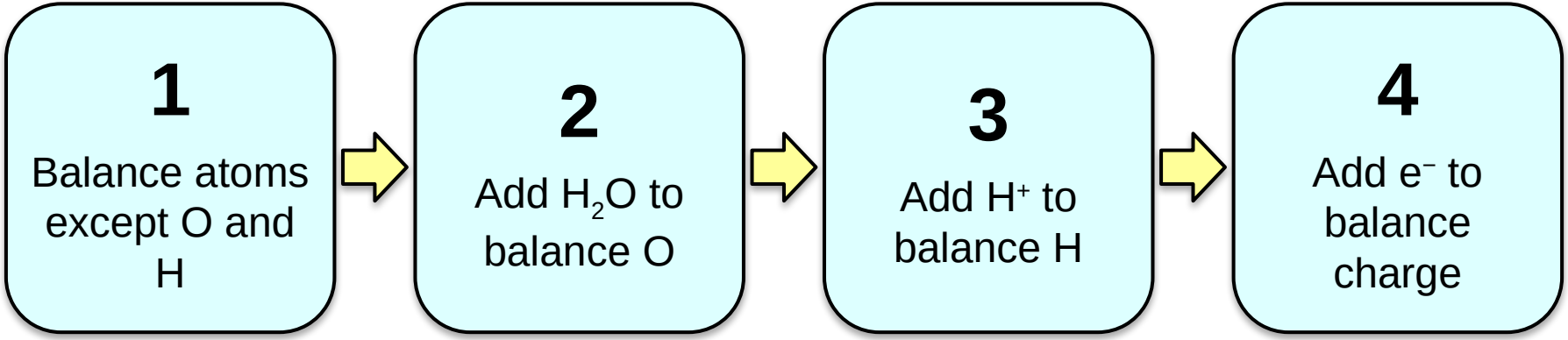
Combining Half-Reactions

- Electrons lost = electrons gained
- Multiply, add, and cancel e^-

$Al \rightarrow Al^{3+} + 3e^-$	× 2	$2Al \rightarrow 2Al^{3+} + \cancel{6e^-}$
$Cu^{2+} + 2e^- \rightarrow Cu$	× 3	$3Cu^{2+} + \cancel{6e^-} \rightarrow 3Cu$

$2Al + 3Cu^{2+} \rightarrow 2Al^{3+} + 3Cu$

Balancing in Acidic Solution



Then match e^- and add

Example: Oxidized or Reduced?

Assign oxidation numbers to each element. Which element is oxidized? Which is reduced?

$$2Fe(s) + 3Cl_2(g) \rightarrow 2FeCl_3(s)$$

Example: Using Half-Reactions

Write the two half-reactions, then the balanced equation.

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

Example: Balancing in Acidic Solution

Balance this reaction in acidic solution.

$$MnO_4^-(aq) + Fe^{2+}(aq) \rightarrow Mn^{2+}(aq) + Fe^{3+}(aq)$$

Oxidation-Reduction (Redox) Reactions

Big Ideas

- Oxidation: lose e^-, number goes up
- Reduction: gain e^-, number goes down
- Half-reactions: match the e^-
- Acidic: H_2O, then H^+, then e^-

OIL
RIG