Chem Unit 13.2 Notes - Balancing Redox Reactions

13.2 Balancing Redox Equations

1. Warmup Problem: Balance this!

$$\underline{\hspace{0.5cm}} \mathsf{P} + \underline{\hspace{0.5cm}} \mathsf{H}_2\mathsf{O} + \underline{\hspace{0.5cm}} \mathsf{HNO}_3 \longrightarrow \underline{\hspace{0.5cm}} \mathsf{H}_3\mathsf{PO}_4 + \underline{\hspace{0.5cm}} \mathsf{NO}$$

Answer Later!

Balancing Procedure

- 1. Assign oxidation numbers to **all** atoms.
- 2. Pair oxidation number changes.
- 3. Add coefficients to equalize charge.
- 4. Balance non-changed elements by inspection.

2. Guided Balancing Example



$$Cu + HNO_3 \rightarrow Cu(NO_3)_2 + NO_2 + H_2O$$

1. Assign oxidation numbers to all atoms.

2. Balancing Example

2. Pair number changes:

Cu is oxidized: +2; N is reduced: -1

H, O, and N (in nitrate) are unchanged.

2. Balancing Example

3. Adjust coefficients to equalize charges:

$$Cu + 2HNO_3 \rightarrow Cu(NO_3)_2 + 2NO_2 + H_2O$$

$$-1 \times 2 = -2$$

4. Use inspection for the rest:

 $\text{Cu} + 4\text{HNO}_3 \rightarrow \text{Cu}(\text{NO}_3)_2 + 2\text{NO}_2 + 2\text{H}_2\text{O}$

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3. Another Example

$$ClO_4$$
 + $HBr \rightarrow Cl^2$ + Br_2 + H_2O

1. Assign oxidation numbers:

$$ClO_4^{-1} + HBr \rightarrow Cl^{-1} + Br_2 + H_2O$$

2. Pair changes:

3. Adjust coefficients:

$$ClO_4^- + 8 HBr \rightarrow Cl^- + 4 Br_2 + H_2O$$

3. Another Example

4. Balance the rest by inspection

$$ClO_4$$
 + 8 HBr \rightarrow Cl + 4 Br₂ + 4 H₂O

Try this again!

$$P + H_2O + HNO_3 \longrightarrow H_3PO_4 + NO$$

$$3P + 2H_2O + 5HNO_3 \longrightarrow 3H_3PO_4 + 5NO$$

4. Now try this!

$$Cl^{-} + HNO_{3} \longrightarrow ClO^{-} + NO + H_{2}O$$

$$3Cl^{-} + 2HNO_{3} \longrightarrow 3ClO^{-} + 2NO + H_{2}O$$

5. Finally this!

$$HCI + MnO_2 \longrightarrow MnCI_2 + CI_2 + H_2O$$

$$4 \text{ HCl} + \text{MnO}_2 \longrightarrow \text{MnCl}_2 + \text{Cl}_2 + 2 \text{ H}_2\text{O}$$

Homework

13.2 Problems.

Due Next Class.