8.3 - Reactivity and Solubility

If long day: sodium demo.

1. Review

What reactions are shown?

A. $2\ Zn + O_2 \longrightarrow 2\ ZnO$

Single Replacement

B. $Ca(OH)_2 + 2\ HNO_3 \longrightarrow Ca(NO_3)_2 + 2\ H_2O$

Acid/Base

2. Review

What reactions are shown?

A. $H_2SO_4 \longrightarrow SO_3 + H_2O$

Decomposition

B. $SnSO_4 + Zn \longrightarrow ZnSO_4 + Sn$

Single Replacement

3. Review

What reactions are shown?

A. $C_4H_{10} + 6.5\ O_2 \longrightarrow 4\ CO_2 + 5\ H_2O$

Combustion

B. $K_2SO_3 + Mn(OH)_2 \longrightarrow 2\ KOH + MnSO_3$

Double Replacement

4. Review!

Balance this and indicate what type of reaction it is.

$\_2\_ AgNO_3 + \_\_\_\_ BaCl_2 \longrightarrow \_\_\_ Ba(NO_3)_2 + \_2\_ AgCl$

Type Double Replacement

Reactivity Series

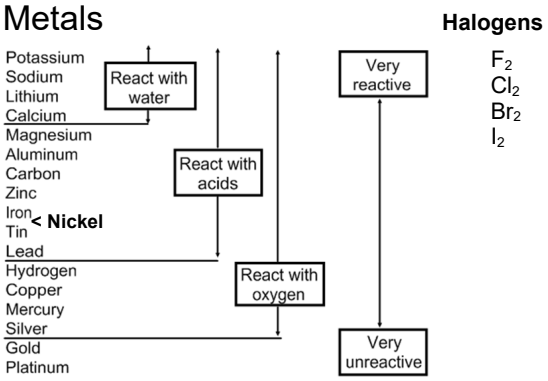
Reactivity is a measure of which elements replace others in **single replacement reactions**.

See Reactivity Table (Resources P. 4)

A metal (or halogen) less reactive than another will be replaced.

Note: halogens relplace halogens, metals replace metals.

Reactivity Table



5. Try These!

A. Name one metal more reactive than copper.
Aluminum

B. Which is more reactive: carbon or lead?

C. Which is more reactive: chlorine or fluorine?

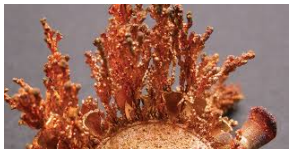
D. Which is less reactive: lithium or magnesium?

6. Example Reaction:

Will this reaction occur?

$$Zn_{(s)} + CuSO_{4(aq)} \rightarrow Cu + ZnSO_{4(aq)}$$

Yes, zinc is more reactive than copper, so Zn will replace Cu. (Demo)



7. Example Reaction:

Will this reaction occur?

$$Al_{(s)} + CaSO_{4(aq)} \longrightarrow Ca_{(s)} + Al_2(SO_4)_{3(aq)}$$

No, aluminum is less reactive than calcium.

Write "NR" (No Reaction) to show that nothing happens:

$$Al_{(s)} + CaSO_{4(aq)} \rightarrow NR$$

8. Example Reaction:

What will the following products be? Write and balance the reaction.

$$F_{2(g)} + \quad NaBr_{(aq)} \longrightarrow \ ? \ ?$$

Fluorine replaces bromine (more reactive.)

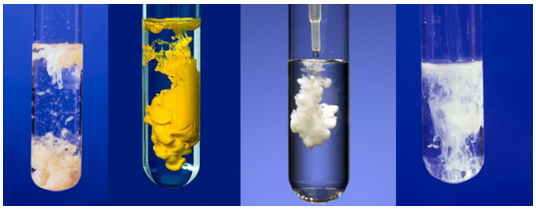
$$F_{2(g)} + 2NaBr_{(aq)} \rightarrow 2NaF_{(aq)} + Br_{2(l)}$$

Solubility

Def: How well a chemical dissolves in water (or other solvent).

In **double replacement** reactions, there might be a solid product (called a precipitate).

Solubility Resource (Resources P. 4) helps determine which product is soluble and which is not.



9. Solubility Check!

A. Would nickel carbonate dissolve, or form a solid in water?

B. Will KCl dissolve, or remain solid in water?

C. Will CuS be aqueous or solid in water?

General Solubility Rules

A. Cations: Ammonium ion, and all Group 1 elements are soluble.

B. Anions: Nitrate is always soluble.

C. Chlorides are always soluble, **except** for silver and lead (II) chloride.

10. Solubility Example

Solutions of aluminum chloride and ammonium phosphate react, forming aluminum phosphate and ammonium chloride.

Balance the reaction and predict the precipitate.

$$\_\_\_AlCl_3 + \_\_\_(NH_4)_3PO_4 \rightarrow \_\_\_AlPO_4 + \_\_\_NH_4Cl$$

$$AlCl_{3(aq)} + (NH_4)_3PO_{4(aq)} \longrightarrow AlPO_{4(?)} + 3NH_4Cl_{(?)}$$

Which is insoluble?

Look at your solubility table: $AlPO_4$ is insoluble, and NH_4Cl is soluble.

$$AlCl_{3(aq)} + (NH_4)_3PO_{4(aq)} \longrightarrow AlPO_{4(s)} + 3NH_4Cl_{(aq)}$$

11. Solubility Demo.

Calcium chloride and sulfuric acid solutions react in a double replacement reaction, forming a precipitate. Write and balance the reaction, THEN determine which product is the precipitate using your table.

$$\_\_\_CaCl_{2(aq)} + \_\_\_H_2SO_{4(aq)} \longrightarrow \_\_\_HCl + \_\_\_CaSO_4$$

$$CaCl_2 + H_2SO_4 \longrightarrow 2\ HCl + CaSO_4$$

From your table, calcium sulfate is insoluble:

$$CaCl_{2(aq)} + H_2SO_{4(aq)} \longrightarrow 2\ HCl_{(aq)} + CaSO_{4(s)}$$

12. Sodium Demo! (If Time)

In a single replacement reaction, sodium metal reacts with water, forming sodium hydroxide and hydrogen gas.

Balance this:

$$\_\_\_ Na_{(s)} + \_\_\_ H_2O_{(l)} \rightarrow \_\_\_ NaOH_{(aq)} + \_\_\_ H_{2(g)}$$

Homework

8.3 Problems
Due: Next Class

Attachments

NI3 two.MOV

NI3 one.MOV