

# Chemistry 6A F2007

Dr. J.A. Mack

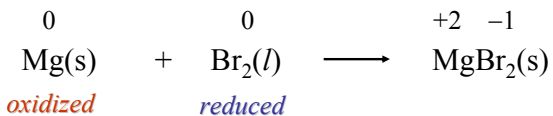
Wednesday

10/17/07

## Metal & Non-metal:

magnesium + bromine

*oxidation numbers*



1 Mg & 2 Br

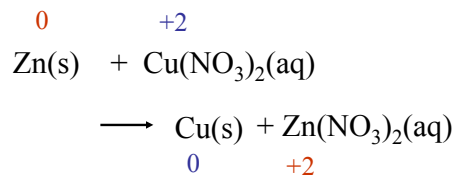
1 Mg & 2 Br

Balanced?

Sometimes the equations balance themselves!

## Metal displacing a metal in the salt:

If a metal is more reactive than a different metal in a salt, it will displace a metal in the inorganic salt compound.

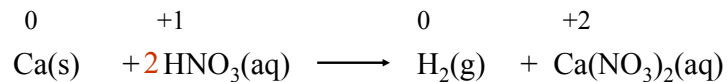


The blue copper ions are displaced by the zinc metal.

## Single Replacement Reactions

Reactions where one element replaces another in a compound.

*Example:* Metal + Acid



calcium is reduced, H<sup>+</sup> is reduced

1 Ca, 2 H & 2 NO<sub>3</sub>

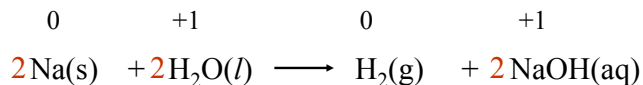
1 Ca, 2 H & 2 NO<sub>3</sub>

## Metals reacting with water:

Group I metals and some Gr. II metals will react with water producing hydrogen and the metal hydroxide.

### Example:

Balancing:

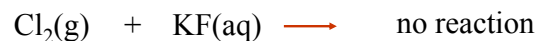
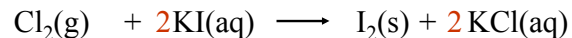
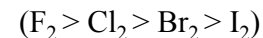


sodium is oxidized, H<sup>+</sup> is reduced

2 Na's, 4H's & 2 O's                  2 Na's, 4H's & 2 O's

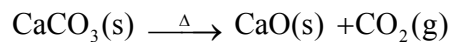
## Halogen with a halogen salt (*halide*):

A stronger halogen (F<sub>2</sub>, Cl<sub>2</sub>, Br<sub>2</sub> & I<sub>2</sub>) will displace a weaker halide (F<sup>-</sup>, Cl<sup>-</sup>, Br<sup>-</sup> & I<sup>-</sup>).



## Decomposition Reactions:

Reactions in which a compound breaks down into more simple compounds or elements.

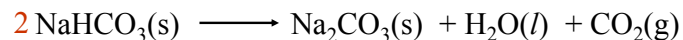


Notice that these are often the reverse of combination reactions.

Sodium bicarbonate decomposes into sodium carbonate, water and carbon dioxide. Write the balanced equation.



### Balancing:



## Types of Reactions in Solution:

### **Precipitation Reactions:**

A reaction where an insoluble solid (precipitate) forms and drops out of the solution

### **Acid–base Neutralization:**

A reaction in which an acid reacts with a base to yield water plus a *salt*.

### **Gas forming Reactions:**

A reaction where an insoluble gas is formed.

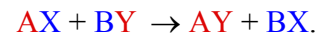
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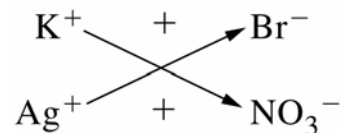
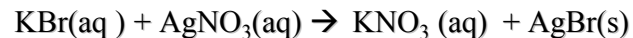
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## **Double Replacement Reactions: (Metathesis)**

Metathesis reactions involve swapping ions in solution:



Metathesis reactions will lead to a *precipitate* if one of the products is an insoluble solid.



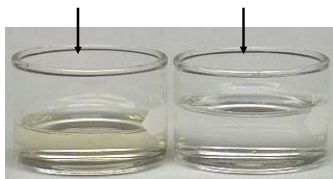
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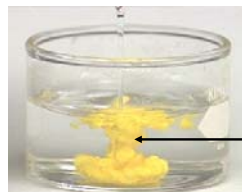
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## Consider the following reaction:

Aqueous solutions  $2KI(aq)$  &  $Pb(NO_3)_2(aq)$  are mixed



A reaction occurs:

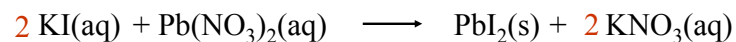


A yellow precipitate forms

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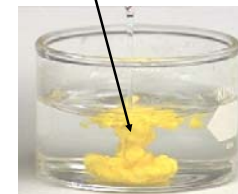
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2 K's, 2 I's, 1 Pb & 2 NO<sub>3</sub>

2 K's, 2 I's, 1 Pb & 2 NO<sub>3</sub>

Balancing:



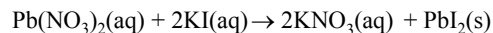
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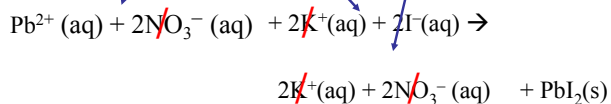
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### Writing the Net Ionic Equation:

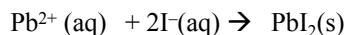
Molecular Equation:



Total Ionic Equation:



Cancel out the *spectator ions* to yield the net ionic equation:



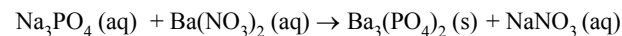
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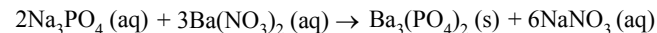
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Example: A solution of sodium phosphate is added to a solution of aqueous barium nitrate. A white ppt is observed.

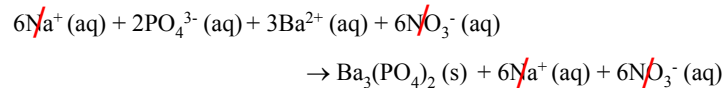
### Unbalanced Equation:



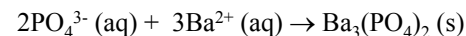
### Molecular:



### Ionic:



### Net Ionic:

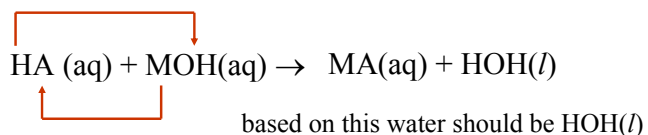


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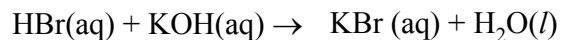
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### Reactions of Acids & Bases: *Acid-Base Neutralization*



*acid - Strong base neutralization:*  $\text{HBr}(\text{aq})/\text{KOH}(\text{aq})$



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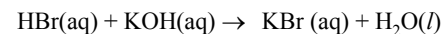
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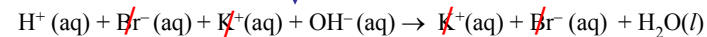
### Reactions of Acids & Bases: *Acid-Base Neutralization*

*Strong acid - Strong base neutralization:*  $\text{HBr}(\text{aq})/\text{KOH}(\text{aq})$

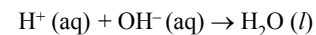
Molecular Equation:



Total Ionic Equation:



Net Ionic equation:

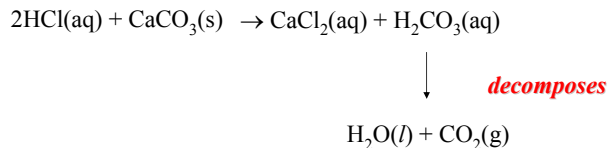


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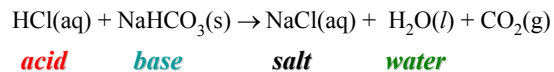
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Metal carbonate salts react with acids to the corresponding metal salt, water and carbon dioxide gas.



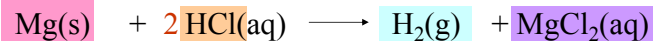
Similarly:



**Neutralization!!!**

### Chemical equations: *Gasses as a product*

Metals reacting with acids to produce hydrogen and a salt in solution.

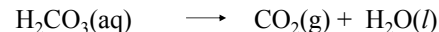


Balancing: 2 H's and 2 Cl's are needed.

Carbonates and bicarbonates react with acids to form carbon dioxide, water and a salt.



the CO<sub>2</sub> and H<sub>2</sub>O form from the decomposition of H<sub>2</sub>CO<sub>3</sub>



### Heat and Energy:

**Heat** is the transfer of **thermal energy** between two bodies that are at different temperatures.

**Temperature** is a measure of the **thermal energy**.



Temperature = Thermal Energy

Temperature ~~≠~~ Heat

You refrigerator uses heat transfer to cool objects down.

Heat always flows spontaneously from hot bodies to cold bodies.



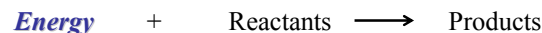
### Energy and Chemical Reactions

*All chemical processes are accompanied by energy changes:*

If a reaction gives off energy (**heat**), it is an **exothermic** reaction.



If a reaction absorbs energy (**heat**), it is an **endothermic** reaction.



Energy can be treated as part of the **reactants** or **products!**