

# Chemical Reactions



How do we know when a chemical reaction has occurred?



- Color Change—not a dye or ink
- Solid forms—precipitate
- Bubbles—form a gas
- Formation of both heat and light—(just one by itself is not enough)
- Smell—rotting food

How do we explain what happens in chemical reactions?



- By Writing Chemical Equations

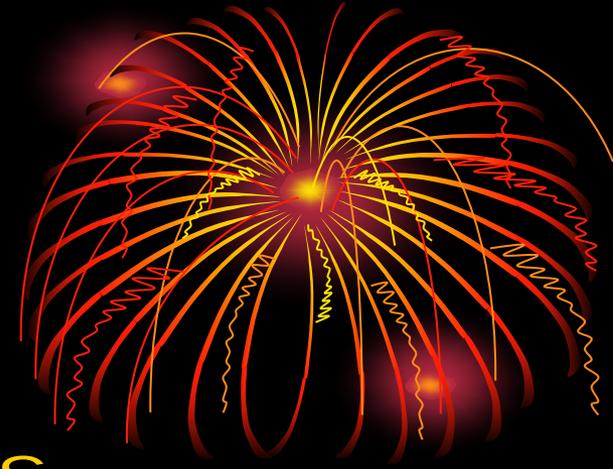
Reactants

→

Products



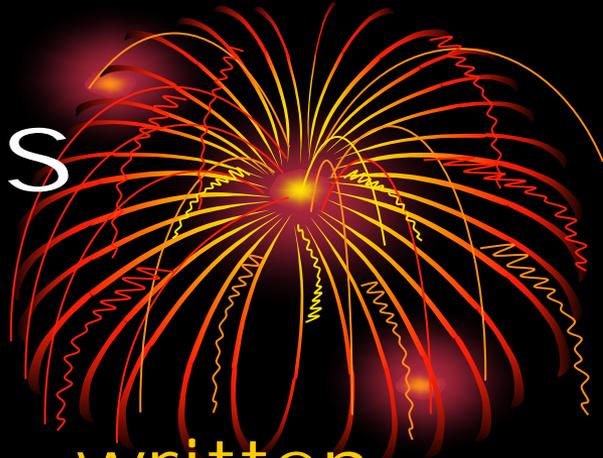
# What can chemical equations tell us?



- Reactants and Products
- Physical states of compounds involved
  - Solid (s)
  - Gas (g)
  - Liquid (l)
  - Dissolved in water / aqueous (aq)
- Ratios- # of atoms/molecules

# Additional Symbols

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- Heat - Greek letter Delta  $\Delta$  - written above the arrow.
- Pressure - word written above arrow
- Catalyst - a chemical that speeds up the reaction without being used up, neither a reactant nor a product - written above the arrow.

# Steps for translating



1) Identify reactants and products

- Write out correct formulas

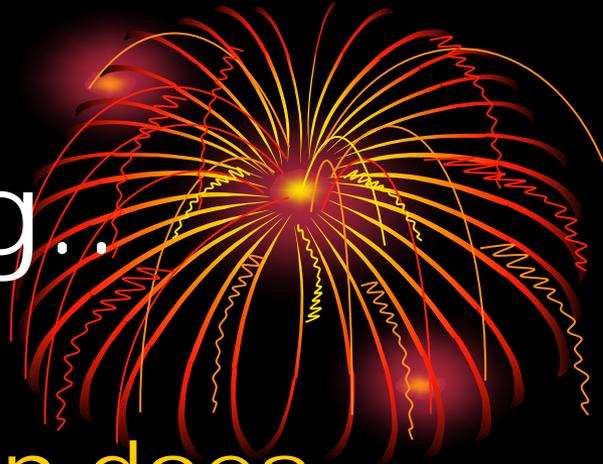
2) Write *unbalanced* equation

# Translating



- Solid magnesium metal reacts with hydrochloric acid to produce hydrogen gas and aqueous magnesium chloride
- **Reactants**
  - Solid Magnesium metal =  $\text{Mg (s)}$
  - Hydrochloric acid =  $\text{HCl (aq)}$
- $\rightarrow$ 
  - To produce
- **Products**
  - Hydrogen gas =  $\text{H}_2 \text{ (g)}$
  - Magnesium chloride =  $\text{MgCl}_2 \text{ (aq)}$

# You try translating.



- Remember this equation does NOT indicate the amounts of the reactants and products—symbols and formulas rather than words.

Write the unbalanced equation:

**solid iron + oxygen gas** → **iron (III) oxide (rust)**

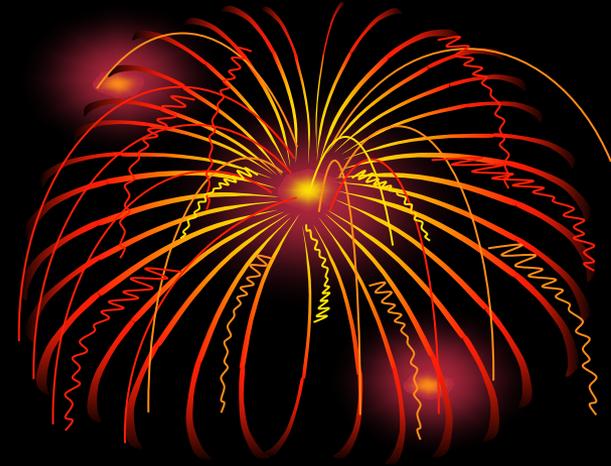


# Conservation of Mass



- Atoms are neither created or destroyed, they are just rearranged.
- Balanced equations—each side of the equation has the same number of atoms of each element.

# Steps for writing balanced equations



1) Identify reactants and products

- Write out correct formulas & states of matter

2) Write *unbalanced* equation



3) Use coefficients to balance

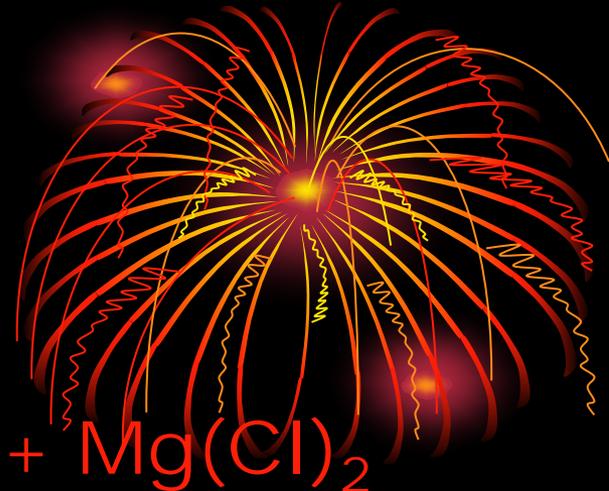
- We can not change the formulas



4) Check to see atoms are balanced

- Atoms may be present in elements, compounds or ions

# Coefficient Rules



Def: a small whole number that is written IN FRONT of a chemical formula in a balanced equation.

- Applies to the whole formula
- Can never be a fraction or decimal
- NEVER put in the middle of a formula
- NEVER change the chemical formula subscripts

# Guidelines for Balancing



- Balance different types of atoms one at a time
- First balance the atoms of elements that are combined and that appear only once on each side of the equation
- Balance polyatomic ions that appear on both sides of the equation as single units
- Balance H atoms and O atoms after atoms of all other elements have been balanced



# Lets practice

- 1) Identify reactants and products - done
- 2) Write *unbalanced* equation- done



- 3) Use coefficients to balance



Xe-1

Xe-1

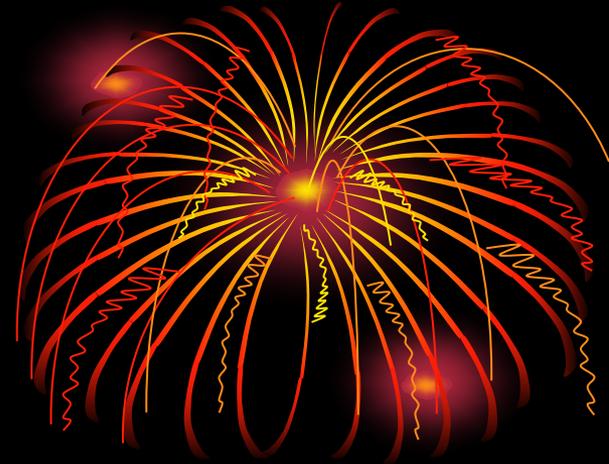
F -2

F-6

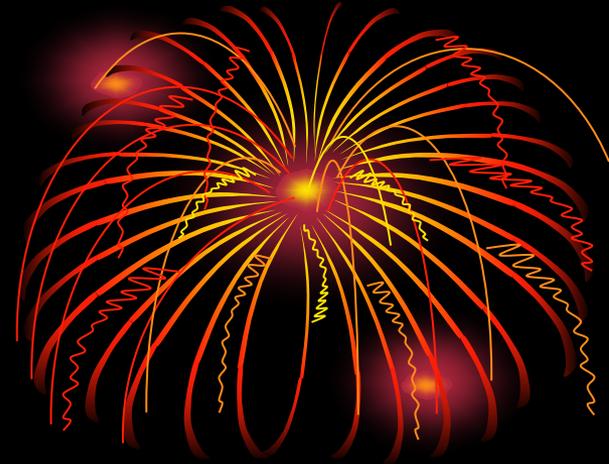
- 4) Check to see atoms are balanced



# Now finish c- j



# Answers...



34. Write a balanced equation for the reaction of zinc with aqueous hydrochloric acid produces a solution of zinc chloride and hydrogen gas.

1) Identify reactants and products

- Write out correct formulas & states of matter

Reactants: Zn (s) HCl (aq)

Products: ZnCl<sub>2</sub> (l) H<sub>2</sub> (g)

2) Write *unbalanced* equation



3) Use coefficients to balance



Zn-1

Zn-1

H-1

H-2

Cl-1

Cl-2



# Now you try



35. Aluminum sulfate and calcium hydroxide are used in a water-purification process. When added to water, they dissolve and react to produce two insoluble products, aluminum hydroxide and calcium sulfate. These products settle out taking the impurities with them. Write a balanced equation for this reaction.