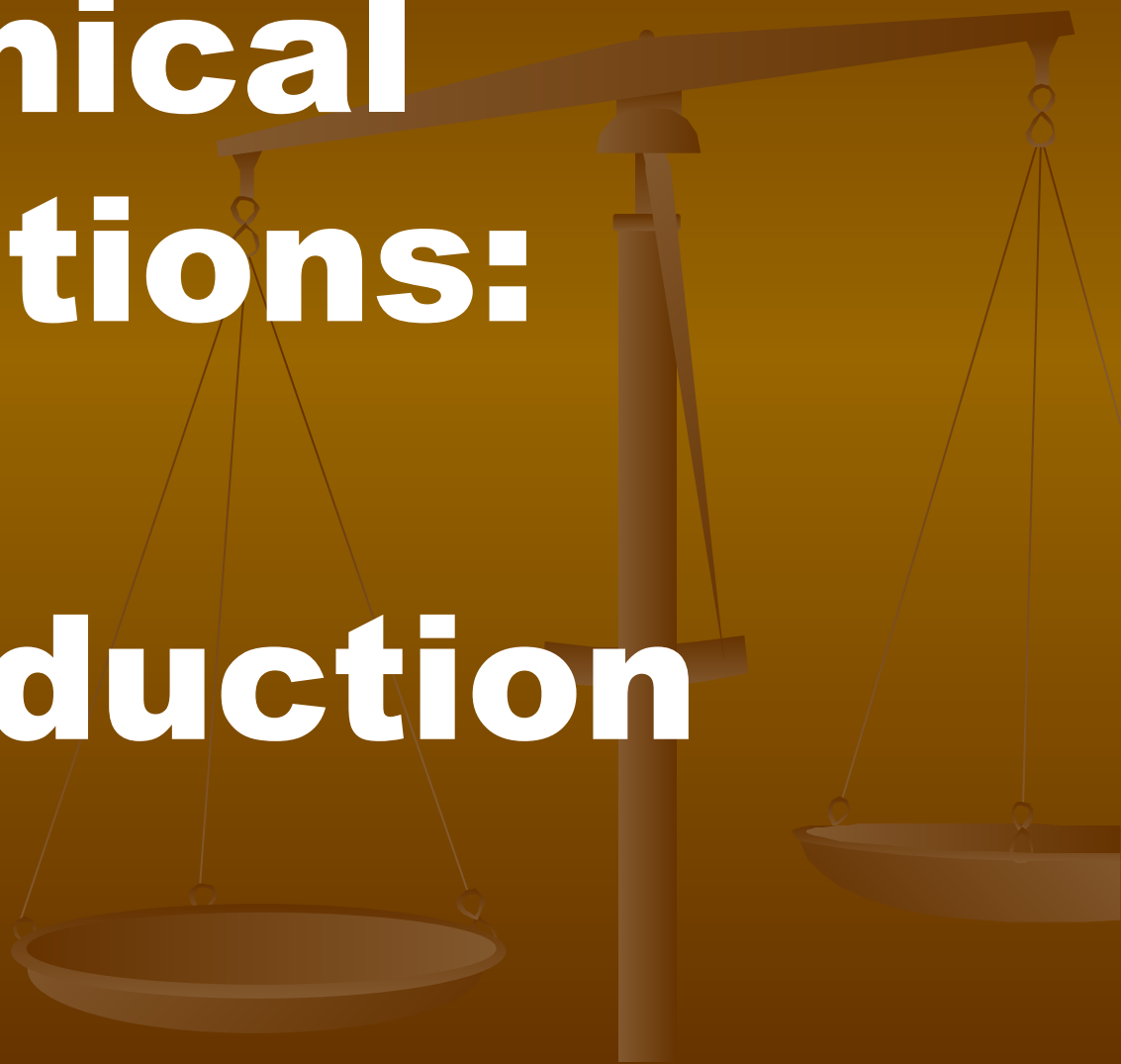
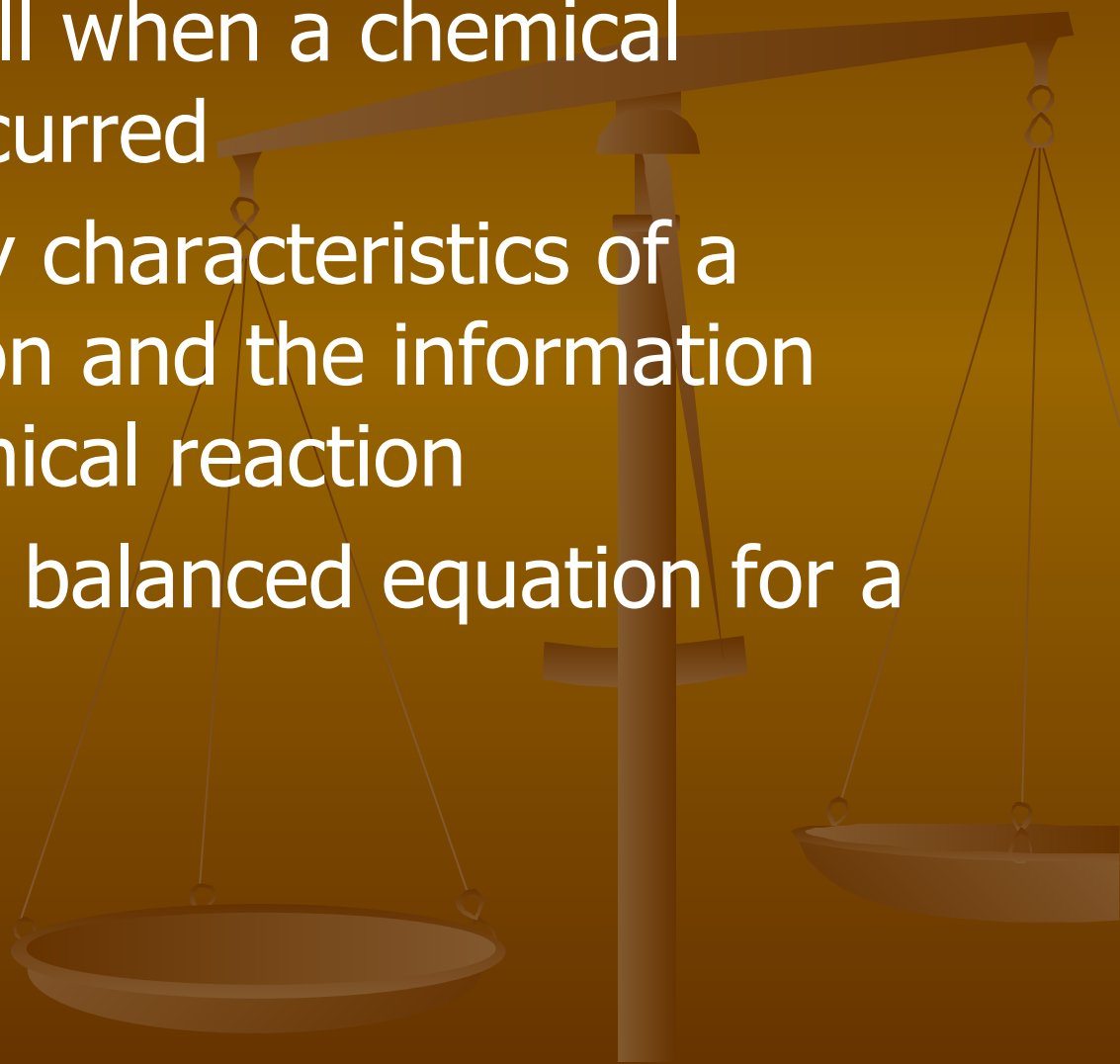


Chemical Reactions: An Introduction



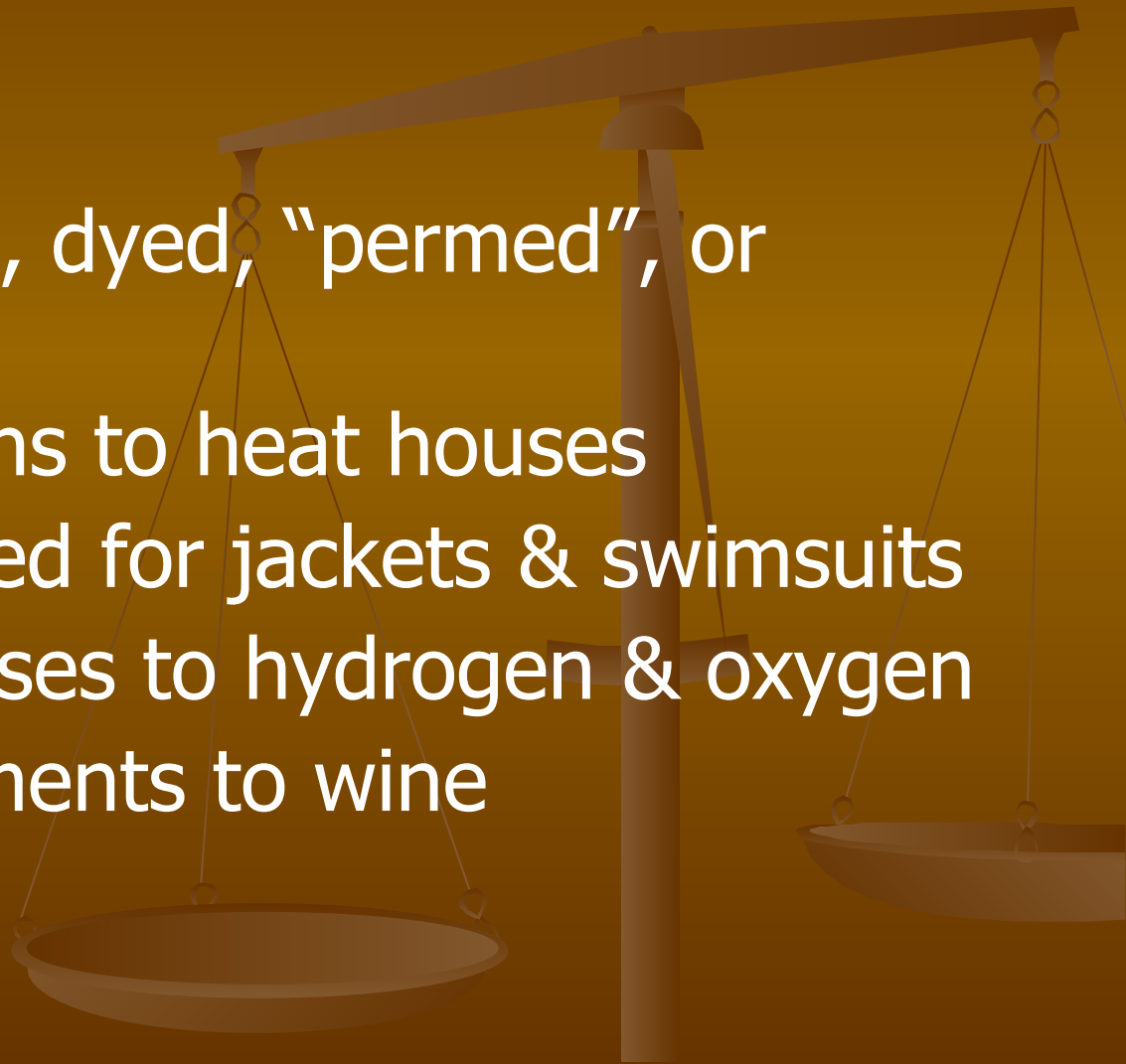
Chapter 7

- Learn how to tell when a chemical reaction has occurred
- Learn to identify characteristics of a chemical reaction and the information given by a chemical reaction
- Learn to write a balanced equation for a reaction



Chemistry = Change

- Grass grows
- Steel rusts
- Hair is bleached, dyed, “permed”, or straightened
- Natural gas burns to heat houses
- Nylon is produced for jackets & swimsuits
- Water decomposes to hydrogen & oxygen
- Grape juice ferments to wine



Evidence of a Chemical Reaction

- Often give a visual signal
 - Steel changes from smooth & shiny to reddish-brown and flaky when it rusts
 - Hair changes color when it is bleached
 - Flame appears when natural gas burns
- Visual clues: color change, solid forms, bubbles are produced, a flame occurs, etc.
- Not always visible
 - Heat produced or absorbed (ex: cold packs & hot packs)

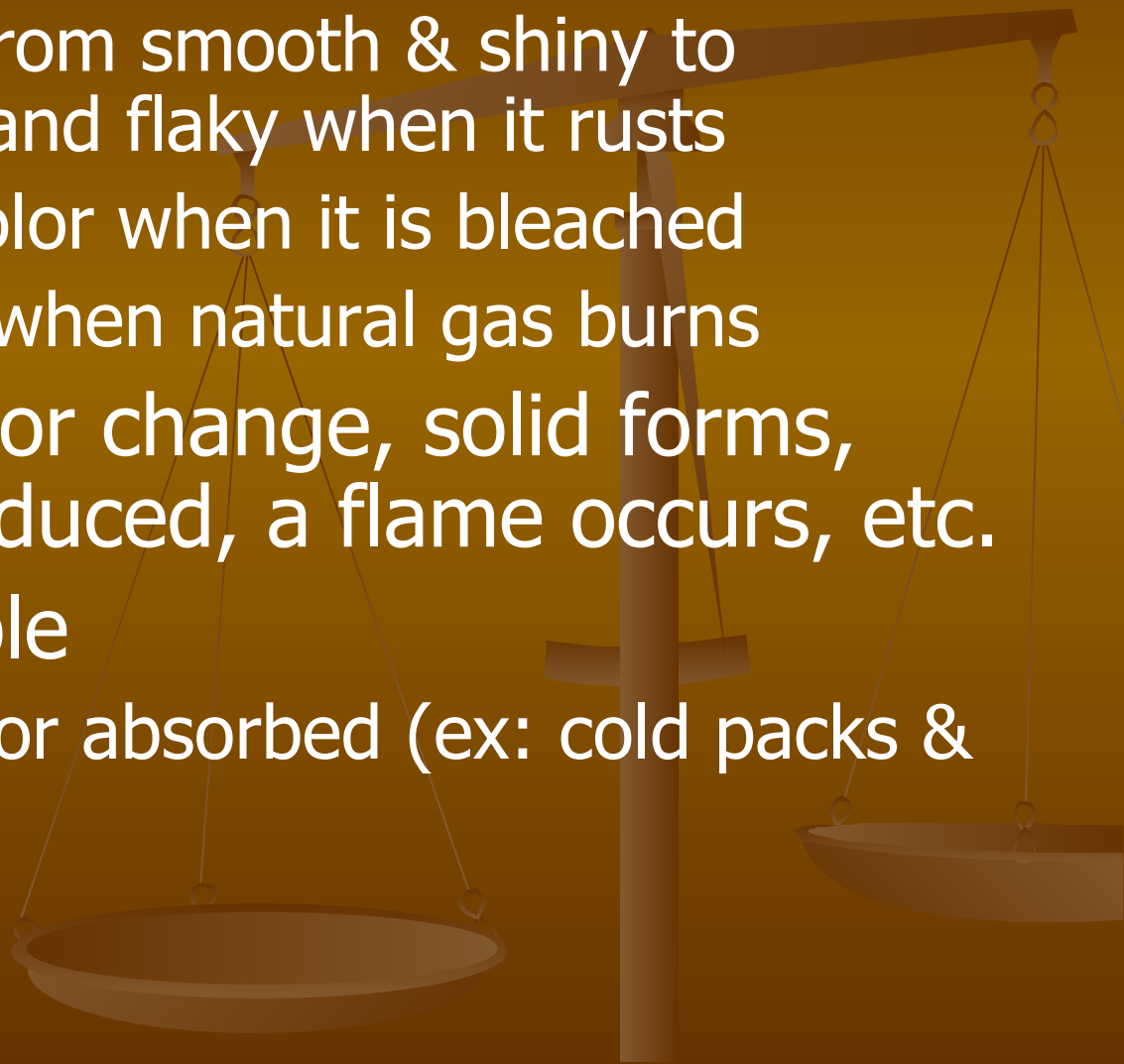
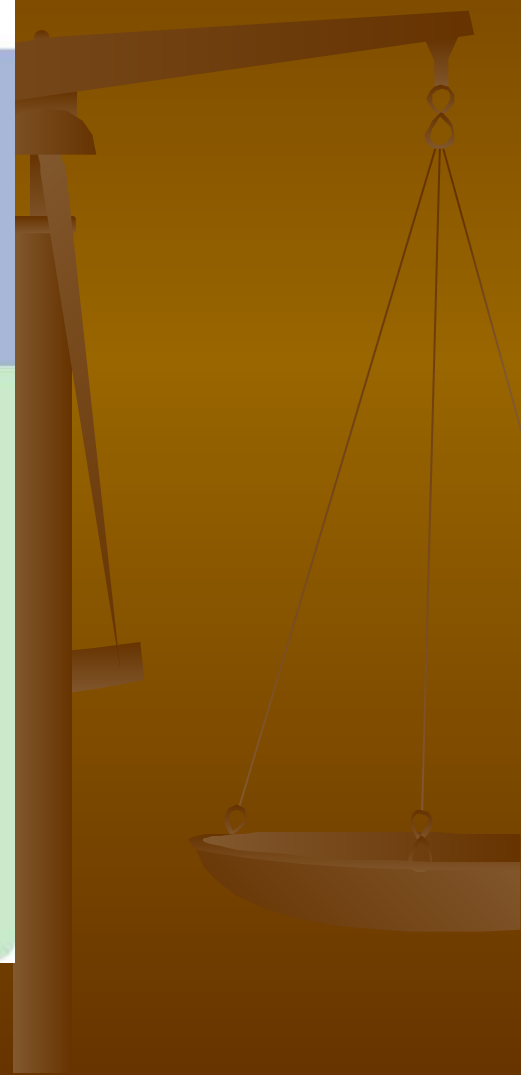


Table 7.1

TABLE 7.1

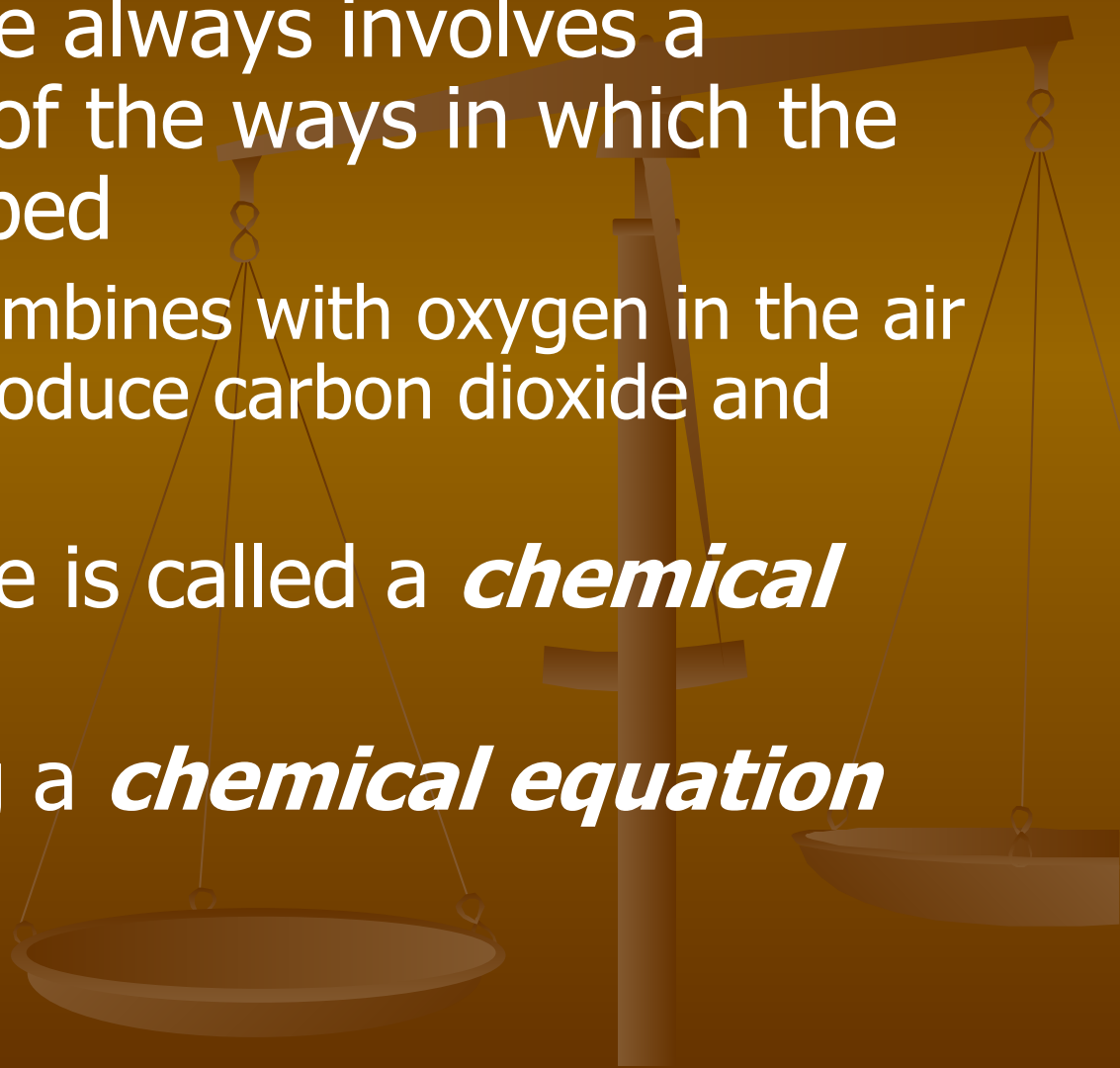
Some Clues That a Chemical Reaction Has Occurred

1. The color changes.
2. A solid forms.
3. Bubbles form.
4. Heat and/or a flame is produced, or heat is absorbed.



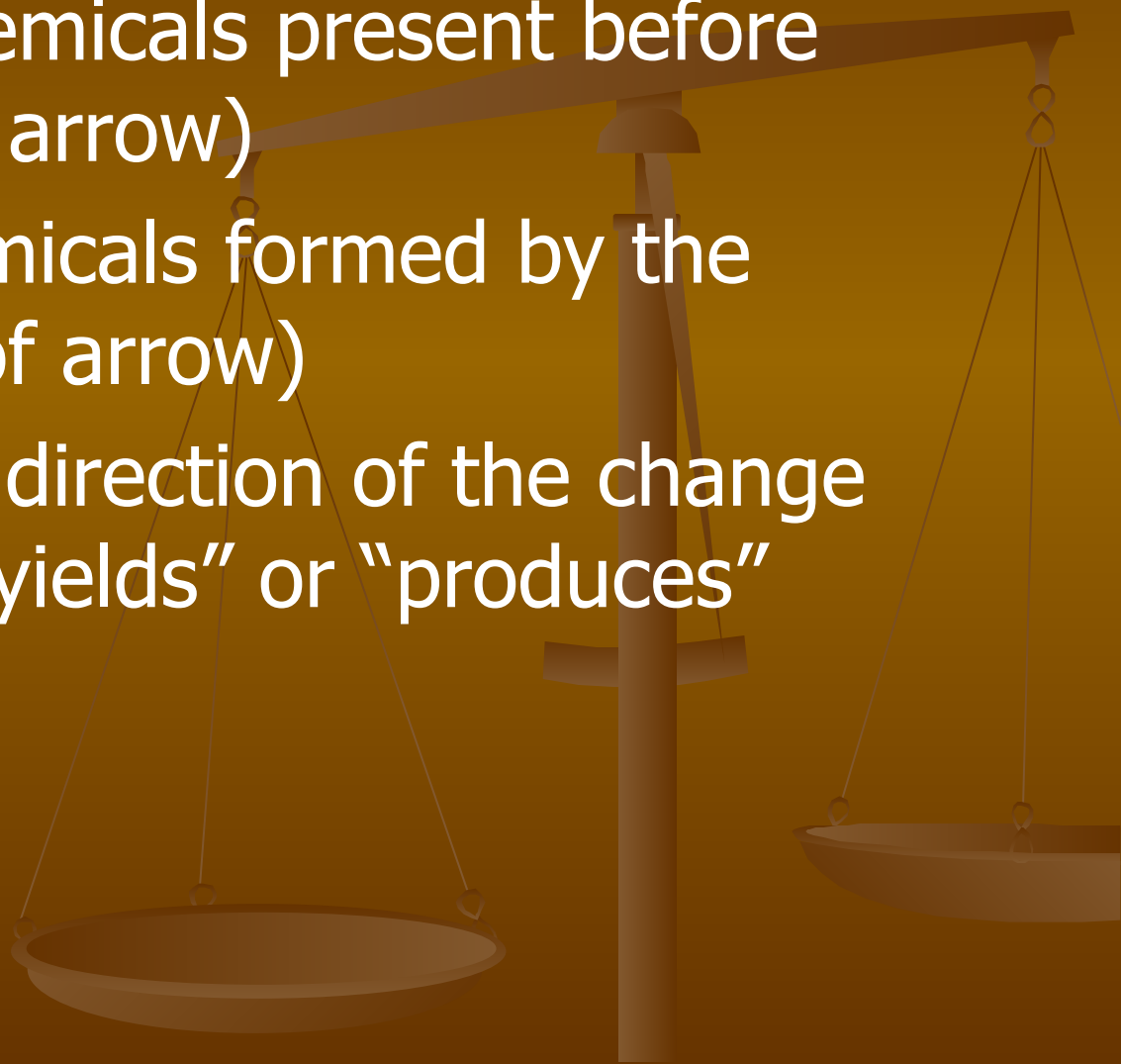
Chemical Equations

- Chemical change always involves a rearrangement of the ways in which the atoms are grouped
 - Ex: methane combines with oxygen in the air and burns to produce carbon dioxide and water
- Chemical change is called a ***chemical reaction***
- Represent using a ***chemical equation***



Reactants → Products

- ***Reactants***: chemicals present before reaction (left of arrow)
- ***Products***: chemicals formed by the reaction (right of arrow)
- Arrow indicates direction of the change and is read as “yields” or “produces”



Example:

- For reaction of methane with oxygen:

Carbon

Methane

OxygenDioxide

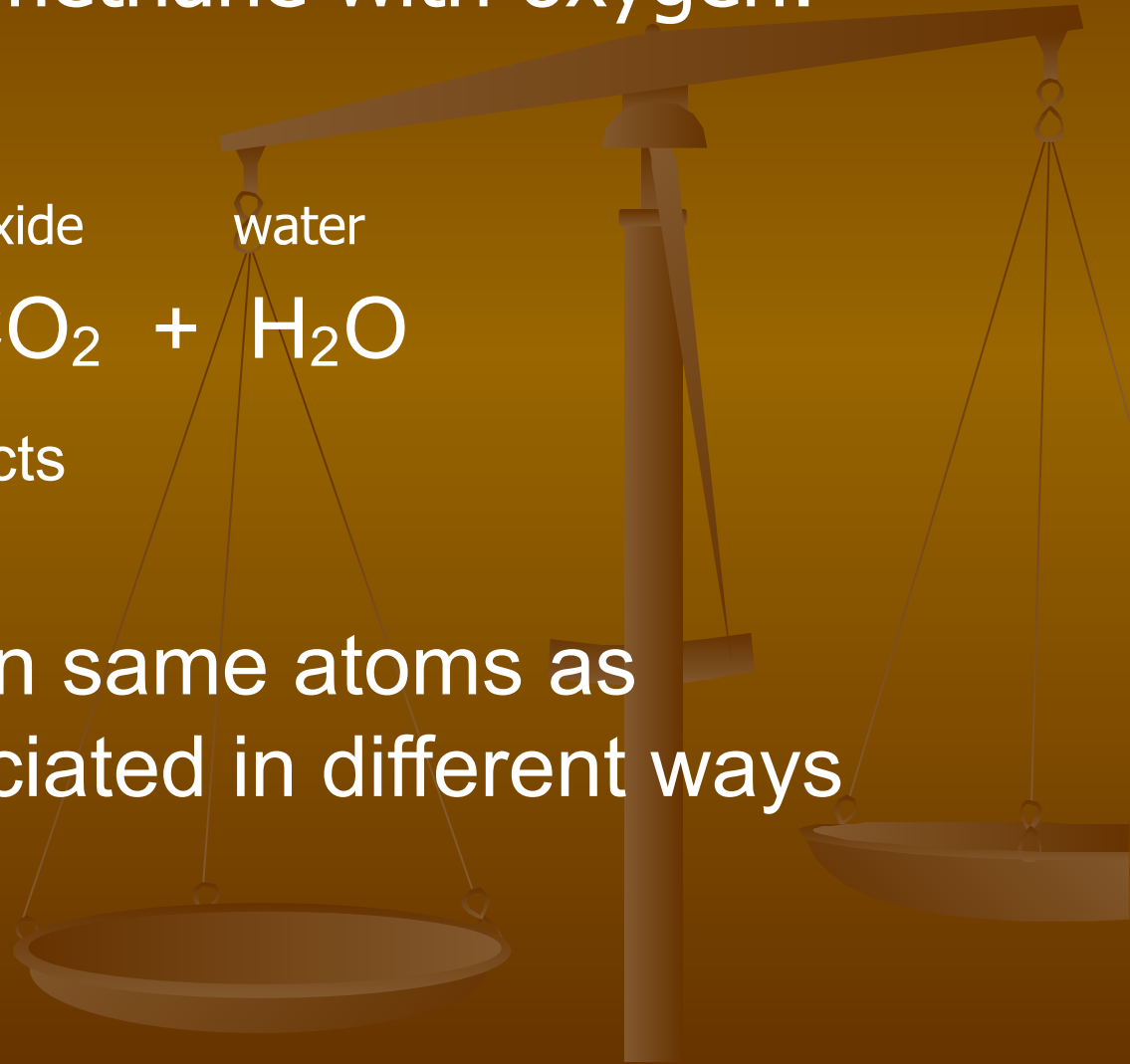
water



Reactants

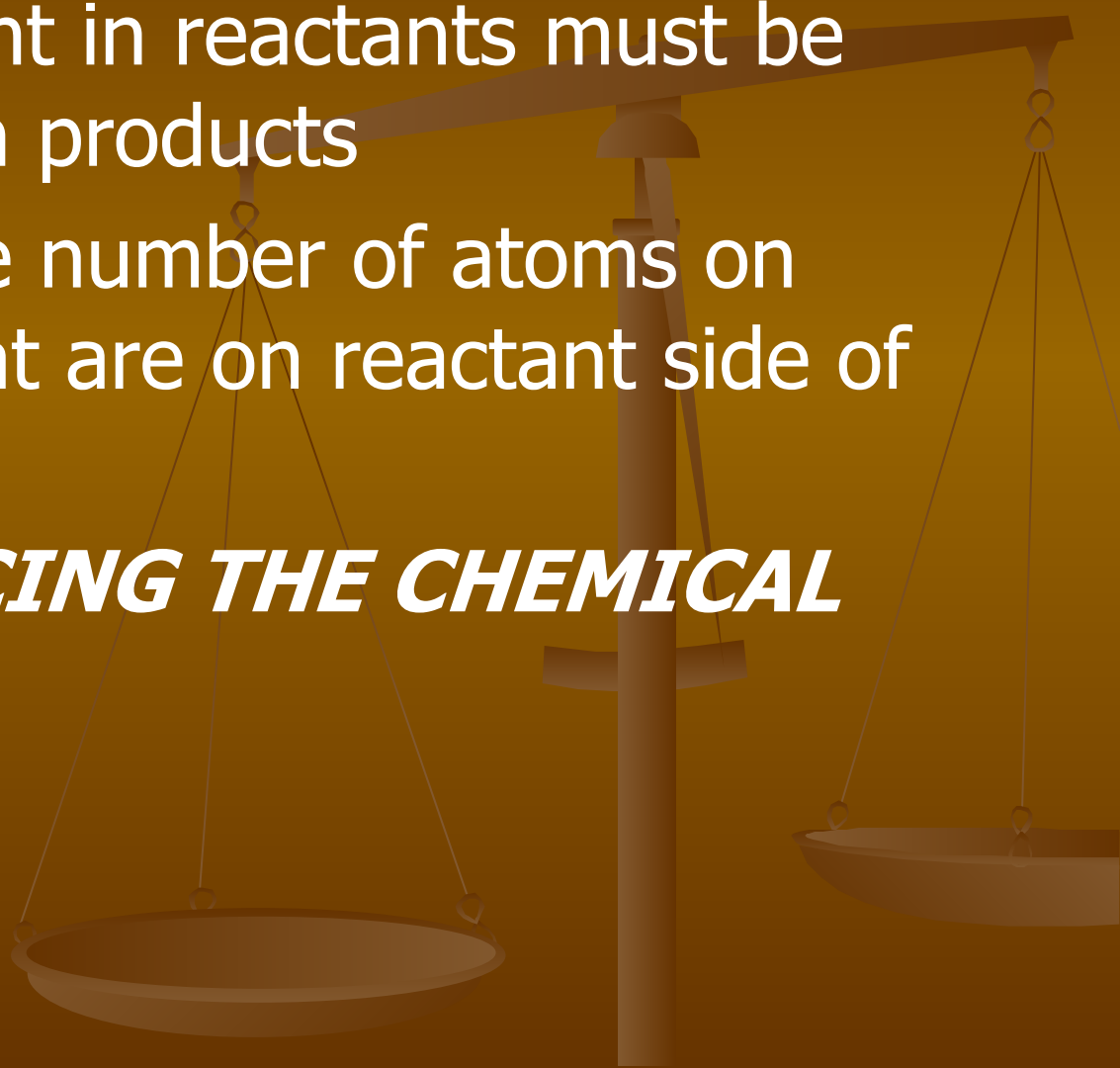
Products

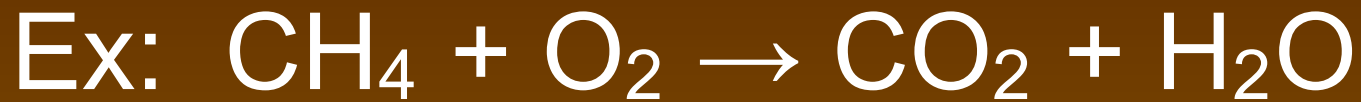
- Products contain same atoms as reactants, associated in different ways



In reaction, atoms are not created or destroyed!

- All atoms present in reactants must be accounted for in products
- Must have same number of atoms on product side that are on reactant side of equation
- Called ***BALANCING THE CHEMICAL EQUATION***





■ Reactant side:

- 1 Carbon (C)
- 2 Oxygen (O)
- 4 Hydrogen (H)

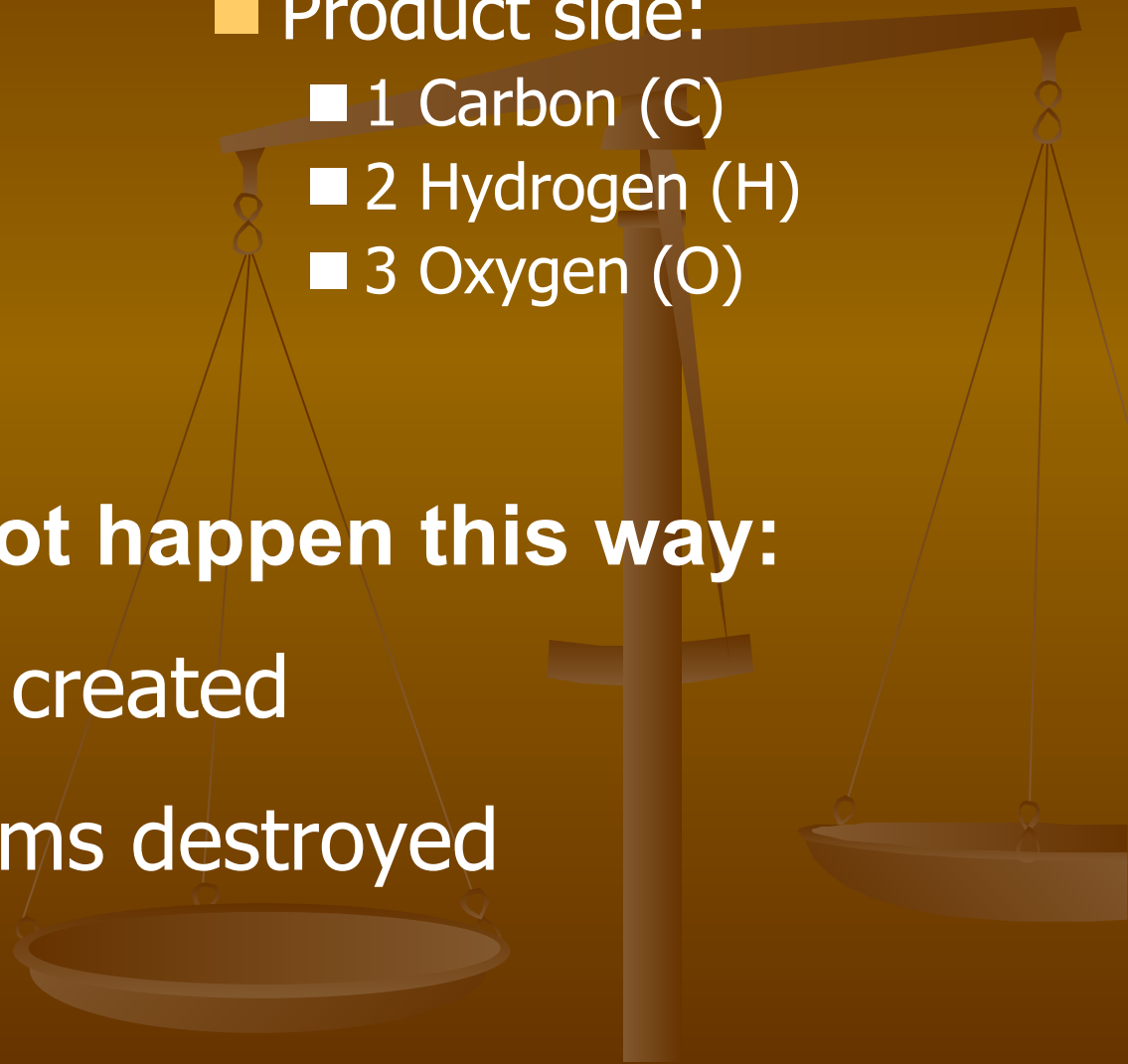
■ Product side:

- 1 Carbon (C)
- 2 Hydrogen (H)
- 3 Oxygen (O)

• **Reaction cannot happen this way:**

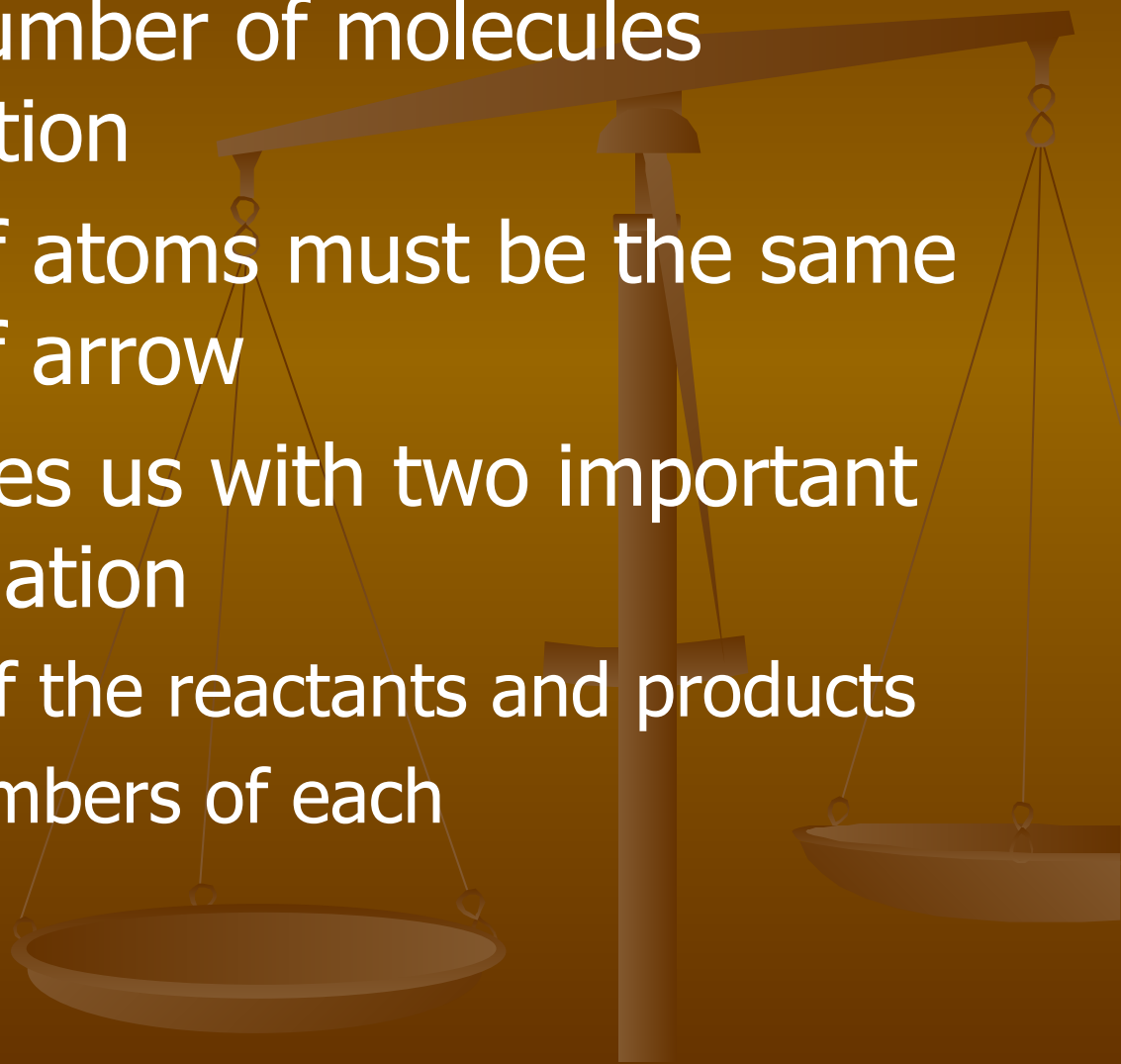
one oxygen atom created

two hydrogen atoms destroyed

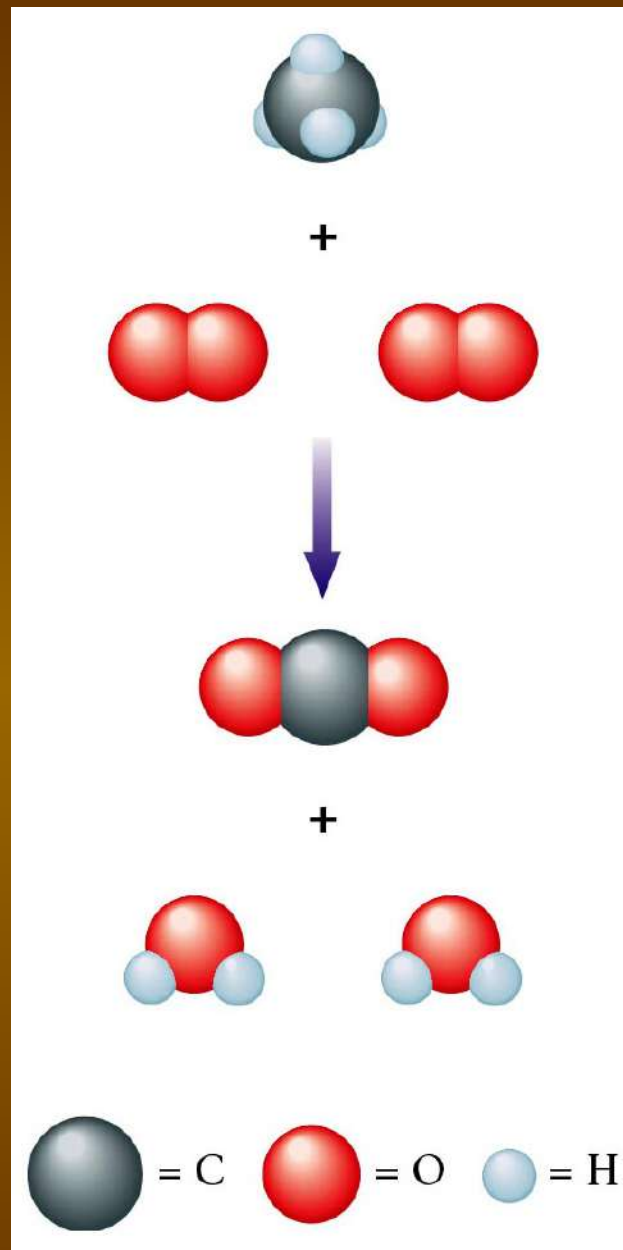


Balanced Chemical Equation

- Shows actual number of molecules involved in reaction
- Total number of atoms must be the same on both sides of arrow
- Equation provides us with two important pieces of information
 - The identities of the reactants and products
 - The relative numbers of each



7.4: The reaction between methane and oxygen.



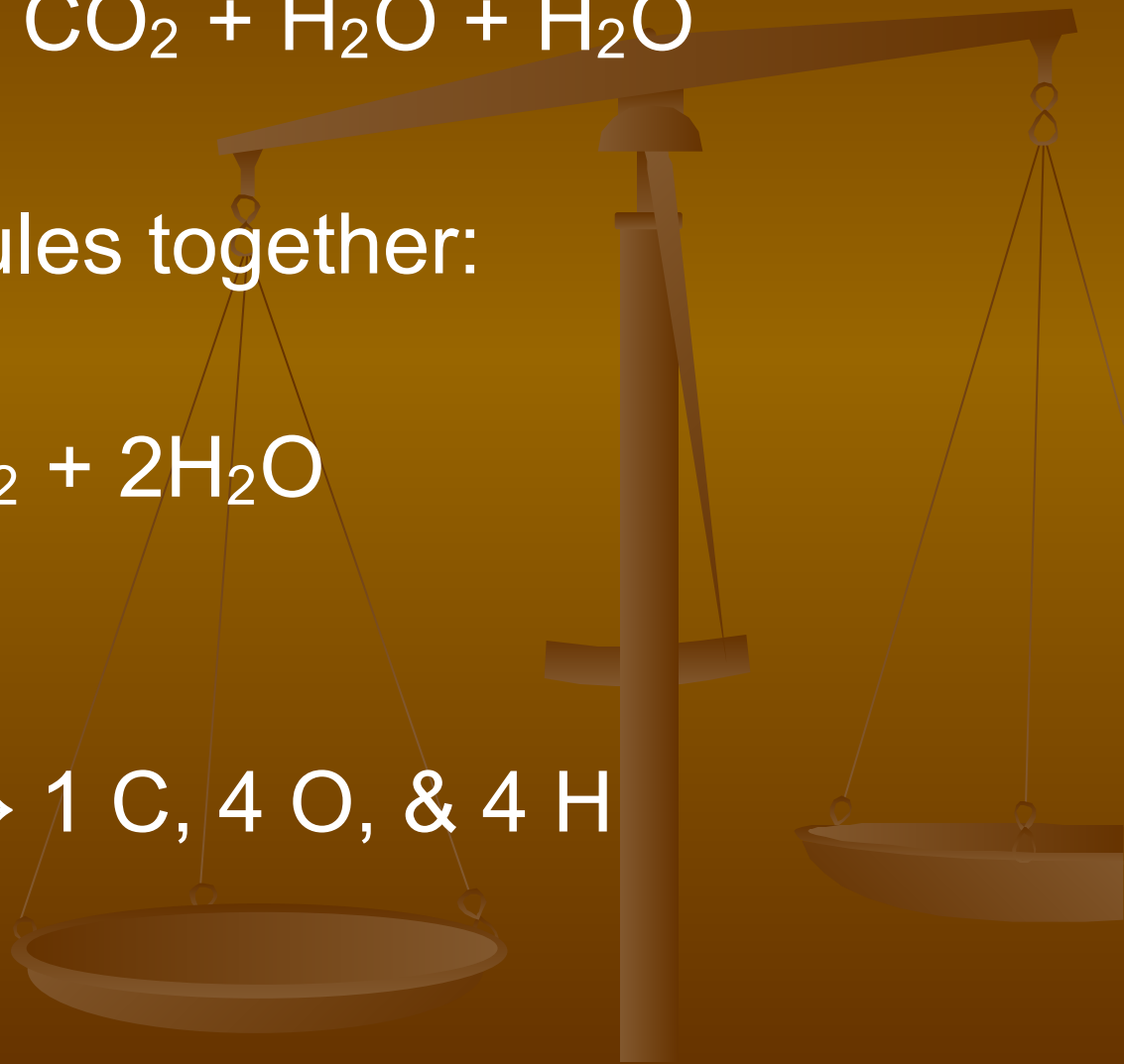
Add needed molecules



Group like molecules together:



Now we have:



Another way to look at it:

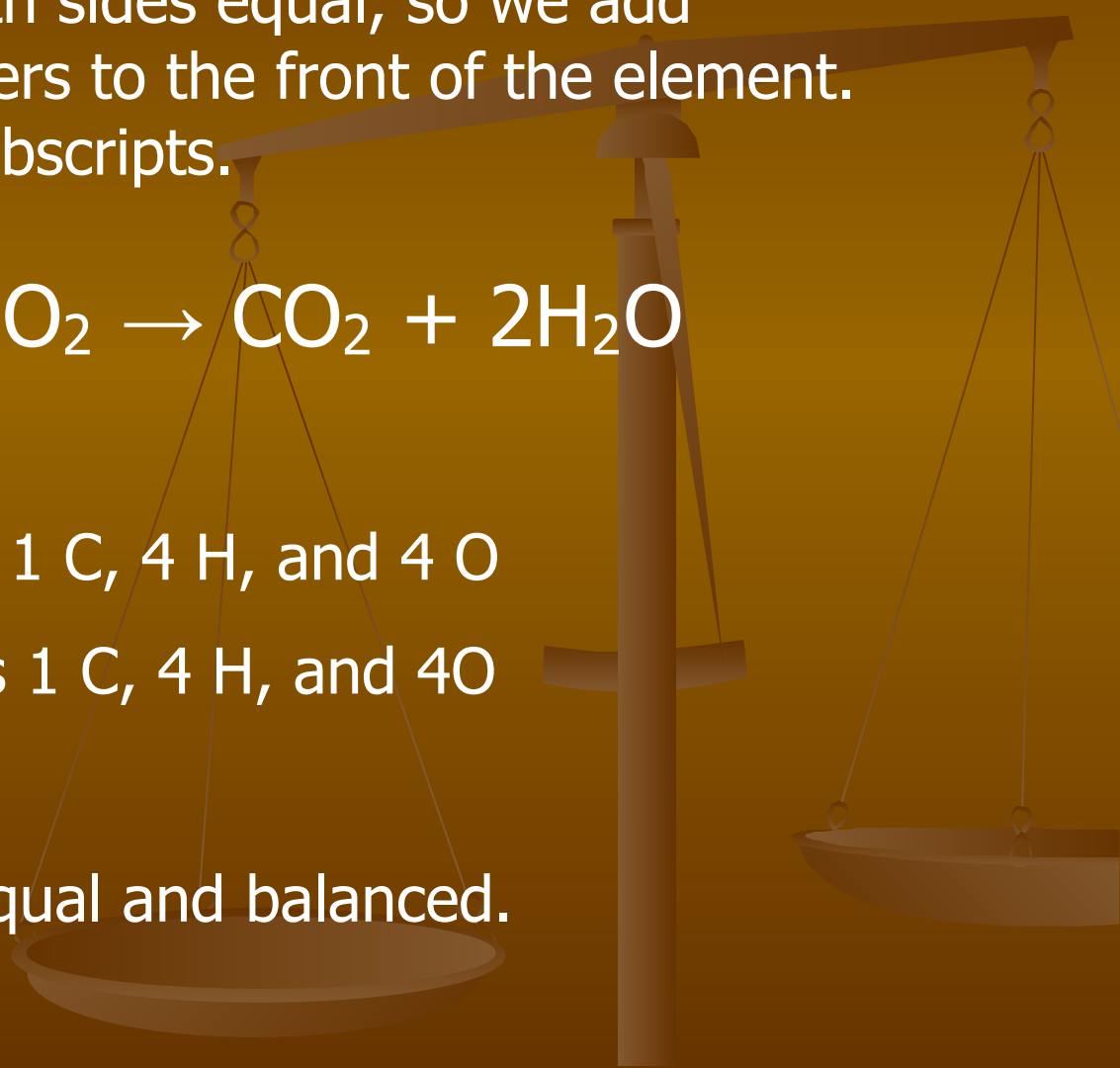
We need to make both sides equal, so we add coefficients, or numbers to the front of the element. Do not change the subscripts.



The product now has 1 C, 4 H, and 4 O

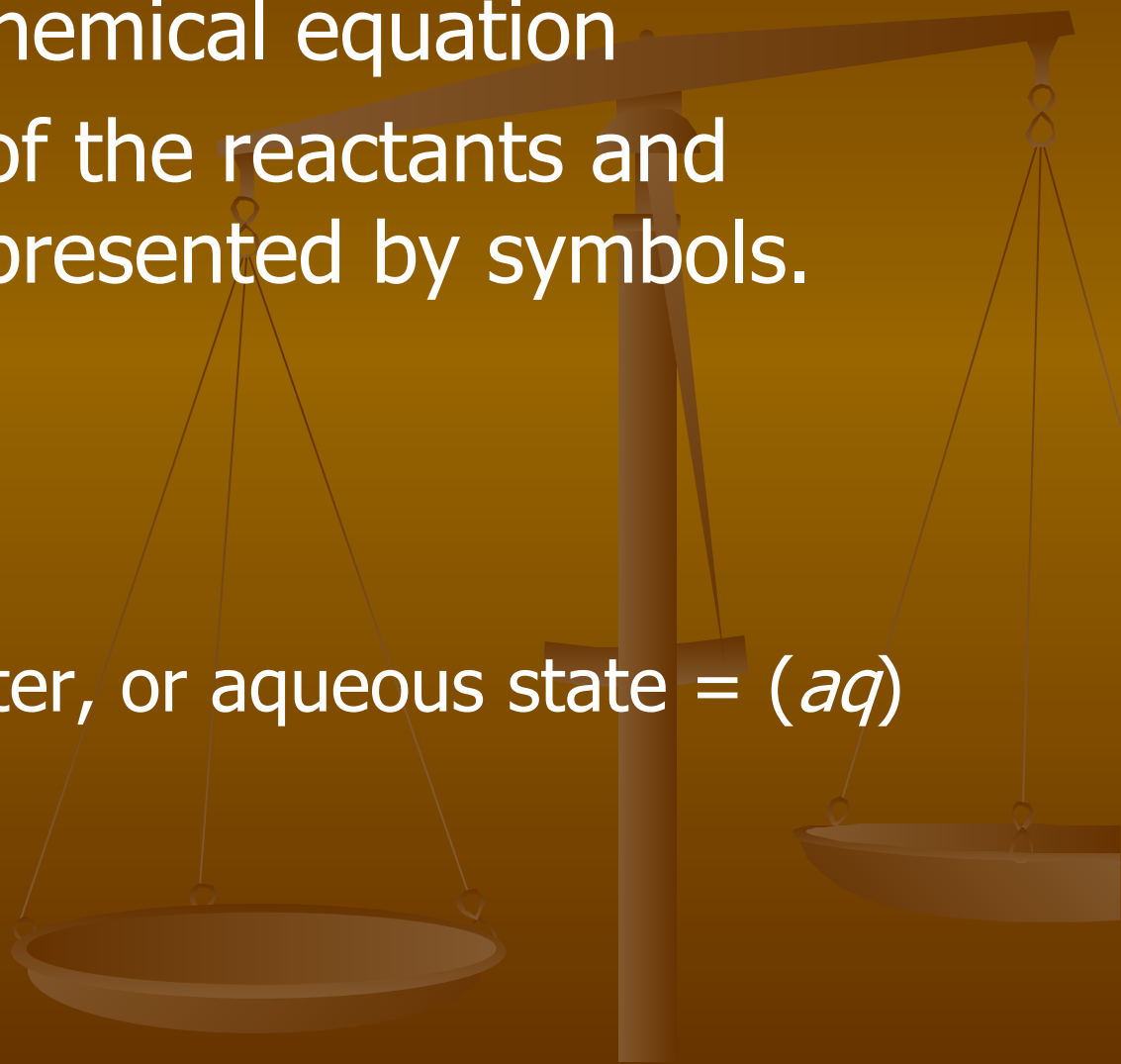
The reactant now has 1 C, 4 H, and 4 O

Both sides are now equal and balanced.



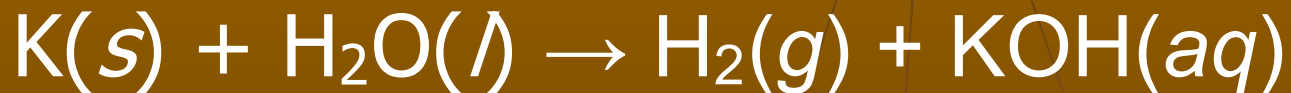
Physical States

- Also placed in chemical equation
- Physical states of the reactants and products are represented by symbols.
 - solid = (*s*)
 - liquid = (*l*)
 - gas = (*g*)
 - dissolved in water, or aqueous state = (*aq*)

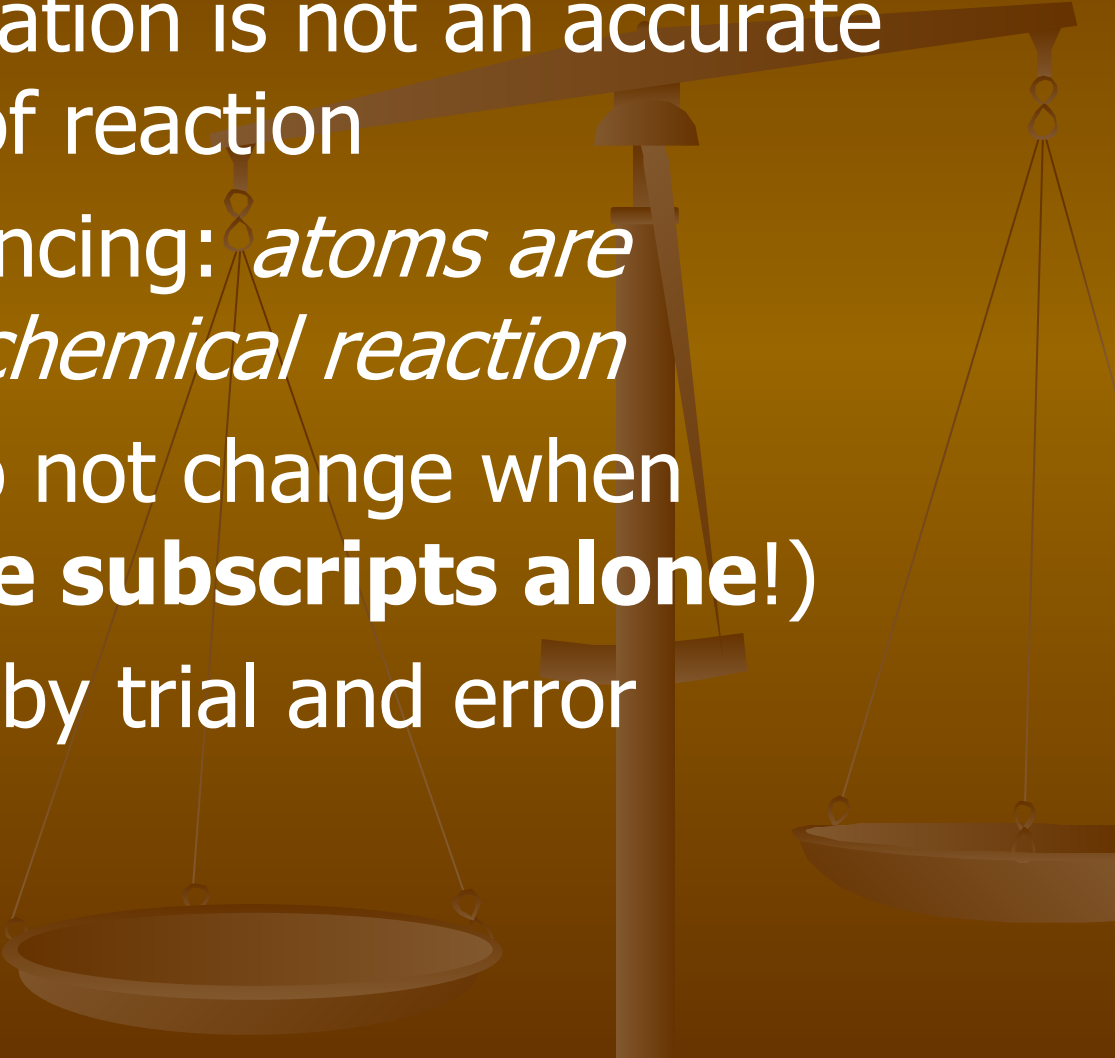


Example:

- Solid Potassium reacts with liquid water forming hydrogen gas and potassium hydroxide (which remains dissolved in water)



Balancing Chemical Equations

- Unbalanced equation is not an accurate representation of reaction
 - Principle of balancing: *atoms are conserved in a chemical reaction*
 - The formulas do not change when balancing (**leave subscripts alone!**)
 - Usually balance by trial and error
- 

How to Write & Balance Equations

1. Read reaction. Write appropriate formulas identifying reactants and products.
 2. Write unbalanced equation.
 3. Balance by inspection. Start with most complicated molecule first. Do not change subscripts!
 4. Check that atoms are equal. Make sure coefficients are smallest integers.
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