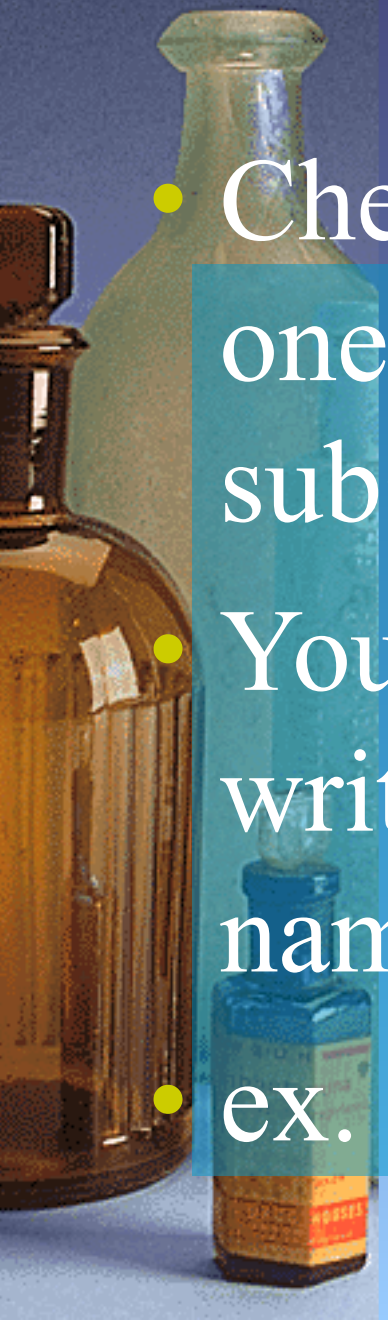
P. Sci.

Unit 11
Chemical Reactions
Chapter 7



Review

- Chemical change –occurs when one substance changes into another substance.
- You will have to know how to write a chemical formula from a name. (last chapter)
- ex. Dihydrogen monoxide = H_2O

Review cont.

- Law of Conservation of …
- Matter – Matter cannot be created nor destroyed, it can only be changed.
- Energy – Energy cannot be created nor destroyed, it can only be changed.

Chemical Reactions

- Occur when substances undergo chemical changes to form new substances.
- Atoms are re-arranged as bonds are broken and formed.

Chemical Reactions cont.

- Nothing is lost or gained
- Atoms cannot change to other atoms.
- Therefore all equations must have the same number and kind of atoms on both sides of the equation.

Produce
Yields
forms

Reactants → Products

The chemicals you start with

What you end up with after the reaction occurs

Signs of a Chemical Reaction

- Production of a gas
- Production of a precipitate
- Change in color
- Production of light or heat

Energy and Reactions

- All chemical reactions release or absorb energy – (heat, light, sound or electricity)
- To break bonds – takes energy
- To form bonds – releases energy

Energy and Reactions cont.

- endothermic – when more energy is required to break bonds than is released when new ones are formed. (ex: photosynthesis)
- exothermic – less energy is required to break the original bonds than is released when new bonds form. (ex: bioluminescence – fireflies.

Energy is conserved.

- Chemical energy is the energy stored in a chemical bond.
  - Example: isooctane (gas) and oxygen plus a tiny spark will set off an explosion – the energy of the explosion comes from the chemical energy stored in the isooctane bonds.

Balancing Chemical Equations

- Chemical Equations summarize reactions by using formulas for each substance.
- Because of conservation of matter (mass) the left side (reactants) **must** equal the right side (products).

Steps for Balancing Equations

1) Write the equation (write the reactants and products as chemical compound formulas and elements)

Ex: $H_2 + O_2 \rightarrow H_2O$

2) Draw a table and fill in all elements in the equation as well as how many atoms of each element are on each side of the equation.

Ex: $H_2 + O_2 \rightarrow H_2O$

Element	Reactants (left)	Products (Right)
H	2	2
O	2	1

3) If the reactant numbers are not the same as the product numbers for each element, you have to balance the equation.

Element	Reactants (left)	Products (Right)
H	2	2
O	2	1

4) Add co-efficients in front of the formulas until they balance.

(**remember – you can't change the formula by changing subscripts – you can only change the amount of the substance you have.**)

Example

$$2\ H_2 + O_2 \rightarrow 2\ H_2O$$

2 2 2 1

Element	Reactants (left)	Products (Right)
H	/ 4	/ 4
O		/ 2

Un-balanced
balanced

balanced

Practice

- Balance the following equations:

1) $HgO \rightarrow Hg + O_2$
2) $N_2 + H_2 \rightarrow NH_3$
3) $KClO_3 \rightarrow KCl + O_2$
4) $KBr + Cl_2 \rightarrow KCl + Br_2$
5) $CO + O_2 \rightarrow CO_2$

Answers

1) $2HgO \rightarrow 2Hg + O_2$

2) $N_2 + 3H_2 \rightarrow 2NH_3$

3) $2KClO_3 \rightarrow 2KCl + 3O_2$

4) $2KBr + Cl_2 \rightarrow 2KCl + Br_2$

5) $2CO + O_2 \rightarrow 2CO_2$

Rates of Change

- To increase the rate (speed) of a reaction (in most cases)
  - Increase temperature
  - Increase surface area
  - Concentrated solutions
  - Increase pressure

Rate of Change cont.

- Massive, bulky molecules react slower.

Catalysts

- a substance that speeds up a chemical reaction without being permanently changed itself.
- They are not reactants nor products.
- *Enzymes* are proteins that are catalysts for chemical reactions in living things.

Inhibitors

- substances that are used to combine with one of the reactants to prevent certain reactions from occurring.
- ex. Food preservatives, lemon juice on cut fruit to keep it from turning brown.

Equilibrium Systems

- Some reactions are reversible

Ex:

- $CaCO_3$ + heat $\leftrightarrows$ CaO +CO_2
- Equilibrium results when rates balance. (when the reaction moving $\rightarrow$ equals the reaction moving $\leftarrow$)

Reaction Types

- There are 5 main types of chemical reactions.
  1) Synthesis
  2) Decomposition
  3) Single-displacement (replacement)
  4) Double-displacement (replacement)
  5) Combustion

Produce
Yields
forms

Reactants → Product

The chemicals you start with

What you end up with after the reaction occurs

Synthesis Reactions

- two or more substances → one compound.
- $A + B \rightarrow AB$

  Ex.: $2H_2 + O_2 \rightarrow 2H_2O$
- Synthesis reactions always join substances so the product is a more complex compound than the reactants.

Decomposition Reaction

- opposite of synthesis –
- one compound → 2 or more substances.
- AB → A + B

  ex: $2H_2O \rightarrow 2H_2 + O_2$
- Decomposition reactions break apart so the reactants are more complex than the products.

Single-displacement Reactions

- When one element replaces another element in a compound.
- $A + BC \rightarrow AC + B$

Ex:

$Cu + 2AgNO_3 \rightarrow Cu(NO_3)_2 + 2Ag$

- Generally, a more reactive element will take the place of a less reactive one.

Double-displacement Reactions

- The positive ion of one compound replaces the positive ion of the other to form two new compounds.
- $AB + CD \rightarrow AD + CB$

Ex:

$Ba(NO_3)_2 + K_2SO_4 \rightarrow BaSO_4 + 2KNO_3$

Combustion Reactions

- Use oxygen as a reactant
- $AB + O_2 \rightarrow A + BO_2$

ex: $2CH_4 + 3O_2 \rightarrow 2CO_2 + 4H_2O$

- Usually the products include water and CO_2

Mole

- The SI base unit that describes how many tiny particles make up a fixed amount of a pure substance.

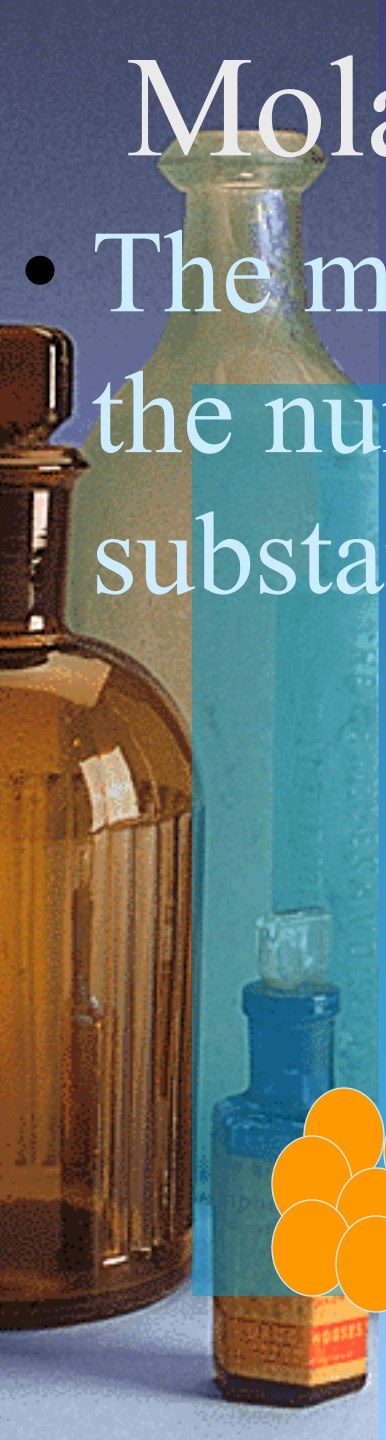
- Ex. If someone counted how many grains of sugar were in 180 g. and found that there were 602,213,670,000,000,000,000,000 grains of sugar in 180 g.
- Abbreviated to 6.022×10^{23}
- Then: $360g = 12.044 \times 10^{46}$

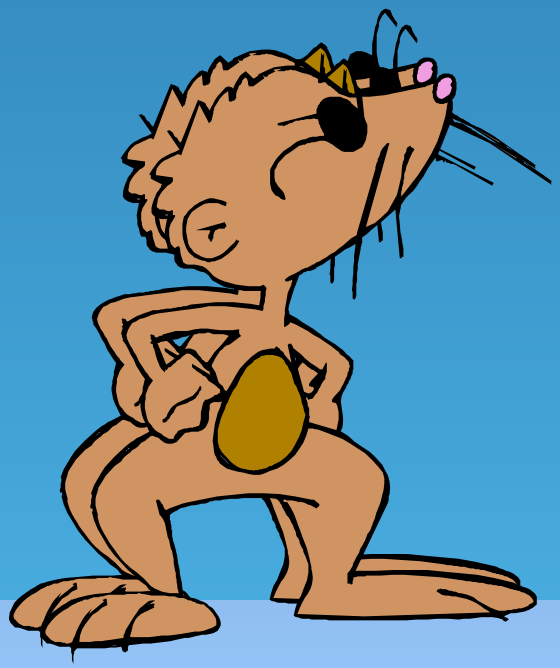
Avogadro's constant

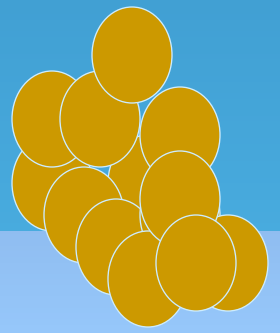
- 6.022×10^{23} = the number of particles in exactly 1 mol (mole) of a substance.
- This number is used to calculate the molar mass of a substance.

Molar mass

- The molar mass is used to compare the number of particles of each substance in a chemical reaction.








The
End