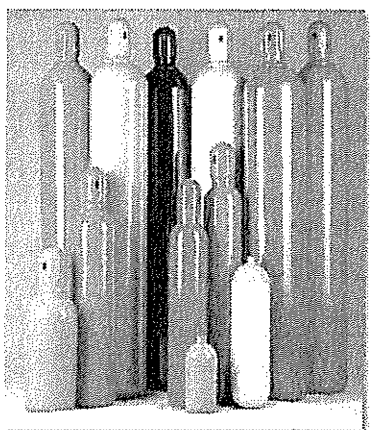
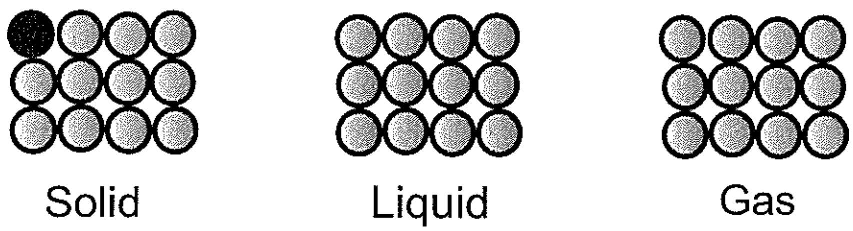
Unit 2: Gas Laws



What makes gases different from solids and liquids?



5 Macroscopic Properties of Gases That Distinguish Them From Solids and Liquids

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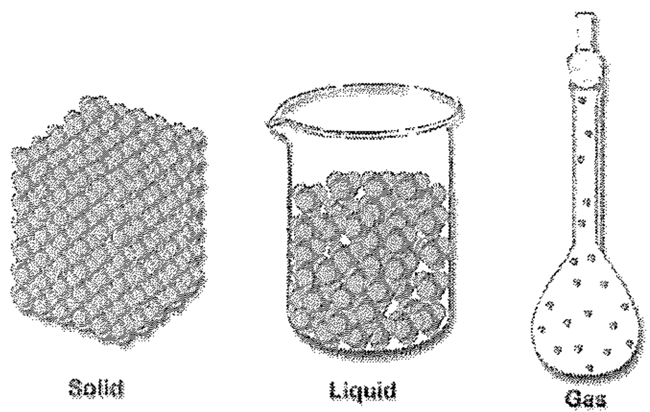


Theoretical Differences

Gases have low IMF, so chemical differences have little effect on properties

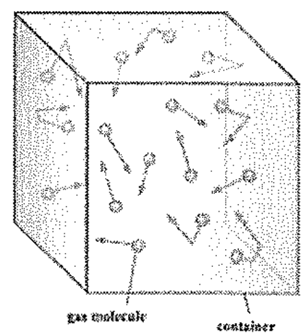
Mathematical relationships can be established that apply to all gases (GAS LAWS)

Assumptions made about gases

A gas is considered to be a large number of point masses, with no attractive forces between the particles
A point mass is a mass that takes up no space (has no volume)

The collisions between gas molecules are elastic
This means that kinetic energy is conserved, and collisions are not influenced by attractive forces

Gas particles move in a straight line until they collide with another gas molecule or the wall of a container



In an ideal gas all of these assumptions are true
- ideal gases do not actually exist

Gases are called real gases because:
- the molecules have size and shape
- their behavior is influenced by chemical properties (to a very small degree)

Kinetic Molecular Theory

-is a model that explains the macroscopic properties of gases

Main Points:

a) All matter is composed in particles in continual motion

b) The average kinetic energy of the particles is directly proportional to the temperature of a gas

c) The greater the E_k the faster the motion of the particles

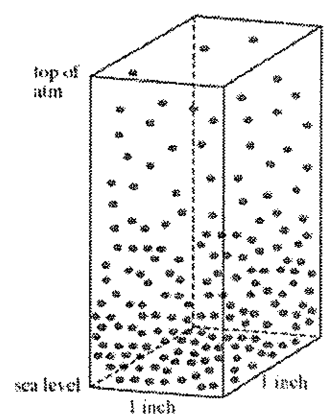
d) The space between the particles is very large compared to the size of the particles

Pressure

-gases exert pressure when they collide with objects and exert a force

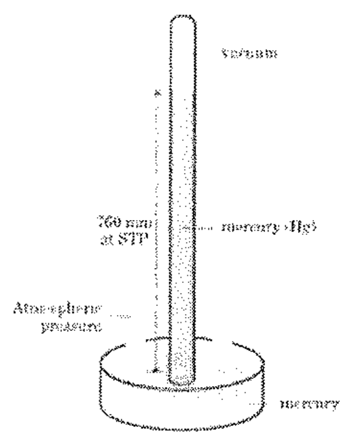
-atmospheric pressure results from a blanket of gases covering the surface of the planet

-it decreases as altitude increases



Measuring Pressure

-uses a barometer
-a simple barometer measures the height of a column of mercury produced by atmospheric pressure



Units for measuring pressure

mm of Hg
torr

atmospheres (atm)

kilopascals and pascals

bar

Conversions (memorize this)

760 mm Hg = 760 torr = 1 atm = 101.325 kPa = 1.01325 bar

Example #1

Convert 95.0 kPa into units of mm of Hg

$$\frac{x}{95.0\,\text{kPa}} = \frac{760\ \text{mm of Hg}}{101.325\ \text{kPa}} \qquad x = \frac{760 \times 95.0}{101.325}$$

$$\boxed{x = 713\ \text{mm of Hg}}$$

Example #2

Convert 500 torr into kPa

$$\frac{x}{500\ \text{torr}} = \frac{101.325\ \text{kPa}}{760\ \text{torr}} \qquad x = \frac{500\ \text{torr} \times 101.325\ \text{kPa}}{760\ \text{tor}}$$

$$\boxed{x = 66.7\ \text{kPa}}$$

Example #3

Convert 2.56 atm into bar

The Kelvin Temperature Scale

-sets zero as the lowest possible temperature

-the point where molecular motion stops

-the point where the volume of a gas decreases to zero

-this temperature is called <u>absolute zero</u>

$0\ K = -273^{\circ}C$

Convert 300 ˚C to Kelvin

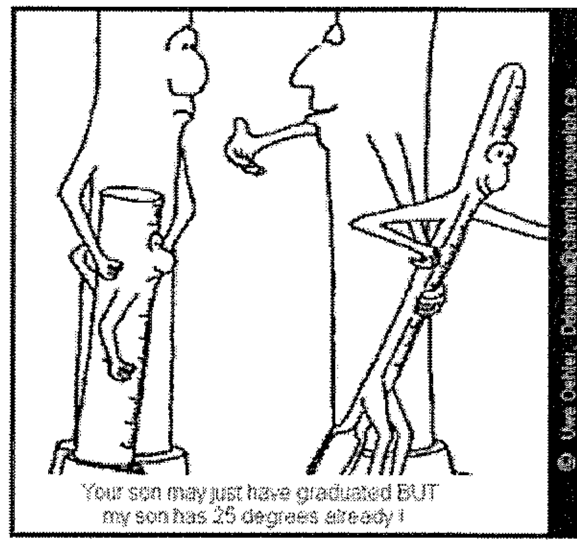
300 + 273 K = 573˚C

Convert 298.15 K into ˚C

298.15
−273
25.15 K

Convert 0.00˚C to Kelvin

+273
273 K



- SATP
- Standard ambient temperature and pressure
- 25°C (298 K)
- 100 kPa

- STP
- Standard tempeature and pressure
- 0˚C (273 K)
- 101.325 kPa

Assignment
Textbook page 101
1-9 omit 2

worksheet
temperature
and pressure.