

Gases

- found all around us and very important to our daily lives
- e.g. breathing, heating, medical uses

Comparison of Properties of Solids, Liquids, and Gases

solids - definite shape

- definite volume
- particles are closely packed
- cannot be compressed
- very little movement of particles
- strong attractive forces exist between particles
- particles have **low E_k** (little motion, E_k is kinetic energy)

liquids

- indefinite shape (takes shape of container)
- definite volume
- particles easily move past each other
- slightly compressible
- fluid (liquids flow)
- weak attractive forces exist between particles
- particles have **more E_k** (significant motion)

gases - indefinite shape (takes shape of container)

- indefinite volume (particles spread out to fill container)
- particles have **large** spaces between them
 - most of the volume of a gas is empty space
 - particles rarely touch each other
- easily compressible
- fluid (gases flow)
- weakest attractive forces exist between particles
- particles have **high E_k** (constant motion)

The properties and behavior of gases can be explained by the **Kinetic Molecular Theory (KMT)** for gases:

1. All matter is composed of tiny particles
2. The particles are in constant motion (\hat{U} temperature, $\hat{U} E_k$)
3. Forces of attraction and repulsion exist between the particles
4. Very large spaces exist between gas particles
5. Force of attraction between particles is very small
6. Particles have elastic collisions (energy is neither gained nor lost)

Gas Pressure

force - a push or a pull

pressure - force per unit area

$$\text{pressure} = \frac{\text{force}}{\text{area}}$$

e.g. step on foot with running shoes

step on foot with high heels

force is the same, but the pressure is different

- results from the collision of gas particles with the walls of the container in which the gas is contained

- SI units - Pascal, Pa

derived unit - a combination of other units

$$1 \text{ Pa} = 1 \frac{\text{N}}{\text{m}^2}$$

$$1 \text{ Newton} = \text{Kg} \times \frac{\text{m}}{\text{s}^2}$$

Gas pressure depends on:

1. area

↑ area ↓ pressure

↓ area ↑ pressure

2. # particles

↑ # particles ↑ pressure

↓ # particles ↓ pressure

3. temperature

↑ temperature ↑ pressure

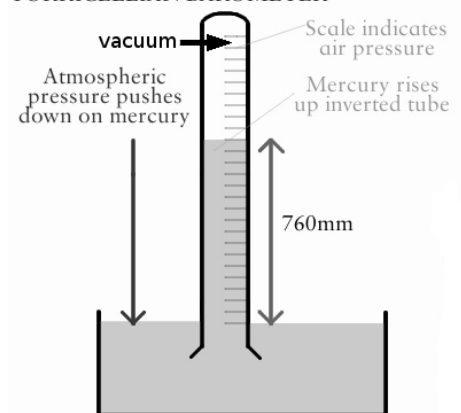
↓ temperature ↓ pressure

Measuring Pressure

- allow gas to exert a pressure on something that exerts a pressure back
ie. usually a column of Hg

barometer - any device used to measure Earth's atmospheric pressure

TORRICELLIAN BAROMETER



- force holds Hg in column or it would run out
- Earth's atmosphere pushes on pool and supports column
- when two forces balance, level of Hg becomes constant

↓ atm. pressure, Hg falls

↑ atm. pressure, Hg rises

Pressure Conversions

At sea level, 1 atm = 101.325 kPa
 = 760 mmHg
 = 760 torr
 = 29.92 " Hg
 = 14.7 p.s.i

Convert the following:

- a. 3.25×10^5 Pa = ____ kPa
- b. 97.8 kPa = ____ psi
- c. 675 mmHg = ____ atm

Homework

- a. 3 atm = ____ kPa
- b. 300 kPa = ____ mmHg
- c. 798 mmHg = ____ atm
- d. 13.2 psi = ____ kPa
- e. 16.4 psi = ____ mmHg
- f. 1.39×10^3 kPa = ____ atm
- g. 670 Pa = ____ kPa