Gases

All gases share some physical properties in common:

- Pressure (P)
- Volume (V)
- Temperature (T)
- number of moles (n)
- These different properties combine to describe the behavior of gases in what are known as the "gas laws"

Pressure

- Pressure is force per unit area (P=F/area)
- greater forces exert greater pressures
  - "direct" relationship
- when the area over which the pressure is exerted is decreased, the pressure increases
  - "inverse relationship

Why is there more pressure on you, the deeper you move in a body of water?

Because there is more water pushing down on you. Greater force means greater pressure.

Why is it harder to breathe when you're up on a mountain?

The air is "thinner" - that is, there is lower atmospheric pressure, because there is less air on top of you pushing down.

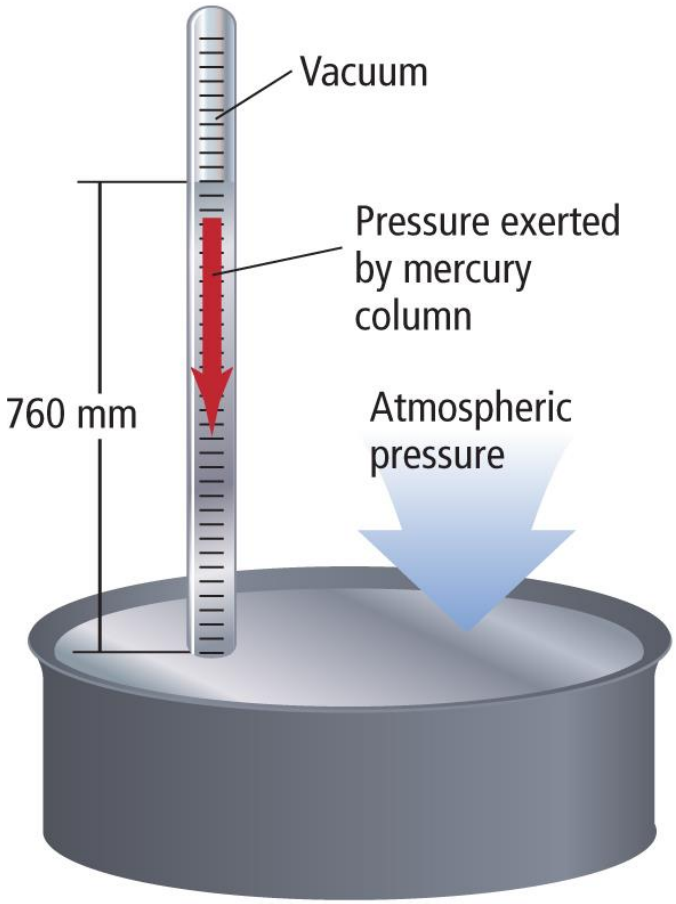
Atmospheric Pressure

- the pressure exerted by the atmosphere on the earth
- decreases as you move higher up
- around 15 psi at sea level

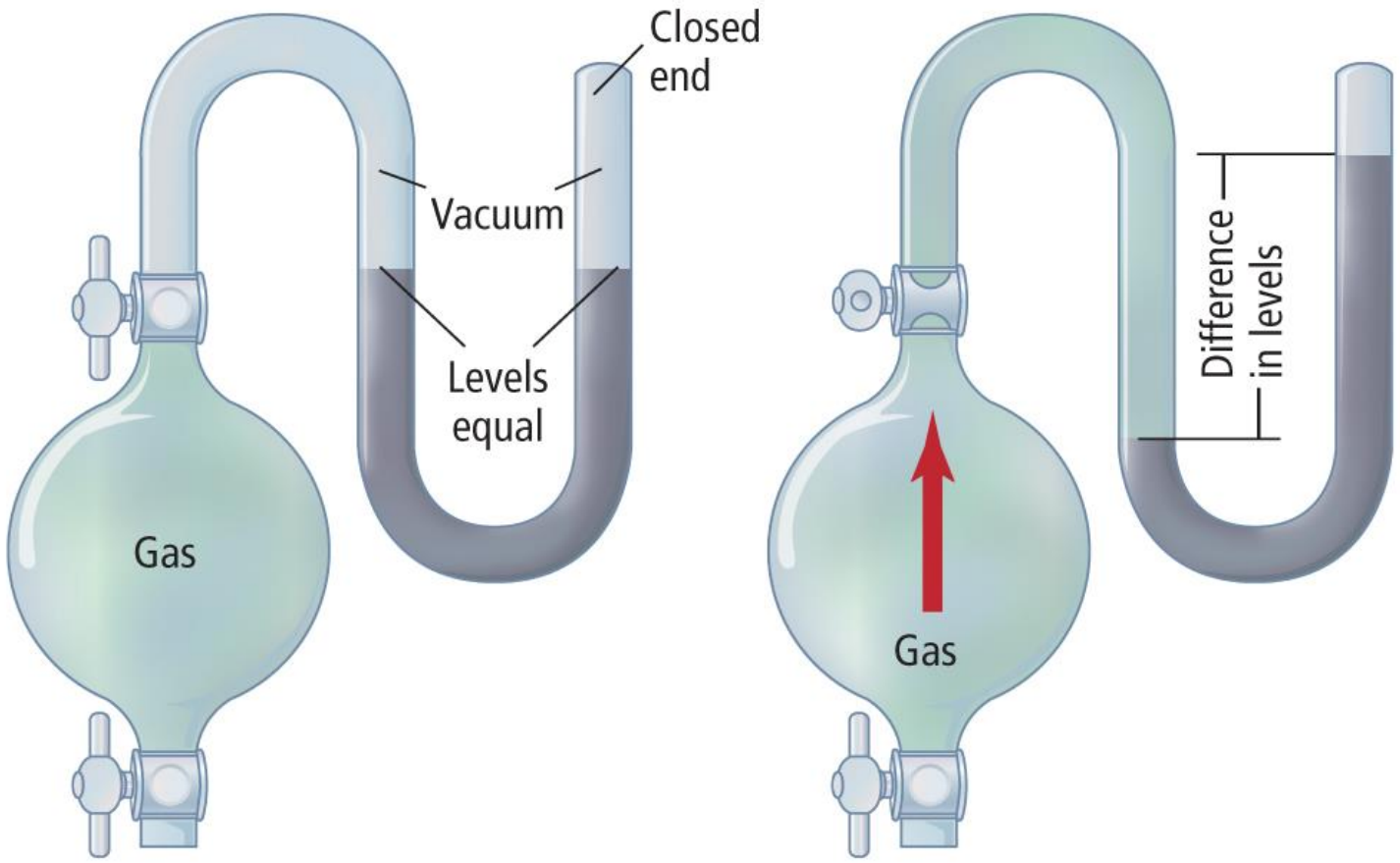
Standard Pressure

- Standard pressure is the "normal" atmospheric pressure at sea level.
- Standard Pressure =
  - →1.00 atm (atmospheres)
  - →101.3 kPa (kilopascals)
  - →760 mmHg (millimeters of mercury)
  - →760 torr

Barometer


Vacuum
Pressure exerted by mercury column
760 mm
Atmospheric pressure

Manometer


Closed end
Vacuum
Levels equal
Gas
Difference in levels
Gas

Kinetic Theory of Gases

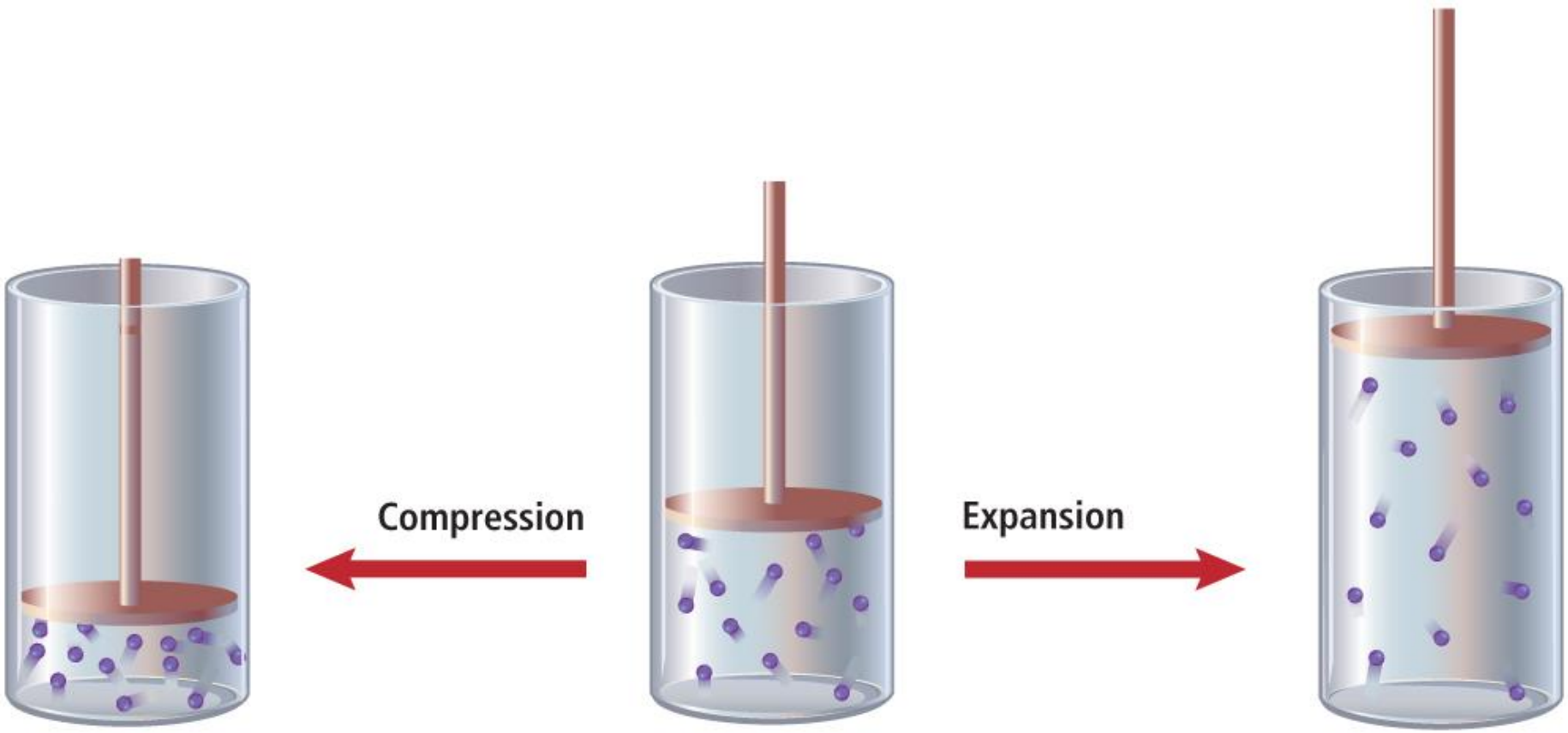
- A set of ideas used to describe and explain the behavior of gases
- Any gas that behaves exactly in this manner is called an "ideal gas"
- five points

- There aren't any ideal gases in real life, but real gases behave much like our "ideal" gas unless they're under very high pressure or temperatures.

Point One

- Gases are composed of tiny particles called molecules.
- Molecules are usually so far apart, gases are mostly empty space.
- Because of this, gases can be easily compressed and mixed.

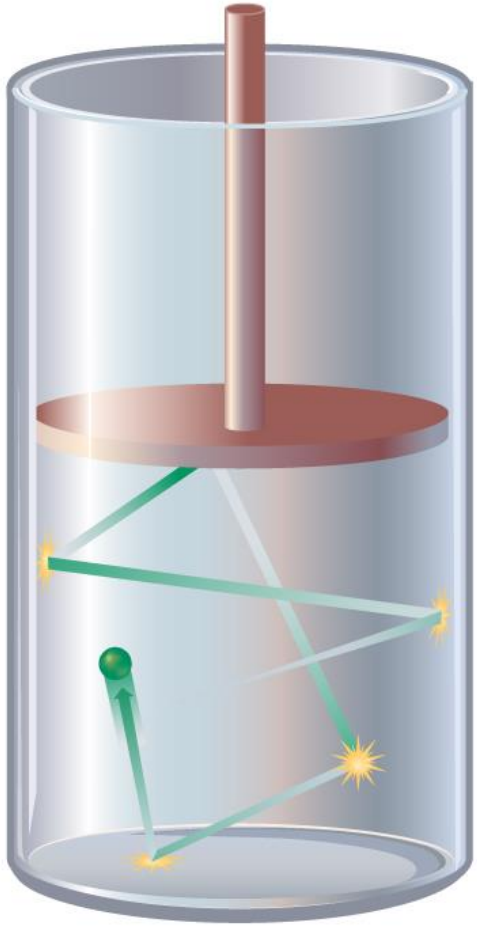
Compression / Expansion



Point Two

- Gas molecules posses kinetic energy ($KE = 1/2mv^2$)
- Gas molecules are in constant, random, straight line motion
- Pressure is the result of collisions of gas molecules and the sides of a container

Gas particle motion and collisions



Point Three

- Collisions between gas molecules and each other or the container are *elastic*
  - no kinetic energy is changed into heat or other forms
- The pressure of an enclosed gas will not change unless its temperature or volume change.

Point Four

- Molecules of a gas are not attracted to or repulsed by each other.
- They move independently of each other.

Point Five

- Individual molecules of a gas are moving at different speeds because they have different kinetic energies.
- The *average* kinetic energy (~speed) is directly proportional to the *temperature* of the gas.