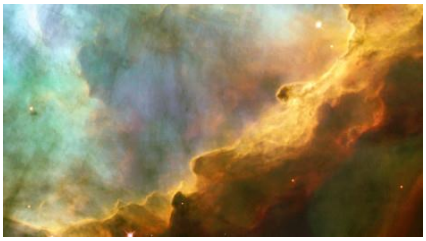
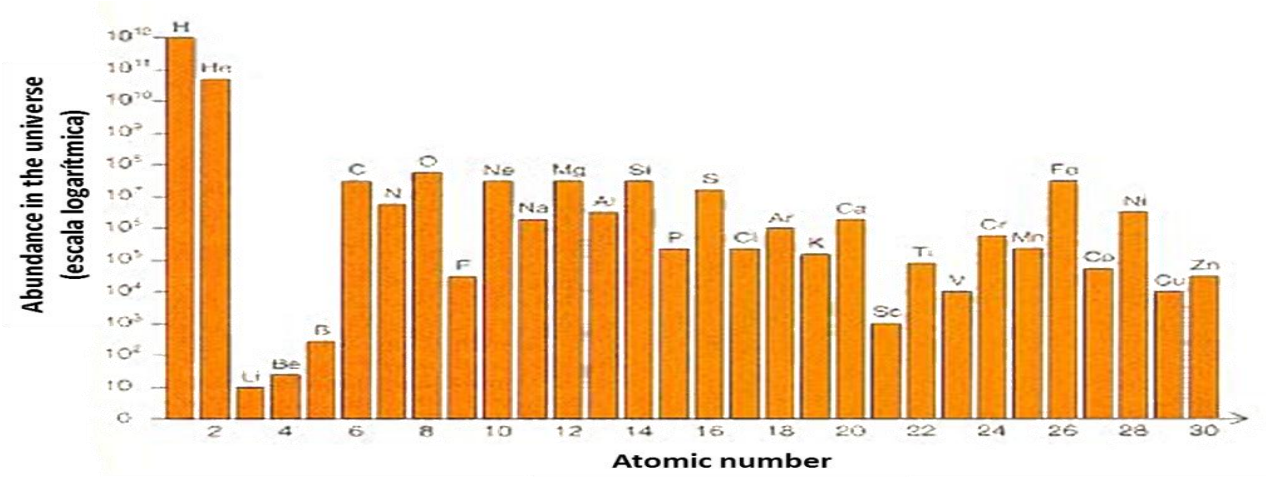
THE GASEOUS STATE OF MATTER



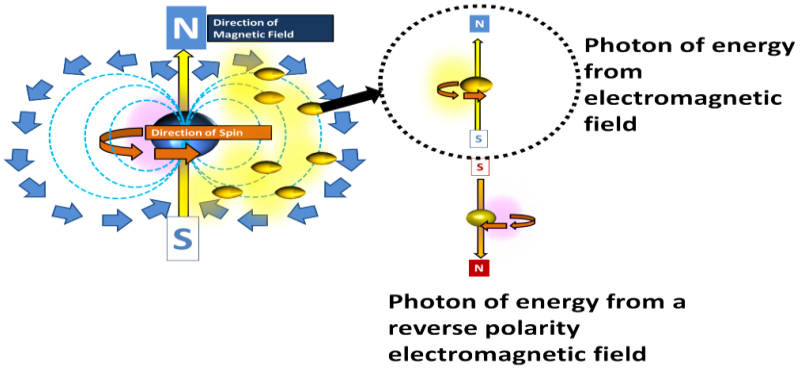
The “gaseous state” of matter is a form of matter in which the particles are in a high state of energy, which causes them to vibrate rapidly, experiencing a strong repulsion among them, and tend to separate the most possible with a vectorial displacement of high speed towards random directions.

The gaseous state, along with the plasma state, is the most abundant state of matter in the universe, with some traces of solid matter, because most of matter is mainly Hydrogen and Helium.



Gas particles change their direction by gravity, by the interaction with other particles (of the same gas, other gases, other objects or their container) with electromagnetic fields, or with any other form of external energy.

Gas particles electromagnetically charged with the same polarity are repelled, while charged particles with opposite polarity are attracted.



The gaseous state is recognized as a state of matter between the liquid state (lower energy levels) and plasma (higher energy levels). Because the gas particles are widely spaced apart, they have weaker intermolecular forces among them than liquids and solids.

When gas particles lose energy in form of heat, they might be condensed or liquefied and will become liquids.

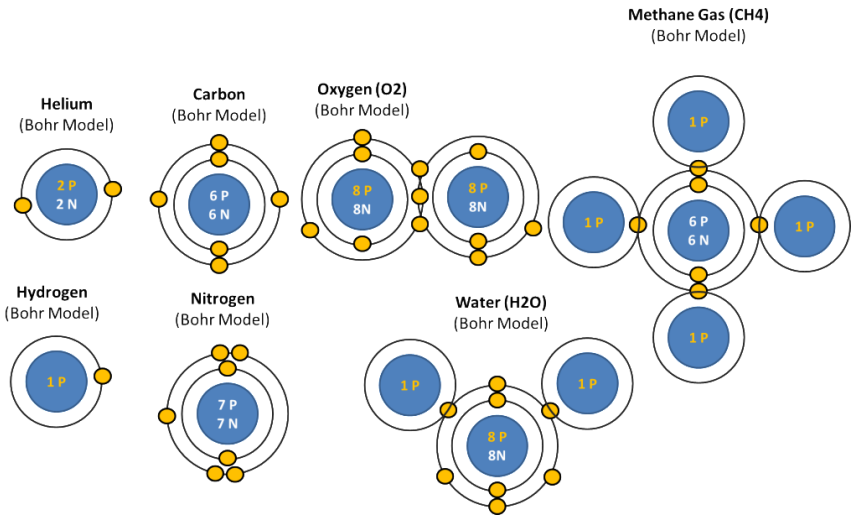
On the other hand, if the gas particles increase their energy level, hence its vibration, they might lose their electrons (ionize) and will change the state of matter called plasma.

Gaseous particles are practically free and have a high energy level sufficient to retain its electrons and possibly make interactions with other particles, usually to react or slide through them, so it is said that matter in gaseous state flows from areas of higher pressure to areas of lower pressure.

The behavior of a gas varies according to the properties of its nuclei structure, its particle symmetry, its size, atomic mass, the amount of kinetic energy in its particles, the characteristics of its electromagnetic charge, the electrostatic field, and their electromagnetic linkages with other particles (in case of compounds).

The simpler the molecular structure of a gas particle its behavior is more predictable, (monatomic noble gases such as helium or simple compounds like

methane natural gas) because their behavior is closer to an “ideal gas”. Gases such as butane gas, due to more complex molecular composition have less than an ideal behavior, so in order to describe their behavior it is required to do more complex considerations.



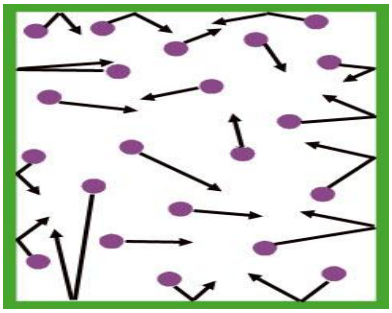
At ambient temperature and pressure in the Earth, examples of gases may be elements such as hydrogen, oxygen, nitrogen, chlorine, fluorine and the noble gases, but can also be compounds such as carbon dioxide, nitrogen dioxide, ozone, propane or mixtures as air.

If a gas is not confined, their particles will spread as rapidly as possible into space (not to infinity) without a definite shape until they lose enough kinetic energy by interaction with other electromagnetic fields or collisions with other particles, which change its course or allow their condensation.

The temperature of any physical system is related to the motion of the particles that compose it.

The speed of a gaseous particle is proportional to its quantity of heat energy. The gas temperature is measured in relation to the average kinetic energy of its moving particles.

By adding energy as heat to the gas particles, they increase their kinetic energy, so their speed and vibration, increasing the possibility of interactions and collisions with the walls of the container (in other words, the pressure in the vessel increases, and if the vessel is flexible, its volume will increase) and other particles around (increasing its reactivity).

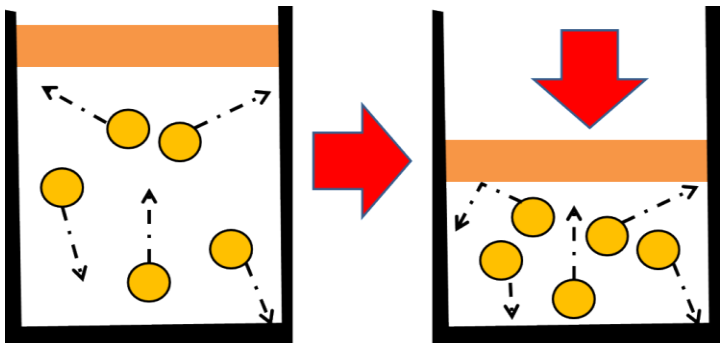


Due to the large repulsion between the particles in a gas, they will tend to separate, thus leave large gaps between them, allowing confined gases to be easily compressed.

The term “gas pressure” refers to the average force per unit area exerted by the gas on the surface of its container.

The gas molecules collide elastically with each other and against the walls of the containing vessel, exerting constant pressure on it.

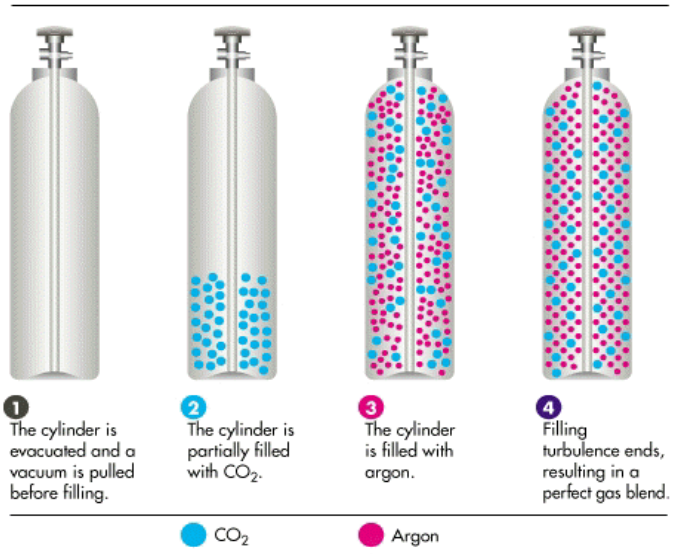
The pressure is the sum of the normal component of force exerted by the particles impacting on the walls of the container divided by the surface area of the wall.



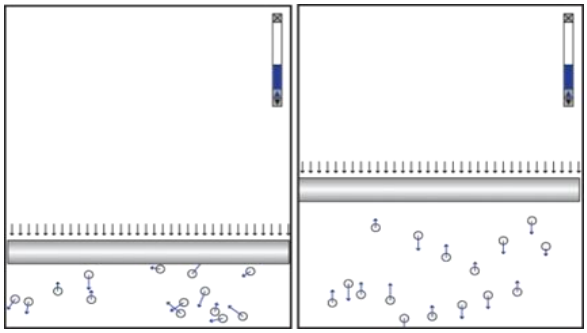
When a gas particle has a magnetic charge or intermolecular force, it will gradually influence each other as the volume between them is reduced by an external force.

Gravity acts on particles of gases. Its influence will always act, because gas particles are composed of matter, but it will be only noticeable when its particles form a certain volume of gaseous mass, and as their electromagnetic charges are canceled by reverse polarity.

Gases are chemically reactive because their particles are in continuous movement, collide with each other, facilitating contact and possible interaction with other substances. This circumstance makes difficult to find pure gases in nature.



If a gas is contained, regardless of the amount of substance in the container, the particles will tend to be distributed and occupy the entire space at high speed and take the shape of the container, with a uniform density, even in the presence gravity.



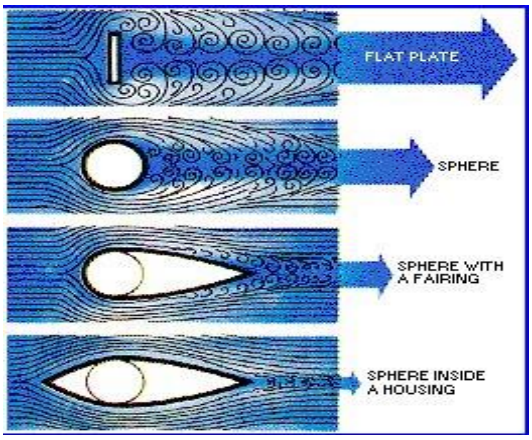
The behavior of gases in a closed system is related to the pressure, volume and temperature similar to a variety of conditions so to understand their behavior, people made simplified models that relate these variables, establishing an “ideal gas” .

In general, it is said that the gas volume will be inversely proportional to the pressure in the vessel.

If the pressure remains constant, the volume occupied by the gas will be directly proportional to its temperature.

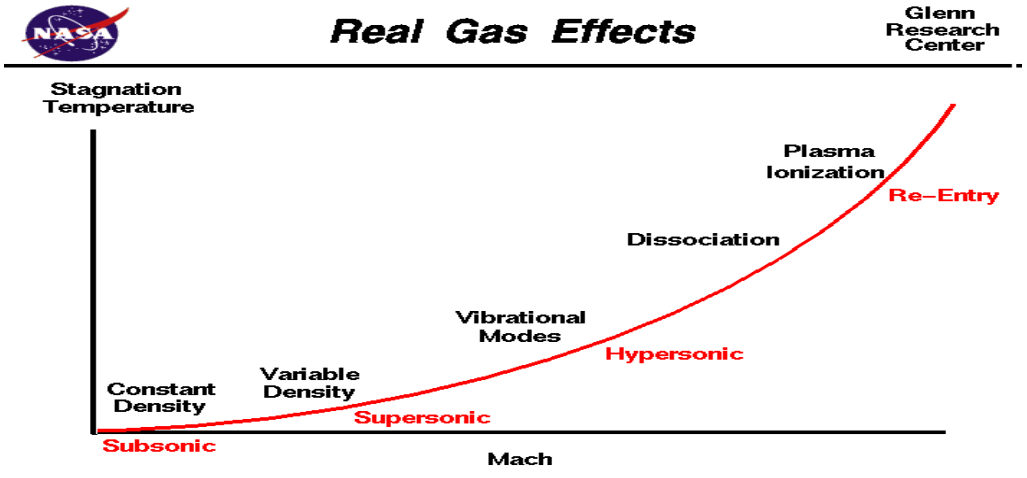
At constant volume, the pressure of a gas is directly proportional to its temperature.

Gases have low density and low viscosity. The viscosity of the gases occurs as they may adhere to other molecules forming a layer on the surface of a moving object and sliding through it, generating resistance and friction.



On the surface of the moving object, the gas particles will adhere to it statically, adding to the shape of the object and forming a new shape and a new surface which will interact with the rest of the molecule as the body approaches to the gas particle.

This behavior changes with respect to the speed of the moving object.



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