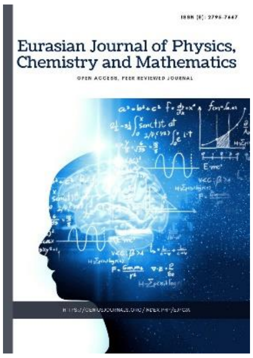


Status Equation and Laws of Ideal Gas

Jurayeva Shakhnoza Akmal qizi

Karshi State University, Faculty of Physics, Physics, 3rd year student, Uzbekistan, Karshi

ABSTRACT

In molecular physics, the equations and laws of the ideal gas have a special place. This article provides detailed information on the equations and laws of the ideal gas, which embody the empirical laws of gas.

Keywords: molecular physics, molecular physics, ideal gas

The equation of state of an ideal gas. Before we study the equation of state of an ideal gas, let us understand what the concept of an ideal gas is.

A gas that has the properties of a set of non-interacting material points is called an ideal gas, meaning that its molecules do not interact at all. This does not take into account the specific volumes of the molecules that make up the gas.

Now we learn about the equation of state of an ideal gas. The macroscopic parameters of an ideal gas determined by its pressure P, volume V, temperature T, mass m, and molar mass μ. These parameters are interrelated. Let us look at some of these parameters first.

The pressure of a gas is P, which is two-thirds of the average kinetic energy of gas molecules per unit volume, which sometimes called the "basic equation of the kinetic energy of an ideal gas."

$$p = \frac{2}{3} n \frac{m\bar{v}^2}{2}$$

Temperature T is a quantity that characterizes the state of heat equilibrium, and its unit is kelvin (K). We know that sometimes we measure temperature in degrees Celsius (°C). They interconnected as follows:

T = t + 273.15

The above quantities are called gas pressure P, temperature T and volume V of a given gas, state parameters. Each of these quantities is a function of the other two, and these three quantities called the equations of state, and are:

F (P, V, T) = 0 (1)

If the equation of state known, we can find the third through knowing the two parameters. We can also derive the equation of state for ideal gases from the basic equations of kinetic theory.

P = NKT (2)

If we replace n here with n = N / V (number of N-molecules), then

p = N / V KT (3)

Will be this equation, which includes all three parameters of the gas state, called the equation of state for ideal gases. If we express N as the amount of substance n, then N = NN_A

PV = NN_A KT (4) arises. In this case NIA k = R = 8.31 J / (MOL * K) is called a universal gas constant. So,

PV = NRT (5)

Will be made it easier, we use the formula n = M / m instead of n

PV = M / m RT (6)

This equation formed. Equation (6) called the Claperon-Mendeleev equation. This equation for one mole of gas (M = μ) is:

$$PV = RT \quad (7)$$

Laws of Ideal Gas: We study the laws of ideal gas using the equation of state for an ideal gas. When a macroscopic parameter of a given gas does not change, the process that describes the relationship in the rest called an isothermal process. Now let us get acquainted with the following processes:

1. Isothermal process or Boyle-Marriott law. The process by which the temperature of an ideal gas does not change is called an isothermal process (T = CONST).

$$PV = CONST$$

This formula, called the isotherm equation, discovered experimentally by the English scientist R. Boyle in 1662 and by the French physicist E. Marriot in 1676. This law called Boyle-Marriott's law. According to this law, the volume given at a constant temperature is inversely proportional to the pressure. This condition determined by the isothermal compressibility, and it is as follows for the isothermal process:

CH= -1 / V (DV / DP) = 1 / P

The isotherm graph is the relationship of p to V, whose lines are hyperbolas.

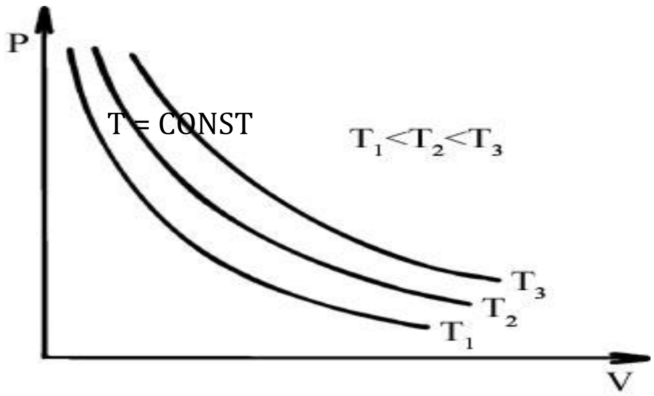


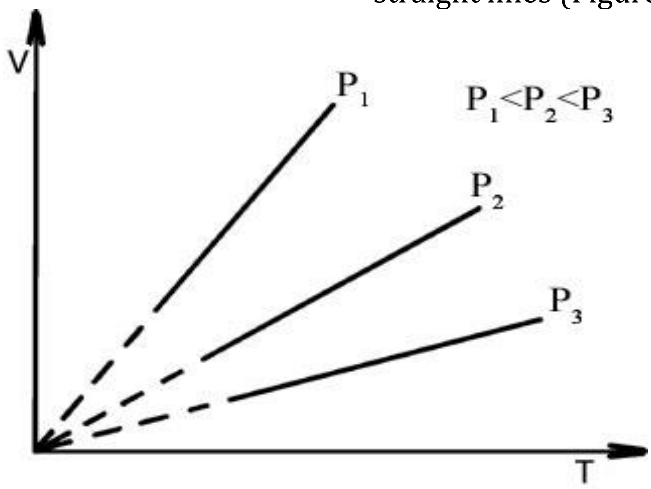
Figure1. Isotherm graphs

Isothermal processes observed mainly in the boiling of liquids and the melting of solids.

2. Isobaric process or Gay-Lussac law. The process by which the pressure of an ideal gas does not change is called an isobaric process (P = CONST).

V / T = CONST

This formula, called the Isobara equation, discovered by the French scientist Gay-Lussac V in 1802. Therefore, this law called the Gay-Lussac law. According to this law, the volume of a gas supplied at constant pressure is directly proportional to the temperature. The isobar graph is the connection of V to T, whose lines are straight lines (Figure 2).



Picture2. Isobar graphs

Isobaric processes can be seen mainly in the example of a rare gas in a moving piston cylinder.

3. The isochoric process or Charles law. The process by which the volume of an ideal gas does not change is called an isochoric process (V = const).

P / T = const

According to this process: the pressure of a given gas at a constant volume is directly proportional to the temperature.

The isochore graph is the relationship of P to T, whose lines are straight lines (Figure 3).

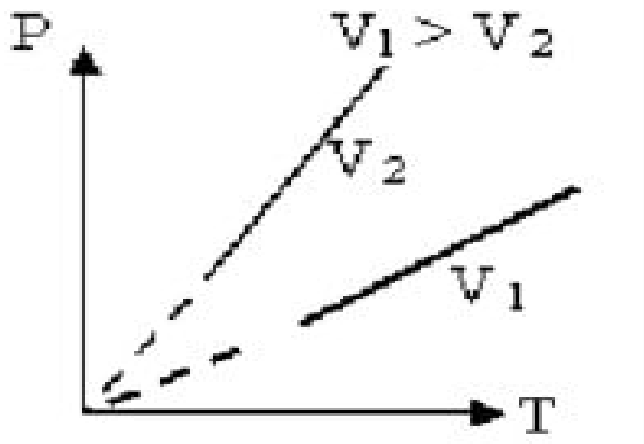


Figure1. Isoxor graph

In an isochoric process, as in an isothermal process, there is a thermal coefficient of pressure, which is the inverse of temperature. It is as follows:

b = -1 / P (DP / DP) = 1 / T

Dalton's law. Using this law, we can determine the pressure of a mixture of gases. Suppose that a container of volume V contains a mixture of different gases that do not react with each other. If the number of molecules of different gases in the mixture is N_1, N_2 〖, ……..N〗 _i, then the equation of state is

PV = (N_1 + N_2 + ⋯ + NI) KT

This expression

p = N_1 / V KT + N_2 / V KT + ⋯ + N_I / V KT

p_1 = N_1 / V KT, P_2 = N_1 / V KT …… PI = N_1 / V KT

If we take into account the equality, then we have the following expression:

P = P_1 + P_2 + ⋯ + P_I

This expression estimated by the mathematical expression of Dalton's law and it defined as follows: the pressure of a gas mixture on the vessel wall is equal to the partial sum of the gas components.

In short, the equation of the state of an ideal gas is the basis of molecular kinetic theory. We have studied the laws of ideal gas based on the ideal gas state equation above. Using these laws, a number of physical processes related to molecular physics analyzed. By studying the theoretical part of these processes, we can perfectly perform these processes in practice in the laboratory. The above formulas used effectively in laboratory work and research.

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