Study of Gas Laws

1. **How can we differ Gas from Solid and Liquid?**
   Ans. The gases differ from Solid and liquids in the following ways:

Properties	Solid	Liquid	Gas
Shape and Volume	Have a definite shape and definite volume.	Do not have definite shape but have a definite volume.	Do not have a definite shape or definite volume.
Position of Molecules	The Molecules of Solid can occupy a fixed position due to its fix volume.	The Molecules of liquid can occupy a fixed position due to its fix volume.	The molecules of gas move constantly in straight line in all direction and occupy the entire space of container.
Intermolecular Force	Maximum	Less than Solid but greater than Gas	Very less
Intermolecular Force	Very less	Less than Solid but greater than Gas	Far larger.

2. **Write Some characteristics of Gas.**
   Gases have following characteristics
   a. Gases have neither fixed volume nor fixed shape.
   b. Gases exert same pressure in all direction.
   c. Gases are highly expandable.
   d. Gases have low density.
   e. Gases have a very high rate of intermixing and diffusion.

3. **Define Boyle's Law**
   Ans. Boyle's law, also referred to as the **Mariotte's law**.
   It states that:
   "The absolute pressure exerted by a given mass of an ideal gas is inversely proportional to the volume it occupies, if the temperature and amount of gas remain unchanged within a closed system."
   Mathematically, Boyle's law can be stated as:

   $P \propto \frac{1}{V}$ Pressure is inversely proportion to the volume.

   Or **PV=K**

   Where P is the pressure of the gas, V is the volume of the gas, and k is a constant.

   The equation states that the product of pressure and volume is a constant for a given mass of confined gas and this holds as long as the temperature is constant. For comparing the same substance under two different sets of conditions, the law can be usefully expressed as:

   $P_1V_1=P_2V_2$

4. **How is molecular motion related with temperature?**
   Ans. Temperature affects the kinetic energy of molecules. So, molecular motion is directly proportional to temperature.

5. **Define Charles' Law.**
   Ans. **Charles's law** (also known as the **law of volumes**) is an experimental gas law that describes how gases tend to expand when heated.

   A modern statement of Charles's law is:
   When the pressure on a sample of a dry gas is held constant, the Kelvin temperature and the volume will be in direct proportion.

   This relationship of direct proportion can be written as:

$$V \propto T$$

   So this means:

$$\frac{V}{T} = k, \quad or \quad V = kT$$

   Where:
   V is the **Volume of the gas**,
   T is the **temperature of the gas** (measured in kelvins),
   and **K** is a **non-zero constant.**

   This law describes how a gas expands as the temperature increases; conversely, a decrease in temperature will lead to a decrease in volume.
   For comparing the same substance under two different sets of conditions, the law can be written as:

$$\frac{V_1}{T_1} = \frac{V_2}{T_2} \quad \text{or} \quad \frac{V_2}{V_1} = \frac{T_2}{T_1} \quad \text{or} \quad V_1 T_2 = V_2 T_1 .$$

   Charles Law also stated:
   The volume of a fixed mass of dry gas increases or decreases by $1/273$ times the volume at 0 °C for every 1 °C rise or fall in temperature. Thus:

$$V_T = V_0 + (\frac{1}{273} \times V_0) \times T$$

$$V_T = V_0(1 + \frac{T}{273})$$

   Where V_T is the volume of gas at temperature T, V_0 is the volume at 0 °C.

6. **What is Absolute Zero Temperature?**
   Ans. The temperature of -273^0C is called Absolute Zero Temperature, because theoretically at this temperature the volume off the gas becomes 0 cc. But practically all the gases liquefy or solidify before reaching this temperature.

7. **What is Absolute Scale of temperature?**
   Ans a temperature scale with absolute Zero as its starting point is known as Absolute Scale or Kelvin Scale.

8. **What is Gas Equation?**
   Ans. A mathematical equation used in calculating the change in volume when the temperature and pressure of an enclosed gas simultaneously change is called Gas Law.
   Mathematical Expression

   Let **V** is the **Volume of the gas**,
   T is the **temperature of the gas** (measured in kelvins),
   P is the **pressure of the gas**

   Applying Boyles' Law

$$P \propto \frac{1}{V}$$

   When temperature T is constant

   Applying Charles' Law

$$V \propto T$$

   When Pressure P is Constant.
   Combine both of them

   V= $K\frac{T}{P}$ Where K is a Constant
   OR, $\frac{PV}{T} = k,$

   If Initial Volume is V_1 when Pressure is P_1 and Temperature is T_1
   And Final Volume is V_2 when Pressure is P_2 and Temperature is T_2

   Then $$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}.$$