Boyle's law.

(1) In 1662, **Robert Boyle** discovered the first of several relationships among gas variables (P, T, and V).

(2) It states that, "For a fixed amount of a gas at constant temperature, the gas volume is inversely proportional to the gas pressure."

Thus, $\boxed{P \propto \frac{1}{V}}$ at constant temperature and mass

or $P = \frac{K}{V}$ (where K is constant)

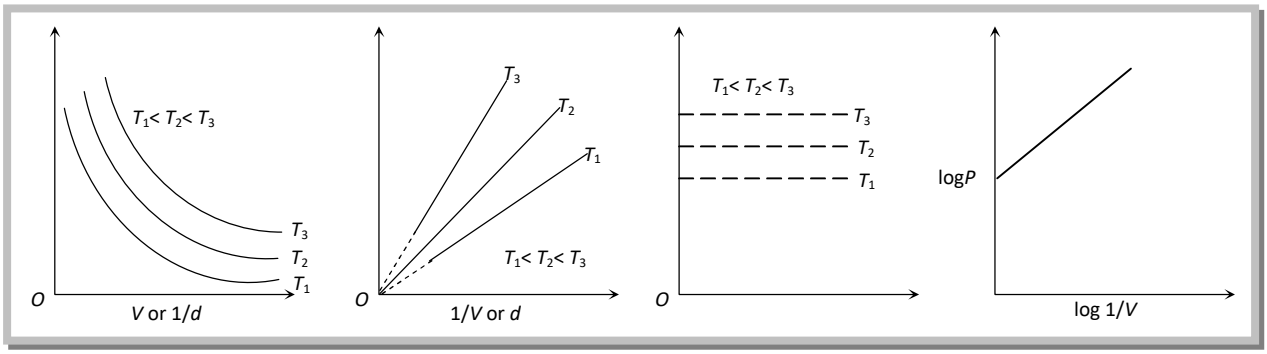
or $PV = K$

For two or more gases at constant temperature and mass.

$P_1 V_1 = P_2 V_2 = \ldots\ldots = K$

Boyle's law can also be given as, $\left(\frac{dP}{dV}\right)_T = -\frac{K}{v^2}$

(3) **Graphical representation of Boyle's law:**Graph between P and V at constant temperature is called **isotherm** and is an equilateral (or rectangular) hyperbola. By plotting P versus $\frac{1}{V}$, this hyperbola can be converted to a straight line. Other types of isotherms are also shown below,



Note: The isotherms of CO_2 were first studied by Andrews.

(4) At constant mass and temperature density of a gas is directly proportional to its pressure and inversely proportional to its volume.

Thus, $\boxed{d \propto P \propto \frac{1}{V}}$ $\left[\because V = \frac{\text{mass}}{d}\right]$

or $\boxed{\frac{d_1}{d_2} = \frac{P_1}{P_2} = \frac{V_2}{V_1} = \ldots\ldots = K}$

(5) At altitudes, as P is low d of air is less. That is why mountaineers carry oxygen cylinders.

(6) Air at the sea level is dense because it is compressed by the mass of air above it. However the density and pressure decreases with increase in altitude. The atmospheric pressure at Mount Everest is only 0.5 atm.