Measurement of the saturated vapor pressure of a rapidly evaporating liquid such as alcohol

Introduction

If we place a small amount of a rapidly evaporating liquid in the space confined above the surface of the mercury in the mercury barometer, the liquid evaporates, and this vapor decreases. The level of mercury in the barometer because the liquid vapor has pressure on the walls of the container it contains due to the collision of its molecules with the walls of the container, as is the case with the pressure of gases, and this pressure reaches a maximum. In the state of satisfaction. If we take a barometer and read the atmospheric pressure on it, then insert a drop of a rapidly evaporating liquid (alcohol) into it, we find that this drop rises in the barometer tube, floats on the surface of the mercury, and evaporates immediately. If we insert other drops, we notice that the surface of the mercury in the barometer decreases, which indicates that the liquid vapor has a pressure. If it happens that one of the drops of alcohol floats on the surface of the mercury and does not evaporate, this is evidence that the space has been saturated with alcohol vapor. The amount of decrease in the mercury column in this case indicates the amount of pressure of the saturated vapor, and it increases with increasing temperature and reaches the boiling point. Then, to the boiling point, the vapor pressure is Saturated is equal to atmospheric pressure.

Theory

It is known that the volume of a gas is inversely proportional to the pressure with constant temperature, which is known as Boyle's Law

Total pressure at a point (X) = atmospheric pressure + liquid column pressure

The part confined above the surface of mercury contains air + liquid vapor (alcohol.)

The total pressure is equal to the atmospheric pressure (P) and the pressure of a column of mercury (h) so it is

$P + h = A + S$---------(1)

But the air pressure (A) is inversely proportional to the volume (V) and therefore inversely proportional to (L) i.e. (K) is constant

$$A \propto \frac{1}{L}, A = \frac{K}{L}$$

The vapor pressure (S) is constant with constant temperature, and therefore equation No. 1 will be in the following form

$P + h = \frac{K}{L} + S$--------(2)

$OR \quad h = \left(\frac{K}{L}\right) - (P - S)$-------(3)

How it works

1- We draw a graph between the values of (h) and (1/L) and find the value of (P_t) from the graph

2- We calculate the saturated vapor pressure from the following equation

$P_t = P_\circ + S$--------(4)

Where ($P_\circ$) represents atmospheric pressure and is equal to76 cm.Hg