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Seg I Chem. Hons Paper - I

Topic :- Gaseous state

Deviation from Ideal behaviour :-

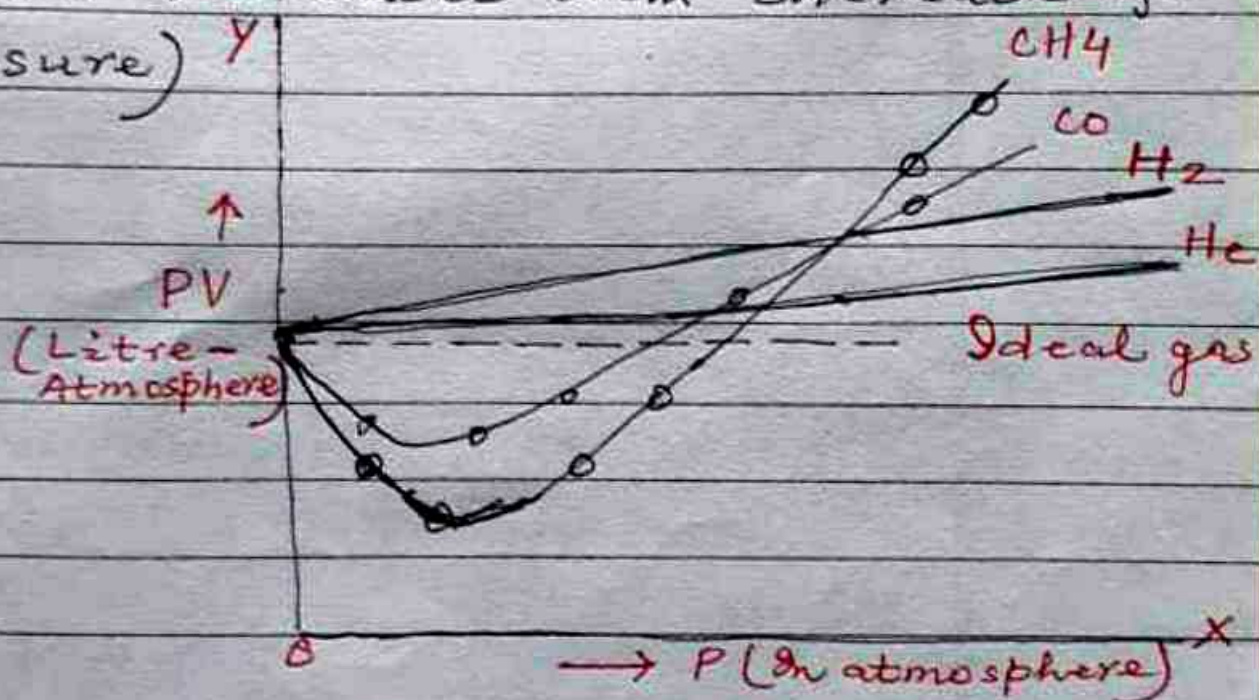
$PV = RT$  for 1 mole gas is called Ideal gas equation. Experiments have shown that no real gases actually obey this equation. They only approach this behaviour if Pressure is low and temperature is high. In the reverse condition i.e. if Pressure is high and temperature is low deviation occurs from Ideal behaviour.

The most easily liquefiable and highly soluble gases show maximum deviations such as  $\text{NH}_3$ ,  $\text{CO}_2$ ,  $\text{SO}_2$  etc. These gases show more deviation in comparison to  $\text{H}_2$ ,  $\text{N}_2$  and  $\text{O}_2$ .

Deviation from Boyle's Law :-

Amagat Plotted the values of  $PV$  against  $P$  at constant temperature (Isotherm) for various gases at  $0^\circ\text{C}$ . If Boyle's law, is obeyed, the value of  $PV$  for a given quantity

Of a gas should be constant at all pressures and the graph should be straight horizontal as shown by dotted line. But this is only an ideal behaviour which no real gases will show. CO and CH<sub>4</sub> gases are more compressible at low pressure than required by the Boyle's law i.e. (PV decreases with increase of pressure)



Isotherms of different gases at 0°C.

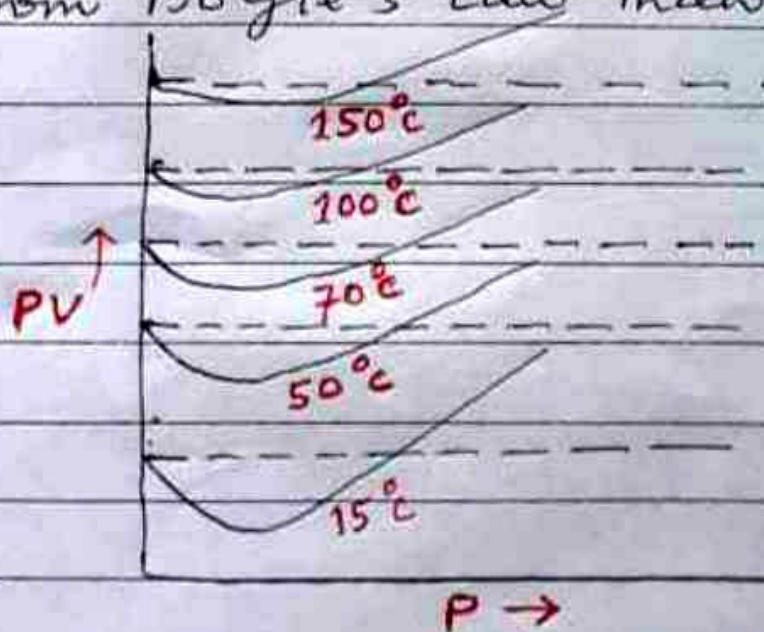
PV decreases with increase in pressure till PV passes through a minimum.

With further increase of pressure, the compressibility is less than expected

(ie  $PV$  increases with increase of Pressure) and this continue throughout

$H_2$  and  $He$  are less compressible than required by the law. But if temperature is  $-80^\circ C$  or less,  $H_2$  also gives a similar curve to that of  $CH_4$  and  $CO$ . This temperature is known as inversion temperature.

The easily liquefiable gases such as  $CO_2$ ,  $NH_3$ ,  $SO_2$  and  $Cl_2$  show even more pronounced deviation from Boyle's Law than  $CO$  and  $CH_4$



(Plot of  $PV$  against  $P$  for  $N_2$  at different temp)

The deviation, however, decreases with ~~with~~ rise in temperature. This shows that Boyle's Law is valid at low Pressure and high temperature.