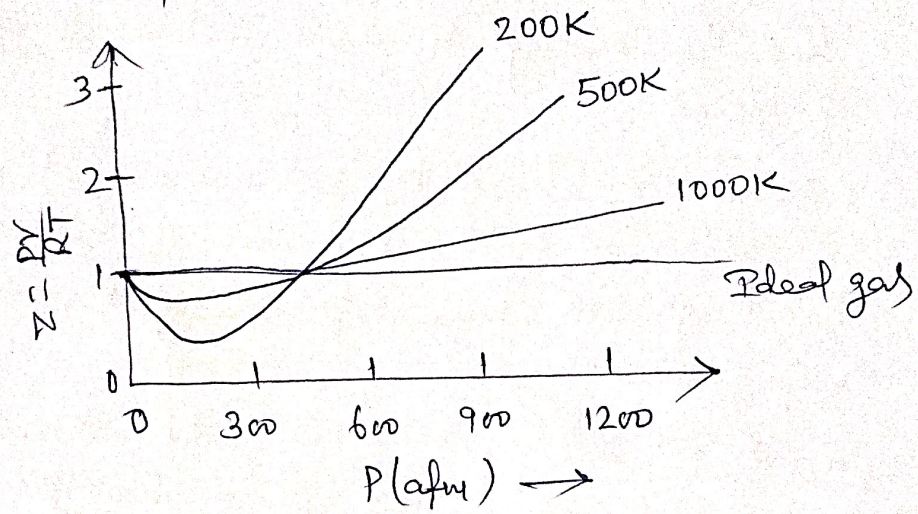
UG SEM II (MJC-2T) Physical chemistry
1. Gaseous state

Deviation of Real Gases from Ideal Behaviour:

→ (ii) Effect of temperature: Fig. below shows plot of Z against P at different temperature for N_2. It is clear from the plot that at low temperature deviation is more and at high temperature the gas tends to become ideal.



- As the temperature rises, the deviations from ideal gas behaviour become smaller and smaller.
- At lower temperatures the curve dips significantly, and the slope of the curve is negative. In this situation, $Z < 1$.
- As the temperature rises, the dip in the curve decreases. The curve's minimum vanishes at a certain temperature and remains horizontal for a wide range of pressures. At this temperature, PV/RT is nearly equal, thus Boyle's law is satisfied. As a result, Boyle's temperature refers to the temperature of the gas.

→ Important facts to remember:

- Real gases perform approximately ideal at low pressures and relatively high temperatures, and the ideal-gas

equation is obeyed.

- A real gas deviates greatly from ideality at low temperatures and sufficiently high pressures, and the ideal gas equation is no longer valid.
- As the gas approaches the liquefaction point, the departure from ideal behaviour grows.

→ Causes of deviation:

The Causes of deviations from ideal behaviour may be due to the following two assumptions of Kinetic theory of gases -

(i) The Volume occupied by gas molecules is negligibly small as Compared to the Volume occupied by the gas.
(ii) The forces of attraction between gas molecules are negligible.

(i) Volume of gas molecules: The first assumption is valid only at low P and high T, when the Volume occupied by the gas molecules is negligible as Compared to the total volume of the gas. But at low T or at high P, the molecules being in Compressible the Volumes of molecules are no more negligible as Compared to the total volume of the gas. This means that the actual volume occupied by the gas is slightly less than the Volume of the Container.

(ii) Intermolecular forces: The second assumption is not valid when P is high and T is low. But at high P or low T when the total Volume of gas is small, the forces of attraction become appreciable and Can't be ignored. Thus, in real gases, there are attractive and repulsive forces between gas molecules, which affect the behaviour of the gas. The attractive forces between gas molecules Cause the gas molecules to be attracted to each other, which reduces the pressure of the gas. The repulsive forces between gas molecules Cause the gas molecules to repel each other, which increases the pressure of the gas.