

The critical state.

(1) A state for every substance at which the vapor and liquid states are indistinguishable is known as critical state. It is defined by critical temperature and critical pressure.

(2) **Critical temperature (T_c)** of a gas is that temperature above which the gas cannot be liquified however large pressure is applied. It is given by, $T_c = \frac{8a}{27Rb}$

(3) **Critical pressure (P_c)** is the minimum pressure which must be applied to a gas to liquify it at its critical temperature. It is given by, $P_c = \frac{a}{27b^2}$

(4) **Critical volume (V_c)** is the volume occupied by one mole of the substance at its critical temperature and critical pressure. It is given by, $V_c = 3b$

(5) **Critical compressibility factor (Z_c)** is given by, $Z_c = \frac{P_c V_c}{RT_c} = \frac{3}{8} = 0.375$

A gas behaves as a Vander Waal's gas if its critical compressibility factor (Z_c) is equal to 0.375.

Note: A substance in the gaseous state below T_c is called vapor and above T_c is called gas.