

Task:

the vanderwalls constant b for a real gas is 0.02788 lit/mole .calculate the radius of molecule?

Solution:

The vanderwalls constant b is the actual volume of 1 mol of molecules. According to Avogadro law 1 mol of gas at STP contains 6.02×10^{23} molecules.

From the data given:

The volume of 1 mol of gas is 0.02788 L

1 mol contains $6.02 \cdot 10^{23}$ molecules.

The volume of 1 molecule $V = V(1 \text{ mol}) / (6.02 \cdot 10^{23}) = 0.02788 / (6.02 \cdot 10^{23}) = 4.63 \cdot 10^{-26} \text{ L} = 4.63 \cdot 10^{-29} \text{ m}^3$

$V(\text{molecule}) = \frac{4}{3} \cdot \pi \cdot r^3$, where r - radius of molecule

The radius of molecule is

$$r = [4V / (3 \cdot 3.14)]^{1/3} = 2.70 \times 10^{-10} \text{ m} = 0.27 \text{ nm}$$

Answer: r = 0.27 nm