① We know $\lambda = \frac{1}{\sqrt{2}\pi\sigma^2 n}$, $m = 6 \times 10^{-24}$ gm

$\rho = 0.178$ gm/cc

as $mn = \rho$

or $n = \rho/m = \frac{0.178}{6 \times 10^{-24}} = 29.7 \times 10^{18}$ /cc.

$\lambda = 28.5 \times 10^{-6}$ cm.

$\therefore \sigma^2 = \frac{1}{\sqrt{2}\pi n \lambda} = \frac{1}{\sqrt{2} \times 3.14 \times 29.7 \times 28.5} \times 10^{-12}$

$\therefore \sigma = 1.63 \times 10^{-8}$ cm.

② $\lambda = \frac{1}{\sqrt{2}\pi\sigma^2 n}$, ~~$\sigma^2 = \frac{1}{\sqrt{2}\pi n \lambda}$~~

~~$= \frac{1}{\sqrt{2} \times 3.14 \times}$~~

$P = nK_BT$.

$\therefore n = P/K_BT = \frac{76 \times 13.6 \times 981}{1.38 \times 10^{-16} \times 273} = \ldots$

$\lambda = \frac{1}{\sqrt{2}\pi\sigma^2 n} = \frac{1.38 \times 10^{-16} \times 293.15}{\sqrt{2}\pi \times 9 \times 10^{-16} \times 76 \times 13.6 \times 981}$

$= 9.29 \times 10^{-6}$ cm.

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③ $\lambda = \frac{1}{\sqrt{2}\pi\sigma^2 n}$

$\therefore \sigma^2 = \frac{1}{\sqrt{2}n\pi\lambda} = \frac{1}{\sqrt{2}\, 2.79 \times 10^{25} \times 3.14 \times 2.2 \times 10^{-8}}$

$\sigma^2 = 0.036 \times 10^{-17}$, $\sigma = 0.06 \times 10^{-8}$ m

$= 6.055 \times 10^{-10}$ m