Solution - Assignment - 1

Q-1 Sol^n Already we have velocity distribution Acc. to Maxwell's.

$$N(v)\,dv = 4\pi N(m/2\pi kT)^{3/2} v^2 \exp(-mv^2/2kT)\,dv \longrightarrow (1)$$

Put $E = \frac{1}{2}mv^2 \longrightarrow (2)$

$$dE = mv\,dv$$

using, then we have

$$\underline{N(E)\,dE = \frac{2\pi N E^{1/2}}{(\pi kT)^{3/2}} \exp\left(-\frac{E}{kT}\right) dE}$$

Q-2

Sol^n We know that velocity distribution

$$N(v)\,dv = 4\pi N(m/2\pi kT)^{3/2} v^2 \exp\left(-\frac{mv^2}{2kT}\right) dv \longrightarrow (1)$$

~~Let $\frac{mv^2}{2kT} = x$~~ $\Rightarrow \left[\frac{1}{2}mv_p^2 = kT\right]$

~~Then $mv^2 = x\,dx$.~~

~~$\Rightarrow v\,dv = \frac{kT}{m}dx$.~~

$$\therefore\ v_p = (2kT/m)^{1/2} \longrightarrow (2)$$

Let $\frac{v}{v_p} = \alpha \longrightarrow (3)$

$dv = v_p\,d\alpha$

using (2) and (3), and then $N(\alpha)\,d\alpha = \frac{4N}{\sqrt{\pi}}\alpha^2\exp(-\alpha^2)d\alpha$

$$\boxed{N(\alpha)\,d\alpha = \frac{4N}{\sqrt{\pi}}\alpha^2\exp(-\alpha^2)\,d\alpha}$$

and.

we have

$$\langle \frac{1}{v} \rangle = \frac{1}{N} \int_0^\infty \frac{1}{v} n(v)\, dv$$

$$= \frac{1}{N} \int_0^\infty \frac{1}{v} 4\pi N \left(\frac{m}{2\pi kT}\right)^{3/2} v^2 \exp\left(-\frac{mv^2}{2kT}\right) dv$$

Let $\frac{mv^2}{2kT} = x$

$v\,dv = \frac{kT}{m} dx$

$$\therefore \langle \frac{1}{v} \rangle = \left(2m/\pi kT\right)^{1/2} \int_0^\infty \exp(-x)\, dx$$

$$\langle \frac{1}{v} \rangle = \left(2m/\pi kT\right)^{1/2}$$