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CHAPTER 1

Q. 1.1

~~The time interval after the time 't' is~~

~~$t \to 2t$.~~

The Probability for the collision in the time interval 't' is given by Poisson distribution.

Because the number of movements can be infinite but the no. of collision is low.

The poisson distribution is

$$P(n) = \frac{\lambda^n e^{-\lambda}}{n!}$$

where $\lambda : Np$.

N: no. of trials. (Here it is one $\Rightarrow N=1$)

p: probability for success.

$$p = \int_0^t \frac{dt}{\tau} = \frac{t}{\tau}.$$

$$\lambda = 1 \times t/\tau.$$

In the time 't' there should be zero collisions.

$\Rightarrow n = 0.$

$$P(0) = \frac{(t/\tau)^0 e^{-t/\tau}}{0!} = \underline{\underline{e^{-t/\tau}}}$$

In the next 't' seconds,

$$p = \int_t^{2t} \frac{dt}{\tau} = \underline{\underline{t/\tau}}$$

So during the next second 't' it will have no collision with the same probability.

b) probability of collision should be in the time interval t and $t+dt$.

$\Rightarrow$ probability $= \int_0^t$ (Probability for no collision) $\times \int_t^{t+dt}$ probability for collision.

$$= e^{-t/\tau} \times \frac{dt}{\tau}$$

c) The probability for a collision in the time interval 't' is $\frac{t}{\tau}$.

Also the mean of poisson distribution is $\lambda = \frac{t}{\tau}$.

There is only one collision in the interval 't'

$$\Rightarrow \lambda = 1 = \frac{t}{\tau}$$

$$\Rightarrow t = \tau$$

~~d) Con~~

1·3 Energy lost in the second collision is proportional to the energy of the electron after the first collision at a distance $(r-d)$ and also the number of electrons.

$$\text{Energy lost} \propto n \times \mathcal{E}[T(r-d)]$$

let ~~$\propto n v$~~ $d = v\tau$.

$$\propto n v \tau \frac{d\mathcal{E}}{dT}\left(\frac{-dT}{dr}\right).$$

now $eE = \frac{mv}{\tau}$

$\Rightarrow$ velocity $v = \frac{\tau e E}{m}$.

$$\text{Energy lost} \propto \left(\frac{ne\tau}{m}\right)\frac{d\mathcal{E}}{dT}(E \cdot \nabla T).$$

1·2 a) The average energy lost to the ions in the energy of electron before collision.

$$= \frac{p^2}{2m}.$$

$$\text{Force} = eE = \frac{dp}{dt}.$$

$$p = \int dp = \int_0^t eE\,dt = eEt$$

$$\text{Energy} = \frac{(eEt)^2}{2m}.$$