Physics

Fundamental physical constants:-

1) Speed of light :- $3 \times 10^8 m/s$ // Unit :- m/s
2) Gravitational Constant (G) :- $6.674 \times 10^{-11} N\text{-}m^2/Kg^2$
   Unit :- ~~m/s~~ Newton m^2/Kg^2
3) Planck's Constant (h) :- 6.626×10^{-34} J.S
   Unit :- Joules seconds
4) Elementary Charge (e) :- 1.602×10^{-19} C
   Unit :- Coulombs (C)
5) Boltzmann Constant (K) :- 1.38×10^{-23} J/K
   Unit :- Joules/Kelvin
6) Avagadro's Number :- 6.022×10^{23}
7) Gas Constant (R) :- 8.314 J/(mol·K)
8) Electron Volt (eV) :- Conversion $1eV = 1.602 \times 10^{-19}$ J
   Units :- Joules

Important Units

1) Force = Newton [$1N = 1 Kg.m/s^2$]
2) Energy/Work = Joule [1 J = 1 N·m]
3) Power = Watt (W) [1W = 1 J/s]
4) Electric charge = Coulomb [1C = Charge of 6.242×10^{18} el.
5) Current = Ampere (A) [1A = 1 C/s]
6) Resistance = ohm (Ω) [1Ω = 1V/A]

⇒ 10^3 → Kilo	⇒ 10^9 = Giga	⇒ 10^{-2} = Centi	⇒ 10^{-6} = micro
⇒ 10^6 → Mega	⇒ 10^{12} = Tera	⇒ $\frac{1}{100}$ = 0.01	⇒ 10^{-9} = Nano
		⇒ 10^{-3} = mili	⇒ 10^{-12} = Pico

① Kirchof's

② stefan law :- $E \propto T^4$ the stefan law states that the energy is directly propotional to T^4

$$E = \sigma T^4$$

③ Wien's law :- The wavelength λm of radiation corresponding to maximum intensity is inversly propotional to the temperature T of the emitting body

$$\lambda_m \propto \frac{1}{T} \Rightarrow \lambda_m T = \text{Constant} \quad (1)$$

⇒ Wein also explained maximum energy E_m of peak emission is directly proportional to 5^{th} power of the absolute temperature

$$E_m \propto T^5 \Rightarrow E_m T^{-5} = \text{Constant} \quad (2)$$

$$E_\lambda d\lambda = C_1 \lambda^{-5} e^{-C_2/\lambda T} d\lambda \quad (3)$$

Draw back :-

It holds good for smaller values of wavelength but doesn't fit the experimental curves for higher values of λ.

The main

1. Energy is
a discreate
quanta

2. Each qu
the freq

Where h
= 6.625

3. An osc
absorbs
~~Where~~
Where
the a
absorpti

$\Rightarrow \lambda = \frac{h}{p}$

Let a

P = mV,

Assume

E=

(E

The main postulates of planK's law :-

1. Energy is absorbed or emitted by a blackbody in a discreate manner, in the form of small packets called quanta

2. Each quantum has energy that depends only on the frequency of the radiation and is given by

$$E = h\nu \text{ --- } (5)$$

Where h is a constant Known as plank's constant $= 6.625 \times 10^{-34}$ J-sec.

3. An oscillator may gain or lose energy when it absorbs or emits radiation of frequency ν given by ~~where~~

$$\nu = \Delta E / h \text{ --- } (6)$$

Where ΔE is the difference in energies of the oscillator before & after emission or absorption

De-Broglie Wavelength (λ) :-

$$\Rightarrow \lambda = \frac{h}{P} = \frac{h}{mV}$$

Let a particle has mass 'm'. moving with Velocity 'V'.

$P = mV$, wavelength can be calculated

Assume particle & wave nature:

$$E = mc^2 \rightarrow (1)$$

[Einstein]

$$E = h\nu \rightarrow (2)$$

[Plank's Law]

Compare ① & ②

$$E = mc^2 = hV$$

$$m(V\lambda)^2 = hV$$

$$mV^2\lambda^2 = hV$$

$$mV\lambda^2 = h$$

$$c = V$$

$$mV\left(\frac{c^2}{V^2}\right) = h$$

$$\frac{m\cancel{V}V^2}{V \times \cancel{V}} = h$$

$$\frac{mV^2}{V} = h$$

$$P\frac{V}{V} = h$$

$$P\lambda = h$$

$$\lambda = \frac{h}{P}$$