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 [$1J = 1N \cdot m$]
3) Power = Watt (W) [$1W = 1 J/s$]
4) Electric charge = Coulomb [1C = Charge of 6.242×10^{18} el.
5) Current = Ampere (A) [$1A = 1C/s$]
6) Resistance = ohm (Ω) [$1\Omega = 1V/A$]

⇒ 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 propootional 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 value 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 oscillates may gain or lose energy when it aborbs or emits radiation of frequency ν given by ~~Where~~

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

Where ΔE is the difference in energies of the oscillater 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]

$$E = hV \rightarrow (2)$$

[Plank's Law]

Compare ① & ②

$$E = mc^2 = hV$$

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

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

$$mV\lambda^2 = h$$

$$C = V$$

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

$$\frac{mVV^2}{V \times V} = h$$

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

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

$$P\lambda = h$$

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

Date

1. Green light has a wavelength of 525nm Determine the energy for the green light in joules

$\lambda_{Green} = 525\text{ nm} = 525 \times 10^{-9}\text{ m}$

$E = ?$ in Joule $\quad h = 6.625 \times 10^{-34}\text{ J-sec}$

$E = nh\nu \qquad c = 3 \times 10^{8}\text{ m/s}$

$\nu = \frac{hc}{\lambda}$

$\nu = \frac{c}{\lambda} \quad \frac{3}{5.5} = 0.005714$

0.03785

$$E = \frac{(6.625 \times 10^{-34} \times 3 \times 10^{8})}{525 \times 10^{-9}}$$

0.03785 x10

$= 0.0378 \times 10^{-17}\text{ J}$

$= 3.78 \times 10^{-19}\text{ J}$ //

3. Calculate the ene

$E = nh\nu$

$= 6.62$

$E = 16.5$

$E = \frac{(6 \ldots)}{525 \ldots}$

$= 0.0378 \times 10^{-17}$ J

$= 3.78 \times 10^{-19}$ J

Q. Let us assume there is a shining Blue light of wavelength 620 nm (620×10^{-9} m). How much energy does the blue light give

$\lambda_{Blue} = 620 nm$

$= 620 \times 10^{-9} m$

$E = ?$ $\quad E = nh\nu$

$\therefore E = \frac{(6.625 \times 10^{-34} \times 3 \times 10^{8})}{620 \times 10^{-9}}$

$\nu = \frac{hc}{\lambda}$

$= 0.03205 \times 10^{-17}$

$= 3.205 \times 10^{-19}$ J

$\nu = \frac{c}{\lambda}$ $\quad [c = 3 \times 10^{8} m/s]$

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Date

3. Calculate the enegy of photon with frequency 2.5×10^{15} Hz

$E = nh\nu$ $\quad h = 6.625 \times 10^{-34}$ J/sec

Or $\quad \nu = 2.5 \times 10^{15}$ Hz

$E = ?$

$= 6.625 \times 10^{-34} \times 2.5 \times 10^{15}$

$E = 16.56 \times 10^{-19}$