ARJUNA NEET BATCH

STRUCTURE OF ATOM

DPP - 03

Wave number is

(A) λ

(B) $1/\lambda$

(C) c/λ

(D) $\lambda \times v$

λ = wavelength
c = speed of light
v = velocity

Wave number ($\bar{\nu}$) : number of wavelengths per unit length (m^{-1})

$$\bar{\nu} = \frac{1}{\lambda}$$

Calculate the number of protons, electrons and neutrons in the following:
Chloride ion (Cl^-) with Z = 17, A = 35

Cl^- → Negative charge means it has gained 1 electron

Z = Atomic Number
A = mass number.

No. of protons = Z = 17

No. of electrons in neutral atom = Z = 17

" " " in negative charge ion $(-1)_{Cl^-}$ = 17 + 1 = 18

No. of neutrons = A - Z

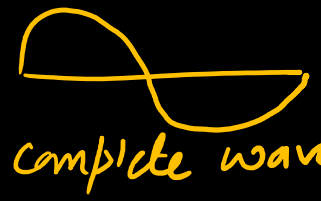
= 35 - 17

= 18

ν

Calculate the wavelength, frequency and wave number of a light whose time period is 4×10^{-8} s.

Time period (T) = Time taken by the wave for complete cycle



complete wave

c = speed of light

$c = 3 \times 10^8$ m/s

$T = \frac{1}{\nu}$

$\nu = 1/T = \frac{1}{4 \times 10^{-8}\ s}$

$\nu = 2.5 \times 10^7\ s^{-1}$

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

$\lambda = \frac{3 \times 10^8\ m/s}{2.5 \times 10^7\ s^{-1}}$

$\lambda = 12\ m$

$\bar{\nu} = \frac{1}{\lambda}$

$= \frac{1}{12\ m}$

$\bar{\nu} = 8.3 \times 10^{-2}\ m^{-1}$

What is the symbol of the species with number of electrons equal to 36, protons equal to 35 and neutron equal to 45?

(Z) Atomic number = no. of protons = no. of electrons in neutral atom

$Z = 35$

But here no. of electrons are more, ∴ the species is negatively charged. (1 more electron = 1 negative charge)

Mass number (A) = protons + neutrons

$= 35 + 45$

$= 80$

$Z = 35 \rightarrow$ Bromine $\rightarrow$ Br

$^{80}_{35}Br^-$

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ν $\bar{\nu}$

Calculate the frequency, wave number of the microwaves with wavelength 4×10^7 nm.

λ

$1\,nm = 10^{-9}\,m$, $\lambda = 4 \times 10^7 \times 10^{-9}\,m$

$\lambda = 4 \times 10^{-2}\,m$

wavenumber (SI unit = m^{-1})

$$\bar{\nu} = \frac{1}{\lambda}$$

$$\bar{\nu} = \frac{1}{4 \times 10^{-2}}\,m^{-1}$$

$$= \frac{100}{4}\,m^{-1}$$

$$\boxed{\bar{\nu} = 25\,m^{-1}}$$

$$\nu = \frac{c}{\lambda} = \frac{3 \times 10^8\,m/s}{4 \times 10^{-2}\,m}$$

$$\boxed{\bar{\nu} = 7.5 \times 10^9\,s^{-1}}$$

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λ ν $\bar{\nu}$

Calculate the wavelength, frequency and wave number of a light wave whose time period is 3×10^{-10} s.

$T = 3 \times 10^{-10}\ s$

$T = \frac{1}{\nu}$

$\nu = \frac{1}{T}$

$= \frac{1}{3 \times 10^{-10}\ s}$

$\boxed{\nu = 3.3 \times 10^{9}\ s^{-1}}$

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

$\lambda = \frac{3 \times 10^{8}\ m/s}{3.3 \times 10^{9}\ s^{-1}}$

$\boxed{\lambda = 9 \times 10^{-2}\ m}$

$1\ m = 10^{10}\ A^{\circ}$

$\lambda = 9 \times 10^{-2} \times 10^{+10}\ A^{\circ}$

$\lambda = 9 \times 10^{8}\ \mathring{A}$

$\bar{\nu} = \frac{1}{\lambda}$

$\bar{\nu} = \frac{1}{9 \times 10^{-2}\ m}$

$\boxed{\bar{\nu} = 11.11\ m^{-1}}$

Calculate the frequency (ν) and wavelength (λ) of photon with energy 3.98×10^{-15} J.

$E = h\nu$ $\qquad h = 6.626 \times 10^{-34}$ Js

$3.98 \times 10^{-15}\ J = 6.626 \times 10^{-34}\ Js \times \nu$

$\nu = \dfrac{3.98 \times 10^{-15}\ J}{6.626 \times 10^{-34}\ Js}$

$\boxed{\nu = 6 \times 10^{18}\ s^{-1}}$ Hz

$\lambda = \dfrac{c}{\nu} = \dfrac{3 \times 10^{8}\ m/s}{6 \times 10^{18}\ s^{-1}}$

$\boxed{\lambda = 5 \times 10^{-11}\ m}$

$1\ \text{Å} = 10^{-10}\ m$

$1\ m = 10^{10}\ \text{Å}$

$\lambda = 5 \times 10^{-11} \times 10^{10}\ \text{Å}$

$\lambda = 0.5\ \text{Å}$

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Which of the following have maximum wavelength?

(A) Cosmic rays (extremely high energy rays radioactive species.)

(B) γ - rays

(C) Micro waves

(D) Radio waves

frequency decrease from γ- rays to Radio waves.

γ- rays | X-rays | UV || IR | Micro waves | Radio waves

Visible spectrum

wavelength increases from γ-rays to Radio ways

Which of the following have maximum frequency? / Energy.

(A) Cosmic rays
(B) γ – rays
(C) Micro waves
(D) Radio waves

Frequency increases from Radio waves to γ-rays

Cosmic rays | γ-rays | X-rays | UV | IR | microwaves | Radio waves.

$E = h\nu$

$E \propto \nu$

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Unit of wavelength is

(A) m

(B) nm

(C) Å

(D) All of these

Wavelength = units of length = meter (m)

$1\text{Å} = 10^{-10}\text{ m}$

$\text{nm} = 10^{-9}\text{ m}$

thanks
for watching