DPP – 3 [Planck's Quantum Theory]

Chapter: Structure of Atom

"Bas shuru karo. Confidence ka wait mat karo. Confidence kaam karne ke baad aata hai."

TYPE 1 : Energy andWavelength of Photon

Q.1 **The energy of a photon of sodium light of wavelength 5.862×10^{-16} m in joule is ($h = 6.6 \times 10^{-34}$ J s, $c = 3 \times 10^{8}$ m s^{-1})**

(1) 3.38×10^{-10} J
(2) 1.69×10^{-10} J
(3) 6.76×10^{-10} J
(4) 8.45×10^{-11} J

Q.2 **Calculate the energy in joule corresponding to light of wavelength 45 nm ($h = 6.63 \times 10^{-34}$ J s, $c = 3 \times 10^{8}$ m s^{-1})**

(1) 6.67×10^{15}
(2) 6.67×10^{11}
(3) 4.42×10^{-15}
(4) 4.42×10^{-18}

Q.3 **What is the wavelength (Å) of a photon that has an energy of 4.38×10^{-18} J?**

(1) 454 Å
(2) 2.3×10^{7} Å
(3) 6.89×10^{15} Å
(4) 1.45×10^{-15} Å

Q.4 **If change in energy $(\Delta E) = 3 \times 10^{-8}$ J, $h = 6.64 \times 10^{-34}$ J s and $c = 3 \times 10^{8}$ m/s, then the wavelength of the light is**

(1) 6.64×10^{3} Å
(2) 6.64×10^{5} Å
(3) 6.64×10^{-8} Å
(4) 6.64×10^{18} Å

Q.5 **Which has a higher energy — a photon of violet light (wavelength 4000 Å) or a photon of red light (wavelength 7000 Å)?**

(1) Violet light photon has higher energy
(2) Red light photon has higher energy
(3) Both have equal energy
(4) Cannot be determined without intensity

Q.6 **The ratio of the energy of a photon of 2000 Å wavelength radiation to that of 4000 Å radiation is**

(1) $\frac{1}{4}$
(2) 4
(3) $\frac{1}{2}$
(4) 2

TYPE 2 : Energy, Frequency & Wavelength of Photon

Q.7 **The frequency and energy of a photon of wavelength 4000 Å are respectively**
($h = 6.626 \times 10^{-34}$ J s, $c = 3 \times 10^{8}$ m s^{-1})

(1) 7.5×10^{14} s^{-1} and 4.96×10^{-19} J
(2) 3.75×10^{14} s^{-1} and 2.48×10^{-19} J
(3) 7.5×10^{14} s^{-1} and 9.92×10^{-19} J
(4) 1.5×10^{15} s^{-1} and 4.96×10^{-19} J

Q.8 **The frequency and wavelength of a photon with energy 3.98×10^{-15} J are respectively**
($h = 6.626 \times 10^{-34}$ J s, $c = 3 \times 10^{8}$ m s^{-1})

(1) 6.0×10^{18} Hz and 0.5 Å
(2) 3.0×10^{18} Hz and 1.0 Å
(3) 6.0×10^{18} Hz and 1.0 Å
(4) 1.2×10^{19} Hz and 0.25 Å

Q.9 **The wavelength and frequency of a photon having energy of 2 electron volt are respectively**
($h = 6.626 \times 10^{-34}$ J s, $c = 3 \times 10^{8}$ m s^{-1}, 1 eV $= 1.602 \times 10^{-19}$ J)

(1) 6.204×10^{-7} m and 4.9×10^{14} s^{-1}
(2) 3.102×10^{-7} m and 9.8×10^{14} s^{-1}
(3) 6.204×10^{-7} m and 9.8×10^{14} s^{-1}
(4) 1.24×10^{-6} m and 2.45×10^{14} s^{-1}

TYPE 3 : Number of Photons

Q.10 **A 1 kW radio transmitter operates at a frequency of 800 Hz. How many photons per second does it emit?**

(1) 1.71×10^{21}
(2) 1.88×10^{33}
(3) 6.02×10^{23}
(4) 2.85×10^{20}

Q.11 **A 100 watt bulb emits monochromatic light of wavelength 400 nm. The number of photons emitted per second by the bulb is**
($h = 6.626 \times 10^{-34}$ J s, $c = 3 \times 10^{8}$ m s^{-1})

(1) 2.012×10^{20}
(2) 1.006×10^{20}
(3) 4.024×10^{20}
(4) 8.05×10^{19}

Q.12 **A bulb of 40 W is producing a light of wavelength 620 nm with 80% efficiency. The number of photons emitted by the bulb in 20 seconds are**
(1 eV $= 1.6 \times 10^{-19}$ J, $hc = 12400$ eV Å)

(1) 2×10^{18}
(2) 10^{18}
(3) 10^{21}
(4) 2×10^{21}

Q.13 **The no. of photons of light of wavelength 7000 Å equivalent to 1 J are**

(1) 3.52×10^{-18}
(2) 3.52×10^{18}
(3) 50,000
(4) 100,000

TYPE 4: Miscellaneous

Q.14 **It has been found that gaseous iodine molecules just dissociate into iodine atoms after absorption of light at wavelengths 4995 Å. The energy required to dissociate 1 mole of iodine molecules is**

(1) 52.2 kcal/mole
(2) 93.4 kcal/mole
(3) 63.4 kcal/mole
(4) 57.3 kcal/mole

Q.15 **The energy required to break one mole of Cl–Cl bonds in Cl_2 is 242 kJ mol^{-1}. The longest wavelength of light capable of breaking a single Cl–Cl bond is**
($C = 3 \times 10^8$ m s^{-1}, $N_A = 6.02 \times 10^{23}$ mol^{-1}) **[AIEEE-2010]**

(1) 494 nm
(2) 594 nm
(3) 640 nm
(4) 700 nm

Q.16 **Ionization energy of gaseous Na atoms is 495.5 kJ mol^{-1}. The lowest possible frequency of light that ionizes a sodium atom is**
($h = 6.626 \times 10^{-34}$ J s, $N_A = 6.022 \times 10^{23}$ mol^{-1}) **[JEE-Main(online) 2014]**

(1) 3.15×10^{15} s^{-1}
(2) 4.76×10^{14} s^{-1}
(3) 1.24×10^{15} s^{-1}
(4) 7.50×10^{4} s^{-1}

Q.17 **A gas absorbs a photon of 355 nm and emits at two wavelengths. If one of the emissions is at 680 nm, the other is at**

(1) 743 nm
(2) 518 nm
(3) 1035 nm
(4) 325 nm