Topic :- Dual nature of radiation and matter

1. Which of the following is incorrect statement regarding photon

   a) $E = \dfrac{hc}{\lambda}$ b) $E = \dfrac{1}{2}mu^2$ c) $p = \dfrac{E}{2v}$ d) $E = \dfrac{1}{2}mc^2$

2. If intensity of incident light is increased in PEE then which of the following is true
   a) Maximum $K.E.$ of ejected electron will increase
   b) Work function will remain unchanged
   c) Stopping potential will decrease
   d) Maximum $K.E.$ of ejected electron will decrease

3. The wavelength of K_a X-rays produced by an X-ray tube is 0.76 Å. The atomic number of the anode material of the tube is

   a) 20   b) 60   c) 40   d) 80

4. In X-ray tube when the accelerating voltage V is halved, the difference between the wavelength of K_α line and minimum wavelength of continuous X-ray spectrum

   a) Remains constant   b) Becomes more than two times
   c) Becomes half   d) Becomes less than two times

5. Which of the following wavelength fall in X-ray region

   a) 10000 Å   b) 1000 Å   c) 1 Å   d) 10^{-2} Å

6. A tiny spherical oil drop carrying a net charge q is balanced in still air with vertical uniform electric field of strength $\dfrac{81\pi}{7} \times 10^5 \text{Vm}^{-1}$. When the field is switched off, the drop is observed to fall with terminal velocity $2 \times 10^{-3} \text{ms}^{-1}$. Given g $= 9.8$ ms^{-2}, viscosity of the air $=1.8 \times 10^{-5}$Ns m^{-2} and the density of oil $= 900$ kg m^{-3}, the magnitude of q is

   a) 1.6×10^{-19} C   b) 3.2×10^{-19} C   c) 4.8×10^{-19} C   d) 8.0×10^{-19} C

7. The potential energy of a particle of mass m is given by

$$U(x) = \begin{cases} E_0; & 0 \le x \le 1 \\ 0; & x > 1 \end{cases}$$

λ_1 and λ_2 are the de-Broglie wavelengths of the particle, when $0 \le x \le 1$ and $x > 1$ respectively.

If the total energy of particle is $2E_0$, the ratio $\frac{\lambda_1}{\lambda_2}$ will be

   a) 2   b) 1   c) $\sqrt{2}$ d) $\frac{1}{\sqrt{2}}$

8. Which of the following metal thermionically emits an electron at a relatively lowest temperature among them

   a) Platinum   b) Copper   c) Aluminium   d) Molybdenum

9. A particle A has a charge q and particle B has charge $+4q$ with each of them having the mass m. When they are allowed to fall from rest through same potential difference, the ratio of their speeds $v_A:v_B$ will be

   a) 4:1   b) 1:4   c) 1:2   d) 2:1

10. Velocity ratio of the two cathode rays 1.2. They are applied to the same electric field. What is the deflection ratio of the two cathode rays

   a) 1:2   b) 1:4   c) 4:1   d) 8:1

11. The maximum wavelength of radiation that can produce photoelectric effect in certain metal is 200 nm. The maximum kinetic energy acquired by electron due to radiation of wavelength 100 nm will be

   a) 12.4 eV   b) 6.2 eV   c) 100 eV   d) 200 eV

12. J. J. Thomson's cathode ray tube experiment demonstrated that

   a) Cathode rays are streams of negatively charged ions

   b) All the mass of an atom is essentially in the nucleus

   c) The e/m of electrons is much greater than the e/m of protons

   d) The e/m ratio of the cathode ray particles changes when a different gas is placed in the discharge tube
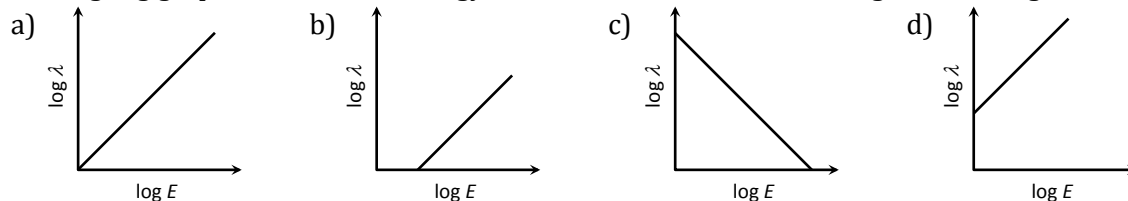
13. If $\lambda = 10\text{Å}$, then it corresponds to

   a) Infra-red   b) Microwave   c) Ultra-violet   d) X-rays

14. Light of wavelength 4000 Å is incident on a metal plate whose work function is 2 eV. The maximum KE of the emitted photoelectron would be

   a) 0.5 eV   b) 1.1 eV   c) 1.5 eV   d) 2.0 eV

15. The log-log graph between the energy E of an electron and its de-Broglie wavelength λ will be

16. Which one of the following statement is wronge in the context of X-rays generated from X-ray tube?
    a) Wavelength of characteristic X-rays decreases when the atomic number of the target increases
    b) Cut-off wavelength of the continuous X-rays depends on the atomic number of the target
    c) Intensity of the characteristic X-rays depends on the electrical power given to the X-ray tube
    d) Cut-off wavelength of the continuous X-rays depends on the energy of the electrons in X-ray tube

17. If f_1, f_2 and f_3 are the frequencies of corresponding K_α, K_β and L_α X-rays of an element, then
    a) $f_1 = f_2 = f_3$ b) $f_1 - f_2 = f_3$ c) $f_2 = f_1 + f_3$ d) $f_2^2 = f_1 f_3$

18. A radio transmitter operates at a frequency of $880\ kHz$ and a power of $10\ kW$. The number of photons emitted per second are
    a) 1.72×10^{31} b) 1327×10^{34} c) 13.27×10^{34} d) 0.075×10^{-34}

19. A photon of wavelength 4400 Å is passing through vacuum. The effective mass and momentum of the photon are respectively
    a) $5 \times 10^{-36} kg, 1.5 \times 10^{-27} kg\text{-}m/s$ b) $5 \times 10^{-35} kg, 1.5 \times 10^{-26} kg\text{-}m/s$
    c) Zero, $1.5 \times 10^{-26} kg\text{-}m/s$ d) $5 \times 10^{-36} kg, 1.67 \times 10^{-43} kg\text{-}m/s$

20. The de-Broglie wavelength associated with the particle of mass m moving with velocity v is
    a) h/mv b) mv/h c) mh/v d) m/hv