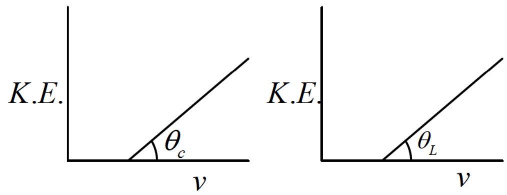
Chapter 2 (Particle Nature of Light)
Worksheet

Q1. The work function of cesium and lead are $2.14\,eV$ and $2.28\,eV$ respectively. In a photoelectric experiment the plot of kinetic energy (K.E.) vs frequency (ν) is shown in figure:



The relation between θ for cesium (θ_c) and lead (θ_L) is given by

(a) $\theta_c = \theta_L$ (b) $\theta_c = \dfrac{\theta_L}{2}$ (c) $\theta_c = 2\theta_L$ (d) Data insufficient

Q2. The maximum kinetic energy of photoelectrons emitted from a surface when photons of energy $6eV$ fall on it is $4eV$. The stopping potential, in volts, is

(a) 2 (b) 4 (c) 6 (d) 10

Q3. The photoelectric equation is derived under the assumption that

(a) electrons are restricted to orbits of angular momentum $n\hbar$, where *n* is an integer

(b) electrons are associated with waves of wavelength $\lambda = h/p$, where *p* is momentum

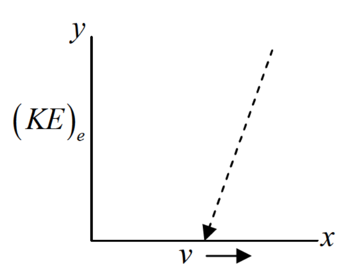
(c) light is emitted only when electrons jump between orbits

(d) light is absorbed in quanta of energy $E = h\nu$

Q4. In photoelectric effect with incoming radiation of frequency ν_0 with $h\nu_0 = 8eV$, electrons of energy $3eV$ are emitted from a metal surface. The energy of the electrons emitted from this surface when radiation with frequency $1.2\nu_0$ is incident, is:

(a) $4.2\,eV$ (b) $5.2\,eV$ (c) $3.6\,eV$ (d) $4.6\,eV$

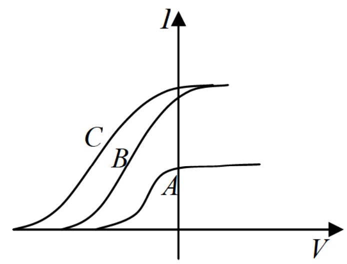
Q5. Diagram shown here corresponds to observations made in photoelectric effect observed with radiation of frequency ν, and wavelength λ, resulting in $K_{\max}$ as the maximum kinetic energy of photoelectrons. The quantities shown on the x and y-axes in the diagram are:



(a) x-axis: λ; y-axis: $E_{\max}$ (b) x-axis: $E_{\max}$; y-axis: λ

(c) x-axis: ν; y-axis: $E_{\max}$ (d) x-axis: $E_{\max}$; y-axis: ν

Q6. In a photoelectric experiment anode potential is plotted against plate current



(a) A and B will have same intensities while B and C will have different frequencies

(b) B and C will have different intensities while A and B will have different frequencies

(c) A and B will have different intensities while B and C will have equal frequencies

(d) B and C will have equal intensities while A and B will have same frequencies.

Q7. Ultraviolet light of wavelength $2,537\,\overset{0}{\mathrm{A}}$ from a mercury arc falls upon a silver photocathode. If the photoelectric threshold wavelength for silver is $3,250\,\overset{0}{\mathrm{A}}$, the least potential difference which must be applied between the anode and the photo-cathode to prevent electrons from the photo-cathode.

(a) $8.6V$ (b) $4.89V$ (c) $3.81V$ (d) $1.08V$

Q8. Planck constant has the same dimensions as

(a) force $\times$ time (b) force $\times$ distance

(c) force $\times$ speed (d) force $\times$ distance $\times$ time

Q9. Let p and E denote the linear momentum and energy of a photon. If the wavelength is decreased,

(a) both p and E increase (b) p increases and E decreases

(c) p decreases and E increases (d) both p and E decrease

Q10. Let n_r and n_b be respectively the number of photons emitted by a red bulb and a blue bulb of equal power in a given time.

(a) $n_r = n_b$

(b) $n_r < n_b$

(c) $n_r > n_b$

(d) The information is insufficient to get a relation between n_r and n_b

Q11. The equation $E = pc$ is valid

(a) for an electron as well as for a photon

(b) for an electron but not for a photon

(c) for a photon but not for an electron

(d) neither for an electron nor for a photon

Q12. The work function of a metal is $h\nu_0$. Light of frequency ν falls on this metal. The photoelectric effect will take place only if

(a) $\nu \geq \nu_0$ (b) $\nu \geq 2\nu_0$ (c) $\nu < \nu_0$ (d) $\nu < 2\nu_0$

Q13. Light of wavelength λ falls on a metal having work function $\frac{hc}{\lambda_0}$. Photoelectric effect will take place only if

(a) $\lambda \geq \lambda_0$ (b) $\lambda \geq 2\lambda_0$ (c) $\lambda \leq \lambda_0$ (d) $\lambda < \lambda_0/2$

Q14. When stopping potential is applied in an experiment on photoelectric effect, no photocurrent is observed. This means that

(a) the emission of photoelectrons is stopped

(b) the photoelectrons are emitted but are re-absorbed by the emitter metal

(c) the photoelectrons are accumulated near the collector plate

(d) the photoelectrons are dispersed from the sides of the apparatus

Q15. If the frequency of light in a photoelectric experiment is doubled, the stopping potential will

(a) be doubled (b) be halved

(c) become more than double (d) become less than double

Q16. The frequency and intensity of a light source are both doubled. Consider the following statements:

(I) The saturation photocurrent remains almost the same

(II) The maximum kinetic energy of the photoelectrons is doubled

(a) Both (I) and (II) are true (b) (I) is true but (II) is false

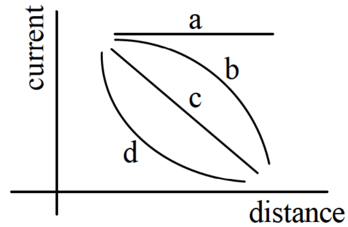
(c) (I) is false but (II) is true (d) Both (I) and (II) are false

Q17. A point source of light is used in a photoelectric effect. If the source is removed farther from the emitting metal, the stopping potential

(a) will increase (b) will decrease

(c) will remain constant (d) will either increase or decrease

Q18. A point source causes photoelectric effect from a small metal plate. Which of the following curves may represent the saturation photocurrent as a function of the distance between the source and the metal?



Q19. A nonmonochromatic light is used in an experimental on photoelectric effect. The stopping potential

(a) is related to the mean wavelength

(b) is related to the longest wavelength

(c) is related to the shortest wavelength

(d) is related to the wavelength

Q20. A proton and an electron are accelerated by the same potential difference. Let λ_e and λ_p denote the de Broglie wavelengths of the electron and the proton respectively.

(a) $\lambda_e = \lambda_p$

(b) $\lambda_e < \lambda_p$

(c) $\lambda_e > \lambda_p$

(d) The relation between λ_e and λ_p depends on the accelerating potential difference.

Q21. The work function of a photoelectric material is $4.0\,eV$. Find the wavelength of light for which the stopping potential is $2.5V$.

(a) $19\,nm$ (b) $190\,nm$ (c) $1900\,nm$ (d) $2500\,nm$

Q22. When a metal plate is exposed to a monochromatic beam of light of wavelength $400\,nm$, a negative potential of $1.1V$ is needed to stop the photocurrent. the threshold wavelength for the metal.

(a) $31\,nm$ (b) $310\,nm$ (c) $62\,nm$ (d) $620\,nm$

Q23. The electric field associated with a light wave is given by

$$E = E_0 \sin\left[\left(1.57\times10^7 m^{-1}\right)\left(x-ct\right)\right].$$

The stopping potential when this light is used in an experiment on photoelectric effect with the emitter having work function $1.9\,eV$.

(a) $3.105\ V$ (b) $1.936\ V$ (c) $1.205V$ (d) $2.412V$

Q24. A photographic film is coated with a silver bromide layer. When light falls on this film, silver bromide molecules dissociate and the film records the light there. A minimum of $0.6\,eV$ is needed to dissociate a silver bromide molecule. Find the maximum wavelength of light that can be recorded by the film.

(a) $20.71\,nm$ (b) $207\,nm$ (c) $2071\,nm$ (d) $20710\,nm$

Q25. If work function of lithium is $2.5\,eV$ The maximum wavelength in nanometer of light that can cause photoelectric effect in lithium is

(a) $497\,nm$ (b) $500\,nm$ (c) $400\,nm$ (d) $300\,nm$

Q26. A monochromatic source of light operating at $200\,W$ emits 4×10^{20} photons per second. the wavelength of the light in nanometer is

(a) $100\,nm$ (b) $200\,nm$ (c) $300\,nm$ (d) $400\,nm$

Q27. Light described at a place by the equation

$$E=\left(100\,Vm^{-1}\right)\left[\sin\left(5\times10^{15}s^{-1}\right)t+\sin\left(8\times10^{15}s^{-1}\right)t\right]$$

falls on a metal surface having work function $2.0\,eV$. Calculate the maximum kinetic energy of the photoelectrons.

(a) $1.3\,eV$ (b) $2\,eV$ (c) $3.27\,eV$ (d) $8.6\,eV$

Q28. In a Compton - scattering experiment, photons with incoming momentum mc (m is the mass of the electron) are scattered at an angle 90°. What is the magnitude of the momentum of the scattered photon?

(a) mc (b) $\frac{mc}{2}$ (c) $\frac{mc}{3}$ (d) $\frac{mc}{4}$

Q29. Photons are elastically scattered from free protons at rest. In this process, the photons are scattered by an angle of 90^0. $\Delta\lambda$ is change in wavelength during scattering. If λ_c is Compton Wavelength for electron then which of the following is correct?

(a) $\frac{\Delta\lambda}{\lambda_c}=1$ (b) $\frac{\Delta\lambda}{\lambda_c}=1840$ (c) $\frac{\Delta\lambda}{\lambda_c}=\frac{1}{1840}$ (d) $\frac{\Delta\lambda}{\lambda_c}=\frac{1}{137}$

Q30. A photon of wavelength λ is incident on a free electron at rest and is scattered in the perpendicular direction to the incident photon. The fractional shift $\left(\frac{\Delta\lambda}{\lambda}\right)$ in its wavelength in terms of the Compton wavelength λ_c of the electron is

(a) $\frac{\lambda_C}{\lambda}$ (b) $\frac{2\lambda_C}{3\lambda}$ (c) $\frac{3\lambda_C}{2\lambda}$ (d) $\frac{2\lambda_C}{\lambda}$

Q31. In a Compton's experiment the maximum kinetic energy transferred to a proton of mass m_p when hit by a photon of energy $h\nu$ is given by

(a) $\dfrac{h\nu}{1+\dfrac{2m_pc^2}{h\nu}}$ (b) $\dfrac{h\nu}{1-\dfrac{2m_pc^2}{h\nu}}$ (c) $\dfrac{h\nu}{1+\dfrac{m_pc^2}{2h\nu}}$ (d) $\dfrac{h\nu}{1+\dfrac{m_pc^2}{h\nu}}$

Q32. Consider an X-ray beam with wavelength λ scattered with free electron. If $\Delta\lambda$ is change in wavelength of X ray after scattering from electron of mass m then what is kinetic energy of recoiling electron.

(a) $\dfrac{hc}{\lambda}\dfrac{\Delta\lambda}{(\lambda+\Delta\lambda)}$ (b) $\dfrac{hc\lambda}{\Delta\lambda(\lambda+\Delta\lambda)}$ (c) $\dfrac{hc\Delta\lambda}{\lambda(\lambda-\Delta\lambda)}$ (d) $\dfrac{hc}{\Delta\lambda}\dfrac{\lambda}{(\lambda-\Delta\lambda)}$

Q33. Consider a X ray beam with wave length λ scattered from free electron so that change in wave length of X ray is λ then the kinetic energy of recoiling electron is:

(a) $\dfrac{hc}{\lambda}$ (b) $\dfrac{hc}{2\lambda}$ (c) $\dfrac{2hc}{\lambda}$ (d) $\dfrac{2hc}{3\lambda}$

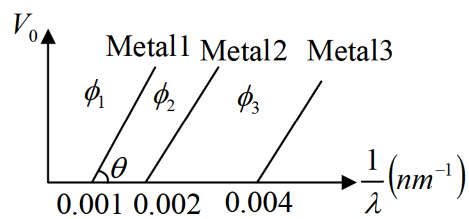
MSQ (Multiple Select Questions)

Q34. When photons of energy $4.25\,eV$ strike the surface of metal A,, the ejected photoelectrons have maximum kinetic energy $T_A eV$ and de Broglie wavelength λ_A. The maximum kinetic energy of photoelectrons liberated from another metal B by photons of energy $4.70eV$ is $T_B=(T_A-1.50)eV$. If the de Broglie wavelength of these photoelectrons is $\lambda_B=2\lambda_A$, then

(a) The work function of A is $2.25eV$ (b) the work function of B is $3.95\ eV$

(c) $T_A=2.00\ eV$ (d) $T_B=2.75eV$

Q35. The graph between the stopping potential (V_0) and $\left(\dfrac{1}{\lambda}\right)$ is shown in the figure ϕ_1,ϕ_2 and ϕ_3 are work functions. Which of the following is/are correct?



(a) $\phi_1:\phi_2:\phi_3=1:2:4$

(b) $\phi_1:\phi_2:\phi_3=4:2:1$

(c) $\tan\theta$ is proportional to $\dfrac{hc}{e}$ where h is Planck's constant and c is the speed of light

(d) Ultraviolet light can be used to emit photoelectrons from metal 2 and metal 3 only

Q36. Light from a discharge tube containing hydrogen atoms falls on the surface of a piece of sodium. The kinetic energy of the fastest photoelectrons emitted from sodium is $0.73\,eV$. The work function for sodium is $1.82\,eV$, then which of the following statements are correct?

(a) The energy of the photons causing the photoelectric emission $E = 2.55\,eV$

(b) The quantum numbers of the two levels involved in the emission of these photons are 4 to 2

(c) The change in the angular momentum of the electron in the hydrogen atom in the above transition is $\Delta L = \frac{h}{2\pi}$

(d) The recoil speed of the emitting atom assuming it to be at rest before the transition is $v = 0.814 \quad m/s$

(Ionization potential of hydrogen is $13.6\,eV$)

Q37. Electrons in hydrogen like atoms $(Z=3)$ make transitions from the fifth to the fourth orbit and from, the fourth to the third orbit. The resulting radiations are incident normally on a plate and eject photoelectrons. The stopping potential for the photoelectrons ejected by the shorter wavelength is 3.95 volt. (Rydberg constant $= 1.094\times10^{7}\,m^{-1}$ Which of the following options is correct?

(a) the work function of the metal is $2eV$

(b) the longer wavelength is corresponds to transition from the fourth to the third orbit

(c) the longer wave length is $4514 A^{0}$

(d) the stopping potential for the photoelectrons ejected by the 1onger wavelength is $0.74V$

Q38. Light described by the equation $E = (90V/m)\left[\sin\left(6.28\times10^{15}s^{-1}\right)t + \sin\left(12.56\times10^{15}s^{-1}\right)t\right]$ is incident on a metal surface. The work function of the metal is $2.0\,eV$. Which of the following is correct?

(a) The threshold frequency is approximately $f = 4.9\times10^{15}\sec^{-1}$

(b) The maximum kinetic energy correspond to frequency $\omega = 9.42\times10^{15}\sec^{-1}$

(c) The stopping potential is $8.24\,eV$

(d) Maximum kinetic energy is $6.24\,eV$

Q39. Which of the following is/are correct?

(a) Photo electric effect will take place with free electron

(b) Photo electric effect will take place both free and bounded electrons

(c) Photo electric effect will take place from bounded electrons

(d) Photo electric effect will possible from any metal

Q40. Photons of energy $4.25eV$ strike the surface of a metal A. The ejected photoelectrons have maximum kinetic energy $T_A eV$ and de Broglie wavelength λ_A. The maximum kinetic energy of photoelectrons liberated from another metal by photons of energy $4.70eV$ is $T_B = (T_A - 1.50)eV$.

If the de Broglie wavelength of the photoelectrons is $\lambda_B = 2\lambda_A$,

Then which of the following is correct?

(a) $T_A = 2eV$ (b) $T_B = 0.5eV$ (c) $W_A = 2.25eV$ (d) $W_B = 4.2eV$

Q41. When the intensity of a light source is increased,

(a) the number of photons emitted by the source in unit time increases

(b) the total energy of the photons emitted per unit time increases

(c) more energetic photons are emitted

(d) faster photons are emitted

Q42. Photoelectric effect supports quantum nature of light because

(a) there is a minimum frequency below which no photoelectrons are emitted

(b) the maximum kinetic energy of photoelectrons depends only on the frequency of light and not on its intensity

(c) even when the metal surface is faintly illuminated the photoelectrons leave the surface immediately

(d) electric charge of the photoelectrons is quantized

Q43. If the wavelength of light in an experiment on photoelectric effect is doubled

(a) the photoelectric emission will not take place

(b) the photoelectric emission may or may not take place

(c) the stopping potential will increase

(d) the stopping potential will decrease

Q44. The photocurrent in an experiment on photoelectric effect increases if

(a) the intensity of the source is increased

(b) the exposure time is increased

(c) the intensity of the source is decreased

(d) the exposure time is decreased

Q45. The collector plate in an experiment on photoelectric effect is kept vertically above the emitter plate. Light source is put on and a saturation photocurrent is recorded. An electric field is switched on which has a vertically downward direction, then which of the following options is/are correct?

(a) The photocurrent will increase

(b) The kinetic energy of the electrons will increase

(c) The stopping potential will decrease

(d) The threshold wavelength will increase

Q46. In which of the following situations the heavier of the two particles has smaller de Broglie wavelength? The two particles

(a) move with the same speed

(b) move with the same linear momentum

(c) move with the same kinetic energy

(d) have fallen through the same height

Q47. When the sun is directly overhead, the surface of the earth receives $1.4\times10^{3}\,Wm^{-2}$ of sunlight. Assume that the light is monochromatic with average wavelength $500\,nm$ and that no light is absorbed in between the sun and the earth's surface. The distance between the sun and the earth is $1.5\times10^{11}\,m$.

(a) The number of photons falling per second on each square metre of earth's surface directly below the sun are 3.5×10^{21}

(b) The photons are there in each cubic meter near the earth's surface at any instant are 3.5×10^{21}

(c) The photons are there in each cubic meter near the earth's surface at any instant are 1.2×10^{13}

(d) Number of photons does the sun emit per second are 9.9×10^{44}.

Q48. The work function of a metal is $2.5\times10^{-19}\,J$.

(a) The threshold frequency for photoelectric emission is $3.8\times10^{14}\,Hz$

(b) If the metal is exposed to a light beam of frequency $6.0\times10^{14}\,Hz$, the maximum kinetic energy is $1.46\times10^{-19}\,J$

(c) If the metal is exposed to a light beam of wavelength of $500\,nm$, the maximum kinetic energy is $0.91\,eV$

(d) If the metal is exposed to a light beam of frequency $6.0\times10^{14}\,Hz$, the stopping potential is $0.91\,V$

Q49. A parallel beam of monochromatic light of wavelength $500\,nm$ is incident normally on a perfectly absorbing surface. The power through any cross-section of the beam is $10W$. Then which of the following is correct

(a) Total energy of photons are $2.48eV$.

(b) The number of photons absorbed per second by the surface is 2.52×10^{19}.

(c) linear momentum of each photon is $3.33\times10^{-8}\,Ns$.

(d) the force exerted by the light beam on the surface. $3.33\times10^{-8}\,N$.

Q50. A beam of $450\,nm$ light is incident on a metal having work function $2.0\,eV$ and placed in a magnetic field B. The most energetic electrons emitted perpendicular to the magnetic field are bent in circular arcs of radius $20\,cm$. Which of the following is correct?

(a) kinetic energy of most energetic electron is $1.2\times10^{-19}J$

(b) The stopping potential is $0.76V$

(c) The linear momentum is given by $4.67\times10^{-25}\,kgms^{-1}$.

(d) The value of magnetic field is $1.46\times10^{-5}T$

Q51. Which of the following is correct for Compton effect?

(a) The energy of incoming X ray is approximately $20KeV$

(b) The Compton shift is not dependent on energy of incoming X ray

(c) The wavelength of scattered X ray is less than wavelength of incoming X ray

(d) Maximum energy is transfer from X ray to electron at scattering angle 90^0 with horizontal

Q52. In the Compton effect, a photon with energy E scatters through a 90^0 angle from a stationary electron of mass m. Then which of the following is correct statement?

(a) Energy of scattered photon is $\dfrac{E\cdot mc^2}{E+mc^2}$

(b) Energy of scattered photon is $\dfrac{E^2}{E+mc^2}$

(c) Energy of recoil electron $\dfrac{E\cdot mc^2}{E+mc^2}$

(d) Energy of recoil electron $\dfrac{E^2}{E+mc^2}$

Q53. Which of the following is correct statement?

(a) The result of Photoelectric effect support particle nature of light

(b) The result of Compton scattering support particle nature of light .

(c) Michelson Morley experiment concludes that velocity of light in invariant.

(d) Davisson Germer experiment concludes wave nature of light.

Q54. In the Compton scattering, the photon of energy $E_0 = h\nu_0$ and momentum $P_0 = h\nu_0 / c$ is scattered from a free electron of rest mass m . if photon is scattered with angle θ which on of following is correct if $\alpha = \dfrac{h\nu_0}{mc^2}$

(a) Energy of scattered photon is $E = \dfrac{E_0}{\left[1+\alpha(1-\cos\theta)\right]}$,

(b) the kinetic energy acquired by the electron is $E = \dfrac{E_0}{\left[1+\alpha(1-\cos\theta)\right]}$

(c) the kinetic energy acquired by the electron is $T = \dfrac{\alpha E_0(1-\cos\theta)}{1+\alpha(1-\cos\theta)}$

(d) $\tan(\theta/2) = (1+\alpha)\tan\varphi$, where φ is the recoil angle of the electron

NAT (Numerical Answer Type Questions)

Q55. Light described by the equation

$$E = (90V/m)\left[\sin\left(6.28\times10^{15} s^{-1}\right)t + \sin\left(12.56\times10^{15} s^{-1}\right)t\right]$$

is incident on a metal surface. The work function of the metal is $2eV$. Maximum kinetic energy of the photoelectrons will be __________ eV

Q56. In a photoelectric effect experiment, for radiation with frequency ν_0 with $h\nu_0 = 8eV$, electrons are emitted with energy $2eV$. if the incoming radiation of frequency $1.25\nu_0$ then the energy of photo electron is _________

Q57. A threshold wavelength of a metal is $7000\,\mathring{A}$. The work function is _________ (Given, velocity of light $c = 3\times10^8 m/s$ and Planck's constant $= 6.624\times10^{-34} J-S$)

Q58. The work function of a substance is $4eV$ The longest wavelength of light that can cause photoelectron emission from this substance is approximately ___________ $\times10^{-9} m$

Q59. A beam of light has three wavelengths $4144\overset{0}{A}, 4972\overset{0}{A}$ and $6216\overset{0}{A}$ with a total intensity of $3.6\times10^{-3}Wm^{-2}$ equally distributed amongst the three wavelengths. The beam falls normally on an area $1.0cm^{2}$ of a clean metallic surface of work function $2.3eV$. Assume that there is no loss of light by reflection and that each energetically capable photon ejects one electron. The number of photo electrons liberated in per second ___________ $\times10^{11}$

Q60. When a beam of $10.6eV$ photons of intensity $2.0\,W/m^{2}$ falls on a platinum surface of area $1.0\times10^{-4}m^{2}$ and work function $5.6eV$, 0.53% of the incident photons eject photoelectrons. Take $1\,eV=1.6\times10^{-19}J$

(a) The number of photoelectrons emitted per second _________$\times10^{11}$.

(b) Minimum energy of photoelectron _________ eV.

(c) Maximum energies __________ eV

Q61. A beam of $450nm$ light is incident on metal having work function $2eV$. The momentum of most energetic electrons is ___________ $10^{-25}kg\,m/\sec$.

Q62. The maximum kinetic energy of photoelectrons emitted from a surface when photons of energy $8eV$ fall on it is $4eV$. The stopping potential in volts is _________

Q63. The wavelength of the photoelectric threshold for silver is $3,250\times10^{-10}m$ If electron ejected from a silver surface by ultraviolet light of wavelength $2,536\times10^{-10}m$ then speed of electron is given by $\alpha\times10^{5}m/\sec$ then value of α is _______

Q64. The maximum wavelength $\alpha\times10^{-9}m$ of light required to produce any current via the photoelectric effect if the anode is made of copper, which has a work function of $4.7eV$ then value of α is __________

Q65. Assume that 60% of the consumed energy is converted into light. The number of photons emitted per second by a $10W$ sodium vapour lamp is $\alpha\times10^{19}$. If wavelength of sodium light is $590\,nm$ then the value of α is _______

Q66. If Work function of cesium $=1.9eV$. Find the maximum kinetic energy of the photoelectrons ejected when light of wavelength $350\,nm$ is incident on a cesium surface is _______ eV

Q67. When light of wavelength $400\,nm$ falls on a metal having work function $2.5eV$ the maximum magnitude of the linear momentum of a photoelectron emitted is $\alpha\times10^{-25}kg-m/s$ then value of α is _________

Q68. The electric field associated with a monochromatic beam becomes zero 1.2×10^{15} times per second. on metal surface whose work function is $2.0\,eV$. the maximum kinetic energy of the photoelectrons is _________ eV

Q69. The electric field at a point associated with a light wave is

$$E=\left(100\,Vm^{-1}\right)\sin\left[\left(3.0\times10^{15}s^{-1}\right)t\right]\sin\left[\left(6.0\times10^{15}s^{-1}\right)t\right].$$

If this light falls on a metal surface having a work function of $2.0\,eV$, what will be the maximum kinetic energy of the photoelectrons _________ eV

Q70. A monochromatic light source of intensity $5\,mW$ emits 8×10^{15} photons per second. This light ejects photoelectrons from a metal surface. The stopping potential for this setup is $2.0\,V$. The work function of the metal is __________ eV

Q71. Number of photons are emitted per second by a $5\,mW$ laser source operating at $632.8\,nm$ is $\alpha\times10^{16}$ then value of α is __________

Q72. In Compton scattering, an incoming photon of wavelength $\lambda_0=\dfrac{h}{2mc}$ ($h=$ Planck's constant, $m=$ mass of electron, $c=$ speed of light) is scattered by an electron at rest. If the photon is scattered backward at angle of 180°, the momentum of the corresponding scattered electron is_________ mc

Q73. In the Compton scattering process, at which scattering angle _______ does the maximum energy transfer to the electron occur

Q74. X-ray of energy $50\,keV$ strikes an electron initially at rest. The change in wavelength of the X-ray scattered at angle 90° is, approximately ________ $\times10^{-12}\,meter$.

(Given, $h=6.63\times10^{-34}\,J-s, m=9.11\times10^{-31}\,kg$)

Q75. In a Compton - scattering experiment, photons with incoming momentum mc (m is the mass of the electron) are scattered at an angle of 90°. Then magnitude of the difference between momentum of the scattered photon and incoming photon is _______ mc

Q76. If an incident photon of wavelength $\lambda=1\overset{0}{\mathrm{A}}$ scattering off a proton initially at rest (Compton scattering analogue with proton instead of electron) the maximum fractional frequency shift is $\alpha\times10^{-5}$ then value of α is _______

Q77. A $30\,keV$ x-ray photon strikes the electron initially at rest and the photon is scattered through an angle of 30^0, what is the recoil velocity of electron is αc where c is speed of light then value of α is ________

Q78. X-rays are Compton scattered at an angle of 60^0. If the wavelength of the scattered radiation is $0.312\overset{0}{\mathrm{A}}$, the wavelength of the incident radiation _________ A^0

Q79. Maximum change in Compton wavelength due to scattering from electron is given by _________ A^0