PHYSICS

BOOKS - MODERN PUBLICATION

UNIT TEST -07

Example

1. What is the maximum frequency which can be transmitted by ground waves ?

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2. Find the

minimum wavelength of X-rays produced by 30

kV electrons.

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3. The work function of caesium metal is 2.14 eV. When light of frequency $6 \times 10^{14} Hz$ is incident on the metal surface, photomission of electrons occurs. What is the

maximum kinectic energy of the emitted electrons.

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4. The work function of caesium metal is 2.14 eV. When light of frequency $6 \times 10^{14} Hz$ is incident on the metal surface, photomission of electrons occurs. What is the stopping potential.

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5. The work function of caesium metal is 2.14 eV. When light of frequency $6 \times 10^{14} Hz$ is incident on the metal surface, photomission of electrons occurs. What is the maximum speed of the emitted photoelectrons?

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6. The photoelectric cut-off voltage in a certain experiment is 1.5 V. what is the maximum kinetic energy of the photoelectrons emitted?

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7. Monochromatic light of wavelength 632.8 nm is produced by a helium-neon laser. The power emitted is 9.42 mW.

Find the energy and momentum of each photon in the light beams.

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8. Monochromatic light of wavelength 632.8 nm is produced by a helium-neon laser. The power emitted is 9.42 mW.

How many photons per second, on the average, arrive at a target irradiated by this beam? (Assume the beam to have uniform cross-section which is less than the taget area).

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9. Monochromatic light of wavelength 632.8 nm is produced by a helium-neon laser. The power emitted is 9.42 mW.

How fast does a hydrogen atom have to travel in order to have the same momentum as that of the photon?

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10. The energy flux of sunlight reaching the surface of the earth is $1.388 \times 10^3 \frac{W}{m^2}$. How

many photons per square metre are incident on the Earth per second? Assume that the photons in the sunlight have an average wavelength of 550 nm.

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11. In an experiment on photoelectric effect, the slope of the cut-off voltage versus frequency of incident light is found to be $4.12 \times 10^{-15} Vs$. Calculate the value of Planck's constant.

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12. A 100 W sodium lamp radiates energy uniformly in all direction. The lamp is located at the centre of a large sphere that absorbs all the sodium light which is incident on it. The wavelength of the sodium light is 589 nm.

What is the energy per photon associated with the sodium light?

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13. A 100 W sodium lamp radiates energy uniformly in all direction. The lamp is located at the centre of a large sphere that absorbs all the sodium light which is incident on it. The wavelength of the sodium light is 589 nm.

At what rate are the photons delivered to the sphere?

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14. The threshold frequency for a certain metal is $3.3 \times 10^{14} Hz$. If light of frequency $8.2 \times 10^{14} Hz$ is incident on the metal, predict the cut-off voltage for the photoelectric emission.

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15. The work function for a certain metal is 4.2 eV. Will this metal give photoelectric emission for incident radiation of wavelenght 330 nm?

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16. Light of frequency $7.21 \times 10^{14} Hz$ is incident on a metal surface. Electrons with a maximum speed of $6.0 \times 10^5 \frac{m}{s}$ are ejected from the surface. What is the threshold frequency for photoemission of electrons?

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17. Light of wavelength 488 nm is produced by an argon laser which is used in the

photoelectric effect. When light from this spectral line is incident on the emitter, the stopping (cut off) potential of photoelectrons is 0.38 V. find the work function of the material from whih the emitter is made.

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18. Calculate the momentum and de-Broglie wavelength of the electrons

accelerated through a potential difference of 56V.

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19. Calculate the momentum and de-Broglie wavelength of the electrons accelerated through a potential difference of 56V.

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20. What is

momentum of an electron with kinetic energy

120 eV.

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21. What is

speed of an electron with kinetic energy 120

eV.

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22. What is the

de-Broglie wavelength of an electron with kinetic energy of 120 eV?

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23. The wavelength of light the spectral emission line of sodium is 589 nm. Find the kinetic energy at which (a) an electron and (b) a neutron,would have the same de Broglie wavelength.

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24. The wavelength of light from the spectral emission line of sodium is 589 nm. Find the kinetic energy at which

a neutron, would have the same de-Broglie wavelength.

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25. What is the de-Broglie wavelength of

a bullet of mass 0.040 kg travelling at the speed of 1.0km/s.

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26. What is the de-Broglie wavelength of a ball of mass 0.060 kg moving at a speed of 1.0 m/s.

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27. What is the de-Broglie wavelength of a dust particle of mass $1.0 \times 10^{-9} kg$ drifting with a speed of 2.2 m/s?

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28. An electron and a photon each have a wavelength of 1.00 nm. Find

their momenta?

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29. An electron and a photon each have a wavelength of 1.00 nm. Find

the energy of the photon?

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30. An electron and a photon each have a wavelength of 1.00 nm. Find

the kinetic energy of electron.

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31. For what kinetic energy of a neutron will the associated de-Broglie wavelength be $1.40 \times 10^{-10} m$?

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32. Also find the de-Broglie wavelength of a neutron, in thermal equilibrium with matter, having an average kinetic energy of $\frac{3}{2}KT$ at 300 K.

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33. Show that the wavelength of electromagnetic radiation is equal to the de-Broglie wavelength of its quantum (Photon).

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34. What is the de-Broglie wavelengths of a nitrogen molecule in air at 300 K? Assume that the molecule is moving with the root-mean-square speed of molecules at this temperature. (Atomic mass of nitrogen = 14.0076 u).

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35. Estimate the speed with which electrons emitted from a heated emitter of an evacuated tube impinge on the collectro maintained at a potential difference of 500 V with respect to the emitter. Ignore the small initial speeds of the electrons. The specific charge of the electrons i.e. its e/m is given to be $1.76 \times 10^{11} Ckg^{-1}$.

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36. Use the same formula you employ in to obtain electron speed for a collector potential of 10 MV. Do you see what is wrong? In what way is the formula to be modified?

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37. A monoenergtic electron beam with electron speed of $5.20 \times 10^{6} ms^{-1}$ is subjected to a magnetic field of $1.30 \times 10^{-4} t$ normal to beam velocity. What is the radius of

the circle traced by the beam, given e/m for electron equals $1.76 \times 10^{11} kg^{-1}$?

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38. Is the formula you employ in (a) valid for calculating radius of the path of a 20 MeV electron beam? If not, in what way is it modified?

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39. An electron gun with its collector at a potential of 100 V fires out electrons in a spherical bulb containing hydrogen gas at low pressure $\left(\sim 10^{-2} mmofHg\right)$. A magnetic field of $2.83 \times 10^{-4} T$ curves the path of the electrons in a circular orbit of radius 12 cm. detremine e/m from the data.

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40. (a) An X-ray tube produces a continuous spectrum of radiation with its short wavelength end at 0.45 . What is the maximum energy of a photon in the radiation? (b) Form your answer to (a), guess what order of accelerating voltage (for electrons) is required in such a tube.

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42. In accelerator experimetn on high energy collisions of electrons with positrons, a certaind event is interprected as annihilation of an electron-position pair of total energy 10.2 BeV into two $\gamma - rays$ of equal energy. What it the wavelength associated with each $\gamma - rays$? $\left(1BeV = 10^9 eV\right)$.

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43. In accelerator experimetn on high energy collisions of electrons with positrons, a certaind event is interprected as annihilation of an electron-position pair of total energy 10.2 BeV into two $\gamma - rays$ of equal energy. What it the wavelength associated with each $\gamma - rays$? $\left(1BeV = 10^9 eV\right)$.

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44. Ultraviolet light of wavelength $2271\overset{\circ}{A}$ from a 100 W mercury source irradiates a photocell made of molybdenum metal. If the stopping potential is -1.3 V, estimate the work function of the metal.

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45. Monochromatic radiation of wavelength $640.2nm\left(1nm = 10^{-9}m\right)$ from a neon lamp irradiates a photosensitive mateiral made of

caesium or tungsten. The stopping voltage is measured to be 0.54 V. The source is replaced by an iron source and its 427.2 nm line irradiates the same photocell. predict the new stopping voltage.

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46. A mercury lamp is a convenient source for studying frequency dependence of photoelectric emission, since, it gives a number of spectral lines ranging from the UV

to the red end of the visible spectrum. In our experiment with rubidium photo-cell, the following lines from a mercury source were used:

$\lambda_1 = 3650\overset{\circ}{A}, \quad \lambda_2 = 4047\overset{\circ}{A}, \quad \lambda_3 = 4358\overset{\circ}{A},$

$\lambda_4 = 5461\overset{\circ}{A}, \lambda_5 = 6907\overset{\circ}{A}$

The stopping voltages respectively were measured to be

$V_0 = 1.28V, \ V_{0.95}V, \ V_0 = 0.74V, \ V_0 = 0.16,$

$V_0 = 0V$

Determine the value of Planck's constant h.

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$V_0 = 0V$

The threshold frequency and work function for the material.

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48. The work function for the following metals is given

Na: 2.75V, K:2.30eV, Mo:4.17eV, Ni:5.15eV

Which of these metals will not give photoelectron emission fro a radiation of

wavelength $3300\overset{\circ}{A}$ from a He-Cl laser placed 1 m away from the photocell?

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49. Light of intensity $10^{-5}Wm^{-2}$ falls on a sodium photocell of surface area $2cm^2$. Assuming that the top 5 layers of sodium absorb the incident energy, estimate the time required for photoelectric emission on the wave picture of radiation. The work function

for the metal is given to be about 2 eV. what is the implication of your answer?

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50. Crystal diffraction experiments can be performed using X-rays, or electrons accelerated through appropriate voltage? Which probe has greater energy? (For quantitative comparison, take the wavelength of the probe equal to $1\overset{\circ}{A}$, which is of the order

of inter atomic spacing in the lattice), $\left(m_e = 9.11 \times 10^{-31} kg\right)$

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51. Obtain the de-Broglie wavelength of a neutron of kinetic energy 150 eV. As you have seen in Q.NO.11.31, an electron beam of this energy is suitable for crystal diffraction experiments. Would a neutron beam of the same energy be equally suitable? Explain $\left(m_n = 1.675 \times 10^{-27}\right)$.

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52. Obtain the de-Broglie wavelength associated with thermal neutrons at room temperature $(27^{\circ} C)$. Hence explain why a fast neutron beam needs to be thermalized with the environment before it can be used for neutron diffraction experiments.

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53. An electron microscope uses electron accelerated by a voltage of 50kV. Determine the de-Broglie wavelengths associated with the electrons. If other factors (such as numerical aperture etc) are taken to be roughly the same how does the resolving power of electron microscope compare with that of an optical microscope which uses yellow light?

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54. The wavelength of a probe is roughly a measure of the size of a structure that it can probe in some detail. The quark structure structure of protons and neutrons appears at the minute length scale of $10^{-15}m$ or less. This structure was probed in early 1970's using high energy electron beams produced by a linear accelerator at stanford, USA. Guess what might have been the order of energy of these electrons beams. (Rest mass energy electron=0.511 MeV).

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55. Find the typical de-Broglie wavelength associated with a He atom in helium gas at room temperatuare $(27^{\circ}C)$ and 1 atm pressure and compare it with the mean separation between two atoms under these conditions.

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56. Compute the typical de-Broglie wavelength of an electron in a metal at $27^{\circ}C$ and

compare it with the mean separation between two electrons in a metal which is given to be about $2 \times 10^{-10} m$.

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57. Quarks inside protons and neutrons are thought to carry fractional charges $\left(+\frac{2}{3}e, -\frac{1}{3}e \right)$.Why do they not show up in Millikan's oil drop experiment?

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58. What is so special about the combination e/m? Why do we not simply talk of e and m specially?

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59. Why should gases be insulators at ordinary pressure and start conducting at very low pressure?

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60. Every mrtal has a definite work function. Why do all photoelectrons not come out with same energy, if incident radiation is monochromatic? Why is there an energy distribution of photoelectrons?

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61. The energy and momentum of an electron are related to the frequency and wavelength of the associated matter wave by the relation:

$E = hv, p = \frac{h}{\lambda}.$

But while the value of λ is physically significant, the value of v (and therefore the value of the phase speed $v\lambda$) has no physical significance. why?

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62. A proton and an $\alpha - partic \leq$ are accelerated using the same potential difference. How are the de-Broglie wavelengths λ_p and λ_α related to each other?

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63. In the explanation of photoelectric effect, we assume one photon of frequency v collidies with an electron and transfers its energy. This leads to the equation for the maximum energy $E_{\max}$ of the emitted electron as

$$E_{\max} = hv - \phi_0$$

Where ϕ_0 is the work function of the metal. if an electron absorbs 2 photons (each of frequency v) what will be the maximum energy for the emitted electron?

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64. Why is this fact (two photon absorption) not taken into consideration in our discussion of the stopping potential?

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65. There are materials which absorb photons of shorter wavelength and emit photons of longer wavelength. Can there be stable substances which absorb photons of larger

wavelength and emit light of shorter wavelength.

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66. Do all the electrons that absorb a photon come out as photoelectrons?

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67. There are two sources of light, each emitting with a power of 100 W. One emits X-

rays of wavelength 1nm and the other visible light of 500 nm. Find the ratio of number of photons of X-rays to the photons of visible light of the given wavelength?

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68. Consider Fig. EP 11.9 for photomission.

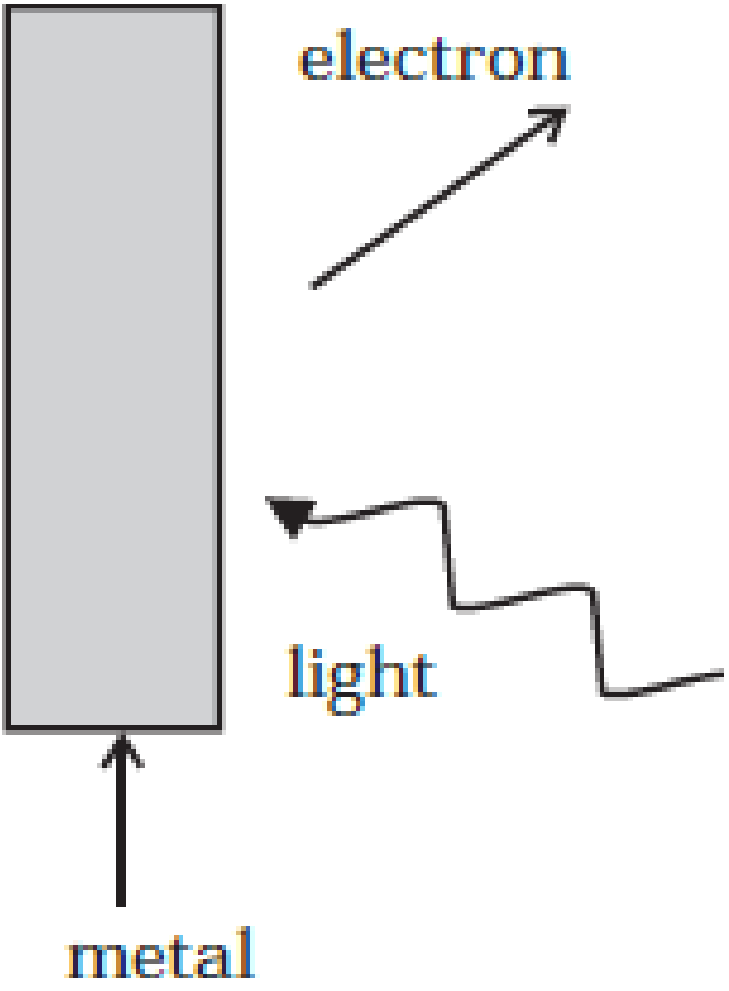

Fig. 11.1

How would you reconcile with momentum conservation? Note light (photons) have momentum in a different direction than the emitted electrons.

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69. Consider a metal exposed to light of wavelength 600 nm. The maximum energy of the electron doubled when light of wavelength 400 nm is used. Find the work function in eV.

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70. Assuming an electron is confined to a 1nm wide region. Find the uncertainty in momentum using Heisenberg Uncertainty principle. You can assume the uncertainty in position Δx as 1nm. Assuming $p = \Delta p$, find the energy of the electron in electron volts.

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71. Two monochromatic beams A and B of equal intensity I, hit a screen. The number of photons hitting the screen by beam A is twice than by beam B. then what inference can you make about their frequencies?

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72. Two particles A and B of de-Broglie wave-lengths λ_A and λ_B combine to form a particle C.The process conserves momentum.Find the

de Broglie waveelngth of the particle C.(the motion is one dimensional).

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73. A neutron beam of energy E scatters from atoms on a surface with a spacing d=0.1nm. The first maximum of intensity in the reflected beam occurs at $\theta = 30$. What is the kinetic energy E of the beam in eV?

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Exercise

1. The photon of frequency v has a momntum associated with it .If c is the velocity of light,then momentum is

A. v/c

B. hvc

C. hv/c^2s

D. hv/c

Answer:

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2. The time taken by a photoelectron to come out after the photon strikes is approximately:

A. $10^{-4}s$

B. $10^{-10}s$

C. $10^{-16}s$

D. $10^{-1}s$.

Answer:

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3. Work function of a metl surface is 4.2 eV. The maximum wavelength which can eject electrons from this metal surface is:

A. 540 nm

B. 400 nm

C. 310 nm

D. 220 nm

Answer:

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4. Sodium and copper have work functions $2.3eV$ and $4.5eV$, respectively. Then, the ratio of the wavelengths is nearest to

A. $1:2$

B. $4:1$

C. $2:1$

D. $1:4$

Answer:

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5. A photocell is illuminated by a small bright source placed 1 m away .when the same source of light is placed 0.5 m away,the number of electrons emitted by photocathode would

A. decrease by a factor of 4.

B. increase by a factor of 4

C. decrease by a factor of 2

D. incease by factor of 2.

Answer:

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6. According to Einstein's photoelectric equation, the graph between kinetic energy of photoelectrons ejected and the frequency of the incident radiation is :

A. depends on the natrue of the metla used

B. depends on the intensity of the radiation

C. depends both on teh ntenstiy of the radiation and the metal used

D. is the same for all metals and independent of the intensity of the radiation.

Answer:

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7. The surface of a metal is illuminted with the light of 400 nm.the kinetic energy of the ejected phtotlectrons was found to be $1.68eV$. If hc=1,240 eV nm,the work function of the metla is

A. 1.42 eV

B. 1,51 eV

C. 1,68 eV

D. 3.09 eV

Answer:

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8. The threshold freuency for a metallic surface corresponds to an energy of 6.2 e and the stopping potential for a radiation incident on this surface is 5 V.The incident radiation lies in:

A. ultraviolet region

B. infra-red-region

C. visible region

D. X-ray region

Answer:

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9. This question has statement - 1 and statement - 2 of the four choice given after the statements choose the one that best describes the two statements

statement - 1 : A metallic surface is irradiated by a monochromatic light of frequency v gtv_0 (the threshold frequency). The maximum kinetic energy and the stopping potential are

$K_{\max}$ and V_0 respectively if the frequency incident on the surface is doubled , both the $K_{\max}$ and V_0 are also doubled

statement - 2 : The maximum kinetic energy and the stopping potential of photoelectron emitted from a surface are linearly dependent on the frequency of incident light

A. Statement-1 is true, Statement-2 is true and Statement-2 is correct explanation of Statement-1.

B. Statement-1 is true, Statement-2 is true, but Statement-2 is not a correct explanation of Statement-1.

C. Statement-1 is true, but Statement-2 is false

D. Statement-1 is false, but Statement-2 is true.

Answer:

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10. Two identical photocathodes receive the light of frequencies f1 and f2 respectively. If the velocities of the photo-electrons coming out are v1 and v2 respectively, then

A. $v_1^2 - v_2^2 = \frac{2h}{m}(f_1 - f_2)$

B. $v_1 + v_2 = \left(\frac{2h}{m}(f_1 + f_2)\right)^{1/2}$

C. $v_1^2 \_ v_2^2 = \frac{2h}{m}(f_1 + f_2)$

D. $v_1 - v_2 = \left(\frac{2h}{m}(f_1 - f_2)\right)^{1/2}$.

Answer:

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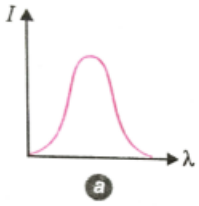
11. The anode vollage of a photocell is kept fixed . The wavelength lambda of the light falling on the cathode varies as follows

A.



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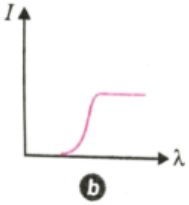
B.



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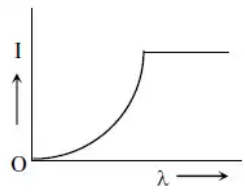
C.



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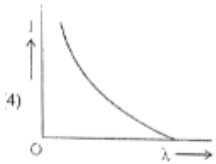
D.



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Answer:

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12. The de-Broglie wavelength of a tennis ball of mass 60 g moving wiht a velocity of $10ms^{-1}$ is approximately:

A. $10^{-33}m$

B. $10^{-31}m$

C. $10^{-16}m$

D. $10^{-25}m.$

Answer:

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13. If the kinetic energy of a free electron doubles,its de-Broglie wavelength changes by the factor

A. $1/2$

B. 2

C. $1/\sqrt{2}$

D. $\sqrt{2}$.

Answer:

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14. A radiation of energy E falls normally on a perfecly reflecting surface.The momentum transferred to the surface is:

A. E/c

B. $2E/c$

C. Ec

D. E/c^2.

Answer:

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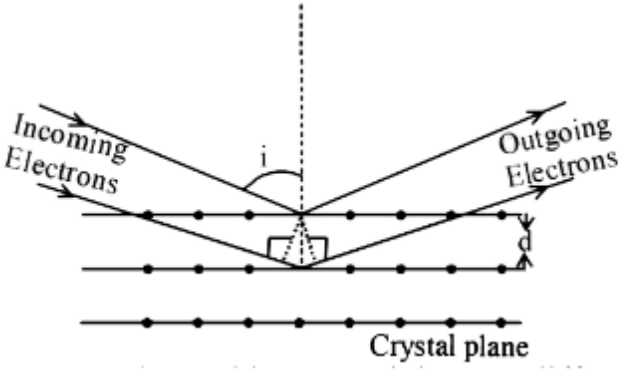
15. Direction:Answer the MCQ no.15 to 17 on the basis of the folowing paragraph:Wave property of electron implies that they will show diffraction effected . Davisson and Germer demonstrated this by diffracting electron from crystals . The law governing the diffraction from a crystals is obtained by requiring that electron waves reflected from the planes of atoms in a crystal interfere constructiely as shown in figure



Electrons accelerated by potential V are diffracted from a crystal.Given that $h = 6.62 \times 10^{-34} Js$, $e = 1.6 \times 10^{-19} C$ and $m_e = 9.1 \times 10^{-31} kg$. .If $d = 1\overset{\circ}{A}$ and $i = 30^\circ$,V should be about

A. 50 V

B. 500 V

C. 1,000 V

D. 2,000 V

Answer:

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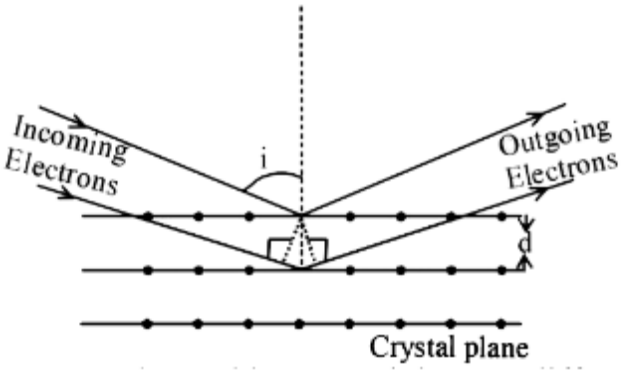
16. Wave property of electron implies that they will show diffraction effected . Davisson and Germer demonstrated this by diffracting electron from crystals . The law governing the diffraction from a crystals is obtained by requiring that electron waves reflected from

the planes of atoms in a crystal interfere constructiely as shown in figure



A strong diffraction peak is obsrved,when electrons incident at an angle i from the normal to the crystal planes with distance d between them and as shown in the figure given above.de-Broglie wave length λ) of electrons can be calculated by the relation (n is an integer)

A. $d \cos i = n\lambda$

B. $d \sin i = n\lambda$

C. $2d \cos i = n\lambda$

D. $2d \sin i = n\lambda$.

Answer:

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17. Wave property of electron implies that they will show diffraction effected . Davisson and Germer demonstrated this by diffracting

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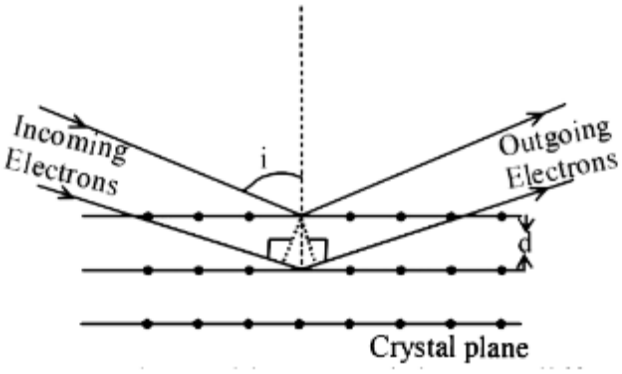
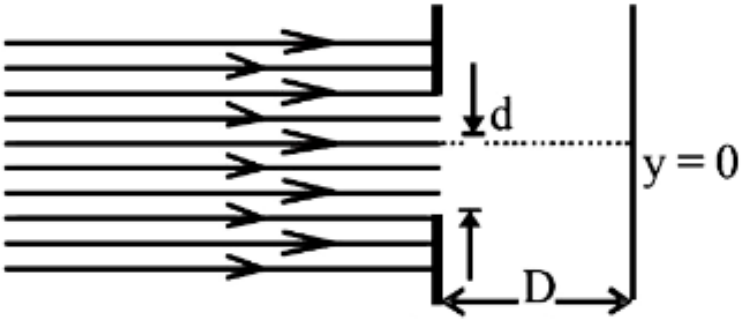


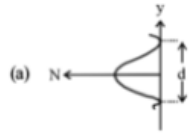
In an experiment,electrons are made to pass through a narrow slit of width d comparable to their de-Broglie wave length. They are detected on a screen at a distance D from the

slit (see figure).



Which of the following graphs can be expected to represent the number of electrons N detected as a function of the detector position y (y=0 corresponds to the middle of the slit).

A.



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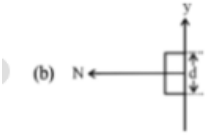
B.



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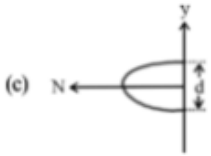
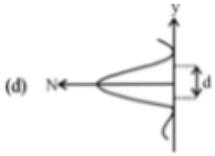
C.



.

D.



.

Answer:

Watch Video Solution

18. Wavelength of the radiation of freuquency 100 Hz is :

A. $2 \times 10^6 m$

B. $3 \times 10^6 m$

C. $4 \times 10^6 m$

D. $5 \times 10^6 m$

Answer:

Watch Video Solution

19. Planck's constant has the dimetnsion of

A. linear momentum

B. angular momentum

C. energy

D. power

Answer:

Watch Video Solution

20. The value of Planck's constant is

A. $6.63 \times 10^{-34} Js^9 - 1)$

B. $6.63 \times 10^{-34} kgms^{-1}$

C. $6.63 \times 10^{-34} kgm^2$

D. $6.63 \times 10^{-34} Js.$

Answer:

Watch Video Solution

21. The energy of a photon of wavelelngth λ is

A. $hc\lambda$

B. hc/λ

C. λ/hc

D. $h\lambda/c$

Answer:

Watch Video Solution

22. If a phtoton has velocity c and frequency v ,then wchich of the following represnts its wvelength?

A. hc/E

B. hv/c

C. hv/c^2

D. hv

Answer:

Watch Video Solution

23. The mass of photon at rest is:

A. zero

B. $1.67 \times 10^{-35} kg$

C. $1 a.\, m.\, u.$

D. $9 \times 10^{-31} kg.$

Answer:

Watch Video Solution

24. Monochromatic light of frequency $6 \times 10^{14} Hz$ is produced by a LASER .the power emitted is $2 \times 10^{-3} W$.The number of phtotons smitted,on the average ,by the source per second is

A. 5×10^{14}

B. 5×10^{15}

C. 5×10^{16}

D. 5×10^{17}.

Answer:

Watch Video Solution

25. Which one among the following shows particle nature of ligth?

A. Photoelectric effect

B. Interfrence

C. Refraction

D. Polarisation

Answer:

Watch Video Solution

Watch Video Solution

26. The energy of a photon of light is 3 eV.Then,the wavelength of photon must be:

A. 4,125 nm

B. 412.5 nm

C. 41,250 nm

D. 4 nm

Answer:

Watch Video Solution

27. A source S_1 is producing 10^{15} photons s^{-1} of wavelength $5,000\overset{\circ}{A}$.Another source S_2 is producing 1.02×10^{15} photons s^{-1} of wavelength$5,100\overset{\circ}{A}$.Then , ratio of the power of s_2 to that of S_1 is equal to

A. 0.98

B. 1

C. 1.02

D. 1.04

Answer:

Watch Video Solution

28. Monochromatic light of wavelength 667 nm is produced by a helium neon laser.The power emitted in 9m W.The number of phototns arriving per second on the average at a target irradiated by this beam is

A. 3×10^{16}

B. 3×1^{19}

C. 9×10^{15}

D. 9×10^{17}.

Answer:

Watch Video Solution

29. The photoelectric work function for a metal surface is 4.125 eV.The cut-off wavelength for this surface :

A. $4125\overset{\circ}{A}$

B. $2,062.5\overset{\circ}{A}$

C. $3,000\overset{\circ}{A}$

D. $6,000\overset{\circ}{A}.$

Answer:

Watch Video Solution

30. The work functins for metals,A ,B and C are 1.92 eV,2 eV and 5 eV repspectively.According to einstein's equation,the metals which will

emit photoelectrons for a radiation of waveelngth $4,100\overset{\circ}{A}$ is /are:

A. none

B. A only

C. A and B only

D. all the three

Answer:

 Watch Video Solution

31. When ultraviolet rays are incident on a metal plate,the photoelectric effect odes not occur.It occcurs by incidence of

A. infraared rays

B. X-rays

C. radio waves

D. light waves

Answer:

Watch Video Solution

32. A photocell is illuminated by a small bright source placed 1 m away .when the same source of light is placed 0.5 m away,the number of electrons emitted by photocathode would

A. remain same

B. become four times

C. become two times

D. become one-fourth

Answer:

Watch Video Solution

33. A photoelectric cell is illuinated by a point source of light 1 m away.When the source is shifted to 2 m ,then

A. each emited electron carrries half the initial energy

B. number of eelctrons emitted is half the initial number

C. number of electrons emitted is quarter the intial number

D. each emitted electron carries one - quareer of the initial energy

Answer: number of elecvtrons emitted is one - quarteer of the initial number.

Watch Video Solution

34. A 5 W source emits monochromatic light of wavelength $5,00\overset{\circ}{A}$.When placed 0.5 m away,it metallic surface.When the source is moved to a distance of 1.0 m ,the number of

photoelectrons liberated will reduce by a factor of

A. 2

B. 4

C. 8

D. 16

Answer:

 Watch Video Solution

35. As the intensity of incident light incrases:

A. photoelectric current increases

B. photoelectric current decreases

C. kinetic energy of emitted photoeelctrons increases

D. kinetic eenrgy of emitted photoelectrons decreases.

Answer:

 Watch Video Solution

36. Which of the following statements is correct?

A. The photocurrent increases with increasingg frequency

B. The photocurent is proportional to the applied voltage

C. the phtotcurrent increases with intensity of light

D. The stopping potential increases with intensity of incident light

Answer:

Watch Video Solution

37. The number of photoelectrons emited for a light of a freqeuency v (higher than the threshold frequency v_0) is proportionla to

A. threshold frequency

B. intensity of light

C. freueyncy of light

D. $v - v_0$

Answer:

Watch Video Solution

38. When monochromatic radition of intensity I falls on a metal surface,the number of phototlectrons and their maximum kinetic energy are N and t respectively.If the intensity

of radiation is 2 I,the n umbe of emitted electrons and their maximum kinetic energy are respectiely

A. N and 2 T

B. 2 N and T

C. 2 N and 2 T

D. N and T.

Answer:

 Watch Video Solution

39. The cathode of a photoelectric cell is hanged,such that the work function chagnes from ω_1 to $\omega_2(\omega_2 > \omega_1)$.If the currents before nad after the change are I_1 and I_2,all other conditions unchanged,then (assuming $hv > \omega_2$),

A. $I_1 = I_2$

B. $I_1 < I_2$

C. $I_1 > I_2$

D. $I_1 < I_2 < 2I_1$.

Answer:

Watch Video Solution

40. Einstien's work on photoelectric effect given support to:

A. $E = mc^2$

B. $E = hv$

C. $E = -\frac{Rhc}{n^2}$

D. $K.E. = \frac{1}{2}mv^2.$

Answer:

Watch Video Solution

41. When photons of energy h v fall on an aluminium plate (of work function ω_0),photoelectrons of maximum kinetic energy K are jeected.If the freuency of radiation is doubled ,the maximum kinetic energy of the jeected photoelectron will be

A. K + h v

B. $K + \omega_0$

C. 2 K

D. K

Answer:

Watch Video Solution

42. The work function of a surface of a phototsensitve materil is 6.2 eV.The wavelength of the incident radiation,for which the stoppintg potential is 5 V.lies in the

A. infrared region

B. X-ray region

C. ultraviolet region

D. visible region

Answer:

Watch Video Solution

43. Light of wavleength $5,000\overset{\circ}{A}$ falls on a photo sensitive plate with photoelectric work

function f 1.9 eV.The kinetic energy of phtotoelectrons emitted will be

A. 0.58 eV

B. 2.48 eV

C. 1.24 eV

D. 1.16 eV

Answer:

Watch Video Solution

44. Photoelectric work function of a metal is 1 eV.Light of wavelength $\lambda = 3,000\overset{\circ}{A}$ falls on it.The photoelectrons come out with velocity

A. $10ms^{-1}$

B. 10^2ms^{-1}

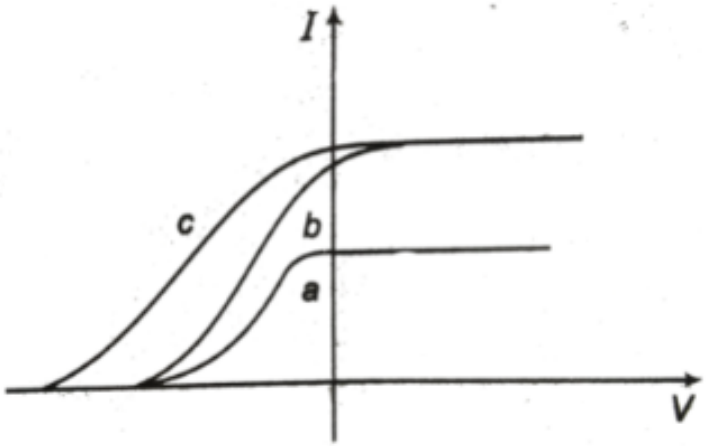
C. 10^4ms^{-1}

D. 10^6ms^{-1}.

Answer:

Watch Video Solution

45. The figure shows a plot of photocurrent versus anode potential for a phtot sensitive surface fo three different radiations.



which one of the following is a correct statement?

A. Curves a and b represent incident radiations of different frequencies and different intensities

B. Curves a and b represent incident radiations of the same frequency but no different intensities

C. Curves b and c represent incident radiations of different frequencies and different intensities

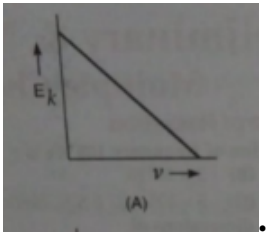
D. Curve b and c represent incident radiations of the same frequency having the same intensity

Answer:

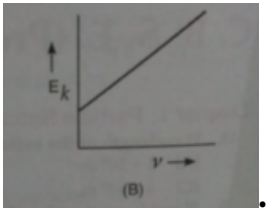
Watch Video Solution

46. According to Einstein's photoelectric equation, the graph between kinetic energy of photoelectrons ejected and the frequency of the incident radiation is :

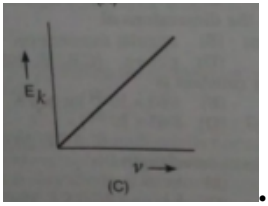
A.



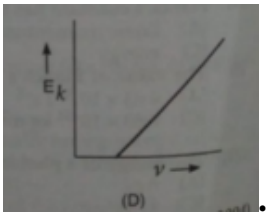
B.



C.



D.

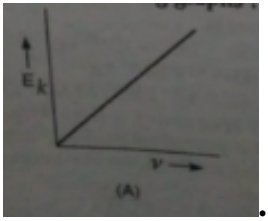


Answer:

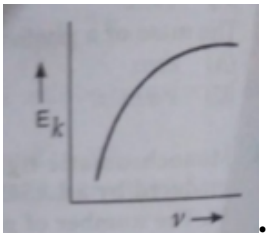
Watch Video Solution

47. According to Einstein's photoelectric equation, the graph between kinetic energy of photoelectrons ejected and the frequency of the incident radiation is :

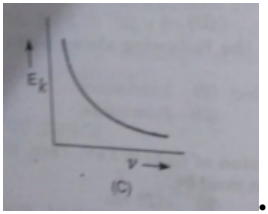
A.



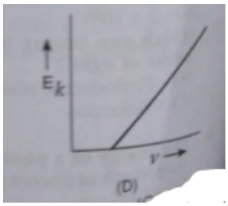
B.



C.



D.



Answer:

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48. In a photoemmisive cell,with exciting waelength λ,the fastest electron has speed of v.If the exciting waelength is changed to $3\lambda/4$

,the speed of the fastest emitted electron will be

A. $v(3/4)^{1/2}$

B. $v(4/3)^{1/2}$

C. less than $v(3/4)^{1/2}$

D. greater than $v(4/3)^{1/2}$.

Answer:

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49. A photosensitive metallic surface has work function hv_0.If photons of energy $2hv_0$ fall on this surface,the electrons come out with a maximum velocity of $4 \times 10^6 ms^{-1}$.When the photon energy is increased to $5hv_0$,then maximum velocity of photoelectron will be:

A. $2 \times 10^7 ms^{-1}$

B. $2 \times 10^6 ms^{-1}$

C. $8 \times 10^6 ms^{-1}$

D. $8 \times 10^5 ms^{-1}$.

Answer:

Watch Video Solution

50. A photocell employs photoelectric effect to convert

A. change in the freuquency of light into a change to the electric current

B. change in the frequency of light into change in electric voltage

C. change in the intensity of illumination into a chnage in photoelectric current

D. change in the intensity of illuminatin into a change in the work function of th photocathode.

Answer:

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51. A particle of mass 1 mg has the same wavelength as an electron moving with a velocity of $3 \times 10^{6} ms^{-1}$.If mass of the leectron is $9.1 \times 10^{-31} kg$,then the velocity of the particle is

A. $2.7 \times 10^{-18} ms^{-1}$

B. $2.7 \times 10^{-21} ms^{-1}$

C. $3.0 \times 10^{-31} ms^{-1}$

D. $9.0 \times 10^{-12} ms^{-1}$

Answer:

Watch Video Solution

52. The kinetic energy of an electron,which is accelerated to the potential difference of 100 V,is

A. $1.6 \times 10^{-17} J$

B. $a.6 \times 10^{4} J$

C. $415.6 cal$

D. 6.636 cal

Answer:

Watch Video Solution

53. The mass of an electron is m, charge is e and it is accelerated form rest through a potential difference of V volts. The velocity acquired by electron will be :

A. $\frac{eV}{2m}$

B. $\frac{eV}{m}$

C. $\sqrt{\frac{2eV}{m}}$

D. $\sqrt{\frac{eV}{m}}$.

Answer:

Watch Video Solution

54. The minimum wavelength of the X-rays produced by elecrons accelerated through a otential of V (in volt) is directly poroportionla to

A. $\sqrt{V}$

B. v^2

C. $1/\sqrt{V}$

D. $1/V$.

Answer:

Watch Video Solution

55. The de-Broglie wave corresponding to a particle of mass m and velocity v has a wavbeelngth associated with it

A. $\frac{h}{mv}$

B. h m v

C. $\frac{mh}{v}$

D. $\frac{m}{hv}$

Answer:

Watch Video Solution

56. If particles are moving with same velocity,then maximum de-Broglie wavelength is for

A. proton

B. α-particle

C. neutron

D. β-particle

Answer:

Watch Video Solution

57. If we consider electrons and photons of same wave length, then they will have the same:

A. energy

B. velocity

C. momentum

D. angular momentum

Answer:

Watch Video Solution

58. The momentum of a photon of energy 1 M eV(in kg m s^{-1}) will be

A. 5.33×10^{-22}

B. 0.33×10^{-16}

C. 7×10^{-24}

D. 10^{-22}.

Answer:

Watch Video Solution

59. An electron of mass m,when accelerated through a potensital difference eV,has de Broglie wavelength λ.the de-Broglie waelength

associated with a proton of mass M and acceleared through the same potential differencee will be

A. $\lambda\sqrt{M/m}$

B. $\lambda\sqrt{(m/M)}$

C. $\lambda M/m$

D. $\lambda m/M.$

Answer:

Watch Video Solution

60. An electron beam has a kinetic energuy equal to 100 eV.Find the wavelngth associated with the beam,if mass of elecron - $9.1 \times 10^{-31} kg 1ev = 1.6 \times 10^{19} J$ and Planck's constnat = $6.6 \times 10^{-34} Js$.

A. $1.2\overset{\circ}{A}$

B. $6.3\overset{\circ}{A}$

C. $24.6\overset{\circ}{A}$

D. $0.12\overset{\circ}{A}$.

Answer:

Watch Video Solution

61. Electron volt is a unit of

A. energy

B. potential

C. current

D. charge

Answer:

Watch Video Solution

62. The energy of a photon of light of waveelngth $5,000\overset{\circ}{A}$ is approximately 2.5 eV.This way the energy of an X-ray photon of wavelength $1\overset{\circ}{A}$ would be

A. $2.5 \times 5,000eV$

B. $2.5 \times (5,000)^2 eV$

C. $\frac{2.5}{5,000} eV$

D. $\frac{2.5}{(5,000)^2} eV.$

Answer:

Watch Video Solution

63. Particle nature and wave nature of electromagnetic waves and electrons can be shown by

A. electrons have small mass,deflected by the metal shet

B. X-rays are diffracted ,reflectred by thick metal sheet.

C. light is refracted and diffracted

D. Photoelectricity and electron microscopy

Answer:

Watch Video Solution

64. A strong argument for the particle nature of cathode rays is that they

A. cast shdow

B. produced fouorescene

C. trvel though vacuum

D. get deflected by electric and magnetic fields.

Answer:

Watch Video Solution

65. The wavelength of a photon is proportional to (where v = frequency)

A. v

B. $\sqrt{v}$

C. $1/\sqrt{v}$

D. $1/v$.

Answer:

Watch Video Solution

66. In photoelecrtric effect ,the electrons are ejected from metals,if the incident light has a certain minimum

A. wavelength

B. frequency

C. amplitude

D. anlge of incidence

Answer:

Watch Video Solution

67. The stopping potential doubles,when the frequency of the incident light changes from v to $3v/2$.Then,the work function of the metal must be

A. $hv/2$

B. hv

C. 2 h v

D. None of the above

Answer:

Watch Video Solution

68. The photoelectrons emitted from a given cathode on the incidence of a given monochromatic beam of liht ,have a /an

A. energy spread with a lower limit

B. energy spread with an upper limit

C. energy spread with o shrap limits

D. definite enregy only.

Answer:

Watch Video Solution

69. the speed of an electron having a wavelenth of 10^{-10} m is

A. $7.25 \times 10^6 ms^{-1}$

B. $6.26 \times 10^6 ms^{-1}$

C. $5.25 \times 10^6 ms^{-1}$

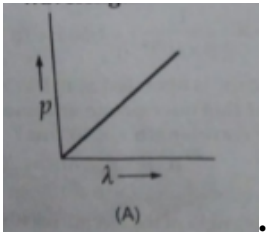
D. $4.24 \times 10^6 ms^{-1}$.

Answer:

Watch Video Solution

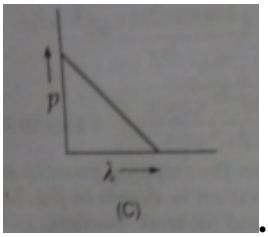
70. Which of following graphs correctly represents the variation of particle momentum with de-Broglie wavelength?

A.

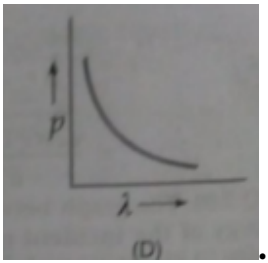


B.

C.



D.



Answer:

Watch Video Solution

71. Hard X-rays for the studdy of fractures in bones shjold have a minimum waelength of $10^{-11}m$. The accelerating voltage for electrons in x-ray machine should be

A. $< 124.2KV$

B. $> 124.2kV$

C. between 60 kV and 70 kV

D. $= 100kV$

Answer:

Watch Video Solution

72. We sidh to see inside an atom.Assuming the atom to have a diameter of 100 pm[1 pictomerer(pm) = $10^{-12}m$],this means that

one must be able to resolve a width of say 10 pm.If an electron micriscope is used,the minimum electron energy required is about

A. 1.5 keV

B. 15 keV

C. 150 keV

D. 1.5 MeV

Answer:

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73. Directions.In the following question, a statement of asertion followed by a statement of reason is given .Choose the correct answer out of the following choices:

Assertion and reason both are correct statements and reason is correct explanation for assertion.

Assertion and reason both are correct statements but reason is not correct explanation for assertion.

Assertion is correct statement but reason is wrong statement.

Assertion is wrong statement but reason is correct statement.

Assertion:Photoelectric effect demonstrates the wave nature of light

Reason:The number of photoelecrons is proportional to the frequency of light

A. A

B. B

C. C

D. D

Answer:

Watch Video Solution

74. Directions.In the following question, a statement of asertion followed by a statement of reason is given .Choose the correct answer out of the following choices:

Assertion and reason both are correct statements and reason is correct explanation for assertion.

Assertion and reason both are correct statements but reason is not correct explanation for assertion.

Assertion is correct statement but reason is wrong statement.

Assertion is wrong statement but reason is correct statement.

Assertion:higher the work function of a metal greater is the threshold freqeuncy.

Reason:The work function of alkali metals is usually lower than for other metals.

A. A

B. B

C. C

D. D

Answer:

Watch Video Solution

75. Directions.In the following question, a statement of asertion followed by a statement of reason is given .Choose the correct answer out of the following choices:

Assertion and reason both are correct statements and reason is correct explanation

for assertion.

Assertion and reason both are correct statements but reason is not correct explanation for assertion.

Assertion is correct statement but reason is wrong statement.

Assertion is wrong statement but reason is correct statement.

Assertion:Visible ligh is unable to uase the photoelectric emission from a metal surface.However,ultaraviolet ligth can cuase the photoelectric emission from the same metal surface

Reason:The threshold fruquency of the metal surface is greater than frequency of the visible light but less than that of the ultravtiolet light.

A. A

B. B

C. C

D. D

Answer:

Watch Video Solution

76. Directions.In the following question, a statement of asertion followed by a statement of reason is given .Choose the correct answer out of the following choices:

Assertion and reason both are correct statements and reason is correct explanation for assertion.

Assertion and reason both are correct statements but reason is not correct explanation for assertion.

Assertion is correct statement but reason is

wrong statement.

Assertion is wrong statement but reason is correct statement.

Assertion:The photoelectric take about 10^{-10} s to come out of a metal surface,after a suitable radiation is incident on it.

Reason:On wave picture of radiation,an electjron would take about an year to come out of a metal surface.

A. A

B. B

C. C

D. D

Answer:

Watch Video Solution

77. Directions.In the following question, a statement of asertion followed by a statement of reason is given .Choose the correct answer out of the following choices:

Assertion and reason both are correct statements and reason is correct explanation

for assertion.

Assertion and reason both are correct statements but reason is not correct explanation for assertion.

Assertion is correct statement but reason is wrong statement.

Assertion is wrong statement but reason is correct statement.

Assertion:teh kinetic energy of photoelectrons chages only with a chae in the frequency of rthe incident radiation.

Reason:The kinetic enregy of the emitted photoelectrons emitted by a photoelectrons

chanes only wiht a change in the frequency of the incident raidaiton.

A. A

B. B

C. C

D. D

Answer:

Watch Video Solution

78. Directions.In the following question, a statement of asertion followed by a statement of reason is given .Choose the correct answer out of the following choices:

Assertion and reason both are correct statements and reason is correct explanation for assertion.

Assertion and reason both are correct statements but reason is not correct explanation for assertion.

Assertion is correct statement but reason is wrong statement.

Assertion is wrong statement but reason is correct statement.

Assertion:The intenstiy of radiation remaining the same .the photocurrent in indepenedent of he nature of the metal surface,proided the frequency of the incident rdiation is above the threshold frequency.

Reason:the photocurrent depends upon the intensity of inciden tradiation.

A. A

B. B

C. C

D. D

Answer:

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79. Directions.In the following question, a statement of asertion followed by a statement of reason is given .Choose the correct answer out of the following choices:

Assertion and reason both are correct statements and reason is correct explanation

for assertion.

Assertion and reason both are correct statements but reason is not correct explanation for assertion.

Assertion is correct statement but reason is wrong statement.

Assertion is wrong statement but reason is correct statement.

Assertion:The photoelectrons produced by a monochromatic ligh beam incident on a metla surface have a spread in their kinetic energies

Reason:The work function of the metal varies as a function of depth from the surface.

A. A

B. B

C. C

D. D

Answer:

Watch Video Solution

80. Directions.In the following question, a statement of asertion followed by a statement of reason is given .Choose the correct answer

out of the following choices:

Assertion and reason both are correct statements and reason is correct explanation for assertion.

Assertion and reason both are correct statements but reason is not correct explanation for assertion.

Assertion is correct statement but reason is wrong statement.

Assertion is wrong statement but reason is correct statement.

Assertion:The maxi8mum kinetic energy of the emitted photoelectrons is equal to the

difference of the energy of incident photon nad the work function of the metal surface.

Reason:The maximum kinetic enregy of the emitted photoelectrons incdreases with the increase of frequency of incident radiation.

A. A

B. B

C. C

D. D

Answer:

Watch Video Solution

81. Directions.In the following question, a statement of asertion followed by a statement of reason is given .Choose the correct answer out of the following choices:

Assertion and reason both are correct statements and reason is correct explanation for assertion.

Assertion and reason both are correct statements but reason is not correct explanation for assertion.

Assertion is correct statement but reason is wrong statement.

Assertion is wrong statement but reason is correct statement.

Assertion:The slope of the plot of Einsteins' photoelecric equation is equal to Planck's constant.

Reason:The intercept made by the plot of Einstein's photoelectric equation of the frequency axi is equal to threshold frequency of the metal.

A. A

B. B

C. C

D. D

Answer:

Watch Video Solution

82. Directions.In the following question, a statement of asertion followed by a statement of reason is given .Choose the correct answer out of the following choices:

Assertion and reason both are correct statements and reason is correct explanation for assertion.

Assertion and reason both are correct statements but reason is not correct explanation for assertion.

Assertion is correct statement but reason is wrong statement.

Assertion is wrong statement but reason is correct statement.

Assertion:in a photoemisive cell,inert gas is used.

Reason:inert gas in the phtotemissive cell gives greater current.

A. A

B. B

C. C

D. D

Answer:

Watch Video Solution

83. Directions.In the following question, a statement of asertion followed by a statement of reason is given .Choose the correct answer out of the following choices:

Assertion and reason both are correct statements and reason is correct explanation for assertion.

Assertion and reason both are correct statements but reason is not correct explanation for assertion.

Assertion is correct statement but reason is wrong statement.

Assertion is wrong statement but reason is correct statement.

Assertion:The energy (E) and momentu (p) of a photon are related by $p = E/c$.

Reason:The photon behaves like a particle.

A. A

B. B

C. C

D. D

Answer:

Watch Video Solution

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84. Directions.In the following question, a statement of asertion followed by a statement of reason is given .Choose the correct answer out of the following choices:

Assertion and reason both are correct statements and reason is correct explanation for assertion.

Assertion and reason both are correct statements but reason is not correct explanation for assertion.

Assertion is correct statement but reason is wrong statement.

Assertion is wrong statement but reason is correct statement.

Assertion:If a photon and electron have same de-Broglie waveelngth,they will possess equal linear momentum.

Reason:The wavelegth de-Broglie wave associated with a moving particle is inversely propertional to its mass.

A. A

B. B

C. C

D. D

Answer:

 Watch Video Solution

85. Directions.In the following question, a statement of asertion followed by a statement of reason is given .Choose the correct answer out of the following choices:

Assertion and reason both are correct

statements and reason is correct explanation for assertion.

Assertion and reason both are correct statements but reason is not correct explanation for assertion.

Assertion is correct statement but reason is wrong statement.

Assertion is wrong statement and reason is also wrong statement.

Assertion:If a photon and electron have same de-Broglie wavelength,they will possess equl energy.

Reason:Both the photon and electron possess rest mass energy.

A. A

B. B

C. C

D. D

Answer:

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86. Directions.In the following question, a statement of asertion followed by a statement of reason is given .Choose the correct answer out of the following choices:

Assertion and reason both are correct statements and reason is correct explanation for assertion.

Assertion and reason both are correct statements but reason is not correct explanation for assertion.

Assertion is correct statement but reason is wrong statement.

Assertion is wrong statement but reason is correct statement.

Assertion:The resolving power of an electron microscope is far greater than that of an optical microscop.

Reason:The de-Broglie wavelength of elecron is much smaller than that of the visible light.

A. A

B. B

C. C

D. D

Answer:

Watch Video Solution

87. What is incorrect photon?

A. Its rest mass is zero

B. its energy is h v.

C. its momentum is hv/c.

D. It does ot exert pressure

Answer:

Watch Video Solution

88. The energy fof an X - ray photon is 2 keV,then the frequency (in per second) is:

A. 3.2×10^6

B. 5×10^{17}

C. 2×10^{17}

D. 2×10^{18}

Answer:

Watch Video Solution

89. Photoelectric effect demonstrate_____ nature of radiation.

A. wave nature of electrons

B. particle nature of light

C. both a and b

D. None of the above

Answer:

Watch Video Solution

90. The minimum energy requied to remove an electron is called

A. work function

B. kinetic enregy

C. stopping potential

D. potential energy

Answer:

Watch Video Solution

91. Light from a bulb is falling on a wooden table but no photoelectrons are emitted. Why?

A. much higher than the energy of photon

B. less then the energy of photon

C. equal to eenrgy of photon

D. None of the above

Answer:

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92. Thge work function of a metallic substance is 5 eV.Teh htreshold frequency is approximately

A. $1.6 \times 10^7 Hz$

B. $8.68 \times 10^{15} Hz$

C. $9.68 \times 10^{17} Hz$

D. $1.2 \times 10^{15} Hz.$

Answer:

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93. The threshold wavelength of sodium metal is $6,780\overset{\circ}{A}$.The work function of metal will be

A. $1.83eV$

B. 2.75 eV

C. 2.95 eV

D. 3.25 eV

Answer:

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94. The work function of a metallic substance is 4.0 eV.If two photons each of energy 3.5 eV strike an electron of aluminium,then emissison of electron:

A. depends upon the density of the surace

B. data is incomplete

C. is not possible

D. is possible

Answer:

95. In photoelecrtric effect ,the electrons are ejected from metals,if the incident light has a certain minimum

A. waelength

B. frequency

C. angle of incidence

D. amplitude

Answer:

 Watch Video Solution

96. For photoelectric emission,tungsten requieds light of $2,300\overset{\circ}{A}$.If light of $1,800\overset{\circ}{A}$ wavelength is incident,then emission

A. tkes place

B. does not take place

C. may or may not take place

D. depends on frequency.

Answer:

Watch Video Solution

97. The magnitude of saturation photoelctric current depends upon:

A. frequency

B. stoppin potential

C. work function

D. intensity.

Answer:

Watch Video Solution

98. When light of wavelength 300 nm falls on a photoelectric emitter,photoelectrons are liberated .For another emitter,light of wavelength 600 nm is suffecient for liberating photoelctrons.The ratio of the work functions of the two emitters is

A. $1:2$

B. $2:1$

C. $1:4$

D. $4:1.$

Answer:

Watch Video Solution

99. According to Einstein's photoelectric equation, the graph between kinetic energy of photoelectrons ejected and the frequency of the incident radiation is :

A. depends on the intensity of the raidaion

B. depends of the naure of the metal

C. depends both on the intensity of the radiation and the metal used

D. is the same for all metals and independent of the intensity of the radiaiton.

Answer:

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100. Light of wavleength $5,000\overset{\circ}{A}$ falls on a photo sensitive plate with photoelectric work function f 1.9 eV.The kinetic energy of phtotoelectrons emitted will be

A. 1.16 eV

B. 2.38 eV

C. 0.58 eV

D. 2.98 eV

Answer:

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101. The strength of transverse magnetic field required to bend all photoelectrons within a circle of radius 0..5 m,when light f wavelength $4,000\overset{\circ}{A}$ is incident on a barium emitter is (the work function of barium is 2.5 eV)

A. $4.0 \times 10^{-6}T$

B. $4.0 \times 10^{-4}T$

C. $5.2 \times 10^{-6}T$

D. $5.2 \times 10^{-4}T.$

Answer:

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102. The momentum of a photon of wavleengh $5,000\overset{\circ}{A}$ will be

A. $1.3 \times 10^{-27} kgms^{-1}$

B. $1.3 \times 10^{-28} kgms^{-1}$

C. $4 \times 10^{-29} kgms^{-1}$

D. $4 \times 10^{-18} kgms^{-1}$.

Answer:

Watch Video Solution

103. What is the de-Brogile wavelength of 1 kg mass moving with a velocity of $10ms^{-1}$?

A. $6.26 \times 10^{-35}m$

B. $6.626x10^{-33}m$

C. $6.26 \times 10^{-34}m$

D. None of the above

Answer:

Watch Video Solution

104. The wavelength of a particle having movement of $2 \times 10^{-28} kgms^{-1}$ is:

A. $3.3 \times 10^{-6} m$

B. $3.3 \times 10^{-5} m$

C. $3.3 \times 10^{-4} m$

D. 30 m

Answer:

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105. If the momentum fo particle is doubled,then its de-|B|roglie wavelength will:

A. remain unchanged

B. become four times

C. become two times

D. become half

Answer:

Watch Video Solution

106. The de-Broglie waelength of an electron of energy 600 eV is

A. $4\overset{\circ}{A}$

B. $20\overset{\circ}{A}$

C. $10\overset{\circ}{A}$

D. $0.5\overset{\circ}{A}$.

Answer:

Watch Video Solution

107. If we consider electrons and photons of same wave length, then they will have the same:

A. energy

B. velocity

C. momentum

D. angular momentum

Answer:

Watch Video Solution

108. A radio transmiter operaties at a frequency of 880 kHz and a power of 10 kW.The number of photons emitted per second is

A. 1.72×10^{31}

B. 13.27×10^{24}

C. 13.27×10^{34}

D. 13.27×10^{44}.

Answer:

Watch Video Solution

109. Photoelecttric effect supports the qunatum nature of light,becuse

A. there is minimum frequency of light below which no photoelectrons are emitted.

B. the maximum kinetic enregy of photoelectrons depends only on the frequency of light and not on intenisty

C. een when metl surfae is failty illuminated,the photoelectrons leasve the surface immediately

D. electric charge of the ccelectrons is quantised.

Answer:

Watch Video Solution

110. the strength of photoelectric curent depends upon

A. the freqeuncy of incident radiation

B. the itnensity of incident radiation

C. the angle of incident radiaion

D. the distance between anode and cathode.

Answer:

Watch Video Solution

111. The work function of a substance is 4.0 eV.The longest wavelength of ight that can cause phtotelctron emission from this substance is approximately

A. 540 nm

B. 400 nm

C. 310 nm

D. 220 nm\]

Answer:

Watch Video Solution

112. The maximum kinetic energy of phtoelectrons emitted from a surface,when photons of energy 6 eV fall on it,is 4 eV.The stpping potential (in volt) is

A. 2

B. 4

C. 6

D. 10

Answer:

Watch Video Solution

113. The threshold wavelength for photoelectric effect for a material is 5200 A. Which of the following will produce this effect- infrared or ultraviolet?

A. 50 W infra-red lamp

B. 1 W infra -red lamp

C. 50 W ultraviolet lamp

D. 1 W ultraviolet lamp.

Answer:

Watch Video Solution

114. A photo-sensitive material would emit elecrons.if excited by photons beyond a threshold.To cross the threshold ,you would increase

A. intensity of light

B. waveelngth of ligh

C. frenquency of light

D. the voltage applied to ligth source.

Answer:

Watch Video Solution

115. Photoelectrons are being obtained by irradiating zinc by a radiation of $3,100\overset{\circ}{A}$. In

order to increase the kinetic energy of ejected photoelectrons,

A. the intensity of radiation should be increased

B. the wavelength of radiation should be increased

C. the wavelength of radiation should be decreasec

D. both wavelength and intensity of radiation should be increased

Answer:

Watch Video Solution

116. Ultraviolet radiaiton of 6.2 eV falls on an aluminium surface(work function 4.2 eV).The kinetic energy (in joule of the fastenst electron emitted is approsimately

A. 3.2×10^{-21}

B. 3.2×10^{-19}

C. 4×10^{-17}

D. 3×10^{-15}.

Answer:

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117. When a monochromatic point source of light is at a distance of 0.2 m from a photoelectric cell,the cut-off voltage and saturation current are respectively 0.6 V and 18.0 mA.If the same source is placed 0.6 m away from the photocell,then

A. the stopping potential will be 0.2 V

B. the stopping potential will be 0.6 V

C. the saturation current will be 2.0 mA

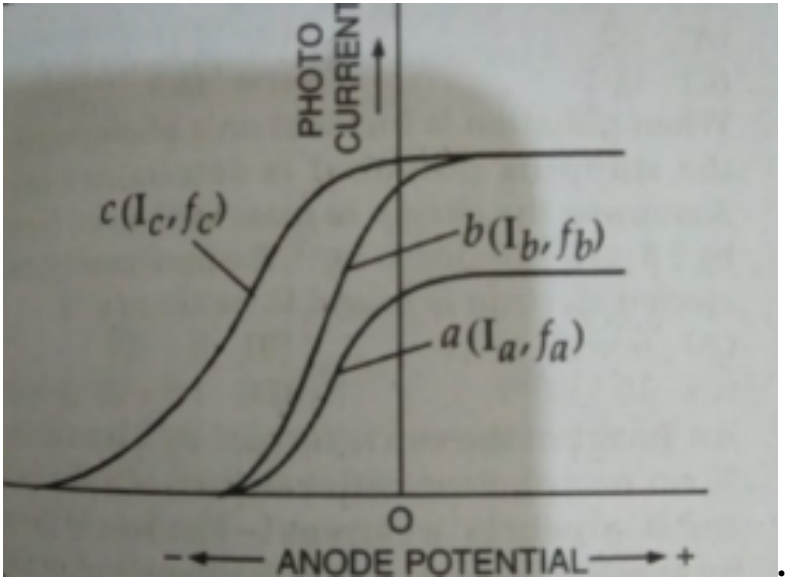
D. the saturation current will be 6.0 mA.

Answer:

Watch Video Solution

118. The figrue shows the variation of photocurrent with anode potential for a photo-sensitive surface for three differenct

radiationslLet I_a, I_b and I be the intensitite snd f_a, f_b and f_c be the frequencies for the curves a,b and c respectrively.



A. $f_a = f_b$ and $I_a = I_c$

B. $f_a = f_c$ and $I_a = I_c$

C. $f_a = f_b$ and $I_a = I_b$

D. $f_b = f_c$ and $I_b = I_c$.

Answer:

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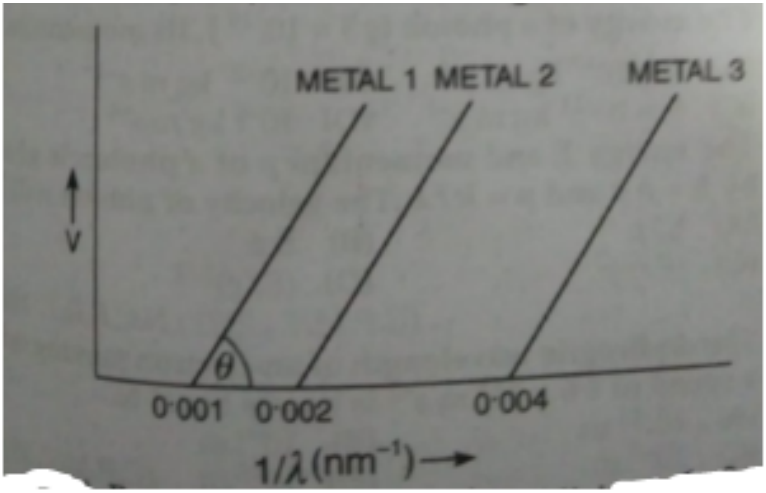
119. The graph between $1/\lambda$ and stopping potential (V) of three metals having work functionω_1, ω_2 and ω_3 in an experiment of photoelectric effect is plotted as shown in the figure.Which of the following statements is /

are correct?



.

A. ratio of work functions is

$$\omega_1 : \omega_2 : \omega_3 = 1 : 2 : 4$$

B. Ratio of work functions is

$$\omega_1 : \omega_2 : \omega_3 = 4 : 2 : 1$$

C. tan θ is directly proportional to hc/e ,where h i sPlanck's constant and c is the speed of light

D. The violet colour light can eject photoelectrons from metals 2 and 3.

Answer:

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120. The energy of a photon is equal to the kinetic energy of a proton.The energy of the photon is E.Let λ_1 be de-Broglie wavelength of the proton and λ_2 be the waveelength of the photon.The ratio λ_1 / λ_2 is proportional to

A. E^0

B. $E^{1/2}$

C. E^{-1}

D. E^{-2}.

Answer:

Watch Video Solution

121. A particle of mass M at rest decays into two particles of masses m_1 and m_2 havibng non zero eloctities.What is the ratio of the de-Bronglie waveelngths of the two particles?

A. m_1 / m_2

B. m_2 / m_1

C. 1

D. $\sqrt{m_2} / \sqrt{m_1}$.

Answer:

Watch Video Solution

122. A beam of electrons is used in an Young's double slit experiment.The slit width is d.When the velocity of electrons is increased,then

A. no interference is observed

B. fringe width increases

C. Fringe width decreases

D. fringes width remains same.

Answer:

Watch Video Solution

123. Electrons with de-Broglie waveelngth λ fall on the target in an X-ray tube.The cut- off wavelength of the emmitted X-rays is:

A. $\lambda_0 = \frac{2h}{mc}$

B. $\lambda_0 = \lambda$

C. $\lambda_0 = \frac{2mc\lambda^2}{h}$

D. $\lambda_0 = \frac{2m^2c^2\lambda^3}{h^2}$

Answer:

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124. Electron volt is a unit of

A. charge

B. momentum

C. potential difference

D. energy

Answer:

Watch Video Solution

125. When a proton is accelerated with IV potential difference, then its kinetic energy is:

A. 1 eV

B. 1837 eV

C. $1/1837eV$

D. None of the above

Answer:

Watch Video Solution

126. Unit of Planck constant is :

A. N m

B. eV

C. Js^{-1}

D. J s

Answer:

Watch Video Solution

127. Which one of the following statements about photon is incorrect?

A. Photon's rest mass is zero

B. Momentum of photon is hv/c.

C. Photon's energy is h v

D. Photons exert no pressure

Answer:

Watch Video Solution

128. A photon behaves as if it had a mass equal to

A. hvc^2

B. c^2 / hv

C. vc^2 / h

D. hv / c^2.

Answer:

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129. The minimum light intensity that can be perceived by the eye is about $10^{-10}. Wm^{-2}$ .The number of photons of wavelength $5.6 \times 10^{-7} m$ that must enter the pupil of area $10^{-4} m^2$ per second for vision is approximately.

A. 2×10^2 photons

B. 2×10^3 photons

C. 3×10^4photons

D. 3×10^5photons

Answer:

Watch Video Solution

130. Photoelectrons are emitted,when

A. a zinc plate is heated

B. a zinc plate is hammered

C. a zinc plate is irradiated with ultraviolet light

D. a zinc plate is subjected to very high pressure.

Answer:

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131. When ultraviolet rays are incident on a metal plate,the photoelectric effect odes not occur.It occcurs by incidence of

A. radio waves

B. infra - red rays

C. visible ligth rays

D. X-rays.

Answer:

Watch Video Solution

132. If the distance of 100 W lamp is increased from a photo cell,the saturation curent I in the photocell varies with distnace d as

A. $1 \propto d^2$

B. $1 \propto d$

C. $1 \propto 1/d$

D. $1 \propto 1/d^2$.

Answer:

Watch Video Solution

133. A photocell is illuminated by a small bright source placed 1 m away .when the same source of light is placed 0.5 m away,the

number of electrons emitted by photocathode would

A. each carry one quarter of their previous energy

B. each carry one quarter of their previous momenta

C. are half as numerous

D. are one quarter as numerous.

Answer:

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134. Consider light of given intensity and frequency falling on a substance that emits photoelectrons .The intensity is dedcreased to one-third its velue and the frequency increased by three times.Consequently the velocity of the photoelectrons will

A. remain the same

B. increase or decrease depending on the exact values of the new intensity and

frequency

C. decrease

D. increase.

Answer:

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135. Einstein's photoelectric equation is expressed as

A. $hv = \frac{1}{2}\omega_0 - mv^2$

B. $hv = \omega_0 - \frac{1}{2}mv^2$

C. $hv \equiv \omega_0 + \frac{1}{2}mv^2$

D. $hv = \frac{1}{2}mv^2\omega_0.$

Answer:

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136. Light of two difference efrequencyies,whose phtothns have energies 1 eV and 2.5 eV respectively successively illuminate a metal of work function 0.5 eV.Thge

ratio of maximum speeds of the emitted electrons will be

A. $1:5$

B. $1:4$

C. $1:2$

D. $1:1.$

Answer:

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137. The maximum velocity of an elecron ejected from a photoelectric emitter,when radiation falls on the latter is found to be $1.2 \times 10^{6} ms^{-1}$.Assuming the charge to mass ratio of electron(e/m) to be $1.8 \times 10^{11} Ckg^{-1}$,the stopping potential is (in volt)

A. 2

B. 3

C. 4

D. 6

Answer:

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138. When radiation is incident on a photoelectron emitteer,the stopping potential is dtermined to be 9 volt.Assuming the charge to mas ratio (e/m) for electron to be 8×10^{11} coulomb kg^{-1},the maximum velocity of the ejected electron is found to be (in m s^{-1}).

A. 6×10^5

B. 8×10^5

C. 10×10^5

D. 1.8×10^6.

Answer:

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139. An image of the sun is formed by a lens of focla length 50 cm on a photosensitive surface of a photoelectric cell and it produces a

current I.The lens is then replaced by another lens of same diameter but of focal length 25 cm.The photoelectric current produced will be

A. $I/2$

B. 2 I

C. I

D. 4 I.

Answer:

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140. If c is velocity of light ,then momentum of a photon of frequency is

A. hv/c^2

B. hv/c

C. v/c

D. hvc^2.

Answer:

Watch Video Solution

141. The energy of a photon is $3 \times 10^{-19} J$.Its momentum is

A. $3 \times 10^{-7} kgms^{-1}$

B. $10^{27} kgms^{-1}$

C. $9 \times 10^{-11} kgms^{-1}$

D. $10^{-8} kgms^{-1}$.

Answer:

Watch Video Solution

142. The energy E and momentum p of a photon is given by $E = hv$ and $p = h/\lambda$.The velocity of photon will be

A. E/p

B. Ep

C. $(E/p)^2$

D. $(E/p)^{1/2}$.

Answer:

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143. The de-Broglie wavelength of an elecrtron mov ing with a speed of $6.6 \times 10^5 ms^{-1}$ is nearly equal to

A. $10^{-11}m$

B. $10^{-9}m$

C. 10^{-7}

D. $10^{-5}m.$

Answer:

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144. The wavelength of an electron moving with a velocity of $500 kms^{-1}$ is

A. 2.9 mm

B. 3.0 mm

C. 0.5 nm

D. 1.47 nm.

Answer:

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145. The de-Broglie wavelength λ of a particle is related to ites kinetic energy E as:

A. $\lambda \propto E$

B. $\lambda \propto 1/E$

C. $\lambda \propto \sqrt{E}$

D. $\lambda \propto 1/\sqrt{E}$.

Answer:

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146. Neglecting variation of mass with energy, the wavelength associated with an electron having the kinetic energy E is proportional to

A. $E^{1/2}$

B. $E^{-1/2}$

C. E

D. E^{-2}.

Answer:

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147. Consider a proton moving with kinetic energy E. Its de-Broglie wavelength is given by (c= speed of light, h = Planck's constant, M=mass of proton, q= charge of proton)

A. $h/\sqrt{2ME}$

B. $\sqrt{2MEq/hc}$

C. $hc/\sqrt{2ME}$

D. $h/q\sqrt{ME}.$

Answer:

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148. An electron accelerated through a potential difference of V volt has a wavelength λ associated with it. Mass of proton is nearly 2000 times that of an electron .In order to have the same λ for proton, it must be accelerated through a potential difference (in volt) of

A. 100 V

B. 2000 V

C. $V / 2000$

D. $\sqrt{2000}$

Answer:

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149. An electron is accelerated through a potential difference of 150 V. The wavelength associated with it is:

A. $100 \overset{\circ}{A}$

B. $1\overset{\circ}{A}$

C. $4.2\overset{\circ}{A}$

D. $10\overset{\circ}{A}$.

Answer:

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150. An electron is accelerated through a potential difference of $1,00,000V$.The energy acquired by the electron is

A. $0.53 \times 10^{-17} J$

B. $1.6 \times 10^{-14} J$

C. $1.6 \times 10^{-10} J$

D. $1.6 \times 10^{-34} J$.

Answer:

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151. A photon and an electron have the same wavelength.Then,the velocity of photon is

A. less than that of the electron

B. greater thant hat of the electron

C. equal to that of the electron

D. None of the above

Answer:

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152. One can study crystal structure by electron diffraction as well as by neutron diffraction.In order to have the same

wavelength λ for the electron (mass = m_e) and neutron (mass =m_n),their velocitites should be i the ratio (electron velocitiy /neutron velocity)

A. 1

B. m_e / m_n

C. $m_e m_n$

D. m_n / m_e.

Answer:

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153. The magnification produec in an electron microscope is of the order of

A. 10

B. 10^3

C. 10^5

D. 10^7.

Answer:

Watch Video Solution

154. An electron microscope given higher magnification than an optical microscope, because

A. more powerful lenses are used in the electron microscope

B. the electrons have lesser waveelngth as compared to light waves

C. the velocity of electrons is smoother than that of ligth

D. the electrons have more energy than the light particles.

Answer:

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