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PHYSICS

FOR IIT JEE ASPIRANTS OF CLASS 12 FOR PHYSICS

DUAL NATURE OF RADIATION AND MATTER

Example

1. Monochromatic light of frequency $6.0 \times 10^{14} Hz$ is produced by a laser. The power emitted is $2.0 \times 10^{-3} W$, (a) What is the energy of a photon in the light beam? (b) How many photons per second, on the average, are emitted by the source? Given $h = 6.63 \times 10^{-34} Js$

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2. While working with light and X-rays, there is a useful relation between the energy of a photon in electron volts (eV) and the wavelength of the photon in angstrom $\left(A^0\right)$.Suppose the wavelength of a photon is $\lambda\left(A^0\right)$ Then energy of the photon is

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3. If wavelength of radiation is $4000\text{Å} = 400nm$ then the energy of the photon is

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4. A monochromatic source of light operation at 200 W emits 4×10^{20} photons per second. Find the wavelength of the light $(\text{in}10^{-7}m)$.

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5. A metal of work function $4eV$ is cexposed to a radiation of wavelegth $140 \times 10^{-9}m$. Find the stopping potential.

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6. The work function of caesium is 2.14 eV. When light of frequency $6 \times 10^{14}Hz$ is incident on the metal surface, photoemission of electrons occurs. What is the (a) maximum kinetic energy of the emitted electrons. (b) stopping potential and (c) maximum speed of the emitted photoelectrons. given , $h = 6.63 \times 10^{-34}Js, 1eV = 1.6 \times 10^{-19}J, c = 3 \times 10^{8}m/s.$

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7. Radiations of wavelenght 200nm propagating in the form of a parallel beam, fall normally on a plane metallic surface. The intensity of the beam is 5nW and its cross sectional area $1.0mm^2$. Find the pressure exerted by the radiation on the metallic surface, if the radition is completely reflected.

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8. In a photocell bi chromatic light of wave length $2480A^0$ and $6000A^0$ are incident on a cathode whose work function is $4.8eV$.If a uniform magnetic field of $3 \times 10^{-5}T$ exists parallel to the plate, find the radius of the circular path described by the photoelectron. (mass of electron is $9 \times 10^{-31}kg$)

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9. A monochromatic light of wavelength λ is incident on an isolated metallic sphere of radius a. The threshold wavelength is λ_0 which is larger then λ. Find the number of photoelectrons emitted before the emission of photo electrons stops.

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10. A small metal plate of work function ϕ is kept at a distance r from a singly ionised, fixed ion. A monochromatic light beam is incident on the metal plate and photoelectrons are emitted. Find maximum wavelength of the light beam so that some of that electrons may go round the ion along a circle.

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11. A particle of mass m projected horizontally with velocity u. if it makes an angle θ with the horizontal after some time, then at that instant, its be Broglie wavelength is

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12. Electrons are accelerated through a potential difference of $150V$. Calculate the de broglie wavelength.

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13. Find the ratio of de Broglie wavelength of molecules of hydrogen and helium which are at temperatures 27° and $127^\circ C$, respectively.

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14. With what velocity must an electron travel so that its momentum is equal to that of a photon with a wavelength of $5000\overset{0}{A}\left(h=6.6\times10^{-34}Js, m_e=9.1\times10^{-31}Kg\right)$

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15. If 10000 V is applied across an X-ray tube, what will be the ratio of de-Broglie wavelength of the incident electrons to the shortest wavelength X-ray produced?

$\left(\frac{e}{m}\text{for electron}=1.8\times10^{11}Ckg^{-1}\right)$

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16. Photons of energies $4.25eV$ and $4.7eV$ are incident on two metal surfaces A and B respectively.The maximum KE of emitted electrons are respectively T_AeV and$T_B=(T_A-1.5)eV$.The

ratio de-Broglie wavelengths of photoelectrons from them is $\lambda_A : \lambda_B = 1.2$,then find the work function of A and B

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17. If the uncertainty in the position of proton is $6 \times 10^{-8} m$, then the minimum uncertainty in its speed is

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18. The correctness of velocity of an electron moving with velocity $50 ms^{-1}$ is $0.005\,\%$. The accuracy with which its position can be measured will be

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Evalutate Yourself 1

1. The correct curve between the stopping potential (V) and intensity of incident light (I) is

A. 

B. 

C. 

D. 

Answer: B

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2. The curve between current (i) and potential difference (V) for a photo cell will be

A. 

B. 

C. 

D. 

Answer: D

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Evalutate Yourself 2

1. Lights of two different frequencies whose photons have energies 1 and 2.5 eV, respectively, successively illuminate a metal whose work function is 0.5 eV. The ratio of the maximum speeds of the emitted electrons

A. $1:2$

B. $2:1$

C. $2:3$

D. $3:1$

Answer: A

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2. The threshold frequency for a certain metal is v_0 when light of frequency v = $2v_0$ is incident on it . The maximum velocity of photoelectrons is 4×10^6 m/s . If the frequency of incident radiation is increase to $5v_0$, the maximum velocity of photo electrons in m/s will be .

A. $4 \times 10^2 m/s$

B. $4 \times 10^6 m/s$

C. $8 \times 10^6 m/s$

D. $8 \times 10^2 m/s$

Answer: C

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3. When a certain metallic surface is illuminated with monochromatic light of wavelength λ, the stopping potential for photo electric current is $6v_0$. When the same surface si illuminated with light of wavelength 2λ, the stopping potential is $2v_0$. The threshold wavelength of this surface for photoelectric effect is -

A. 2λ

B. 8λ

C. 6λ

D. 4λ

Answer: D

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4. Two separate monochromatic light beams A and B of the same intensity (energy per unit area per unit time) are falling normally on a unit area of a metallic surface. Their wavelength are λ_A and λ_B respectively. Assuming that all the the incident light is used in ejecting the photoelectrons, the ratio of the number of photoelectrons from beam A to that from B is

A. $\frac{\lambda_B}{\lambda_A}$

B. $\frac{\lambda_A}{\lambda_B}$

C. Both (1) & (2)

D. None of these

Answer: B

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5. 1.5 mW of 400 nm light is directed at a photoelectric cell. If 0.1% of the incident photons produce photoelectrons, find the current in the cell.

A. $0.32\mu A$

B. $0.58\mu A$

C. $0.84\mu A$

D. $0.48\mu A$

Answer: D

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Evalutate Yourself 3

1. What is the de-Broglie wavelength associated with (a) an electron moving with speed of $5.4 \times 10^{6} ms^{-1}$, and (b) a ball of mass 150g traveling at $30.0 ms^{-1}$? $h = 6.63 \times 10^{-34} Js$, mass of electron $= 9.11 \times 10^{-31} kg$.

A. $0.155 nm, 1.47 \times 10^{-24} m$

B. $0.145 nm, 1.47 \times 10^{-32} m$

C. $0.125 nm, 1.47 \times 10^{-36} m$

D. $0.135 nm, 1.47 \times 10^{-34} m$

Answer: D

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2. What is the de-Broglie wavelength associated with an electron accelerated through a potential difference of 100 volt?

A. 1.227Å

B. 1.237Å

C. 1.197Å

D. 1.217Å

Answer: A

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3. The de Broglie wavelenght of an electron whose speed is half that of light is:

A. $3.6 \times 10^{-12} m$

B. $4.8 \times 10^{-12} m$

C. 8.4×10^{-12}

D. $0.12 \times 10^{-12} m$

Answer: B

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4. In order to have the same wavelength for the electron (mass m_e) and the neutron (mass m_n) their velocities should be in the ratio (electron velocitiy/neutron velocitity) :-

(a). m_n / m_e

(b). $m_n \times m_e$

(c). m_e / m_n

(d). one

A. m_n / m_e

B. $m_n \times m_e$

C. m_e / m_n

D. one

Answer: A

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5. An electron of mass m_e and a proton of mass m_p are accelerated through the same potential difference. The ratio of the de Broglie wavelength associated with an electron to that associated with proton is

A. m_e / m_n

B. m_p / m_e

C. m_e / m_p

D. one

Answer: A

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Evalutate Yourself 4

1. X- rays are produced in an X- rays tube operating at a given accelerating voltage . The wavelength of the continuous X- rays has values from

A. $0 \text{to} \infty$

B. $\lambda_{\min} \text{to} \infty \text{where} \lambda_{\min} > 0$

C. $0 \text{to} \lambda_{\min} \text{where} \lambda_{\max} < \infty$

D. $\lambda_{\min} \text{to} \lambda_{\max} \text{where} 0 < \lambda_{\min} < _{\max} < \infty$

Answer: B

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2. Four physical quantities are listed in column I. Their values are listed in column II in random order.

Column I	Column II
[a] *Thermal energy of air molecule at room temperature*	[e] 0.02 *eV*
[b] *Binding energy of heavy nuclei per nucleon*	[f] 2 *eV*
[c] *X-ray photon energy*	[g] 1 *keV*
[d] *Photon energy of visible light*	[h] 7 *MeV*

Match the column correctly.

A. a - e, b - h, c - g, d - f

B. a - e, b - g, c - f, d - h

C. a - f, b - e, c - g, d - h

D. a - f, b - h, c -e, d - g

Answer: A

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3. The shorted wavelength of X- rays emitted from an X- rays tube depends on

A. the current in the tube

B. the voltage applied across the tube

C. the nature of the gas in tube

D. the atomic number of the target matcrial

Answer: B::D

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4. Electrons with energy $80keV$ are incident on the tungsten target of an X - rays tube , k- shell electrons of tungsten have $72.5keV$ energy X- rays emitted by the tube contain only

A. a cntinuous X - rays spectrum with a minimum wavelenght of 0.155 Å

B. a continuous X - rays spectrum with all wavelenght

C. The characteristic X - rays spectrum of tungsten

D. a continuous X - rays spectrum with a minimum wavelenght of 0.155 Å and the characteristic x - rays spectrum of tungsten.

Answer: D

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5. The K_α X-ray emission line of lungsten accurs at $\lambda = 0.021nm$. What is the energy difference between $K$and L levels in the atom?

A. 0.51 MeV

B. 1.2 MeV

C. 59 keV

D. 13.6 eV

Answer: C

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CUQ

1. Photo electric effect shows

A. wave like behaviour of light

B. particle like behaviour of light

C. both wave like and particle like behaviour of light

D. neither wavelike nor particle like behaviour of light.

Answer: B

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2. The best metal to be used for photoemission is

A. Patassium

B. Sodium

C. Cesium

D. Lithium

Answer: C

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3. The maximum energy of the electrons released in photocell is independent of -

A. the frequency of the incident light

B. the intensity of the incident light

C. the nature of the cathode

D. all are ture.

Answer: B

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4. X-rays are used to irradiate sodium and copper surfaces in two separate experiments and stopping potential are determined. The stopping potential is

A. equal in both cases

B. greater for sodium

C. greater for copper

D. infinite in both cases.

Answer: B

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5. Sodium surface is illuminated with ultraviolet light and visible radiation successively and the stopping potentials are determined. Then the potential

A. more with visible light

B. more with ultraviolet light

C. varies randomly

D. None of these

Answer: B

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6. If the work function of a metal is $'\phi'$ and the frequency of the incident light is $'v'$, there is no emission of photoelectron if

A. $v < \frac{\phi}{h}$

B. $v = \phi / h$

C. $v > \phi / h$

D. $v \geq \phi h$

Answer: A

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7. If E and P are the energy and the momentum of a photon respectively then on increasing the wavelenght of photon

A. p and E both will decrease

B. p and E both will increase

C. p will increase and E will decrese

D. p will decrease and E will increase

Answer: A

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8. In photoelectric emission, the energy of the emitted electron is

A. larger than that of the incident photons

B. smaller than that of the incident photons

C. same at that of the incident photons

D. proportional to the intensity of the incident light

Answer: B

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9. A laser beam of output power P consists only of wavelength λ. If Planck's constant is h and the speed of light is c, then the number of photons emitted per second is

A. $P\lambda / hc$

B. $P\lambda / h$

C. $hc / p\lambda$

D. hc / p

Answer: A

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10. In photoelectric effect, which of the following property of incident light will not affect the stopping potential

A. Frequency

B. Wavelenght

C. Energy

D. Intensity

Answer: D

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11. Photo electric effect can be explained only by assuming that light

A. is a form of transverse waves

B. is a form of longitudinal waves

C. can be polarized

D. consists of quanta

Answer: D

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12. When green light is incident on a certain metal surface, electrons are emitted but no electrons are emitted with yellow light. If red light is incident on the same metal surface.

A. No electron will be emitted

B. Less electrons will be emitted

C. More electrons will be emitted

D. we can not predict

Answer: A

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13. The energy of a photon is $E = hv$ and the momentum of photon $p = \frac{h}{\lambda}$, then the velocity of photon will be

A. E/P

B. $(E/P)^2$

C. EP 4

D. $3 \times 10^7 m/s$

Answer: A

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14. The photoelectric effect proves that light consists of

A. Photons

B. Electrons

C. Electromagnetic waves

D. Mechanical waves

Answer: A

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15. Insentity of light incident on a photo sensitive surface is doubled. Then

A. the number of emitted electrons is tripuled

B. the number of emitted electrons is doubled

C. the K.E of emitted electrons is doubled

D. the momentum of emitted electrons is doubled

Answer: B

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

A. will increse

B. will decrease

C. will remain constant

D. will either increase or decrease

Answer: C

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17. 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. becomes less than double

Answer: C

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18. With the decrease in the wave length of the incident radiation the velocity of the photoelectrons emitted from a given metal

A. remains same

B. increases

C. decreases

D. increases first and then decreases

Answer: B

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19. Sodium surface is illuminated with ultraviolet light and visible radiation successively and the stopping potentials are determined. Then the potential

A. is equal in both the cases

B. greater for ultraviolet light

C. more for visible light

D. varies randomly

Answer: B

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20. In photo electric effect, the slope of the straight line graph between stopping potential and frequency of the incident light gives the ratio of Planck's constant to

A. charge of electron

B. work function of emitter

C. photo electric current

D. K.E of electron

Answer: A

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21. The slope of frequency of incident light and stopping potential for a given surface will be

A. h.e

B. h/e

C. e/h

D. (e-h)

Answer: B

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22. In an experiment of photo electric emission for incident light of $4000A^0$,the stopping potential is $2V$.If the wavelength of incident light is made $3000A^0$, then the stopping potential will be

A. Less than 2 volt

B. More than 2 volt

C. 2 volt

D. Zero

Answer: B

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23. Light of wavelength λ falls on metal having work functions hc/λ_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. $\lambda \leq \lambda_0/2$

Answer: C

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24. Emission of electrons in photoelectric effect is possible, if

A. metal surface is highly polished

B. the incident light is of sufficiently high intensity

C. the light is incident at right angles to the surface

D. the incident light is of sufficiently low wavelenght

Answer: D

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25. The work function of a metal is

A. is different for different metals

B. is the same for all the metals

C. depends on the frequnecy of the light

D. depends on the intensity of the incident light

Answer: A

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26. The process of photo electric emission depends on

A. Temperature of incident light

B. Nature of surface

C. Speed of emitted photo electrons

D. Speed of the incident light

Answer: B

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27. The threshold wavelength of lithium is $8000A^0$ When light of a wavelength $9000A^0$ is made to be incident on it, then the photo electrons

A. Will not be emitted

B. Will be emitted

C. Will sometimes be emitted and sometimes not Data insufficient

D. Data insufficient

Answer: A

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28. The photo electrons emitted from the surface of sodium metal are

A. Of speeds from 0 to a certain maximum

B. Of same de Broglie wavelenght

C. Of same kinetic energy

D. Of same frequency

Answer: A

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29. The necessary condition for photo electric emission is

A. $hv \leq hv_0$

B. $hv \geq hv_0$

C. $E_K > hv_0$

D. $E_k < hv_0$

Answer: B

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30. At stopping potential, the photo electric current becomes

A. Minimum

B. Maximum

C. Zero

D. Infinity

Answer: C

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31. In photoelectric effect, stopping potential depends on

A. Frequency of incident light

B. Intensity of incident light

C. Number of emitted electrons

D. Number of incident photons

Answer: A

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32. Work function is the energy required

A. to excite an atom

B. to produce X - rays

C. to eject an electron just out of the surface

D. to explode the atom

Answer: C

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33. Threshold wavelenght depends on

A. frequency of incident radiation

B. work function of the substance

C. velocity of electrons

D. energy of electrons

Answer: B

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34. If the work function of a mental is ϕ_0 then its threshold wavelength will be

A. $hc\phi_0$

B. $\frac{c\phi_0}{h}$

C. $\frac{h\phi_0}{c}$

D. $\frac{hc}{\phi_0}$

Answer: D

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35. The work function of a mental is XeV when light of energy $2XeV$ is made to be incident on it then the maximum kinetic energy of emitted photo electron will be

A. 2 eV

B. 2X eV

C. XeV

D. 3X eV

Answer: C

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36. If the distance of 100 Watt lamp is increased from a photocell, the saturation current i in the photo cell varies with distance d as

A. $i \propto d^2$

B. $i \propto d$

C. $i \propto \frac{1}{4}$

D. $i \propto \frac{1}{d^2}$

Answer: D

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37. a source of light in placed at a distance $4m$ from a photocell and the stopping potential is then 7.7 volt. If the distence is helved the stopping potential now will be

A. 7.7 volt

B. 15.4 volt

C. 3.85 volt

D. 1.925 volt

Answer: A

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38. A milliammeter in the circuit of a photocell measures

A. number of electrons released per second

B. energy of photon

C. velocity of photoelectorns

D. momentum of the photo electrons

Answer: A

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39. The Einstein photoelectric equation is based upon the conservation of

A. Mass

B. momentum

C. angular momentum

D. energy of electrons

Answer: D

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40. The stopping potential of the photocell is independent of

A. wavelenght of incident light

B. nature of the metal of photo cathode

C. time for which light is incident

D.

Answer: C

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41. The maximum energy of emitted photo electrons is measured by

A. the current they produce

B. the potential difference they produce

C. the largest potential difference they can transverse

D. the speed with which they emerge

Answer: C

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42. Three metals have work function in the ratio $2:3:4$ Graphs are drawn for all between the stopping potential and the incident frequency The graphs have slopes in the ratio

A. $2:3:4$

B. $4:3:2$

C. $6:4:3$

D. $1:1:1$

Answer: D

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43. Which conservation law is obeyed in Einstein's photo electric equation?

A. Charge

B. energy of photon

C. Momentum

D. Mass

Answer: B

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44. In photo electric effect, the photo electric current

A. increases when the frequency of incident photon increase

B. decreases when the frequency of incident photon decreases

C. does not depend upon the photon frequency but depends on the intensity of incident beam

D. depends both on the intensity and frequency of the incident beam.

Answer: C

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45. The photoelectric current can be increased by

A. increasing frequency

B. increasing intensity

C. decreasing intensity

D. decreasing wavelenght

Answer: B

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46. The thresold wavelength for sodium is $5 \times 10^{-7} m$. Photoemission occurs for light of

A. Wavelenght of 6×10^{-7} m and above

B. Wavelenght of 5×10^{-7} m and below

C. Any wavelenght

D. All frequencies below 5×10^{14} Hz

Answer: B

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47. If Planck's constant is denoted by h and the charge by e, experiments on photoelectric effect allow the determination of

A. Only h

B. Only e

C. Both h and e

D. Only h/e

Answer: D

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48. The electron behaves as waves because they can

A. be diffracted by a crystal

B. ionise a gas

C. be deflected by magnetic fields

D. be deflected by electric fields

Answer: A

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49. A non-monochromatic light is used in an experiment on photoelectric effect. The stopping potential

A. is related to the mean wavelenght

B. is related to the longest wavelenght

C. is related to the shortest wavelenght

D. is not related to the wavelenght

Answer: C

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50. The incident photon involed in the photoelectric effect experiment

A. completely disappears

B. comes out with increased frequency

C. comes out with a decreased frequency

D. comes out with out change in frequency

Answer: A

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51. In a photoelectric experiment , the maximum velocity of photoelectric emitted

A. depends on intensity of incident radiation

B. dose not depend on cathode material

C. depends on frequency of incident radiation

D. does not depend on wavelenght of incident radiation

Answer: C

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52. Number of electrons emitted by a surface exposed to light is directly proportional to

A. Frequency of light

B. Work function

C. Thereshould wavelenght

D. Intensity of light

Answer: D

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53. Emission of electrons in photoelectric effect is possible, if

A. metal surface is highly polished

B. the incident light is of sufficiently high intensity

C. the light is incident at right angles to the surface

D. the incident light is of sufficiently low wavelenght

Answer: D

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54. When orange light falls on a photo sensitive surface the photocurrent begins to flow. The velocity of emitted electrons will be more whwn surface is hit by

A. red light

B. violet light

C. thermal radiations

D. radio waves

Answer: B

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55. When the amplitude of the light wave incident on a photometal sheet is increased then

A. the photoelectric current increases

B. the photoelectric current remains unchanged

C. the stopping potential increases

D. the stopping potential decreases

Answer: A

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56. Which of the following is dependent on the intensity of incident radiation in a photoelectric experiment

A. work function of the surface

B. amount of photoelectric current

C. stopping potential

D. maximum kinetic energy

Answer: B

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57. If the work function of a metal is $'\phi'$ and the frequency of the incident light is $'v'$, there is no emission of photoelectron if

A. $v < W/h$

B. $v > W/h$

C. $v \geq W/h$

D. $v \leq W/h$

Answer: A

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58. When ultraviolet radiation is incident on a surface , no photoelectrons are emitted If a second beam causes photoelectrons to be ejected, it may consist of

A. radio waves

B. infrared rays

C. visible light rays

D. X - rays

Answer: D

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59. The function of photoelectric cell is

A. to convert electrical energy into light energy.

B. to convert light energy into electrical energy

C. to convert mechanical energy into electrical energy

D. to convert DC into AC.

Answer: B

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60. Photo electric effect can be explained only by assuming that light

A. is a form of transverse waves

B. is a form of longitudinal waves

C. can be polarised

D. consists of quanta

Answer: D

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61. Though quantum theory of light can explain a number of phenomena observed with light , it is necessary to retain the wave-nature of light to explain the phenomena of :

A. photoelectric effect

B. diffraction

C. compton cffcct

D. black body radiation

Answer: B

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62. When an X-ray photon collides with an electrons and bounces off, its new frequency

A. is lower than its original frequency

B. is same as its original frequency

C. is higher than its original frequency

D. depends upon the electron's frequency

Answer: A

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

potential

A. will increse

B. will decrease

C. will remain constant

D. will either increase or decrease

Answer: C

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64. De- Broglie wavelenght depends on

A. mass of the particle

B. size of the particle

C. material of the particle

D. shape of the particle

Answer: A

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65. The de broglie wavelength associated with a particle of mass m, moving with a velocity v and energy E is given by

A. $\frac{h}{m}v^2$

B. mv/h^2

C. $h/\sqrt{2mE}$

D. $\sqrt{2mE}/h$

Answer: C

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66. The rest mass of a photon of wavelength λ is

A. zero

B. $1.6 \times 10^{-19} kg$

C. $3.1 \times 10^{-30} kg$

D. $9.1 \times 10^{-31} kg$

Answer: A

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67. The mass of a photon in motion is given its frequency = x)

A. $\frac{hx}{c^2}$

B. hx^3

C. $\frac{hx^3}{c^2}$

D. zero

Answer: A

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68. Which of the following particles - neutron, proton, electron and deuteron has the lowest energy if all have the same de Broglie wavelength

A. neutron

B. proton

C. electron

D. deuteron

Answer: D

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69. The momentum of a proton is p. the corresponding wavelength is

A. h/p

B. h p

C. p/h

D. $\sqrt{hp}$

Answer: A

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70. A wave is associated with matter when it is

A. stationary

B. in motion with a velocity

C. in motion with speed of light

D. in motion with speed greater than that of light

Answer: B

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71. An electron of mass $9.1 \times 10^{-31} kg$ and charge $1.6 \times 10^{-19} C$ is accelarted through a potential difference of V volt. The de Broglie wavelength (λ) associated with the electron is

A. $\frac{12.27}{\sqrt{V}} A^0$

B. $\frac{12.27}{V} A^0$

C. $12.27\sqrt{V} A^0$

D. $\frac{1}{12.27\sqrt{V}} A^0$

Answer: A

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72. The de Broglie wavelength of a molecules of thermal energy KT (K is Boltzmann constant and T is absolute temperature) is given by

A. $\frac{h}{\sqrt{2mKT}}$

B. $\frac{h}{2mKT}$

C. $h\sqrt{2mKT}$

D. $\frac{1}{h\sqrt{2mKT}}$

Answer: A

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73. The wavelength of a proton and a photon are same. Then

A. Their velocities are same

B. Their momenta are equal

C. Their energies are same

D. Their speeds are same

Answer: B

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74. If the value Plank's constant is more than its present value. Then de Broglie wavelength associated with a material particle will be

A. more with visible light

B. Less electrons will be emitted

C. same at that of the incident photons

D. More for lighter particles and less for heavy paraticles

Answer: A

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75. The wavelength of matter waves does not depend on

A. Momentum

B. Velocity

C. Mass

D. Charge

Answer: D

Watch Video Solution

76. The wave nature of matter is not observed in daily life because their wave length is

A. Less

B. More

C. In infrared region

D. In ultraviolet region

Answer: A

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77. The ratio of de-Broglie wave length of a photon and an electron of mass 'm' having the same kinetic energy E is: (Speed of light=c)

A. $\sqrt{\frac{2m}{E}}$

B. $\sqrt{\frac{E}{2m}}$

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

D. $\sqrt{\frac{EC}{2m}}$

Answer: C

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78. Matter waves are:

A. electromagnetic waves

B. mechanical waves

C. either mechanical or electromagnetic waves

D. neither mechanical not electromagnetic waves

Answer: D

Watch Video Solution

79. The magnitude of the de-Broglie wavelength (λ) of an electron (e),proton(p),neutron (n) and α particle (a) all having the same energy of Mev, in the increasing order will follow the sequence:

A. $\lambda_e, \lambda_p, \lambda_n, \lambda_\alpha$

B. $\lambda_\alpha, \lambda_n, \lambda_n, \lambda_e$

C. $\lambda_e, \lambda_n, \lambda_p, \lambda_\alpha$

D. $\lambda_p, \lambda_e, \lambda_\alpha, \lambda_n$

Answer: B

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80. Moving with the same velocity . One of the following has the longest deBroglie wavelength

A. β - particle

B. α - particle

C. proton

D. neutron

Answer: A

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81. Debroglie wavelength of a particle at rest position is

A. zero

B. finite

C. infinty

D. cannot be calculated

Answer: C

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82. Debroglie wavelength of proton accelerated by an electric field at a potential difference V is

A. $\frac{0.108}{\sqrt{V}}$

B. $\frac{0.202}{\sqrt{V}}$

C. $\frac{0.286}{\sqrt{V}}$

D. $\frac{0.101}{\sqrt{V}}$

Answer: C

Watch Video Solution

Watch Video Solution

83. Debroglie wavelength of uncharged particles depends on

A. mass of particle

B. kinetic energy of particle

C. nature of particle

D. All above

Answer: D

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84. Debroglie wavelength of a moving gas molecule is

A. proportional to temperature

B. inversely proportional to temperature

C. independent of temperature

D. inversely proportional to square root of temperature

Answer: D

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85. The particles that can be accelarted by an electric field is

A. proton

B. Electrons

C. alpha particle

D. all above

Answer: D

Watch Video Solution

86. If a proton and an electron are confined to the same region, then uncertainty in momentum

A. for proton is more, as compared to the electron

B. for electron is more, as compared to the proton

C. same for both the particles

D. directly proportional to their masses

Answer: C

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87. Which phenomenon best supports the theory that matter has a wave nature?

A. electron momentum

B. electron diffraction

C. photon momentum

D. photon diffraction

Answer: B

Watch Video Solution

88. The wavelength of de-Broglie wave associated with a thermal neutron of mass m at absolute temperature T is given by (here, k is the Boltzmann constant)

A. $\frac{h}{\sqrt{2mkT}}$

B. $\frac{h}{\sqrt{mkT}}$

C. $\frac{h}{\sqrt{3mkT}}$

D. $\frac{h}{2\sqrt{mkT}}$

Answer: C

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Exercise 1 C W

1. If the energy of a photon corresponding to a wavelength of $6000Åis3.32 \times 10^{-19}J$, the photon energy for a wavelength of $4000Å$ will be

A. $1.11 \times 10^{-19}j$

B. $2.22 \times 10^{-19}j$

C. $4.44 \times 10^{-19}j$

D. $4.8 \times 10^{-19}j$

Answer: 4

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2. The photo electric threshold wavelength of Tungsten is 2300 Å. The energy of the electrons ejected from the surface by ultraviolet light of wavelenghth 1800 Å is

A. 0.15 eV

B. 1.5 eV

C. 15 eV

D. 150 eV

Answer: 2

Watch Video Solution

3. Lights of two different frequencies whose photons have energies 1 and 2.5 eV, respectively, successively illuminate a metal whose work function is 0.5 eV. The ratio of the maximum speeds of the emitted electrons

A. $1:2$

B. $3:1$

C. $1:\sqrt{2}$

D. $2:1$

Answer: 3

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4. The work function of a substance is 4.0 eV. The longest wavelength of light that can cause photoelectron emission from

this substance is approximately equal to

A. 220 nm

B. 310 nm

C. 540 nm

D. 400 nm

Answer: 2

Watch Video Solution

5. The threshold wavelength for emission of photoelectrons from a metal surface is $6 \times 10^{-7} m$.The work function of the material of the metal surface is.

A. $3.3x10^{-19} j$

B. $6.67 \times 10^{-19} j$

C. $1.23 \times 10^{-19} j$

D. $2.37 \times 10^{-19} j$

Answer: 1

Watch Video Solution

6. The frequency of a photon associated with an energy of $3.31 eV$ is (given $h = 6.62 \times 10^{-34} Js$)

A. $0.8 \times 10^{15} Hz$

B. $1.6 \times 10^{15} Hz$

C. $3.2 \times 10^{15} Hz$

D. $8.0 \times 10^{15} Hz$

Answer: 1

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Watch Video Solution

7. A radiation of wave length $2500A^0$ is incident on a metal plate whose work function is $3.5eV$. Then the potential required to stop the fastest photo electrons emitted by the surface is $\left(h = 6.63 \times 10^{-34} Js \& c = 3 \times 10^8 m/s\right)$

A. 1.86V

B. 3.00 V

C. 1.46 V

D. 2.15 V

Answer: 3

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8. The work function of a metal is $2.5eV$. The maximum kinetic energy of the photoelectrons emitted if a photon of wavelength $3000A^0$ falls on it is $\left(h = 6.63 \times 10^{-34} Js \& c = 3 \times 10^8 m/s\right)$

A. $1.12 \times 10^{-19} j$

B. $4.8 \times 10^{-19} j$

C. $9.6 \times 10^{-19} j$

D. $2.6 \times 10^{-19} j$

Answer: 4

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9. A metal of work function 2.5 eV is irradiated by light. If the emitted electrons have maximum kinetic energy 1.8 eV, then the energy of irradiating light is

A. 0.7 eV

B. 3.8 eV

C. 4.3 eV

D. 4.8 eV

Answer: 3

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10. The work function of nickle is $5eV$. When light of wavelength $2000A^0$ falls on it, emits photoelectrons in the circuit. The the potential difference necessary to stop the fastest electrons emitted is (given $h = 6.67 \times 10^{-34} Js$)

A. 1.0 V

B. 1.75 V

C. 1.2 V

D. 0.75 V

Answer: 3

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11. A photocell is illuminated by a small bright source places 1 m away when the same source of light is placed $\frac{1}{2}$ m away. The number of electron emitted by photocathode would be

A. increases by a factaor of 2

B. decrease by a factor of 2

C. increase by a factor of 4

D. decrease by a factor of 4

Answer: 3

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12. The threshold wavelength for a surface having a threshold frequency of $0.6 \times 10^{15} Hz$ is (given $c = 3 \times 10^8 m/s$)

A. $4000 A^0$

B. $6000 A^0$

C. $5000 A^0$

D. $3500 A^0$

Answer: 3

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13. Two photons of energies twice and thrice the work function of a metal are incident on the metal surface .Then, the ratio of

maximum velocities of the photoelectrons emitted in the two cases respectively ,is

A. $\sqrt{2}:1$

B. $\sqrt{3}:1$

C. $\sqrt{3}:\sqrt{2}$

D. $1:\sqrt{2}$

Answer: 4

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14. The momentum of a photon is $33 \times 10^{-29} kg - m/\sec$. Its frequency will be

A. $3 \times 10^3 Hz$

B. $6 \times 10^3 Hz$

C. $7.5 \times 10^{12} Hz$

D. $1.5 \times 10^{13} Hz$

Answer: 4

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15. The energy of a photon of wavelength λ is given by

A. $h\lambda$

B. $ch\lambda$

C. λ / hc

D. hc / λ

Answer: 4

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16. The momentum of a photon is $2 \times 10^{-16} gm - cm/\sec$. Its energy is

A. $0.16 \times 10^{-26} erg$

B. $2.0 \times 10^{-26} erg$

C. $6 \times 10^{-6} erg$

D. $6 \times 10^{-8} erg$

Answer: 4

Watch Video Solution

17. The rest mass of the photon is

A. 0

B. ∞

C. Between 0 and

D. Equal to that of an electron

Answer: A

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18. The momentum of the photon of wavelength 5000Å will be

A. $1.3 \times 10^{-27} kg - m/\sec$

B. $1.3 \times 10^{-28} kg - m/\sec$

C. $4 \times 10^{29} kg - m/\sec$

D. $4 \times 10^{-18} kg - m/\sec$

Answer: 1

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19. The momentum of a photon of energy will be

A. hv

B. hv/c

C. hvc

D. h/v

Answer: 2

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20. A photon in motion has a mass

A. c/hv

B. hv/c^2

C. hv

D. h/v

Answer: 2

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21. If the momentum of a photon is p, then its frequency is

A. $\frac{ph}{c}$

B. $\frac{pc}{h}$

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

D. $\frac{mc}{h}$

Answer: B

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22. A particle of mass 5M at rest decays into two particle of masses 2 m and 3 m having non zero velocities. The ratio of de - broglie wavelengh of the particles is

A. $3/2$

B. $2/3$

C. $1/3$

D. none of these

Answer: 4

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23. An electron and a photon have same wavelength of 10^{-9} m. If E is the energy of the photon and p is the momentum of the electron, the magnitude of E/p in SI units is

A. 3.33×10^{-9}

B. 3.0×10^{8}

C. 1.1×10^{-19}

D. 9×10^{16}

Answer: 2

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24. A proton and an α-particle are accelerated through same potential difference. Find the ratio of their de-Brogile wavelength.

A. $1:1$

B. $1:2$

C. $2:1$

D. $2\sqrt{2}:1$

Answer: 4

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25. A particle with rest mass m_0 is moving with velocity c. what is the de-Broglie wavelength associated with it?

A. ∞

B. zero

C. $m_{0c/h}$

D. $hv/m_0c.$

Answer: 2

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26. The velocity of a body of mass 10 gm is $2 \times 10^4 ms^{-1}$. The value of de - Broglie waavelenght associated with it will be

A. $3.3 \times 10^{-33} m$

B. $3.3 \times 10^{-34} m$

C. $3.3 \times 10^{-35} m$

D. $3.3 \times 10^{-36} m$

Answer: 4

Watch Video Solution

27. The ratio of wavelength of deutron and proton accelerated through the same potential difference will be -

A. $1:2$

B. $2:1$

C. $\sqrt{2}:1$

D. $1:\sqrt{2}$

Answer: 3

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28. The wavelenght of an electron of energy 10 keV will be

A. 1.2Å

B. 0.12 Å

C. 12Å

D. 120Å

Answer: 1

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29. Through what potential difference should an electron be accelerated so that its de - Broglie wavelenght becomes 0.5 Å

A. 6022 V

B. 602.2 V

C. 60.22 V

D. 6.022 V

Answer: 2

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30. Find the ratio of de Broglie wavelength of a proton and as α-particle which have been accelerated through same potential

difference.

A. $\frac{1}{\sqrt{2}}$

B. $\frac{1}{2\sqrt{2}}$

C. $\frac{1}{3\sqrt{2}}$

D. $2\sqrt{2}$

Answer: 4

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31. Consider a hypothetical annihilation of a stationary electron with a stationary positron. What is the wavelength of the resulting radiation?

A. $\frac{h}{m_0 c}$

B. $\frac{h}{2m_0}c\Big)$

C. $\frac{2h}{m_0 c}$

D. $\frac{h}{4\pi m_0 c}$

Answer: 1

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32. The de Broglie wavelength of an electron accelerated by an electric field of V volt is given by:

A. $\sqrt{\frac{150}{V}A}$

B. $\frac{h}{\sqrt{2mEA}}$

C. $\frac{h}{\sqrt{2mKTA}}$

D. $\sqrt{\frac{12.26}{V}A}$

Answer: 1

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33. The de Broglie wavelenght associated with neutrons in thermal equilibrium with matter at 300 K is:

A. 1790A

B. 179A

C. 17.9A

D. 1.79A

Answer: 4

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34. When an electron experiences a potential difference of 150 volt, the wave associated with it will have a wavelenght:

A. $1.0 \times 10^{-5} cm$

B. $1.0 \times 10^{-8} cm$

C. $1.2 \times 10^{-8} cm$

D. $10.0 \times 10^{-8} cm$

Answer: 2

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35. For what kinetic energy of a neutron will the associated de broglie wavelenght be $1.04 \times 10^{-10} m$?

A. $6,29 \times 10^{-23} j$

B. 5.99×10^{-19j}

C. $6.69 \times 10^{-21} j$

D. $9.66 \times 10^{-21} j$

Answer: 3

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36. A particle is moving three times as fast as an electron. The ratio of the de- Broglie wavelength of the particle to that of the electron is 1.813×10^{-4}. Calculate the particle's mass and identify the particle. Mass of electron $= 9.11 \times 10^{-31} kg$.

A. $1.275 \times 10^{-26} kg$, Neutron

B. 1.576×10^{-27} kg, Proton

C. $1.765 \times 10^{-25} kg$, Electron

D. $1.675 \times 10^{-27} kg,$ Neutron

Answer: 4

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37. An X-ray tube is operated at 50 kV. The minimum wavelength produced is

A. 0.5 Å

B. 0.75 Å

C. 0.25 Å

D. 1 Å

Answer: 3

Watch Video Solution

38. Which of the following wavelength falls in X - ray region

A. 10000 Å

B. 1000 Å

C. 1 Å

D. 10^{-2} Å

Answer: 3

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39. A metal block is exposed to beams of X-rays of different wavelength. X-rays of which wavelength penetrate most

A. 2 Å

B. 4 Å

C. 6 Å

D. 8 Å

Answer: 1

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40. In producing X-rays a beam of electrons accelerated by a potential difference V is made to strike a metal target. For what value of V, X-rays will have the lowest wavelength of 0.3094 Å

A. 10 kV

B. 20 KV

C. 30 KV

D. 40 K V

Answer: 4

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Exercise 1 H W

1. Light of wavelength $0.6\mu m$from a sodium lamp falls on a photocell and causes the emission of photoelectrons for which the stopping potential is 0.5 V. With wavelength $0.4\mu m$ from a sodium lamp, the stopping potential is 1.5 V. With this data , the value of h/e is

A. $4 \times 10^{-15}V$

B. $3 \times 10^{-15}V$

C. $4 \times 10^{-9}V$

D. $2 \times 10^{-9}V$

Answer: 1

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

A. $4125A^0$

B. $2062.5A^0$

C. $3006.06A^0$

D. $6000A^0$

Answer:

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3. The energy of emitted photoelectrons from a metal is $0.9ev$, The work function of the metal is $2.2eV$. Then the energy of the incident photon is

A. 0.9 eV

B. 2.2 eV

C. 4.4 eV

D. 3.1 eV

Answer:

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4. A photoelectron is moving with a maximum velocity of $10^6 m/s$. Given $e = 1.6 \times 10^{-19} c$, and $m = 9.1 \times 10^{-31} kg$, the stopping potential is

A. 2.5 V

B. 2.8 V

C. 2.0 V

D. 1.4 V

Answer:

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5. A metal of work function $4eV$ is cexposed to a radiation of wavelegth $140 \times 10^{-9}m$. Find the stopping potential.

A. 6.42 V

B. 2.94 V

C. 4.86 V

D. 3.2 V

Answer:

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6. Threshold wavelength for a metal having work function w_0 is λ. Then the threshold wavelength for a metal having work function $2w_0$ is

A. 4λ

B. 2λ

C. $\lambda/2$

D. $\lambda/4$

Answer:

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7. The work functions of metals A and B are in the ratio $1:2$. If light of frequencies f and $2f$ are incident on the surfaces of A and B respectively , the ratio of the maximum kinetic energy of photoelectrons emitted is (f is greater than threshold frequency of A, $2f$ is greater than threshold frequency of B)

A. $1:1$

B. $1:2$

C. $1:3$

D. $1:4$

Answer: 2

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8. The threshold wavelength for photoelectric emission from a material is 5200Å. Photoelectrons will be emitted when this material is

illuminated with monochromatic radiation from a

(a) 50 W infrared lamp

(b) 1 W infrared lamp

(c) 50 W ultraviolet lamp

(d) 1 W ultraviolet lamp

.

A. 50 wait infraced lamp

B. 1 wait infrared lamp

C. 1 wait ultraviolet lamp

D. 50 wait sodium vapour lamp

Answer:

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9. An AIR station is broadcasting the waves of wavelength $300 metres$. If the radiating power of the transmitter is $10 kW$, then the number of photons radiated per second is

A. 1.5×10^{29}

B. 1.5×10^{31}

C. 1.5×10^{33}

D. 1.5×10^{35}

Answer:

Watch Video Solution

10. The energy of a photon is $E = hv$ and the momentum of photon $p = \frac{h}{\lambda}$, then the velocity of photon will be

A. E/P

B. EP

C. $\left(\frac{E}{P}\right)^2$

D. $3 \times 10^8 m/s$

Answer:

Watch Video Solution

11. The approximate wavelength of a photon of energy $2.48eV$ is

A. 500 Å

B. 5000 Å

C. 2000 Å

D. 1000 Å

Answer:

Watch Video Solution

12. An important spetral emission line has a wavelength of 21 cm.

The corresponding photon energy is

$\left(h = 6.62 \times 10^{-34} Js, c = 3 \times 10^{8} m/s\right)$

A. $5.9 \times 10^{-4} eV$

B. $5.9 \times 10^{-6} eV$

C. $5.9 \times 10^{-8} eV$

D. $11.8 \times 10^{-6} eV$

Answer:

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13. A particle having a de Broglie wavelength of $1.0 A^0$ is associated with a momentum of (given $h = 6.6 \times 10^{-34} Js$)

A. $6.6 \times 10^{-26} kgm/s$

B. $6.6 \times 10^{-25} kgm/s$

C. $6.6 \times 10^{-24} kgm/s$

D. $6.6 \times 10^{-22} kgm/s$

Answer:

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14. The de - Broglie wavelength of an electron having $80ev$ of energy is nearly

$\left(1eV = 1.6 \times 10^{-19}J\right.$, Mass of electron $= 9 \times 10^{-31}kg$ Plank's constant $= 6.6 \times 10^{-34}J - \sec)$

A. $140A^0$

B. $0.14A^0$

C. $14A^0$

D. $1.4A^0$

Answer:

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15. Electrons are accelerated through a $p.d.$ Of $150V$. Given $m = 9.1 \times 10^{-31}kg, e = 1.6 \times 10^{-19}c, h = 6.62 \times 10^{-34}Js,$ the de Broglie wavelength associated with it is

A. $1.5A^0$

B. $1.0A^0$

C. $3.0A^0$

D. $0.5A^0$

Answer:

Watch Video Solution

16. If accelerating potential of an alpha particle is doubled than its new debrolgie wavelength becomes

A. $\frac{1}{Sqrt(2)}$ times of intial

B. $\sqrt{2}$ times of initial

C. 1/2 times of initial

D. 2 times of initial

Answer:

Watch Video Solution

17. The ratio of the deBroglie wavelengths of proton, deuteron and alpha particle accelerated through the same potential difference $100V$ is

A. $2:2:1$

B. $1:2:2\sqrt{2}$

C. $1:2:2\sqrt{2}$

D. $2\sqrt{2}:2:1$

Answer:

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18. The energy that should be added to an electron, to reduce its de-Broglie wavelengths from $10^{-10}m$ to 0.5×10^{-10} m wil be

A. Four times the initial energy

B. Thrice the initial energy

C. Equal to the initial energy

D. Twice the initial energy

Answer:

Watch Video Solution

19. The de - Broglie wavelength of an electron having $80ev$ of energy is nearly

$\left(1eV = 1.6 \times 10^{-19}J\right.$, Mass of electron $= 9 \times 10^{-31}kg$ Plank's constant $= 6.6 \times 10^{-34}J - \sec)$

A. 140 Å

B. 0.14 Å

C. 14 Å

D. 1.4 Å

Answer:

Watch Video Solution

20. If particles are moving with same velocity , then maximum de - Broglie wavelength will be for

A. Neutron

B. Proton

C. b-particle

D. α - particle

Answer:

Watch Video Solution

21. The wavelength of most energetic X-rays emitted when a metal target is bombarded by $40keV$ electrons, is approximately $\left(h = 6.62 \times 10^{-34} J - \sec, 1eV = 1.6 \times 10^{-19} J, c = 3 \times 10^{8} m/s\right)$.

A. 300 Å

B. 10 Å

C. 4 Å

D. 0.31 Å

Answer:

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22. X - rays which can penetrate through longer distances in substance are called

A. Soft X-rays

B. Continouns X - rays

C. Hard X-rays

D. None of the above

Answer:

Watch Video Solution

23. An X - ray machine has an accelerating potential difference of 25,000 volts. By calculation the shortest wavelength will be obtained as

$\left(h = 6.62 \times 10^{-34} J - \sec, e = 1.6 \times 10^{-19} \text{coulomb}\right)$

A. 0.25 Å

B. 0.50 Å

C. 1.00 Å

D. 2.50 Å

Answer:

Watch Video Solution

24. Four the production of X-rays of wavelength 0.1 Å the minimum potential difference will be

A. 12.4 KV

B. 24.8 KV

C. 124 KV

D. 248 KV

Answer:

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Exercise 2 C W

1. When a certain metallic surface is illuminated with mono chromatic light of wavelength λ, the stopping potential for

photoelectric current is $3V_0$. When the same surface is illuminated with light of wavelength 2λ the stopping potential is V_0. The threshold wavelength for this surface for photoelectric effect is.

A. 4λ

B. 2λ

C. 6λ

D. 3λ

Answer: 1

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2. The stopping potential for the photo-electrons emitted from a metal surface of work-function 1.7 eV is 10.4 eV. Find the

wavelength of the radiation used. Also identify the energy-levels in hydrogen atom which will emit this wavelength.

A. 1322.5 Å

B. 1022.7 Å

C. 1332.9 Å

D. 1222.7 Å

Answer: 2

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3. The threshold frequency of a certain metal is v_0. When frequency of incident radiation is $2v_0$, the maximum velocity of photoelectrons is found to be $3 \times 10^6 m/s$. If the frequency of radiataions is increased to $10v_0$, the maximum velocity of photoelectrons will be

A. $\frac{3}{10} \times 10^6 m/s$

B. $\frac{10}{3} \times 10^6 m/s$

C. $9 \times 10^6 m..s$

D. $\sqrt{3} \times 10^6 m/s$

Answer: 3

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4. The kinetic energy of an electron is E when the incident wavelength is λ To increase ti KE of the electron to 2E, the incident wavelength must be

A. 2λ

B. $\lambda/2$

C. $\frac{hc\lambda}{E\lambda + hc}$

D. $\frac{hc\lambda}{2E\lambda + hc}$

Answer: 3

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5. The threshold frequency for a metal is 10^{15} Hz. When light of wavelenght 4000 Å is made incident on it, then

A. photoelectric will be emitted from it with zero speed

B. photoelectric emission will not be started by it.

C. photoelectrons will be emitted with speed 10^5 m/s

D. photoelectrons will be emitted with speed $10^d(3)$ m/s

Answer: 2

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6. When photons of energy hv are incident on the surface of photosensitive material of work function hv_0, then

A. the kinetic energy of all emitted electrons is hv_0

B. the kinetic energy of all emitted electrons is $h(v - v_0)$

C. the kinetic energy of all fastest electrons is $h(v - v_0)$

D. the kinetic energy of all emitted electrons is hv.

Answer: 3

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7. The thereshold wavelenght for a metal of work function W_0 is λ . The threshold wavelenght for a metal having work function $3W_0$ will be

A. λ

B. $\frac{\lambda}{2}$

C. $\frac{\lambda}{3}$

D. $\frac{\lambda}{4}$

Answer: 3

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8. The number of photoelectrons emitted for light of a frequency v (higher than the threshold frequency V_0) is proportional to

A. $v - v_0$

B. Threshold frequency (v_0)

C. Intensity of light

D. Frequency of light (v)

Answer: 3

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9. When photons of energy hv fall on an aluminium plate (of work function E_0), photoelectrons of maximum kinetic energy K are ejected . If the frequency of the radiation is doubled , the maximum kinetic energy of the ejected photoelectrons will be

A. K + hv

B. $K + E_0$

C. 2 K

D. K

Answer: 1

Watch Video Solution

10. A photosensitive metallic surface has work funtion hv_0. If photons of energy $2hv_0$ fall on this surface the electrons come out with a maximum velocity of $4 \times 10^6 m/s$. When the photon energy is increases to $5hv_0$ then maximum velocity of photo electron will be

A. $2 \times 10^7 m/s$

B. $8 \times 10^6 m/s$

C. $2 \times 10^6 m/s$

D. $8 \times 10^5 m/s$

Answer: 2

Watch Video Solution

11. The work functions for metals A, B and C are respectively 1.92 eV, 2.0 eV and 5 eV. According to Einstein's equation the metals which will emit photoelectrons for a radiation of wavelength 4100 Å is/are

A. None

B. A only

C. A and B only

D. All the three metals

Answer: 3

Watch Video Solution

12. K.E. of photo electron is E when incident frequency is λ_1. It is 2E when incident frequency is λ_2. The relation between the

wavelength is

A. $\lambda_2 = \lambda_1$

B. $\lambda_2 > 2\lambda_1$

C. $\lambda_2 < 2\lambda_1$

D. $\lambda_2 = 2\lambda_1$

Answer: 3

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13. Maximum velocity of photo electrons is $3.5 \times 10^6 m/s$. If the specific charge of an electron is 1.75×10^{11} C/kg, stopping potential of the electron is

A. 7 volt

B. 3.5 volt

C. 35 volt

D. 10.5 volt

Answer: 3

Watch Video Solution

14. Light from a hydrogen discharge tube is made incident on the cathode of photoelectric cell. The work function of the cathode surface is 3.1 eV. In order to reduce the photoelectric current to zero value, the minimum potential applied to anode with respect to cathode should be

A. -3.1 volt

B. $+10.5$ volt

C. -16.7 volt

D. -10.5 volt

Answer: 4

View Text Solution

15. Photoelectric emission is observed from a metallic surface for frequencies v_1 and v_2 of the incident light rays $(v_1 > v_2)$. If the maximum values of kinetic energy of the photoelectrons emitted in the two cases are in the ratio of $1:k$, then the threshold frequency of the metallic surface is

A. $\frac{v_2 - v_1}{k-1}$

B. $\frac{kv_1 - v_2}{k-1}$

C. $\frac{kv_2 - v_2}{k-1}$

D. $\frac{v_2 - v_1}{k-1}$

Answer: 2

Watch Video Solution

16. In an experiment on photo- electric effect, stopping potential is 1.0 V when light of wavelenght 6520 Å is incident on the emitting surface. The stopping potential is 2.9 V for light of wavelenght 3260 Å. The function of the metal is

A. 0.9 eV

B. 1.9 eV

C. 5.8 eV

D. Cannot be deduced from the given data

Answer: 1

View Text Solution

17. The work functions of metals A and B are in the ratio $1:2$. If light of frequencies f and $2f$ are incident on the surfaces of A and B respectively , the ratio of the maximum kinetic energy of photoelectrons emitted is (f is greater than threshold frequency of A, $2f$ is greater than threshold frequency of B)

A. $1:1$

B. $1:2$

C. $1:3$

D. $1:4$

Answer: 2

Watch Video Solution

18. A particle with rest mass m_0 is moving with velocity c. what is the de-Broglie wavelength associated with it?

A. zero

B. ∞

C. $\frac{hv}{m_0 c}$

D. $\frac{m_0 c}{h}$

Answer: 1

Watch Video Solution

19. Photon and electron are given same energy $\left(10^{-20} J\right)$. Wavelength associated with photon and electron are λ_{ph} and λ_{el} then correct statement will be

A. $\lambda_{ph} < \lambda_{el}$

B. $\lambda_{ph} > \lambda_{el}$

C. $\lambda_{ph} = \lambda_{el}$

D. $\frac{\lambda_{el}}{\lambda_{ph}} = c$

Answer: 2

Watch Video Solution

20. If an electron and an α - particle are accelerated from rest through a potential difference of 100 volt. The ratio of their momenta will be

A. $\sqrt{\left(\frac{M_e}{M_\alpha}\right)}$

B. 1

C. $\frac{\sqrt{2M_e}}{M_\alpha}$

D. $\sqrt{\frac{M_e}{2M_\alpha}}$

Answer: 4

View Text Solution

21. The wavelength of de-Broglie wave associated with a thermal neutron of mass m at absolute temperature T is given by (here, k is the Boltzmann constant)

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

B. $\frac{h}{\sqrt{3mkT}}$

C. $\frac{\sqrt{3mkT}}{h}$

D. $\sqrt{3mkT}$

Answer: 2

Watch Video Solution

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22. The De Broglie wavelenght associated with electron in n Bohr orbit is

A. $\frac{2\pi r}{n}A^0$

B. $2\pi nA^0$

C. $\frac{1}{n}A^0$

D. nA^0

Answer: 1

Watch Video Solution

23. A proton and an α-particle are accelerated through same potential difference. Find the ratio of their de-Brogile wavelength.

A. $\sqrt{8}:1$

B. $1:\sqrt{8}$

C. $1:2$

D. $1:\sqrt{2}$

Answer: 1

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24. An electron accelerated under a $p.\ d.$ Of V volt has a certain wavelength λ. Mass of the proton is 2000 times the mass of an electron. If the proton has to have the same wavelength λ, then it will have to be accelerated under $p.\ d.$ of (volts)

A. V volt

B. 2000 V volt

C. $\frac{V}{2000}$ volt

D. $\sqrt{2000V}$ volt

Answer: 3

Watch Video Solution

25. If E and λ represent the energy and wavelenght respectively of an electron, then the graph between log λ and log E will have

A. Positive slope

B. Negative slope

C. Zero slope

D. Infinite slope

Answer: 2

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Exercise 2 H W

1. Ultraviolet light of wavelength 300nn and intensity $1.0Wm^{-2}$ falls on the surface of a photosensitive material. If one per cent of the incident photons produce photoelectrons, then the number of photoelectrons emitted per second from an area of 1.0 cm^2 of the surface is nearly

A. 9.61×10^{14}

B. 4.12×10^{13}

C. 1.51×10^{12}

D. 2.13×10^{11}

Answer: 3

Watch Video Solution

2. Light rays of wavelength $6000A^{\circ}$ and of photon intensity $39.6Wm^{-2}$ is incident on a metal surface. If only one percent of photons incident on the surface of electrons emitted per second unit area from the surface will be [Planck constant = $6.64 \times 10^{-34}J - S$,Velocity of light =$3 \times 10^{8}ms^{-1}$]

A. 12×10^{18}

B. 10×10^{18}

C. 12×10^{17}

D. 12×10^{15}

Answer: 3

Watch Video Solution

3. Ligth of wavelength $4000A^{\circ}$ is incident on a metal surface of work function $2.5eV$. Given $h = 6.62 \times 10^{-34} Js, c = 3 \times 10^{8} m/s$, the maximum KE of photoelectrons emitted and the corresponding stopping potential are respectively

A. 0.6 eV, 0.6 V

B. 2.5 eV, 2.5 V

C. 3.1 eV, 3.1 V

D. 0.6 eV, 0.3 V

Answer: 1

Watch Video Solution

4. A photomental is illuminated by lights of wavelenght λ_1 and λ_2 respectively. The maximum kinetic enegies of electrons emitted in the two cases are E_1 and E_2 respectively. The work function of metal is.

A. $\frac{E_2\lambda_1 - E_1\lambda_2}{\lambda_1}$

B. $\frac{E_1\lambda_1 - E_2\lambda_2}{\lambda_1 + \lambda_2}$

C. $\frac{E_1\lambda_1 + E_2\lambda_2}{\lambda_1 - \lambda_2}$

D. $\frac{E_2\lambda_2 - E_1\lambda_1}{\lambda_1 - \lambda_2}$

Answer: 4

View Text Solution

5. $U.V.$ light of wavelength $800A^\circ \& 700A^\circ$ falls on hydrogen atoms in their ground state $\&$ liberates electrons with kinetic

energy $1.8eV$ and $4eV$ respectively. Calculate planck's constant.

A. $6.57 \times 10^{-34} js$

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

C. $6.66 \times 10^{-34} js$

D. $6.77 \times 10^{-34} js$

Answer: 1

Watch Video Solution

6. In a photoelectric effect experiment, photons of energy $5eV$ are incident on a metal surface They liberate photoelectron which are just stopped by an electrode at a potential of $-3.5V$ with respect to the metal. The work fuction of the metal is

A. 1.5 eV

B. 3.5 eV

C. 5.0 eV

D. 8.5 eV

Answer: 1

Watch Video Solution

7. The number of photons emitted per second by a $62W$ source of monochromatic light of wavelength $4800A^{\circ}$ is

A. 1.5×10^{19}

B. 1.5×10^{20}

C. 2.5×10^{20}

D. 4×10^{20}

Answer: 2

Watch Video Solution

8. Photons of frequencies $2.2 \times 10^{15} Hz$ and $4.6 \times 10^{15} Hz$ are incident on a metal surface. The corresponding stopping potentials were found to be $6.6V$ and $16.5V$ respectively. Given $e = 1.6 \times 10^{-19} c$, the value of universal planck's constant is

A. $6.6 \times 10^{-34} js$

B. $6.7 \times 10^{-34} js$

C. $6.5 \times 10^{-34} js$

D. $6.8 \times 10^{-34} js$

Answer: 1

Watch Video Solution

9. If stopping potentials corresponding to wavelengths $4000A$ and $4500A$ are 1.3 V and 0.9 V, respectively, then the work function of the metal is

A. 0.3 eV

B. 1.3 eV

C. 1.8 eV

D. 5 eV

Answer: 3

Watch Video Solution

10. Photons of energy $2.0eV$ fall on a metal plate and release photoelectrons with a maximum velocity V. By decreasing λ and

$25\,\%$ the maximum velocity of photoelectrons is doubled. The work function of the metal of the material plate in eV is nearly

A. 2.22

B. 1.985

C. 2.35

D. 1.8

Answer: 4

Watch Video Solution

11. A proton when accelerated through a potential difference of V volt has a wavelength λ associated with it. An alpha-particle in order to have the same λ must be accelerated through a potential difference of

A. V/8 volt

B. V/4 volt

C. V volt

D. 2V volt

Answer: 1

Watch Video Solution

12. If the velocity of a particle is increased three times, then the percentage decrease in its de Broglie wavelength will be

A. 33.3%

B. 66.6%

C. 99.9%

D. 22.2%

Answer: 2

Watch Video Solution

13. If the momentum of electron is changed by P_m then the de-Broglie wavelength associated with it changes by 0.50%. The initial momentum of electron will be:

A. $P_m / 200$

B. $P_m / 100$

C. $200 p_m$

D. $100 p_m$

Answer: 3

Watch Video Solution

14. A proton when accelerated through a $p.d$ of V volt has wavelength λ associated with it. An electron to have the same λ must be accelerated through a $p.d$ of

A. $\frac{V}{8}\text{volt}$

B. 4 V volt

C. 2V volt

D. 1838 V volt

Answer: 4

Watch Video Solution

15. If the energy of a particle is reduced to one fourth, then the percentage increase in its de Broglie wavelength will be

A. 0.41

B. 1.41

C. 1

D. 0.71

Answer: 3

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16. The de Broglie wavelength associated with an electron of velocity $0.3c$ and rest mass $9.1 \times 10^{-31} kg$ is

A. $7.68 \times 10^{-10} m$

B. $7.68 \times 10 - 12m$

C. $5.7 \times 10^{-12} m$

D. $9.1 \times 10^{-12} m$

Answer: 2

Watch Video Solution

17. The uncertainity in the position of a particle is equal to the de-Broglie wavelength. The uncertainity in its momentum will be

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

B. $\frac{2h}{\lambda}$

C. $\frac{\lambda}{h}$

D. $\frac{3\lambda}{2h}$

Answer: 1

Watch Video Solution

18. If the uncertainty in the position of proton is $6 \times 10^{-8} m$, then the minimum uncertainty in its speed is

A. $1 cms^{-1}$

B. $1 ms^{-1}$

C. $1 mms^{-1}$

D. $100 ms^{-1}$

Answer: 2

Watch Video Solution

19. From Davisson-Germer experiment an α particle and a proton are accelerated through the same pd V. Find the ratio of the de Broglie wavelengths associated with them

A. $1:2\sqrt{2}$

B. $2\sqrt{2}:11:\sqrt{2}$

C. $1:\sqrt{2}$

D. $\sqrt{2}:1$

Answer: 1

Watch Video Solution

20. If the uncertainity in the position of an electron is $10^{-10}m$, then the value of uncertainity in its momentum (in $kg-ms^{-1}$) will be

A. 3.33×10^{-24}

B. 1.03×10^{-24}

C. 6.6×10^{-24}

D. 6.6×10^{-20}

Answer: 2

Watch Video Solution

Exercise 3

1. A photocell employs photoelectric effect to convert

A. chanae in the frequency of light into a change in the electric current

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

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

D. change in the intensity of illumination into a change in the work

Answer: 3

Watch Video Solution

2. When photons of energy hv fall on an aluminium plate (of work function E_0), photoelectrons of maximum kinetic energy K are ejected . If the frequency of the radiation is doubled , the maximum kinetic energy of the ejected photoelectrons will be

A. K + hv

B. $K + E_0$

C. `2K

D. K

Answer: 1

Watch Video Solution

3. The momentum of a photon of energy 1 MeV in kg-m/s, will be

A. 5×10^{-22}

B. 0.33×10^{6}

C. 7×10^{-24}

D. 10^{-22}

Answer: 1

Watch Video Solution

4. Monochromatic light of frequency $6.0 \times 10^{14} Hz$ is produced by a laser. The power emitted is 2×10^{-3} w. The number of photons emitted, on the average, by the sources per second is

A. 5×10^{14}

B. 5×10^{15}

C. 5×10^{16}

D. 5×10^{17} sa

Answer: 2

Watch Video Solution

5. A $5W$ source emits monochromatic light of wavelength 5000Å. When placed $0.5m$ away , it liberates photoelectrons from a photosensitive metallic surface . When the source is moved to a

distance of $1.0m$ the number of photoelectrons liberated will be reduced by a factor of

A. be reduced by a factor of 2

B. be reduced by a factor of 4

C. be reduced by a factor of 8

D. be reduced by a factor of 16

Answer: 2

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6. A particle of mass $1mg$ has the same wavelength as an electron moving with a velocity of $3 \times 10^6 ms^{-1}$. The velocity of the particle is

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

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

C. $9 \times 10^{-2} ms^{-1}$

D. $3 \times 10^{-31} ms^{-1}$

Answer: 2

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7. The work function of a surface of a photosensitive material is $6.2eV$. The wavelength of the incident radiation for which the stopping potential is $5V$ lies in the

A. X - ray region

B. Ultraviolet region

C. Visible region

D. Infrared region

Answer: 1

Watch Video Solution

8. A particle of mass $1mg$ has the same wavelength as an electron moving with a velocity of $3 \times 10^6 ms^{-1}$. The velocity of the particle is

A. $3 \times 10^{-31} ms^{-1}$

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

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

D. $9 \times 10^{-2} ms^{-1}$

Answer: 3

Watch Video Solution

9. The number of photoelectrons emitted for light of a frequency v (higher than the threshold frequency V_0) is proportional to

A. 9×10^{17}

B. 3×10^{16}

C. 9×10^{15}

D. 3×10^{19}

Answer: 4

Watch Video Solution

10. Monochromatic light of wavelength $667nm$ is produced by a helium neon laser . The power emitted is $9mW$. The number of photons arriving per second on the average at a target irradiated by this beam is

A. 9×10^{17}

B. 3×10^{16}

C. 9×10^{15}

D. 3×10^{19}

Answer: 2

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11. The figure shows a plot of photo current versus anode potential for a photo sensitive surface for the different radiations. Which one of the following is a correct statement? (CBSE 2009)

A. curves (1) and (2) represent incident radiatons of different frequencies and different intensities.

B. curves (1) and (2) represent incident radiations of same frequency but of different intensities.

C. curves (2) and (3) represent incident radiations of different frequency and different frequencies and differentd intensities.

D. curves (2) and (3) represent incident radiations same frequency having same intensity

Answer: 2

View Text Solution

12. A $0.66kg$ ball is moving wih a speed of $100m/s$. The associated wavelength will be.

A. $6.6 \times 10^{-34} js$

B. $1.0 \times 10^{-35} m$

C. 1.0×10^{-32}

D. 6.6×10^{-32}

Answer: 2

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13. When monochromatic radiation of intensity I falls on a metal surface, the number of photoelectrons and their maximum kinetic are N and T respectively. If the intensity of radiation is 2 I, the number of emitted electrons and their maximum kinetic energy are respectively.

A. N and 2T

B. 2N and T

C. 2N and 2T

D. N and T

Answer: 2

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14. The potential difference that must be applied to stop the fastest photoelectrons emitted by a nickel surface , having work function $5.01eV$, when ultraviolet light of $200nm$ falls on it , must be

A. 1.2 V

B. 2.4 V

C. $-1.2V$

D. `-2.4 V

Answer: 1

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15. Photoelectric emission occurs only when the incident light has more than a certain minimum

A. power

B. wavelenght

C. Intensity

D. Frequency

Answer: 4

Watch Video Solution

16. In photoelectric emission process from a metal of work function $1.8eV$, the kinetic energy of most energetic electrons is $0.5eV$. The corresponding stopping potential is

A. 1.8 V

B. 1.3 V

C. 0.5 V

D. 2.3 V

Answer: 3

Watch Video Solution

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

A. 1 V

B. 2 V

C. 3 V

D. 5 V

Answer: 2

Watch Video Solution

18. Electrons used in an electron microscope are accelerated by a voltage of 25 kV. If the voltage is increased to 100 kV then the de Broglie wavelength associated with the electrons would

A. increase by 2 times

B. decrease by a times

C. increase by 4 times

D.

Answer: 2

Watch Video Solution

19. Monochromatic radiation emitted when electron on hydrogen atom jumps from first excited to the ground state irradiates a photosensitive material. The stopping potential is measured to be $3.57V$. The threshold frequency of the material is

A. $1.6 \times 10^{15} Hz$

B. $2.5 \times 10^{15} Hz$

C. $4 \times 10^{15} Hz$

D. $5 \times 10^{15} Hz$

Answer: 1

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20. Lights of two different frequencies whose photons have energies 1 and 2.5 eV, respectively, successively illuminate a metal whose work function is 0.5 eV. The ratio of the maximum speeds of the emitted electrons

A. $1:1$

B. $1:5$

C. $1:4$

D. $1:2$

Answer: 4

Watch Video Solution

21. A α -parhticle moves in a circular path of radius $0.83cm$ in the presence of a magnetic field of $0.25Wb/m^2$. The de-Broglie wavelength assocaiated with the particle will be

A. 10 Å

B. 0.01 Å

C. 1 Å

D. 0.01 Å

Answer: 2

Watch Video Solution

22. If the momentum of an electron is changed by p, then the de - Broglie wavelength associated with it changes by $0.5\,\%$. The initial momentum of electron will be

A. $\frac{p}{200}$

B. 100p

C. 200p

D. 400p

Answer: 3

Watch Video Solution

23. For photoelectric emission from certain metal the cut - off frequency is v. If radiation of frequency $2v$ incident on the metal plate , the maximum possible velocity of the emitted electron will be (m is the electron mass).

A. $2\sqrt{hv/m}$

B. $2\sqrt{hv/(2m)}$

C. $\sqrt{hv/m}$

D. $\sqrt{2hv/m}$

Answer: 4

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24. If velocity of a particle is 3 times of that of electron and ratio of de-broglie wavelength of particle to that of electron is 1.814×10^{-4} . The particle will be -

A. neutron

B. deuteron

C. alpha particle

D. tritium

Answer: 1

Watch Video Solution

25. The wavelength λ_e of an electron and λ_p of a photon of same energy E are related by

A. $\lambda_p \propto \frac{1}{\sqrt{\lambda_e}}$

B. $\lambda_p \propto \lambda_e^2$

C. $\lambda_p \propto \lambda_e$

D. $\lambda_p \propto \sqrt{\propto_e}$

Answer: 2

Watch Video Solution

26. If the kinetic energy of the particle is increased to 16 times its previous value , the percentage change in the de - Broglie

wavelength of the particle is

A. 50

B. 25

C. 75

D. 60

Answer: 3

Watch Video Solution

27. Light with an enargy flux of $25 \times 10^4 Wm^{-2}$ falls on a perfectly reflecting surface at normal incidence. If the surface area is $15cm^2$, the average force exerted on the surface is

A. $3.0 \times 10^{-6} N$

B. $1.25 \times 10^{-6} N$

C. $2.50 \times 10^{-6} N$

D. $1.20 \times 10^{-6} N$

Answer: 3

Watch Video Solution

28. When the energy of the incident radiation is increased by $20\,\%$, kinetic energy of the photoelectrons emitted from a metal surface increased from $0.5eV \rightarrow 0.8eV$. The work function of the metal is

A. 1.5 eV

B. 0.65 eV

C. 1.0 eV

D. 1.3 eV

Answer: 3

Watch Video Solution

29. When a certain metallic surface is illuminated with mono chromatic light of wavelength λ, the stopping potential for photoelectric current is $3V_0$. When the same surface is illuminated with light of wavelength 2λ the stopping potential is V_0. The threshold wavelength for this surface for photoelectric effect is.

A. $\frac{\pi}{4}$

B. $\frac{\lambda}{6}$

C. 6λ

D. 4λ

Answer: 4

Watch Video Solution

30. A photoelectric surface is illuminated successively by monochromatic light of wavelength λ and $\frac{\lambda}{2}$. If the maximum kinetic energy of the emitted photoelectrons in the second case is 3 times than in the first case , the work function of the surface of the material is

(h = Plank's constant , c = speed of light)

A. $\frac{2hc}{\lambda}$

B. $\frac{hc}{3\lambda}$

C. $\frac{hc}{2\lambda}$

D. $\frac{hc}{\lambda}$

Answer: 3

Watch Video Solution

31. Light of wavelength $500nm$ is incident on a metal with work function $2.28eV$. The de Broglie wavelength of the emitted electron is

A. $\geq 2.8 \times 10^{-9}m$

B. $\leq 2.8 \times 10^{-12}m$

C. $< 2.8 \times 10^{-10}m$

D. $< 2.8 \times 10^{-9}m$

Answer: 1

Watch Video Solution

32. Electrons with de-Broglie wavelength λ fall on the target in an X-ray tube. The cut-off wavelength of the emitted X-ray is

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

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

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

D. $\lambda_0 = \lambda$

Answer: 1

Watch Video Solution

33. Photons with energy $5eV$ are incident on a cathode C in a photoelectric cell . The maximum energy of emitted photoelectrons is $2eV$. When photons of energy $6eV$ are incident on C , no photoelectrons will reach the anode A , if the stopping potential of A relative to C is

A. $-1V$

B. $-3V$

C. $+3V$

D. $+4V$

Answer: 3

Watch Video Solution

34. An electron of mass m and a photon have same energy E. The ratio of de - Broglie wavelengths associated with them is :

A. $\left(\frac{E}{2m}\right)^{\frac{1}{2}}$

B. $c(2mE)^{\frac{1}{2}}$

C. $\frac{1}{c}\left(\frac{2m}{E}\right)^{\frac{1}{2}}$

D. $\frac{1}{c}\left(\frac{E}{2m}\right)^{\frac{1}{2}}$

Answer: 4

Watch Video Solution

35. When a metallic surface is illuminated with radiation of wavelength λ, the stopping potential is V. If the same surface is illuminated with radiation of wavelength 2λ , the stopping potential is $\frac{V}{4}$. The threshold wavelength surface is :

A. $5lamabda$

B. $\frac{5}{2}\lambda$

C. 3λ

D. 4lambda`

Answer: 3

Watch Video Solution

Exercise 4

1. A particle is droped from a height H. The de-broglie wavelength of the particle as a function of height is proportional to

A. H

B. $H^{1/2}$

C. H^(0)`

D. $H^{-1/2}$

Answer: 4

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2. An electron (mass m) with an initial velocity $v = v_0\hat{i}(v_0 > 0)$ is in an electric field $E = -E_0\hat{l}\,(E_0 = \text{constant} > 0)$. Its de-Broglie wavelength at time t is given by

A. $\dfrac{\lambda_0}{\left(1+\frac{eE_0t}{mv_0}\right)}$

B. $\lambda_0\left(1+\dfrac{eE_0t}{mv_0}\right)$

C. λ_0

D. $\lambda_0 t$

Answer:

Watch Video Solution

3. An electron (mass m) with an initial velocity $\overrightarrow{v} = v_0\hat{i}$ is in an electric field $\overrightarrow{E} = E_0\hat{j}$. If $\lambda_0 = h/mv_0$. It's de-broglie wavelength at time t is given by

A. λ_0

B. $\lambda_0\sqrt{1+\frac{e^2E_0^2t^2}{m^2v_0^2}}$

C. $\frac{\lambda_0}{\sqrt{1+\frac{e^2E_0^2t^2}{m^2v_0^2}}}$

D. $\frac{\lambda_0}{\left(1+\frac{e^2E_0^2t^2}{m^2v_0^2}\right)}$

Answer: 3

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4. When a surface 1 cm thick is illuminated with light of wavelength λ, the stopping potential is V_0, but when the same surface is illuminated by light of wavelength 3λ, the stopping potential is $\frac{V_0}{6}$. Find the threshold wavelength for metallic surface.

A. 4λ

B. 5λ

C. 3λ

D. 2λ

Answer: 2

Watch Video Solution

5. A photon of energy $2.5eV$ and wavelength λ falls on a metal surface and the ejected electron have velocity $'v'$. If the λ of the incident light is decreased by $20\,\%$ the maximum velocity of the emitted electrons is doubled. The work function of the metal is

A. 2.6 eV

B. 2.23 eV

C. 2.5 eV

D. 2.29 eV

Answer: 4

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6. A source of light is placed above a sphere of radius $10cm$. How many photoelectrons must be emitted by the sphere before emission of photoelectrons stop? The energy of incident photon is $4.2eV$ and the work function of the metal is $1.5eV$.

A. 2.08×10^{18}

B. 1.875×10^{8}

C. 2.88×10^{18}

D. 4 xx 10^(19)`

Answer:

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7. From the above figure the values of stopping potentials for M_1 and M_2 for a frequency $v_3 (> v_{02})$ of the incident radiatioins are V_1 and V_2 respectively. Then the slope of the line is equal to

A. $\frac{V_2 - V_1}{v_{02} - v_{01}}$

B. $\frac{V_1 - V_2}{v_{02} - v_{01}}$

C. $\frac{V_2}{v_{02} - v_{01}}$

D. $\frac{V_1}{v_{02} - v_{01}}$

Answer:

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8. For certain photosensitive material, a stopping potential of $3.0V$ is required for light of wavelength $300nm$, $2.0V$ for $400nm$ and $1.0V$ for $600nm$. The work function of the material is `(nearly)

A. 2.5 eV

B. 1.5 eV

C. 2.0 eV

D. 1.0 eV

Answer:

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9. Light of wavelength 180 nm ejects photoelectrons from a plate of metal whose work - function is 2 eV. If a uniform magnetic field of 5×10^{-5} T be applied parallel to the plate, what would be the

radius of the path followed by electrons ejected normally from the plate with maximum energy.

A. 0.148 m

B. 0.2 m

C. 0.25 m

D. 0.3 m

Answer:

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10. Light described at a place by the equation $E = (100V/m) \times \left[\sin\left(5 \times 10^{15} s^{-1}\right)t + \sin\left(8 \times 10^{15} s^{-1}\right)t\right]$ falls on a metal surface having work function $2.0eV$. Calculate the maximum kinetic energy of the similar having work function $1.9eV$

A. 3.27 eV

B. 5 eV

C. 1.27 eV

D. 2.5 eV

Answer:

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11. The electric field associated with a light wave is given by $E = E_0 \sin\left[\left(1.57 \times 10^7 m^{-1}\right)(ct - x)\right]$. Find the stopping potential when this light is used in an experiment on a photoelectric effect with the emitter having work function 2.1eV. $h = 6.62 \times 10^{-34} Js$.

A. 1.2 V

B. 1.1 V

C. 2 volt

D. 2.1 V

Answer:

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12. An electron of mass m and charge e initially at rest gets accelerated by a constant electric field E. The rate of change of de-Broglie wavelength of this electron at time t ignoring relativistic effects is

A. $\frac{-h}{eEt^2}$

B. $\frac{-eEt}{E}$

C. $\frac{-mh}{eEt^2}$

D. $\frac{-h}{e.E}$

Answer:

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13. A praticle of mass M at rest decays into two particle of masses m_1 and m_2, having non-zero velocities. The ratio of the de Broglie wavelength of the particles $\frac{\lambda_1}{\lambda_2}$ is

A. m_1/m_2

B. m_2/m_1

C. 1.0

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

Answer: 3

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14. A photon and an electron have equal energy E. $\lambda_{\text{photon}} / \lambda_{\text{electron}}$ is proportional to

A. $\sqrt{E}$

B. $1/\sqrt{E}$

C. $1/E$

D. Does not depend upon E

Answer: 2

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15. When a monochromatic point source of light is at a distance of 0.2 m from a photoelectric cell, the cut off voltage and the saturation current

are respectively 0.6 V and 18.0 mA. If the same source is placed 0.6 m away

from the photoelectric cell, 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 6.0 mA

(d) the saturation current will be 2.0 mA

A. The stopping potential will be 0.2 V

B. The stopping potential will be 0.6 V

C. Thte saturation current will be 6 mA

D. The saturation current will be 18 mA

Answer:

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16. An X-ray tube is operated at $50kV$ and $20mA$. The target material of the tube has mass of $1kg$ and specific heat $495Jkg^{-1}$ ^(@)C^(-1)`. One perent of applied electric power is converted into X-rays and the remaining energy goes into heating the target. Then,

A. A suitable target material must have a high melting temperature

B. A suitable target material must have low thermal conductivity

C. The average rate of rise of temperature of target would be $2.^{0} C/s$

D. The minimum wavelenght of the X-rays emitted is about 0.25×10^{-10} m

Answer:

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

$V(x) = E_0$ when $x = \ \leq x \leq 1$and $x > 1$ repectively.

$\lambda_1 \ \text{and} \ \lambda_2$ are the de - Broglie wavelength of the particle, ,if the total energy of particle is $2E_0$ find λ_1 / λ_2

A. 2

B. 1

C. $\sqrt{2}$

D. $\frac{1}{\sqrt{2}}$

Answer: 3

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

A. 

B. 

C. 

D. 

Answer:

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19. Which of the following figure represents the variation of particle momentum and the associated de - Broglie wavelength ?

A. 

B. 

C. 

D. 

Answer:

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20. The de Broglie wave present in fifth Bohr orbit is:

A. 

B. 

C. 

D. 

Answer:

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21. The graph shown in figure show the variation of photoelectric current (i) and the applied voltage (V) for two different material and for two different intensities of the incident radiation.

Indentify thte pairs of curves that correspond to (a) different material (b) same intensity of incident radiations.

A. Curve 1 and 3, Curve 2 and 4

B. Curve 1 and 2, Curve 3 and 4

C. Curve 1 and 4, Curve 2 and 3

D. Curve 1 only, Curve 2 and 4

Answer:

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22. The anode voltage of photocellis kept fixed. The wavelength λ of the light falling on the cathode is gradually changed. The plate current I of the photocell varies as follows:

A. 

B. 

C. 

D. 

Answer:

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23. The two lines A and B shown in figure are the graphs of the de Broglie wavelenght λ as a function of $\frac{1}{\sqrt{V}}$ (V is the accerlerating potential) for two particles having the same charge.

Which of the two represents the particle of heavier mass ?

A. A

B. B

C. Both A and B

D. Data insuffcient

Answer:

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24. A graph regarding photoelectric effect is shwon between the maximum kinetic energy of electrons and the frequency of the incident light. On the basis of data as shown in the graph, calculate the work function

A. 2eV

B. 4 eV

C. 4.2 eV

D. 2.5 eV

Answer:

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25. Name the experiment for which the adjacent graph, showing the variation of intensity of scattered electrons with the angle of scattering (θ) was obtained.

b) Also name the important hypothesis that was confirmed by this experiment.

A. (A) Davisson and Germer experiment, (B) de Broglie hypothesis

B. (A) Photo electric effect, (B) de Broglie hypothesis

C. (A) Thermionic emission, (B) de Broglie hypothesis

D. None of the above

Answer: A

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Assertion And Reason

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

Reason : The photon behaves like a particle.

A. If both assertion and reason are ture and the reason is the correct explanation of the assertion.

B. If both assertion and reason are true but reason is not the correct explanation of the assertion.

C. If assertion is true but reason both are false.

D. If assertion is false but reason is true.

Answer:

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2. Assertion : Photoelectric effect demonstrates the wave nature of light.

Reason: The number of photoelectrons is proportional to the frequency of light.

A. If both assertion and reason are ture and the reason is the correct explanation of the assertion.

B. If both assertion and reason are true but reason is not the correct explanation of the assertion.

C. If assertion is true but reason both are false.

D. If assertion is false but reason is true.

Answer:

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3. Assertion : When the speed of an electron increases its specific charge decreases.

Reason : Specific charge is the ratio of the change to mass.

A. If both assertion and reason are ture and the reason is the correct explanation of the assertion.

B. If both assertion and reason are true but reason is not the correct explanation of the assertion.

C. If assertion is true but reason both are false.

D. If assertion is false but reason is true.

Answer: 2

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4. Assertion : X - rays travel with the speed of light.

Reason : X- rays are electromagnetic rays.

A. If both assertion and reason are ture and the reason is the correct explanation of the assertion.

B. If both assertion and reason are true but reason is not the correct explanation of the assertion.

C. If assertion is true but reason both are false.

D. If assertion is false but reason is true.

Answer: 1

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5. The kinetic energy of photoelectrons emitted by a photosensitive surface depends on the internsity of the incident

radiation

A. If both assertion and reason are ture and the reason is the correct explanation of the assertion.

B. If both assertion and reason are true but reason is not the correct explanation of the assertion.

C. If assertion is true but reason both are false.

D. If assertion is false but reason is true.

Answer:

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6. Assertion : Kinetic energy of photo electrons emitted by a photosensitive surface depends upon the intensity of incident photon.

Reason : The ejection of electrons from metallic surface is possible with frequency of incident photon below the threshold frequency.

A. If both assertion and reason are ture and the reason is the correct explanation of the assertion.

B. If both assertion and reason are true but reason is not the correct explanation of the assertion.

C. If assertion is true but reason both are false.

D. If assertion and reason both are false.

Answer: 4

7. Assertion : Separation of isotope is possible because of the difference in electron numbers of isotope.

Reason : Isotope of an element can be separated by using a mass spectrometer.

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A. If both assertion and reason are ture and the reason is the correct explanation of the assertion.

B. If both assertion and reason are true but reason is not the correct explanation of the assertion.

C. If assertion is true but reason both are false.

D. If assertion is false but reason is true.

Answer:

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8. Assertion : The specific charge of positive rays is not constant.

Reason : The mass of ions varies with speed.

A. If both assertion and reason are ture and the reason is the correct explanation of the assertion.

B. If both assertion and reason are true but reason is not the correct explanation of the assertion.

C. If assertion is true but reason both are false.

D. If assertion is false but reason is true.

Answer:

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9. Assertion : Photosensitivity of a metal is high if its work function is small.

Reason : Work function $= hf_0$ where f_0 is the threshold frequency.

A. If both assertion and reason are ture and the reason is the correct explanation of the assertion.

B. If both assertion and reason are true but reason is not the correct explanation of the assertion.

C. If assertion is true but reason both are false.

D. If assertion is false but reason is true.

Answer:

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10. Assertion : The de - Broglie wavelength of a molecule varies inversely as the square root of temperature.

Reason : The root mean square velocity of the molecule depends on the temperature.

A. If both assertion and reason are ture and the reason is the correct explanation of the assertion.

B. If both assertion and reason are true but reason is not the correct explanation of the assertion.

C. If assertion is true but reason both are false.

D. If assertion is false but reason is true.

Answer:

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11. An electron is not deflected on passing through a certain region , because

A. If both assertion and reason are ture and the reason is the correct explanation of the assertion.

B. If both assertion and reason are true but reason is not the correct explanation of the assertion.

C. If assertion is true but reason both are false.

D. If assertion is false but reason is true.

Answer:

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12. Assertion : Electric conduction in gases is possible at normal pressure.

Reason : The electric conduction in gases depends only upon the potential difference between the electrodes.

A. If both assertion and reason are ture and the reason is the correct explanation of the assertion.

B. If both assertion and reason are true but reason is not the correct explanation of the assertion.

C. If assertion is true but reason both are false.

D. If assertion is false but reason is true.

Answer:

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13. Assertion : Light is produced in gases in the process of electric discharge through them at high pressure.

Reason : At high pressure electrons of gaseous atoms collide and reach excited state.

A. If both assertion and reason are ture and the reason is the correct explanation of the assertion.

B. If both assertion and reason are true but reason is not the correct explanation of the assertion.

C. If assertion is true but reason both are false.

D. If assertion is false but reason is true.

Answer:

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14. Assertion : If different gases are filled turn by turn at the same pressure in the discharge tube the discharge in them takes place at the same potential.

Reason : The discharge depends only on the pressure of discharge tube and not on the ionisation potential of gas.

A. If both assertion and reason are ture and the reason is the correct explanation of the assertion.

B. If both assertion and reason are true but reason is not the correct explanation of the assertion.

C. If assertion is true but reason both are false.

D. If assertion is false but reason is true.

Answer:

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15. Assertion : An electric field is preferred in comparison to magnetic field for detecting the electron beam in a television picture tube.

Reason : Electric field require low voltage.

A. If both assertion and reason are ture and the reason is the correct explanation of the assertion.

B. If both assertion and reason are true but reason is not the correct explanation of the assertion.

C. If assertion is true but reason both are false.

D. If assertion is false but reason is true.

Answer:

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