PHYSICS

BOOKS - NCERT FINGERTIPS PHYSICS (HINGLISH)

DUAL NATURE OF RADIATION AND MATTER

Introduction

1. Who established that electric charge is quantized ?

A. J.J. Thomson

B. William Crookes

C. R.A Millikan

D. Wilhelm Rontgen

Answer: C

Watch Video Solution

2. Cathode rays were discovered by

A. Maxwell Clerk James

B. Heinrich Hertz

C. William Crookes

D. J.J. Thomson

Answer: C

Watch Video Solution

3. The specific charge of a proton is $9.6 \times 10^7 \mathrm{C\,kg}^{-1}$.

The specific charge of an alpha particle will be

A. $9.6 \times 10^7 \mathrm{C\,kg}^{-1}$

B. $19.2 \times 10^7 \mathrm{C\,kg}^{-1}$

C. $4.8 \times 10^7 \mathrm{C\,kg}^{-1}$

D. $2.4 \times 10^7 \mathrm{C\,kg}^{-1}$

Answer: C

Watch Video Solution

Electron Emission

1. Thermionic emissions are related to

A. conduction

B. convection

C. radiation

D. none of these

Answer: B

Watch Video Solution

2. The minimum energy required for the electron emission from the metal surface can be supplied to the free electrons by which of the following physical processes ?

A. Thermionic emission

B. Field emission

C. photoelectric emission

D. All of these

Answer: D

Watch Video Solution

1. The phenomenon of photoelectric emission was discovered in 1887 by

A. Albert Einstein

B. Heinrich Hertz

C. Wilhelm Hallwachs

D. Philipp Lenard

Answer: B

Watch Video Solution

2. A metal surface ejects electrons when hit by green light but none when hit by yellow light. The electrons will be ejected when the surface is hit by

A. blue light

B. heat rays

C. infrared light

D. red light

Answer: A

Watch Video Solution

Experimental Study Of Photoelectric Effect

1. Which of the following statements is correct regarding the photoelectric experiment ?

A. The photocurrent increases with intensity of light.

B. Stopping potential increases with increase in intensity of incident light.

C. The photocurrent increases with increase in frequency.

D. All of these

Answer: A

Watch Video Solution

2. In photoelectric effect, the photocurrent

A. depends both on intensity and frequency of the incident light.

B. does not depend on frequency of incident light but depends on intensity of the incident light.

C. decreases with increase in frequency of incident light.

D. increases with increase in frequency of incident light.

Answer: B

Watch Video Solution

3. The maximum value of photoelectric current is called

A. base current

B. saturation current

C. collector current

D. emitter current

Answer: B

Watch Video Solution

4. In photoelectric effect, the photoelectric current is independent of

A. intensity of incident light

B. potential difference applied between the two electrodes

C. the nature of emitter material

D. frequency of incident light

Answer: D

Watch Video Solution

5. In photoelectric effect, stopping potential depends on

A. frequency of incident light

B. nature of the emitter material

C. intensity of incident light

D. both (a) and (b)

Answer: D

Watch Video Solution

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

A. $10^{-1}s$

B. $10^{-4}s$

C. $10^{-10}s$

D. $10^{-16}s$

Answer: C

Watch Video Solution

7. In a photoelectric experiment, if both the intensity and frequency of the incident light are doubled, then the saturation photoelectric current

A. remains constant

B. is halved

C. is doubled

D. becomes four times

Answer: C

Watch Video Solution

8. A photoelectric cell is illuminated by a point sources of light 1 m away. When the sources is shifted to 2 m then

A. each emitted electron carries one quarter of the initial energy

B. number of electrons emitted is half the initial number

C. each emitted electrons carries half the initial energy

D. number of electrons emitted is quarter of the initial number

Answer: D

Watch Video Solution

9. 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. $\lambda \leq \lambda_0$

C. $\lambda \geq 2\lambda_0$

D. $\lambda = 4\lambda_0$

Answer: B

Watch Video Solution

10. The photoelectric cut off voltage in a certain experiment is 1.5V. What is the maximum kinetic energy of photoelectrons emitted? $e = 1.6 \times 10^{-19} C.$

A. 2.4 eV

B. 1.5 eV

C. 3.1 eV

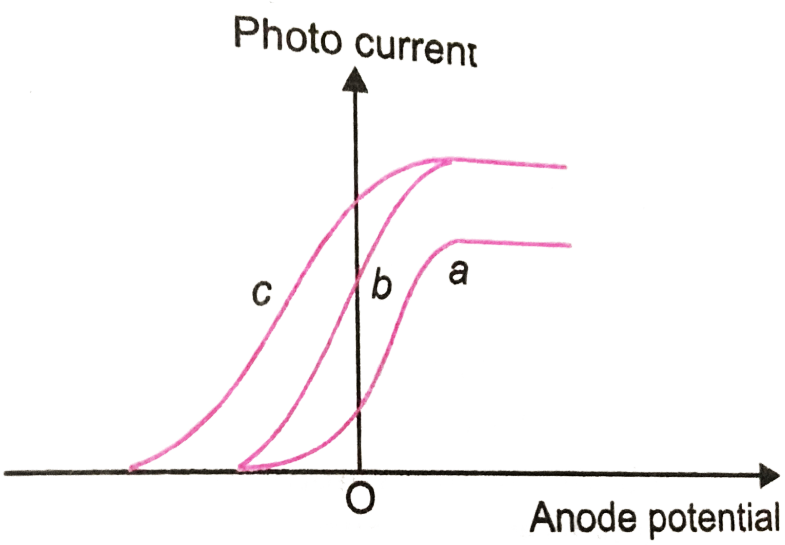
D. 4.5 eV

Answer: B

Watch Video Solution

11. The fig. shows the variation of photon current with anode potential for a photo-sensitive surface for three different radiation. Let I_a, I_b and I_c be the intensities and f_a, f_b and f_c be the

frequency for the curves a,b and c respectively.



A. $v_a = v_b$ and $I_a \neq I_b$

B. $v_a = v_c$ and $I_a = I_c$

C. $v_a = v_b$ and $I_a = I_b$

D. $v_b = v_c$ and $I_b = I_c$

Answer: A

Watch Video Solution

Particle Nature Of Light The Photon

1. Which of the following phenomena exhibits particle nature of light ?

A. Photoelectric effect

B. Interference

C. Refraction

D. Polarization

Answer: A

Watch Video Solution

2. Which of the follwing statements about photon is incorrect ?

A. Photons exert no pressure.

B. Momentum of photon is $\frac{hv}{c}$.

C. Rest mass of photon is zero.

D. Energy of photon is hv.

Answer: A

Watch Video Solution

3. In a photon-particle collision (sauch as photon-electron collision), which of the following may not be conserved ?

A. Total energy

B. Number of photons

C. Total momentum

D. both (a) and (b)

Answer: B

View Text Solution

4. The rest mass of the photon is

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

B. $\frac{hv}{c^2}$

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

D. zero

Answer: D

Watch Video Solution

5. n' photons of wavelength $'\lambda'$ are absorbed by a black body of mass 'm'. The momentum gained by the body is

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

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

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

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

Answer: D

Watch Video Solution

6. The linear momentum of a 3 MeV photon is

A. $0.01eVsm^{-1}$

B. $0.02eVsm^{-1}$

C. $0.03eVsm^{-1}$

D. $0.04eVsm^{-1}$

Answer: A

Watch Video Solution

7. The wavelength of light in the visible region is about 390 nm for violet colour and about 760 nm for red colour. The energy of photon in eV at violet end is

A. 2.32

B. 3.19

C. 1.42

D. 4.13

Answer: B

Watch Video Solution

8. In the question number 48, the energy of photon in eV at the red of the visible spectrum is

A. 6.63

B. 3.62

C. 7.61

D. 1.64

Answer: D

Watch Video Solution

9. Monochromatic light of frequency $6 \times 10^{14} Hz$ is produced by a laser. The power emitted is 2×10^{-3} W.

The number of photons emitted per second is

$\left(\text{Given h} = 6.63 \times 10^{-34} Js\right)$

A. 2×10^{15}

B. 3×10^{15}

C. 4×10^{15}

D. 5×10^{15}

Answer: D

Watch Video Solution

10. A 100W sodium lamp radiates energy uniformly in all directions. The lamp is located at the center of a large sphere that absorbs all the sodium light which is incident on it. The wavelength of the sodium light is 589nm. (a) What is energy associated per photon with the sodium light? (b) At what rate are photons delivered to the sphere?

A. 3×10^{15}

B. 3×10^{10}

C. 3×10^{20}

D. 3×10^{19}

Answer: C

Watch Video Solution

11. The energy flux of sunlight reaching the surface of the earth is $1.388 \times 10^3 Wm^{-2}$. The photons in the sunlight have an average wavelength of 550 nm.

How many photons per square meter are incident on the earth per second ?

A. 4×10^{21}

B. 4×10^{34}

C. 4×10^{31}

D. 4×10^{28}

Answer: A

Watch Video Solution

12. If h is Plank's constant. Find the momentum of a photon of wavelength 0.01Å.

A. 10^{-2}

B. h

C. $10^{2}h$

D. $10^{12}h$

Answer: D

Watch Video Solution

13. A bulb lamp emits light of mean wavelength of $4500A$. The lamp is rated at $150W$ and $8\,\%$ of the energy appears as emitted light. How many photons are emitted by the lamp per second?

A. 3×10^{19}

B. 3×10^{24}

C. 3×10^{20}

D. 3×10^{18}

Answer: A

Watch Video Solution

14. There are two sources of light, each emitting with a power of $100W$. One emits X-rays of wavelength $1nm$ and the other visible light at $500nm$. Find the ratio of number of photons of X-rays to the photons of visible light of the given wavelength?

A. $1:500$

B. $1:400$

C. $1:300$

D. $1:200$

Answer: A

Watch Video Solution

15. A monochromatic light of frequency $3 \times 10^{14} Hz$ is produced by a LASER, emits the power of 3×10^{-3} W. Find how many number of photons are emitted per second.

A. 1.5×10^{16}

B. 2.5×10^{16}

C. 4.5×10^{16}

D. 8.5×10^{16}

Answer: A

Watch Video Solution

16. A source S_1 is producing 10^{15} photons per second of wavelength $5000\tilde{A}$. . .. Another source S_2 is producing 1.02×10^{15}

Then, $(\text{Power of} S_2) / (\text{Power of} S_1)$ is equal to

A. 1.00

B. 1.02

C. 1.04

D. 0.98

Answer: A

Watch Video Solution

17. Photons absorbed in matter are converted to heat. A source emitting n photons/ sec of frequency ν is used to convert 1kg of ice at $0^\circ C$ to water at $0^\circ C$. Then, the time T taken for the conversion

A. decreases with increasing n, with v fixed.

B. decreases with n fixed, v increasing.

C. remains constant with n and v changing such that nv=constant.

D. All of these.

Answer: D

Watch Video Solution

18. An X-ray tube produces a continuous spectrum of radiation with its short wavelength end at $0.45\tilde{A}...$.

The maximum energy of a photon in the radiation is

A. 30.4 ke V

B. 27.6 ke V

C. 15.2 ke V

D. 12.8 ke V

Answer: B

Watch Video Solution

19. If m is the mass of an electron and c the speed of light, the ratio of the wavelength of a photon of energy E to that of the electron of the same energy is

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

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

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

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

Answer: A

Watch Video Solution

1. Who won the Nobel prize in physics in the year 1929 for the discovery of the nature of electrons ?

A. Erwin Schrodinger

B. R.A Millikan

C. Louris Victor de Broglie

D. Albert Einstein

Answer: C

View Text Solution

2. The wavelength of the matter wave is independent of

A. mass

B. velocity

C. momentum

D. charge

Answer: D

Watch Video Solution

3. 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

4. The matter-wave picture of electromagnetic wave/radiation elegantly incorporated the

A. Heinsenberg's uncertainty principle

B. correspondence principle

C. cosmic theory

D. Hertz's observations

Answer: A

View Text Solution

5. Wave theory cannot explain the phenomena of

A. Polarization , B.Diffraction

C. Compton effect , D. Photoelectric effect

Which of the following is correct ?

A. A and B

B. B and D

C. C and D

D. D and A

Answer: C

View Text Solution

6. Why is a photoelectric cell also called an electric eye?

A. LED

B. Photocell

C. Integrated chip (IC)

D. Solar cell

Answer: B

Watch Video Solution

7. In which of the following photocell is not used ?

A. Burglar alarm

B. Television camera

C. Automatic street lights

D. Vacuum cleaner

Answer: D

View Text Solution

8. The de Broglie wavelength is given by

A. $p = \frac{2\pi h}{\lambda}$

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

C. $p = \frac{2\pi}{h\lambda}$

D. $p = \frac{2\pi}{\lambda}$

Answer: A

Watch Video Solution

9. Which of these particles having the same kinetic energy has the largest de Broglie wavelength ?

A. Electron

B. Alpha particle

C. Proton

D. Neutron

Answer: A

Watch Video Solution

10. Consider the four gases hydrogen, oxygen, nitrogen and helium at the same temperature. Arrange them in the increasing order of the de Broglie wavelengths of their molecules.

A. Hydrogen, helium, nitrogen, oxygen

B. Oxygen, netrogen, hydrogen, helium

C. Oxygen, nitrogen, helium, hydrogen

D. Nitrogen, oxygen, helium, hydrogen

Answer: C

Watch Video Solution

11. A particle of mass $4m$ at rest decays into two particles of masses m and $3m$ having non-zero velocities. The ratio of the de-Broglie wavelengths of the particles 1 and 2 is

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

B. $\frac{1}{4}$

C. 2

D. 1

Answer: D

Watch Video Solution

12. If a proton and electron have the same de Broglie wavelength, then

A. kinetic energy of electron $<$ kinetic energy of proton

B. kinetic energy of electron = kinetic energy of proton

C. momentum of electron = momentum of proton

D. momentum of electron $<$ momentum of proton

Answer: C

Watch Video Solution

13. The energy that should be added to an electron to reduce its de - Broglie wavelength from one $nm \rightarrow 0.5nm$ is

A. four times the initial energy

B. equal to the initial energy

C. twice the initial energy

D. thrice the initial energy

Answer: D

Watch Video Solution

14. If alpha particle, proton and electron move with the same momentum, them their respective de Broglie wavelengths $\lambda_\alpha, \lambda_p, \lambda_e$ are related as

A. $\lambda_\alpha = \lambda_p = \lambda_e$

B. $\lambda_\alpha < \lambda_p < \lambda_e$

C. $\lambda_\alpha > \lambda_p > \lambda_e$

D. $\lambda_p > \lambda_e > \lambda_\alpha$

Answer: A

Watch Video Solution

15. Two particles A_1 and A_2 of masses $m_1, m_2 (m_1 > m_2)$ have the same de-broglie wavelength. Then

A. their momenta are the same.

B. their energies are the same.

C. momentum of A_1 is less than the momentum of A_2.

D. energy of A_1 is more than the energy of A_2.

Answer: A

Watch Video Solution

16. A particle moves in a closed orbit around the origin, due to a force which is directed towards the origin. The de-broglie wavelength of the particles varies cyclically between two values $\lambda_1, \lambda_2 with \lambda_1 > \lambda_2$. Which of the following statements are true?

A. The particle could be moving in a circular orbit with origin as centre.

B. The particle could be moving in an elliptical orbit with origin as its focus.

C. When the de Broglie wavelength is λ_1, the particle is nearer the origin than when its value is λ_2.

D. Both (a) and (c)

Answer: B

Watch Video Solution

17. A particle A with a mass m_A is moving with a velocity v and hits a particle B (mass m_B) at rest (one dimensional motion). Find the change in the de-Broglie wavelength of the particle A. Treat the collision as elastic.

A. $\frac{h}{2m_{A^v}}\left[\frac{(m_A+m_B)}{(m_A-m_B)}-1\right]$

B. $\frac{h}{m_{A^v}}\left[\frac{(m_A-m_B)}{(m_A+m_B)}-1\right]$

C. $\frac{h}{m_{A^v}}\left[\frac{(m_A+m_B)}{(m_A-m_B)}-1\right]$

D. $\frac{2h}{m_{A^v}}\left[\frac{(m_A+m_B)}{(m_A-m_B)}+1\right]$

Answer: C

Watch Video Solution

18. The de Broglie wavelength associated with a ball of mass 150 g travelling at 30 m s^{-1} is

A. $1.47 \times 1^{-34} m$

B. $1.47 \times 1^{-16} m$

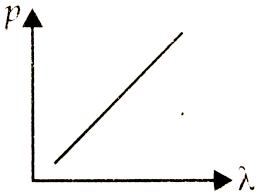
C. $1.47 \times 1^{-19} m$

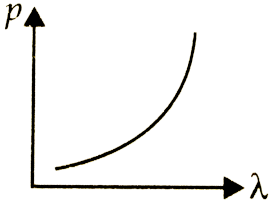
D. $1.47 \times 1^{-31} m$

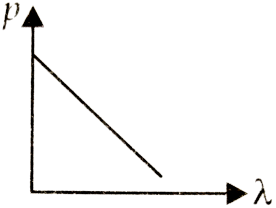
Answer: A

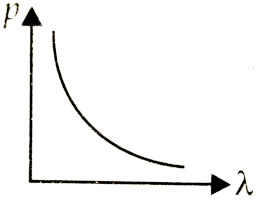
Watch Video Solution

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

A. 

B. 

C. 

D. 

Answer: D

Watch Video Solution

20. Relativistic corrections become necessary when the expression for the kinetic energy $\frac{1}{2}mv^2$, becomes comparable with mc^2, where m is the mass of the particle. At what de-broglie wavelength will relativistic corrections become important for an electron?

A. $\lambda = 1nm$

B. $\lambda = 10nm$

C. $\lambda = 10^{-1}$

D. $\lambda = 10^{-4}$

Answer: D

Watch Video Solution

21. A proton and an alpha - particle are accelerated through same potential difference. Then, the ratio of de-Broglie wavelength of

proton and alpha-particle is

A. $\sqrt{2}:1$

B. $\sqrt{4}:1$

C. $\sqrt{6}:1$

D. $\sqrt{8}:1$

Answer: D

Watch Video Solution

22. The deBroglie wavelength of a particle of kinetic energy K is λ. What would be the wavelength of the particle, if its kinetic energy were $\frac{K}{4}$?

A. λ

B. 2λ

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

D. 4λ

Answer: B

Watch Video Solution

23. When the velocity of an electron increases, its de Broglie wavelength

A. increases

B. decreases

C. remains same

D. may increase or decrease

Answer: B

Watch Video Solution

24. The de-broglie wavelength of a photon is twice the de-broglie wavelength of an electron. The speed of the electron is $v_e = \frac{c}{100}$. Then

A. $\frac{E_e}{E_p} = 10^{-4}$

B. $\frac{E_e}{E_p} = 10^{-2}$

C. $\frac{P_e}{E_{eC}} = 10^{-1}$

D. $\frac{P_e}{E_{eC}} = 10^{-4}$

Answer: B

Watch Video Solution

25. 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. $1.67 \times 10^{-27} kg$

B. $1.67 \times 10^{-31} kg$

C. $1.67 \times 10^{-19} kg$

D. $1.67 \times 10^{-14} kg$

Answer: A

Watch Video Solution

26. The de Broglie wavelength of an electron with kinetic energy 120 e V is

$\left(\text{Given h} = 6.63 \times 10^{-34} Js, m_e = 9 \times 10^{-31} kg, 1eV = 1.6 \times 10^{-19} J\right)$

A. $2.13Ã...$

B. $1.13Ã...$

C. $4.15Ã...$

D. $3.14Ã...$

Answer: B

Watch Video Solution

27. The de Broglie wavelength λ of an electron accelerated through a potential V in volts is

A. $\frac{1.227}{\sqrt{V}}nm$

B. $\frac{0.1227}{\sqrt{V}}nm$

C. $\frac{0.01227}{\sqrt{V}}nm$

D. $\frac{12.27}{\sqrt{V}}nm$

Answer: A

Watch Video Solution

28. Assuming an electron is confined to a 1 nm wide region. Find the uncertainty in momentum using Heisenberg uncertainty principle.

$\left(\text{Take h} = 6.63 \times 10^{-34} Js\right)$

A. $1.05 \times 10^{-25} \text{kg m s}^{-1}$

B. $2.03 \times 10^{-31} \text{kg m s}^{-1}$

C. $3.05 \times 10^{-34} \text{kg m s}^{-1}$

D. $3.05 \times 10^{-32} \text{kg m s}^{-1}$

Answer: A

Watch Video Solution

29. If an em wave of wavelength λ is incident on a photosensitive surface of negligible work function. If the photoelectrons emitted from this surface have the de-Broglie wavelength λ_1, prove that $\lambda = \left(\frac{2mc}{h}\right)\lambda_1^2$

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

B. $\lambda = \frac{3mc}{2h}\lambda'^2$

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

D. $\lambda = \frac{5mc}{h}\lambda'^2$

Answer: C

Watch Video Solution

30. 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. 200p

B. 400p

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

D. 100p

Answer: A

Watch Video Solution

31. 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. $25\ \%$

B. $75\ \%$

C. $60\ \%$

D. $50\ \%$

Answer: B

Watch Video Solution

32. The de Broglie wavelength of an electron in a metal at $27^{\circ}C$ is $\left(\text{Given} m_e = 9.1 \times 10^{-31} kg,\ k_B = 1.38 \times 10^{-23} JK^{-1}\right)$

A. $6.2 \times 10^{-9} m$

B. $6.2 \times 10^{-10} m$

C. $6.2 \times 10^{-8} m$

D. $6.2 \times 10^{-7} m$

Answer: A

Watch Video Solution

33. What is the de-Broglie wavelength of nitrogen molecule in air at 300K ? Assume that the molecule is moving with the root mean square speed of molecules at this temperature. (Atomic mass of nitrogen $= 14.0076U$) Plank's constant=$6.63 \times 10^{-34} Js$, Boltzmann constant $= 1.38 \times 10^{-23} JK^{-1}$

A. $2.75 \times 10^{-11} m$

B. $2.75 \times 10^{-12} m$

C. $3.24 \times 10^{-11} m$

D. $3.24 \times 10^{-12} m$

Answer: A

Watch Video Solution

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

A. $1\tilde{A}...$

B. $0.1\tilde{A}...$

C. $10\tilde{A}...$

D. $0.01\tilde{A}...$

Answer: D

Watch Video Solution

35. 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: A

Watch Video Solution

36. Find the (a) maximum frequency and (b) minimum wave-length of X-rays produced by 30 kV electrons. Given, $h = 6.63 \times 10^{-34} Js$.

Watch Video Solution

37. The potential energy of particle of mass m varies as

$$U(x) = \begin{cases} E_0 \text{for} 0 \leq x \leq 1 \\ 0 \quad \text{for} \quad > 1 \end{cases}$$

The de Broglie wavelength of the particle in the range $0 \leq x \leq 1$ is λ_1 and that in the range $x > 1$ is λ_2.

If the total of the particle is $2E_0$, find λ_1 / λ_2.

A. $\sqrt{2}$

B. $\sqrt{3}$

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

D. $\sqrt{\frac{2}{3}}$

Answer: A

Watch Video Solution

Davisson And Germer Experiment

1. In Davisson and Germer experiment, the tungsten filament is coated with

A. aluminium oxide

B. barium chloride

C. titanium oxide

D. barium oxide

Answer: D

Watch Video Solution

2. In the Davisson and Germer experiment , the velocity of electrons emitted from the electron gun can be increased by

A. increasing the potential difference between the anode and filament

B. increasing the filament current

C. decreasing the filament current

D. decreasing the potential difference between the anode and filament

Answer: A

Watch Video Solution

3. G.P Thomson experimentally confirmed the existence of matter waves by the phenomena

A. diffraction

B. refraction

C. polarization

D. scattering

Answer: A

Watch Video Solution

Higher Order Thinking Skills

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

(b) Use the same formula you employ in (a) to obtain electron speed

for an anode potential of 10 MV. Do you see what is wrong? In what way is the formula to be modified?

A. $1.33 \times 10^6 ms^{-1}$

B. $1.33 \times 10^7 ms^{-1}$

C. $2.66 \times 10^7 ms^{-1}$

D. $2.66 \times 10^6 ms^{-1}$

Answer: C

Watch Video Solution

2. Two particles A and B of de-broglie wavelength λ_1 and λ_2 combine to from a particle C. The process conserves momentum. Find the de-Broglie wavelength of the particle C. (The motion is one dimensional).

A. λ_A

B. $\lambda_A \lambda_B / (\lambda_A + \lambda_B)$

C. $\lambda_A\lambda_B/|\lambda_A - \lambda_B|$

D. both (b) and (c)

Answer: D

Watch Video Solution

3. A silver of radius $1cm$ and work function $4.7eV$ is suspended from an insulating thread in free space. It is under continuous illumination of $200nm$ wavelength light. As photoelectron are emitted the sphere gas charged and acquired a potential . The maximum number of photoelectron emitted from the sphere is $A \times 10^z (where 1 < A < 10)$ The value of z is

A. 6

B. 7

C. 8

D. 9

Answer: B

Watch Video Solution

4. A proton is fired from very far away towards a nucleus with charge Q = 120 e, where e is the electronic charge. It makes a closest approach of $10fm$ to the nucleus. The de - Broglie wavelength (in units of fm) of the proton at its start is take the proton mass, $m_p = 5/3 \times 10^{-27} kg, h/e = 4.2 \times 10^{-15} J - s/C,$ $\frac{1}{4\pi\varepsilon_0} = 9 \times 10^9 m/F, 1fm = 10^{-15}.$

A. 7

B. 9

C. 11

D. 13

Answer: A

Watch Video Solution

5. Two metallic plates A and B , each of area $5 \times 10m$ are placed parallel to each other at a separation of 1 cm . Plate B carries a positive charge of 33.7 pc . A monochromatic beam of light, with photons of energy 5 eV each, starts falling on plate A at t = 0, so that 10 photons fall on it per square meter per second. Assume that one photoelectron is emitted for every 10 incident photons. Also assume that all the emitted photoelectrons are collected by plate B and the work function of plate A remains constant at the value 2 eV . Electric field between the plates at the end of 10 seconds is

A. 5×10^6

B. 7×10^7

C. 5×10^7

D. 9×10^6

Answer: C

Watch Video Solution

6. In question number 5, find the kinetic energy of the most energetic photoelectron emitted at t = 10 s when it reaches plate B.

(Neglect the time taken by the photoelectron to reach plate B)

A. 23 eV

B. 30 eV

C. 15 eV

D. 20 eV

Answer: A

Watch Video Solution

7. When a beam of $10.6eV$ photons of intensity $2.0W/m^2$ falls on a platinum surface of area $1.0 \times 10^{-4}m^2$ and work function $5.6eV$, $0.53\,\%$ of the incident photons eject photoelectrons. Find the number of photoelectrons emitted per second and their minimum and maximum energy (in eV).

Take $1eV = 1.6 \times 10^{-19}J$.

A. 6.25×10^8

B. 1.25×10^9

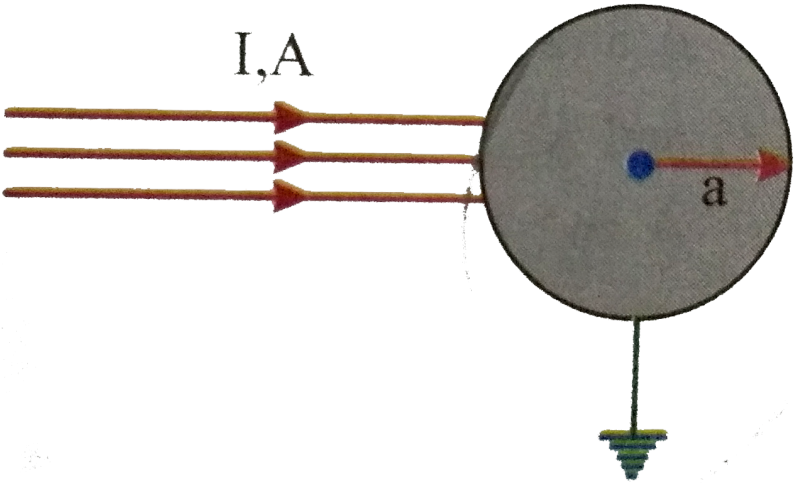
C. 1.25×10^6

D. 6.25×10^{11}

Answer: D

Watch Video Solution

8. A parallel beam of monochromatic radiation of cross-section area $A\left(<\pi a^2\right)$, intensity I and frequency v is incident on a solid conducting sphere of work function$\phi_0[hv>\phi_0]$ and radius $'a'$. The sphere is grounded by a conducting wire. Assume that for each incident photon one photoelectron is ejected. Just after this radiation is incident on initially unchanged sphere, the current through the conducting wire is:



A. $\frac{IAe}{hv}$

B. $\frac{IAe}{2hv}$

C. $\frac{2IAe}{hv}$

D. $\frac{2}{3}\frac{IAe}{hv}$

Answer: A

Watch Video Solution

Ncert Exemplar

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: D

Watch Video Solution

Watch Video Solution

2. The wavelength of a photon needed to remove a proton from a nucleus which is bound to the nucleus with 1MeV energy is nearly

A. 1.2 nm

B. $1.2 \times 10^{-3} nm$

C. $1.2 \times 10^{-6} nm$

D. $1.2 \times 10^{1} nm$

Answer: B

Watch Video Solution

3. Consider a beam of electrons (each electron with energy E_0) incident on a metal surface kept in an evacuated chamber. Then

A. no electrons will be emitted as only photons can emit electrons.

B. electron can be emitted but all with an energy E_0.

C. electrons can be emitted with any energy, with a maximum of

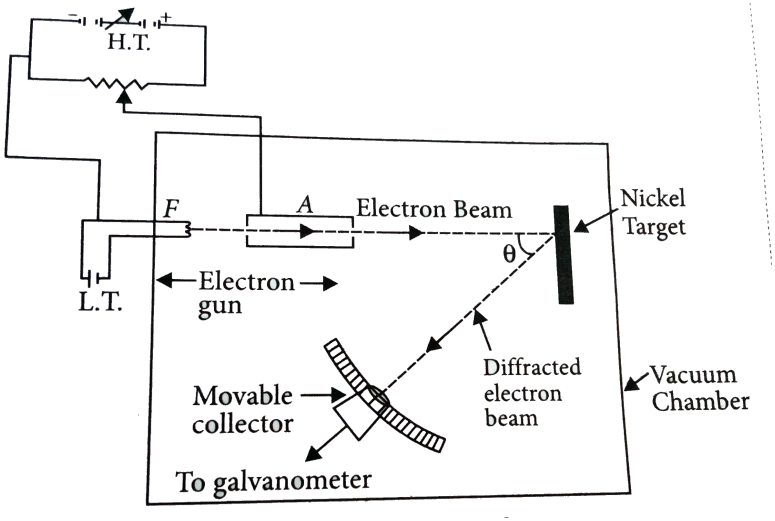
$E_0 - \phi(\phi \text{is the work function})$.

D. electrons can be emitted with energy, with a maximum of E_0.

Answer: D

Watch Video Solution

4. Consider figure. Suppose the voltage applied to A is increased. The diffracted beam will have the maximum at a value of θ that



A. will be larger then the earlier value

B. will be the same as the earlier value

C. will be less than the earlier value

D. will depend on the target

Answer: C

Watch Video Solution

5. A proton, a neutron, an electron and an α-particle have same energy. Then their de-Broglie wavelengths compare as

A. $\lambda_p = \lambda_n > \lambda_e > \lambda_\alpha$

B. $\lambda_\alpha < \lambda_p = \lambda_n < \lambda_e$

C. $\lambda_e < \lambda_p = \lambda_n > \lambda_\alpha$

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

Answer: B

Watch Video Solution

6. An electron is moving with an initial velocity $\overrightarrow{v} = v_0\hat{i}$ and is in a magnetic field $\overrightarrow{B} = B_0\hat{j}$. Then it's de-Broglie wavelength

A. remains constant

B. increases with time

C. decreases with time

D. increases and decreases periodically

Answer: A

Watch Video Solution

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

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

C. λ_0

D. $\lambda_0 t$

Answer: A

Watch Video Solution

8. An electron of mass m with an initial velocity $\vec{v} = v_0\hat{}$(i) $(v_0 > 0)$ enters an electric field $\vec{E} = -E_0\hat{i}$ $(E_0 = cons\tan t > 0)$ at $t = 0$. If λ_0 is its de - Broglie wavelength initially, then its de - Broglie wavelength at time t is

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: C

Watch Video Solution

Assertion And Reason

1. Assertion : Millikan's experiment established that electric charge is quantised.

Reason : From this experiment mass of the electron could nit be determined.

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

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

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: C

Watch Video Solution

2. Assertion : Though light of a single frequency (monochromatic) is incident on a metal , the energies of emitted photoelectrons are different.

Reason : The energy of electrons emitted from inside the metal surface is lost in collision with the other atoms in the metal.

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

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

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: A

Watch Video Solution

3. Assertion : The stopping potential depends on the frequency of incident light.

Reason : The stopping potential is related to maximum kinetic energy by $eV_0 = K_{\max}$.

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

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

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: A

Watch Video Solution

4. 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 true and reason is the correct explanation of assertion.

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

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: B

Watch Video Solution

5. Assertion : If the frequency of the incident light on a metal electrons is more than doubled.

Reason : The metal will provide additional energy to the emitted photoelectron for light of higher frequency than for lower frequency.

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

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

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: A

View Text Solution

6. Assertion : All the photoelectrons emitted from the matal do not have the same energy.

Reason : The maximum kinetic energy of photoelectrons depends on the light soures and the emitted plate material.

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

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

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: B

View Text Solution

7. Assertion : Photoelectric effect supports the quantum nature of light.

Reason : Photoelectric emission is instantaneous.

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

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

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: B

Watch Video Solution

8. Assertion : Photoelectric effect is the phenomenon of emission of photon by metal when illuminated by light of suitable frequency.

Reason : An electron beam carries sufficient energy to release photons from the metal.

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

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

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: D

Watch Video Solution

9. Assertion : Photoelectric current depends on the intensity of incident light.

Reason : Number of photoelectrons emitted per second is directly proportional to intensity of incident radiation.

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

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

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: A

Watch Video Solution

10. Assertion : Free electrons inside a metal are free to move out of the metal.

Reason : Free electrons inside conductor do not need additional energy to get out of the metal.

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

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

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: D

Watch Video Solution

11. Assertion : The threshold frequency of photoelectric effect supports the particle nature of light.

Reason : If frequency of incident light is less than the threshold frequency, electrons are not emitted from metal surface.

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

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

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: B

Watch Video Solution

12. Assertion : In photon-particle collision the total energy and total momentum are conserved. Reason : The number of photons are conserved in a collision.

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

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

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: C

Watch Video Solution

13. Assertion : A photocell is a technological application of the photoelectric effect.

Reason : Photocell is a device whose electric properties are affected by electricity.

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

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

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: C

Watch Video Solution

14. Assertion: photocell is called electric eye. *Reason: Photocell can see the things placed before it.*

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

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

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: C

Watch Video Solution

15. Assertion : The wave nature of electrons was first experimentally verified by Davisson and Germer Experiment.

Reason : From the electron diffraction measurements, the wavelength of meter waves was found to 0.165 nm.

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

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

C. *If assertion is true but reason is false.*

D. *If both assertion and reason are false.*

Answer: B

View Text Solution