PHYSICS

BOOKS - PHYSICS

DUAL NATURE OF RADIATION AND MATTER

Evalution Multiple Choice Questions

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

A. $\lambda_p \propto \lambda_e$

B. $\lambda_p \propto \sqrt{\lambda_e}$

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

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

Answer: D

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2. In an electron microscope, the electrons are accelerated by a voltage of 14kV. If the voltage is changed to 224 kV, then the de Broglie

wavelength associated with the electrons would

A. increase by 2 times

B. decrease by 2 times

C. decrease by 4 time

D. increaseby 4 times

Answer: C

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

A. $1.82 \times 10^{-18} ms^{-1}$

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

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

D. $1.82 \times 10^{-15} ms^{-1}$

Answer: D

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

A. 4λ

B. 5λ

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

D. 3λ

Answer: D

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5. If a light of wavelength 330nm is incident on a metal with word function 3.55eV, the electrons are emitted. Then the wavelength of the emitted electron is (Taken $h = 6.6 \times 10^{-34} Js$)

A. $< 2.75 \times 10^{-9} m$

B. $\geq 2.75 \times 10^{-9} m$

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

D. $< 2.5 \times 10^{-10} m$

Answer: B

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6. 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 that in the first case, the work function at the surface of material is

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

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

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

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

Answer: D

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7. In photoelectric emission, a radiation whose frequency is 4 times threshold frequency of a certain metal is incident on the metal. Then the maximum possible velocity of the emitted electron will be

A. $\sqrt{\frac{hv_0}{m}}$

B. $\sqrt{\frac{6hv_0}{m}}$

C. $2\sqrt{\frac{hv_0}{m}}$

D. $\sqrt{\frac{hv_0}{2m}}$

Answer: B

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8. Two radiations with photon energies 0.9 eV and 3.3eV respectively are falling on a metallic surface successively. If the work function of the metal is 0.6 eV , then the ration of maximum speeds of emitted electrons will be

A. $1:4$

B. $1:3$

C. $1:1$

D. $1:9$

Answer: B

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9. A light source of wavelength 520nm emits 1.04×10^{15} photons per second while the second source of 460nm produces 1.38×10^{15} photons per second. Then the ratio of power of second source to that of first source is

A. 1.00

B. 1.02

C. 1.5

D. 0.98

Answer: C

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10. The mean wavelength of light from sun is taken to be 550nm and its mean power is 3.8×10^{26}W. The number of photons received

by the human eye per second on the average from sunlight is of the order of

A. 10^{45}

B. 10^{42}

C. 10^{54}

D. 10^{51}

Answer: A

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11. The threshold wavelength for a metal surface whose photoelectric work function is $3.313eV$ is

A. $4125Å$

B. $3750Å$

C. $6000Å$

D. $2062.5Å$

Answer: B

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12. A light of wavelength 500nm is incident on a sensitive plate of photoelectric work function 1.235 eV. The kinetic energy of the photo electrons emitted is be (Take h $= 6.6 \times 10^{-34} Js$)

A. $0.58eV$

B. 2.48eV

C. 1.24 eV

D. 1.16 eV

Answer: C

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13. Photons of wavelength λ are incident on a metal. The most energies electrons ejected from the metal are bent into a circular arc of radius R by a perpendicular magnetic field having magnitude B. The work function of the metal is

A. $\frac{hc}{\lambda} - m_e + \frac{e^2B^2R^2}{2m_e}$

B. $\frac{hc}{\lambda} + 2m_e\left[\frac{eBR}{2m_e}\right]^2$

C. $\frac{hc}{\lambda} - m_ec^2 - \frac{e^2B^2R^2}{2m_e}$

D. $\frac{hc}{\lambda} - 2m_e\left[\frac{eBR}{2m_e}\right]^2$

Answer: D

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14. The work functions for metals A,B and Care 1.92 eV, 2.0 eV and 5.0 eV respctively. The metals which will emit photoelectrons for a radiation of wavelength 4100Å is / are

A. A only

B. both A and B

C. all these metals

D. none

Answer: B

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15. Emission of electrons by the absorption of heat energy is called _____ emission.

A. photoelectric

B. field

C. thermionic

D. secondary

Answer: C

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Short Answer Question

1. Why do means have a large number of free electrons ?

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2. Define work function of a metal. Give its unit.

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3. What is photoelectric effect ?

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4. How does photocurrent vary with the intensity of the incident light ?

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5. Give the definition of intensity of light and its unit.

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6. How will you define threshold frequency?

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7. What is a photo cell ? Mention the different types of photocells.

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8. Write the expression for the de Broglie wavelength associated with a charged particle of charge q and mass m, when it is accelerated through a potential V.

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9. State de Broglie hypothesis.

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10. Why we do not see the wave properties of a baseball ?

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11. A proton and an electron have same kinetic energy. Which one has greater de Broglie wavelength. Justify.

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12. Write the relationship of de Broglie wavelength λ associated with a particle of mass m in terms of its kinetic energy K.

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13. Name an experiment which shows wave nature of the electron. Which phenomenon was observed in this experiment using an electron beam?

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14. An electron and an alpha particle have same kinetic energy. How are the de Broglie wavelengths associated with them related ?

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Long Answer Questions

1. What do you mean by electron emission ? Explain briefly various methods of electron emission.

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2. Briefly discuss the observations of Herts, Hallwachs and Lenard.

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3. Explain the effect of potential difference on photoelectric current.

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4. Explain how frequency of incident light varies with stopping potential.

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5. List out the laws of photoelectric effect.

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6. Explain why photoelectric effect cannot be explained on the basis of wave nature of light.

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7. Explain the quantum concept of light.

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8. Obtain Einstein's photoelectric equation with necessary explanation.

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9. Explain experimentally observed facts of photoelectric effect with the help of Einstein's explanation.

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10. Give the construction and working of photo emissive cell.

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11. Derive an expression for de Broglie wavelength of electrons.

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12. Briefly explain the principle and working of electron microscope.

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13. Describe briefly Davisson-Germer experiment which demonstrated the wave nature of electrons.

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Numerical Problems

1. How many photons per second emanate from a 50 mW laser of 640 nm ?

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2. Calculate the maximum kinetic energy and maximum velocity of the photoelectrons emitted when the stopping potential is 81V for the photoelectric emission experiment.

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3. Calculate the energies of the photons associated with the following radiation:

violet light of 413 nm

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4. Calculate the energies of the photons associated with the following radiation:

X-rays of 0.1 nm

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5. Calculate the energies of the photons associated with the following radiation :

radio waves of 10m

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6. A 150 W lamp emits light of mean wavelength of 5500Å. If the efficiency is $12\ \%$, find out the number of photons emitted by the lamp in one second.

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7. How many photons of frequency $10^{14} Hz$ will make up 19.86 J of energy ?

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8. What should be the velocity of the electron so that its momentum equals of $4000 Å$ wavelength photon.

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9. When a light of frequency $9 \times 10^{14} Hz$ is incident on a metal surface, photoelectrons are emitted with a maximum speed of $8 \times 10^{5} ms^{-1}$. Determine the threshold frequency of the surface.

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10. When a $6000 Å$ light falls on the cathode of a photo cell and produced photoemission. If a stopping potential of 0.8 V is required to stop

emission of electron, then determine the frequency of the light

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11. When a 6000Å light falls on the cathode of a photo cell and produced photoemission. If a stopping potential of 0.8 V is required to stop emission of electron, then determine the energy of the incident photon

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12. When a 6000Å light falls on the cathode of a photo cell and produced photoemission. If a stopping potential of 0.8 V is required to stop emission of electron, then determine the work function of the cathode material

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13. When a 6000Å light falls on the cathode of a photo cell and produced photoemission. If a stopping potential of 0.8 V is required to stop

emission of electron, then determine the threshold frequency

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14. When a 6000Å light falls on the cathode of a photo cell and produced photoemission. If a stopping potential of 0.8 V is required to stop emission of electron, then determine the net energy of the electron after it leaves the surface

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15. A 3310Å photon liberates an electron from a material with energy $3 \times 10^{-19} J$ while another 5000Å photon ejects an electron with energy 0.972×10^{-19} J from the same material. Determine the value of Planck's constant and the threshold wavelength of the material.

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16. At the given point of time, the earth receives energy from sun at $4 cal cm^{-2} min^{-1}$ .Determine the number of photons received on the surface of the Earth per cm^2 per minute. (Given : Mean wavelength of sun light $= 5500 Å$)

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17. UV light of wavelength $1800 Å$ is incident on a lithium surface whose threshold wavelength

4965Å. Determine the maximum energy of the electron emitted.

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18. Calculate the de Broglie wavelength of a proton whose kinetic energy is equal to $81.9 \times 10^{-15} J$. (Given : mass of proton is 1836 times that of electron) .

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19. A deuteron and an alpha particl are accelerated with the same potential. Which one of the two has

greater value of de Broglie wavelength associated with it and i

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20. A deuteron and an alpha particle are accelerated with the same potential. Which

one of the two has

less kinetic energy ? Explain

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21. An electron is accelerated through a potential difference of 81V. What is the de Broglie wavelength associated with it? To which part of electromagnetic spectrum does this wavelength corresspond ?

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22. The ratio between the de Broglie wavelength associated with protons, accelerated through a potential of 512 V and that of alpha particles accelerated through a potential of X volts is found to be one. Find the value of X.

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23. Determine the distance of closest approach when an alpha particle of kinetic

energy 4.5 MeV strikes a nucleus of Z = 80, stops and reverses its direction.

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24. A 12.3 eV electron beam is used to bombard gaseous hydrogen at room temperature. Upto which energy level the hydrogen atoms would be excited ?

Calculate the wavelengths of the second member of Lyman series and second member of Balmer series.

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25. The ground state energy of hydrogen atom is -13.6 eV. If an electron makes a transition from an energy level -1.51eV to -3.4 eV, calculate the wavelength of the spectral line emitted and name the series of hydrogen spectrum to which it belongs.

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26. When an electron in hydrogen atom jumps from the third excited state to the ground state, how would the de Broglie wavelength associated with the electron change ? Justify your answer.

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27. For photoelectronic effect in sodium, the figure shows the plot of cut-off voltage versus

frequency of incident radiation. Calculate threshold frequency

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28. For photoelectronic effect in sodium, the figure shows the plot of cut-off voltage versus frequency of incident radiation. Calculate work function for sodium.

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29. A monochromatic light source of power 5mW emits 8×10^{15} photons per second. This light ejects photo electrons from a metal surface. The stopping potential for this set up is 2V. Calculate the work function of the metal.

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30. Determine the value of the de Broglie wavelength associated with the electron orbiting in the ground state of hydrogen atom

(Given $En = -(13.6)eV$ and Bohr radius $r_0 = 0.53\text{Å}$). How will the de Broglie wavelength change when it is the first excited state?

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31. An electron and a proton, each have de Broglie wavelength of 1.00 nm.

Find the ratio of their momenta.

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32. An electron and a proton, each have de Broglie wavelength of 1.00 nm.

Compare the kinetic energy of the proton with that of the electron.

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33. Write briefly the underlying principle used in Davison-Germer experiment to verify wave nature of electrons experiementally . What is the de-Broglie wavelengths of an electron with kinetic energy (KE) 120 eV ?

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34. Work function of sodium is 2.3 eV . Does sodium show photoelectric emission for light of wavelength 6800Å ?

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35. An electron and photon have same energy 100 eV. Which has greater associated wavelength ?

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36. Calculate the de Broglie wavelength of a neutron of kinetic energy 150eV. Mass of neutron $= 1.67 \times 10^{-27} kg$.

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37. Plot a graph showing the variation of photoelectric current with intensty of light. The work function for the following metals is given.

Na : 2.75eV and Mo : 4.175 eV.

Which of these willnot give photoelectron emission from a radiation of wavelength 3300Å from a laser beam ?

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38. An electron is accelerated through a potential difference of 100V. What is the de Broglie wavelength associated with it ? To

which part of the electromagnetic spectrum does this value of wavelength correspond ?

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39.

	List - I		List - II
i.	$p \vee p \equiv p, p \wedge p \equiv p$	a)	Identity law
ii.	$p \vee (q \vee r) = (p \vee p) \vee r$	b)	Idempotent law
iii.	$p \vee (q \vee r) = (p \wedge p) \vee (p \wedge r)$	c)	Associative law
iv.	$p \vee \text{II} = \text{II}$	d)	Distributive law

The correct match is

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40. Monochromatic light of frequency 6×10^{14}Hz is produced by a laser. The power emitted is $2.0 \times 10^{-3} W$. How many photons per second on an average are emitted by the source ?

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41. What is the stopping potential of a photocell, in which electrons with a maximum kinetic energy of 6eV are emitted ?

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42. Plot a graph showing variation of de-Broglie wavelength λ versus $\frac{1}{\sqrt{V}}$, where V is accelerating potential for two particles A and B carrying same charge but of masses $m_1, m_2, (m_1 > m_2)$. Which one of the two represents a particle of smaller mass and why ?

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43. Define intensity of radiation on the basis of photon picture of light. Write its SI unit.

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44. Plota graph showing the variation of photo current vs collector potential for three difference intensities $I_1 > I_2 > I_3$ two of which (I_2 and I_2) have the same frequency v and the third has frequency $v_1 > v$.

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45. Explain the nature of the curves on the basis of Einstein's equation.

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46. Show on a graph the variation of the de Broglie wavelength (λ) associated with an electron. With the square root of acelerating potential (V) .

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47. Write the expression for the de Broglie wavelength associated with a charged particle of charge q and mass m, when it is accelerated through a potential V.

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48. The stopping potential in an experiment on photoelectric effect is 1.5V. What is the maximum kinetic energy of the photoelectrons emitted ?

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49. The maximum kinetic energy of a photoelectron is 3eV . What is its stopping potential ?

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50. An electron microscope uses electrons accelerated by a voltage of 50 kV. Determine the de Broglie wavelength associated with the electrons. If other factors (such as numerical

aperture, etc.) are taken roughly to be the same, how does the resolving power of an electron microscope compare with that of an optical microscope which uses yellow light ($\lambda_y = 5.9 \times 10^{-7} m$).

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

an electron moves

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

a neutron, would have the same the Broglie wavelength.

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53. An electron and a proton, each has a wavelenght of 1.00 nm. Find

their momenta

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54. An electron and a proton, each has a wavelenght of 1.00 nm. Find

the energy of the photon

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55. An electron and a proton, each has a wavelenght of 1.00 nm. Find

the kinetic energy of electron.

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56. An $\alpha -$ particle and a photon are accelerated from rest through the same potential difference V. Find the ratio of de Broglie wavelength associated with them.

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57. Calculate the momentum of electrons if their wavelengths is 2Å . Given $: h = 6.626 \times 10^{-34} Js$ and $m = 9.1 \times 10^{-31} kg$

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58. A proton and an electron have same de Broglie wavelength. Which of them moves faster and which possesses more kinetic energy ? Justify your answer.

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59. If h is Planck's constant, find the momentum of a photon of wavelength 0.1Å.

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60. Two lines A and B shown in the graph represent the de Broglie wavelength (λ) as a function of $\frac{1}{\sqrt{V}}$ (V is the accelerating potential) for two particles having the same charge. Which of the two represents the

particle of smaller mass ?

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61. X-rays of wavelength $'\lambda'$ fall on a photosensitive surface emitting electrons. Assuming that the work-function of the surface can be neglected, prove that the de Broglie wavelength of electrons emitted will be $\sqrt{\frac{h\lambda}{2mc}}$

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62. An electron and a proton are moving in the same direction and possess same kinetic energies. Find the ratio of de Broglie wavelength associated with these particles.

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63. An electron microscope uses electrons accelerated by a voltage of 50 kV. Determine the de Broglie wavelength associated with the electrons. If other factors (such as numerical

aperture, etc.) are taken roughly to be the same, how does the resolving power of an electron microscope compare with that of an optical microscope which uses yellow light ($\lambda_y = 5.9 \times 10^{-7} m$).

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64. What is the frequency of a photon whose energy 66.3 eV ? Given : $h = 6.63 \times 10^{-34} Js$

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65. Ultraviolet light of wavelength 2271Å from a 100 W mercury source irradiates a photocell made of molybdenum metal. If the stopping potential is 1.3 volt, estimate the work function of the metal. How would the photocell respond to a high intesity $\left(=10^{5} W m^{-2}\right)$ red light of wavelength 6328Å produced by He-Ne laser ?

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66. The ground state energy of hydrogen atom is -13.6 eV. If an electron makes a transition from an energy level -1.51eV to -3.4 eV, calculate the wavelength of the spectral line emitted and name the series of hydrogen spectrum to which it belongs.

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67. For photoelectric effect in sodium, the figure shows the plot of cut-off voltage versus

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68. For photoelectric effect in sodium, the figure shows the plot of cut-off voltage versus frequency of incident radiation. Calculate work function for sodium

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69. A monochromatic light source of power 5mW emits 8×10^{15} photons per second. This light ejects photo electrons from a metal surface. The stopping potential for this set up is 2V. Calculate the work function of the metal.

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70. Define intensity of radiation on the basis of photon picture of light. Write its SI unit.

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71. Two monochromatic beams , one red and the other blue, have the same intensity. In which case

the number of photons per unit area per second is larger.

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72. Two beams, one of red light and the other of blue light, of the same intensity are incident on a metallic surface to emit photoelectrons.

Which one of the two beams emits electrons of greater kinetic energy ?

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73. When an electron in hydrogen atom jumps from the third excited state to the ground state, how would the de Broglie wavelength associated with the electron change ? Justify your answer.

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74. An electron and a proton, each have de Broglie wavelength of 1.00 nm.

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Additional Questions And Answers

1. P and E denote the linear momentum and energy of a photon . If the wavelength is decreased.

A. Both P and E increase

B. P increases and E decreases

C. P decreases and E increases

D. both P & E decrease

Answer:

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2. The work function of a metal is hv_0 . Light of frequency v falls on this metal. The photoelectric effect will take place only if

A. $v < v_0$

B. $v > 2v_0$

C. $v < v_0$

D. $v > v_0/2$

Answer: A

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

A. The emission of photoelectrons is stopped

B. The photoelectrons are emitted but are reabsorbed by the emitter metal

C. The photo electrons are accumulated near the collector plate

D. The photoelectrons are dispersed from the sides of the apparatus.

Answer: B

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4. If the frequency of light in a photoelectron experiment is doubled the stopping potential will

A. be doubled

B. be halved

C. become more than double

D. become less than double.

Answer: C

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5. Light of wavelength falls on a metal having work function $\frac{h_c}{\lambda_0}$. Photoelectric effect will place only if

A. $\lambda \geq \lambda_0$

B. $\lambda \geq 2\lambda_0$

C. $\lambda \leq \lambda_0$

D. $\lambda < \lambda_0 / 2.$

Answer: C

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6. When the intensity of a light source is increased.

A. the number of photons emitted by the source in unit time increases .

B. more energies photons are emitted

C. faster photons are emitted

D. total energy of the photons emitted per unit time decreases.

Answer: A

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7. Photoelectron effect support quantum nature of light because

A. there is a minimum frequency which no photo electrons are emitted.

B. the maximum kinetic energy of photo electron depends only one of the frequency of light and not in intensity

C. even when the metal surface is faintly illuminated the photoelectrons leave the

surface immedietly

D. All the above

Answer: D

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8. A photon of energy hv is absorbed by a free electrons of a metal having work function $\phi < hv$

A. The electron is sure to come out.

B. The electron is sure to come out with a kinetic energy $\phi < hv$

C. Either the electron does not come out or it comes out with kinetic energy $hv - \phi$

D. It may come out with a kinetic energy less than $hv - \phi$

Answer: D

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9. If the wavelength of light in an exept on photoelectric effect is doubled

A. the photoelectric emission will not take place

B. the photoelectric emission may or may not take place

C. the stopping potential will increase

D. the stopping potential will decrease

Answer: D

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10. The photo current in an experiment on photoelectrie effect increases if

A. the intensity of the source is increased

B. the exposure time is increased

C. the intensity of the source is decreased

D. the exposure time is decreased

Answer: A

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11. The anode plate in an experiment on photoelectric effect is kept vertically above the emitter plate. Light source is put on.An electric field is switched on which has vertically downward direction.

A. The photocurrent will increase

B. The kinetic energy of the electrons will increase

C. The stopping potential will decrease

D. The transhold wavelength will increase

Answer: B

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12. According to Einstein's photoelectric equation, the plot of the K.E. of the emitted photoelectrons from ametal vs the frequency of incident radiation gives a straight line where slope

A. depends on the nature of the metal used

B. depends on the intensity of the radiation

C. both a & b

D. Depends on neither a orb

Answer: D

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13. A charged oil drop is suspended in uniform field of $3 \times 10^4 Vm^{-1}$ so that it neither falls nor rises. The charge on the drop will be

A. $3.3 \times 10^{-18} C$

B. $3.2 \times 10^{-18} C$

C. $1.6 \times 10^{-18} C$

D. $4.8 \times 10^{-18} C$

Answer: A

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14. Photon of frequency v has a momentum associated with it. If c is the velocity of light, the momentum is

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

B. hvc

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

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

Answer: C

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15. According to Einstein's photo electric equation , the graph between the K.E. of photo electrons ejected and the frequency of incident radiation is

A. 

B. 

C. 

D. 

Answer: B

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16. When intensity of incident light increases

A. K.E. of emitted photo electrons increases

B. photoelectric current decreases

C. photoelectric current incrases

D. K.E. of emitted photo electrons decreases.

Answer: C

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17. If the K.E. of free electron doubles, its de-Broglie wavelength changes by the factor

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

B. 2

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

D. $\sqrt{2}$

Answer: C

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18. Sodium and copper have work functions of 2.3eV and 4.5 eV respectively, then the ratio of the wavelengths is nearest to

A. $1:2$

B. $4:1$

C. $2:1$

D. $1:4$

Answer: C

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19. Light frequency v falls on material of threshold frequency v_0, the maximum K.E. of emitted electron is proportional to

A. $v - v_0$

B. v

C. $\sqrt{v - v_0}$

D. v_0

Answer: A

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20. What is the energy of a photon of wavelength 6000Å

A. $3.3 \times 10^{-10} J$

B. $4.4 \times 10^{-19} J$

C. $3.3 \times 10^{-19} J$

D. $4.4 \times 10^{-10} J$

Answer: A

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21. Which phenomenon supports that matter has a wavel nature ?

A. electron momentum

B. electron diffraction

C. photon momentum

D. photon diffraction

Answer: B

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22. Stopping potential of emitted photo electrons is given by (where $\phi = hv_0$)

A. $\frac{hv - \phi_0}{e}$

B. $hv - \phi$

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

D. $\frac{hv + \phi_0}{e}$

Answer: A

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23. The de-Broglie wavelength 1 associated with an elementary particle of linear moemntum, p is best represented by the graph.

A. 

B. 

C. 

D. 

Answer: D

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24. The anode voltage of a photocell is kept fixed. The wavelength of the light falling on the cathode is gradually changed. The plate current I of the potential varies as

A. 

B. 

C. 

D. 

Answer: A

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25. When intensity of incident light increases

A. photo current increases

B. photo current decreases

C. K.E. of photoelectrons increases

D. K.E of photoelectrons decreases

Answer: A

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

A. 4125 nm

B. 4125nm

C. 412.5 nm

D. 4 nm

Answer: A

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27. The following particles are moving with the same velocity, then maximum de-Broglie wavelength will be for

A. proton

B. $\alpha -$ particle

C. neutron

D. $\beta -$ particle

Answer: D

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28. If the threshold wavelength for a certain metal 3000Å, then the work function of the metal is

A. 4. 1J

B. 4.1 eV

C. 4.1 MeV

D. 4.1KeV

Answer: B

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29. An electron of mass m and charge e is accelerated from rest through a potential difference of V vot in vacuum. Ifs final speed will be

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

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

C. $\sqrt{\frac{2eV}{m}0}$

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

Answer: C

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30. A photocell employs photoelectric effect to convert

A. Change in the frequency of light into a change in the electric voltage

B. Change in the intensity of light into a change in photoelectric current

C. Change in the intensity of light into a change in work function of

photocathode.

D. Change in the frequency of light into a change in electric current.

Answer: B

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31. Einstein's work on photoelectric effect gives support to

A. $E = mc^2$

B. $E = hv$

C. $hg - \frac{1}{2}mv^2$

D. $E = \frac{h}{\lambda}$

Answer: B

View Text Solution

32. Light of wavelength 5000Å falls on a sensitive plate with photoelectric work function of 1.9 eV. The K.E. of the photo electron emitted will be

A. $0.58eV$

B. $2.48eV$

C. $1.24eV$

D. $1.16eV$

Answer: A

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33. Gases begin to conduct electricity at low pressure because

A. at low pressure gases turn to plasma

B. colliding electrons can acquire higher K.E. dur to increased mean free path leading to ionisation of atoms

C. atoms breakup into electrons and protons

D. the electrons in atoms can move freely at low pressure

Answer: B


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34. If the radius of third Bohr orbit in hydrogen atom is r, then de-Broglie wavelength of electron in this orbit is

A. $\frac{r}{3}$

B. 3r

C. $\frac{2\pi r}{3}$

D. $3(2\pi r)$

Answer: B

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35. The value of stopping potential when the frequency of light is equal to the threshold frequency is

A. maximum

B. zero

C. minimum

D. infinity

Answer: B

Watch Video Solution

36. Two photons, each of energy 2.5eV are simultaneously incident on the metal surface. If the work function of the metal is 4.5eV then from the surface of the metal.

A. one electron will be emitted

B. two electrons will be emitted

C. more than two electrons will be emitted

D. not a single electron will be emitted

Answer: D

Watch Video Solution

37. According to special theory of relativity the only constant in all frames is

A. mass

B. length

C. time

D. velocity of light

Answer: D

Watch Video Solution

38. The work function of a metal is 6.626×10^{-19} J. The threshold frequency is

A. $1 \times 10^{15} Hz$

B. 10×10^{19} Hz

C. $1 \times 10^{-15} Hz$

D. $10 \times 10^{19} Hz$

Answer: A

 Watch Video Solution

39. When a material particle of rest mass m_0 , attains the velocity of light, its mass becomes.

A. 0

B. $2m_0$

C. $4m_0$

D. ∞

Answer: D

Watch Video Solution

40. The particle which has zero mass but has energy is

A. electron

B. photon

C. proton

D. neutron

Answer: B

Watch Video Solution

41. Photon has _____.

A. energy but zero mass

B. mass but zero energy

C. zero mass and zero energy

D. infinity mass and energy

Answer: A

Watch Video Solution

42. An electron of mass 'm' and charge 'e' accelerated from rest through a potential of V volt , then its final velocity is

A. $\sqrt{\frac{V_e}{m}}$

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

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

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

Answer: C

View Text Solution

43. Einstein's photoelectric equation is

A. $W + hv = \frac{1}{2}mV_{\text{mass}}^2$

B. $\frac{1}{2}mV_{\text{mas}}^2 = W$

C. $hv + \frac{1}{2}mV_{\text{mass}}^2 = W$

D. $W + \frac{1}{2}mV_{\text{mass}}^2 = hv$

Answer: C

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44. Electron microscope works on the principle of

A. photoelectron effect

B. particle nature of electron

C. wave neture of moving electron

D. dual nature of matter

Answer: C

View Text Solution

45. A graph is drawn taking frequency of incident radiation (v) along the X-axis and its stopping potential (V_0) along the Y-axis. The nature of the graph

A. straight line

B. a parabola

C. an ellipse

D. a circle

Answer: A

View Text Solution

46. A photon of energy 2 E is incident on a photosensitive surface of photoelectric work function E. The maximum K.E. of photoelectron emitted is

A. E

B. 2E

C. 3

D. 4E

Answer: A

Watch Video Solution

47. In the photoelectric phenomenon, if the ratio of the frequency of incident radiation incident on a photosensitive surface is $1:2:3$, the ratio of the photoelectric current is

A. $1:2:3$

B. $\sqrt{1}:\sqrt{2}:\sqrt{3}$

C. $1:4:9$

D. $1:1:1$

Answer: D

View Text Solution

48. When the momentum of a particle increases, the de Broglie wavelength

A. increases

B. decreases

C. does not change

D. infinity

Answer: B

Watch Video Solution

49. When an electron is accelerated with potential difference V,' its de Broglie wavelength is directly proportional to

A. V

B. V^{-1}

C. $V^{1/2}$

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

Answer: D

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50. Light exhibits _____ duality.

A. particle-wave

B. solid - liquid

C. liquid-gas

D. gas-plasma

Answer: D

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51. The wave particle duality was extended to particles as " Matter Waves " by _____.

A. Einstein

B. Sommerfeld

C. de Broglie

D. Louis Pasteur

Answer: C

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52. Louis de Broglie proposed the theory of _____.

A. waves

B. matter waves

C. matter corpuscles

D. secondary wavelets

Answer: B

Watch Video Solution

Watch Video Solution

53. The new wave mechanics of paritcle is called _____ mechanics.

A. quantum

B. statistical

C. classical

D. non-linear

Answer: A

Watch Video Solution

54. The phenomena by which metals emit electrons under the influence of radiation is called _____

A. interference

B. polarization

C. ionization

D. photoelectric effect

Answer: D

Watch Video Solution

55. Photo-electric effect was first discovered by _____.

A. Einstein

B. Newton

C. Hertz

D. Germer

Answer: C

 Watch Video Solution

56. The photoelectric current is due to the flow of _____

A. photons

B. protons

C. electrons

D. holes

Answer: C

Watch Video Solution

57. The minimum potenital given to the anode for which the photoelectric current becomes zero is called _____ potential.

A. cut-off

B. threshold

C. saturation

D. active

Answer: A

Watch Video Solution

58. At the stopping potential, photoelectric current is _____.

A. maximum

B. a constant

C. zero mass and zero energy

D. infinity

Answer: C

 Watch Video Solution

59. If m_e is the mass of the photoelectron emitted with a velocity of $2m/s$ then the kinetic energy associated with it is _____ units.

A. $2m_e$

B. $4m_e$

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

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

Answer: A

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60. If the kinetic energy of photo electron is found to be 16J, whose mass is m_e, the maximum velocity of that electron will be _____.

A. $\sqrt[4]{\frac{2}{m_e}}$

B. $\sqrt{4m_e}$

C. $\sqrt{\frac{4}{2m_e}}$

D. $\sqrt[2]{\frac{1}{m_e}}$

Answer: A

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61. The saturation current is proportional to the _____ of the radiation.

A. intensity

B. time of travel

C. target material

D. frequency

Answer: A

Watch Video Solution

62. For frequency $v_3 > v_2 > v_1$, the corresponding stopping voltage are in the order _____.

A. $(V_0)_1 > (V_0)_2 > (V_0)_3$

B. $(V_0)_2 > (V_0)_1 > (V_0)_3$

C. $(V_0)_3 > (V_0)_2 > (V_0)_1$

D. $(V_0)_1 > (V_0)_3 > (V_0)_2$

Answer: C

Watch Video Solution

63. The frequency of the incident radiation below which of the photo electric emission is not possible completely is known as _____ frequency .

A. stopping

B. zero-level

C. threshold

D. highest

Answer: C

Watch Video Solution

64. At the threshold frequency, stopping potential is _____.

A. minimum

B. maximum

C. infinity

D. zero

Answer: D

Watch Video Solution

65. Below the threshold frequency, if the intensity of radiation is increased, the emission of photoelectrons _____.

A. increases

B. decreases

C. is zero

D. is a constant

Answer: C

Watch Video Solution

66. _____ theory of light was proposed by Maxwell

A. Electromagnetic

B. Corpuscular

C. Wave

D. Quantum

Answer: A

Watch Video Solution

67. _____ proposed quantum theory.

A. Maxwell

B. Max Planck

C. Einstein

D. Huygens'

Answer: B

Watch Video Solution

68. _____ theory explains photo electric effect.

A. Electromagnetic

B. Quantum

C. Wave

D. Corpuscular

Answer: B

Watch Video Solution

69. Energy of each photon is _____.

A. $\frac{3}{2}hv$

B. 3hv

C. 2hv

D. hv

Answer: D

Watch Video Solution

70. The light photon has _____ nature.

A. wave

B. particle

C. matter

D. dual

Answer: B

Watch Video Solution

71. The photon behaves as a particle in _____ phenomenon.

A. emission

B. diffraction

C. polarization

D. interference.

Answer: A

Watch Video Solution

72. The energy spent in releasing a photoelectron is called photoelectric _____ of the metal.

A. energy

B. ionization potential

C. work function

D. absorption energy

Answer: C

Watch Video Solution

73. The minimum amount of energy required to liberate a photo electron from the metal surface is called as _____.

A. cut -off energy

B. work function

C. threshold potential

D. potential energy

Answer: B

Watch Video Solution

74. The maximum kinetic energy of the photo electron is

A. $(hv + W)$

B. $(hv - W)$

C. (hvW)

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

Answer: B

Watch Video Solution

75. Einstein's photoelectric equation is an equation of a _____.

A. circle

B. sphere

C. straight line

D. ellipse

Answer: C

Watch Video Solution

76. A photoelectric cell converts_____ energy into _____ energy.

A. light, sound

B. light, electrical

C. sound,electrical

D. light, heat

Answer: B

Watch Video Solution

77. Photoelectric cells are of _____ types.

A. two

B. three

C. four

D. five

Answer: B

Watch Video Solution

78. In a photo emissive cell, the evacuated bulb is made of _____.

A. plastic

B. nylon

C. wood

D. quartz

Answer: D

 Watch Video Solution

79. The cathode in a photo emissive cell is coated with _____ material.

A. low work function

B. high work function

C. transparent

D. opaque

Answer: A

Watch Video Solution

80. The cathode is coated with a material of low work function because _____.

A. a large number of photo -electrons can be got

B. high work function should be achieved later

C. it is transparent

D. it is low in cost

Answer: A

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81. The anode of a simple photo emissive cell is _____

A. glass tube

B. quartz crystal

C. platinum wire

D. iron rod

Answer: C

Watch Video Solution

82. Photoelectric cells are used for _____ in cinematography

A. lighting purposes

B. mirrors

C. reproducing sound

D. switches

Answer: C

Watch Video Solution

83. Photoelectric cells are used to control _____ of furnaces.

A. pressure

B. temperature

C. output power

D. input power

Answer: B

Watch Video Solution

84. Photoelectric cells are used in obtaining electrical energy from _____ during space travel.

A. sunlight

B. chemicals

C. batteries

D. power grids

Answer: A

Watch Video Solution

85. Photoelectric cells are used in a _____ alarms.

A. burglar and fire

B. rain

C. light

D. smoke.

Answer: A

Watch Video Solution

86. In burglar-alarm, _____ is continuously made to fall on the photo cell.

A. radio waves

B. UV rays

C. visible light

D. $\gamma -$ rays

Answer: B

Watch Video Solution

87. The alphabet 'h ' represent _____ constant

A. Planck's

B. Boltzman

C. Einstein

D. gravitational

Answer: A

Watch Video Solution

88. Calculate the momentum of the particle of mass = 2g and velocity = 5.2 cm/s.

A. $10.58kgm/s$

B. $10.4gcm/s$

C. $5.2gcm/s$

D. $4.10kgm/s$

Answer: B

Watch Video Solution

89. For a particle moving with a velocity of v, if v =c, then its wavelength is _____.

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

B. $\lambda = \frac{h}{mc}$

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

D. $\lambda = \frac{c}{h}$

Answer: B

Watch Video Solution

90. Matter waves is applicable only for _____ particles

A. very light

B. heavy

C. slow moving

D. macroscopic

Answer: A

Watch Video Solution

91. If E = eV is the kinetic energy associated with the electron, de-Broglie's equation becomes _____.

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

B. $\lambda = eVh$

C. $\lambda = \frac{h}{\sqrt{2mE}}$

D. $\lambda = \frac{\sqrt{2mE}}{h}$

Answer: C

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92. On the basis of de Broglie hypothesis, electrons in various orbits behave as _____.

A. stationary objects

B. particles

C. matter

D. waves

Answer: D

Watch Video Solution

93. _____ are those orbits which contain the complete waves of electron.

A. Stable orbits

B. Stationary orbits

C. Helial orbits

D. Half-integral orbits

Answer: B

Watch Video Solution

94. de-Broglie's concept confirms _____ postulate.

A. Bohr's

B. Newton's

C. Sommerfeld

D. Huygen's

Answer: A

Watch Video Solution

95. Total angular momentum of a moving electron is an integral multiple of _____.

A. h

B. λ

C. $\frac{h}{2\pi}$

D. 2π

Answer: C

Watch Video Solution

96. An electron microscope is used for _____

A. observing stars

B. magnifying small objects

C. heating purposes

D. pressure measurement

Answer: B

Watch Video Solution

97. _____ is the basis for the electron microscope

A. Matter waves

B. Integral wavelength

C. Circular orbits

D. Electron mass

Answer: A

View Text Solution

98. The resolving power of a microscope is limited by the _____ of the radiation used

A. wavelength

B. intensity

C. amplitude

D. time of travel

Answer: A

 Watch Video Solution

99. The modern electron microscope is usually of _____ type.

A. reflection

B. diffraction

C. polarization

D. transmission

Answer: D

Watch Video Solution

100. Electron microscope employ magnetic lenses of _____ focal lengths to obtain large magnification.

A. short

B. long

C. infinite

D. zero

Answer: A

Watch Video Solution

101. In an electron microscope, the electron beam is associated through a large potential difference in a device called _____

A. accelerator

B. electron gun

C. CRO

D. vibrator

Answer: B

Watch Video Solution

102. In an electron microscope, the doughnut-shaped electromagnet is called as _____

A. accelerator

B. electron gun

C. projector

D. condenser magnetic lens

Answer: D

Watch Video Solution

103. The third electromagnet put in the path of an electron beam in an electron microscope is called _____.

A. projector magnetic lens

B. accelerator

C. velocity selector

D. oscilloscope

Answer: A

Watch Video Solution

104. Electron microscope operates in _____ media.

A. UV

B. X-ray

C. complete vacuum

D. air

Answer: C

Watch Video Solution

105. _____ are used to study virus and bacteria.

A. Lenses

B. mirrors

C. Electron microscopes

D. Telescopes

Answer: C

Watch Video Solution

106. _____ is the only disadvantage of electron microscope

A. Operation only in high vacuum

B. Small size

C. High magnification

D. Cost

Answer: A

Watch Video Solution

107. Electron microscope could not be used in the study of_____.

A. surface of metals

B. living organisms

C. structure of textile fibres

D. crystal structure

Answer: B

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108. In Newtonian mechanics, mass, time, length and space were treated as _____ .

A. relative

B. absolute

C. variables

D. infinity

Answer: B

View Text Solution

109. Newtanian mechanics regarded that space existed _____.

A. with reference to objects

B. as a variable

C. without any reference to objects

D. as only vacuum

Answer: C

View Text Solution

110. In Einstein's view, all motions are _____

A. meaningless

B. relative

C. constant

D. confined to one reference

Answer: B

View Text Solution

111. Einstein held that time, mass, length and space are _____.

A. independent

B. dependent

C. variables

D. absolute

Answer: B

View Text Solution

112. Albert Einstein got his Nobel prize for his theory on _____.

A. General theory of relativity

B. Special theory of relativity

C. Universal constant

D. photoelectric effect

Answer: D

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113. Fixed frames of reference are used in _____.

A. General theory of relativity

B. classical mechanics

C. statistical mechanics

D. special theory of relativity

Answer: B

View Text Solution

114. In classical mechanics,the time interval between two events has _____ value (s) for any two observers in motion.

A. different

B. zero

C. variable

D. same

Answer: D

View Text Solution

115. In classical mechanics, mass of a moving body is _____.

A. constant

B. not absolute

C. dependent on velocity

D. interdependent

Answer: A

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116. A system of coordinate axes which defines the positive of a paritcle in space is called _____.

A. base

B. basis vectors

C. frame of reference

D. 3-D space

Answer: C

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117. The simplest frame of reference is coordinate system.

A. cartesian

B. cylindrical

C. spherical

D. polar

Answer: A

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118. In cartesian coordinate system, the position of a particle is defined by _____ coordinates.

A. 3

B. 5

C. 9

D. inifinite

Answer: A

View Text Solution

119. The number of reference frames in our universe is _____.

A. 3

B. 2

C. zero

D. inifinite

Answer: D

View Text Solution

120. Bodies in inertial frames obey _____

A. Newtonaian mechanics

B. Laws of electro magnetism

C. Einstein's relativity

D. Nuclear laws

Answer: A

View Text Solution

121. Bodies in non-inertial frames disobey _____.

A. Newton's law

B. Theory of Relativity

C. General Relativity

D. Einstein's theories

Answer: A

View Text Solution

122. Inertial frames are_____ frames

A. variable

B. accelerated

C. unaccelerated

D. varying

Answer: C

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123. Equation of length contraction is _____

A. $l = l_0 = \sqrt{1 - \frac{v^2}{c^2}}$

B. $\frac{l}{l_0} = \sqrt{1 - \frac{v^2}{c^2}}$

C. $l_0 = \sqrt{l - \frac{v^2}{c^2}}$

D. $\frac{v_2}{c_2} = (l - l_0)^2 + 1$

Answer: B

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124. Length contraction is known as _____ .

A. Gerner resolution

B. Thomson contraction

C. Compton effect

D. Lorentz-Fitzgerald contraction

Answer: D

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125. Lorentz-Fitzgerald contraction occus in _____ direction of motion.

A. the same

B. a perpendicular

C. random

D. no

Answer: A

View Text Solution

126. The time interval observed in a frame at rest is _____ that observed in a moving frame

A. longer than

B. smaller than

C. equal to

D. varying

Answer: A

View Text Solution

127. The clocks in moving ships will appear to go _____ clocks on earth

A. faster than

B. slower than

C. the same as

D. stops after leaving earth

Answer: B

View Text Solution

128. Electrons when accelerated in a cyclotron acquires _____.

A. zero mass

B. higher mass

C. zero velocity

D. uniform acceleration

Answer: B

View Text Solution

129. Einstein's mass energy equivalence is _____.

A. $E = mc^2$

B. $E = m_0c - mc^2$

C. $E = \left(m_0 + m^2\right)$

D. $E = m^2c^4$

Answer: A

View Text Solution

130. Force is the rate of change of _____.

A. mass

B. acceleration

C. momentum

D. velocity

Answer: C

Watch Video Solution

131. Relativistc formula for kinetic energy is

_____

A. $E_k = mc^2$

B. $E_k = mc^2 - m_0c^2$

C. $E_k = \frac{1}{2}mv^2$

D. $E_k = m.\, c.\, v.$

Answer: B

View Text Solution

132. The rest energy is the _____ energy.

A. heat

B. kinetic

C. internal

D. total

Answer: C

View Text Solution

133. The change in kinetic energy of the particle is proportional to _____.

A. change in its mass and velocity

B. its mass

C. its velocity

D. its velocity change

Answer: A

View Text Solution

134. Photon carries _____.

A. energy

B. mass

C. volume

D. electron

Answer: A

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135. Rest energy of a photon is _____.

A. infinite

B. 10^5 units

C. zero

D. 2.3 units

Answer: C

View Text Solution

136. Antiparticle of an electron is _____.

A. proton

B. neutron

C. positron

D. photon diffraction

Answer: C

Watch Video Solution

137. Nuclear fission and fusion processes are examples of _____.

A. Newton's laws

B. mass-energy equivalence

C. gravitational laws

D. Maxwell's laws

Answer: B

View Text Solution

138. If $v = c$, the mass of the moving body, of rest mass $'m_0'$ is _____.

A. zero

B. infinity

C. m0

D. $\frac{m}{m_0}$

Answer: B

View Text Solution

139. The value of Planck's constant is _____.

A. $6.62 \times 10^{-34} Js$

B. $6.62 \times 10^{34} Js$

C. $6.62 \times 10^{-45} Js$

D. $6.62 \times 10^{23} Js$

Answer: A

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140. Mass of an electron in grams _____.

A. 9.11×10^{-31}

B. 9.11×10^{-28}

C. 9.11×10^{-33}

D. 9.11×10^{-30}

Answer: B

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141. Which of the following two form a pair in pair-production ?

A. electron and positron

B. proton and positron

C. electron and neutron

D. neutron and positron

Answer: A

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142. _____ lenses are used in electron microscope.

A. Optical

B. Glass

C. Silica

D. Electromagnetic

Answer: D

Watch Video Solution

143. Wavelength of X-rays is _____ the wavelength of visible light.

A. smaller than

B. greater than

C. negligible when compared to

D. equal to

Answer: A

Watch Video Solution

144. The discrete packets of light energy are called as _____

A. proton

B. positron

C. quanta

D. electron

Answer: C

Watch Video Solution

145. If the work function is given, the formula to find the threshold frequency of the metal surface is _____.

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

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

C. hW

D. h^2W

Answer: B

Watch Video Solution

146. If V_0 is the stopping potential of an electron of mass 'm' charge 'e' and its mass velocity is given by

A. $\frac{meV_0}{2}$

B. $\sqrt{\frac{meV_0}{2}}$

C. $\sqrt{\frac{2eV_0}{m}0}$

D. $\frac{2eV_0}{m}$

Answer: C

Watch Video Solution

147. The work function of a metal is $6.6 \times 10^{-14} J$. Find its threshold frequency.

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

B. $1 \times 10^{20} Hz$

C. $1 \times 10^{15} Hz$

D. $10^{25} Hz$

Answer: B

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148. 1 joule = eV

A. 1.6×10^{19}

B. $\frac{1}{1.6 \times 10^{19}}$

C. $\frac{10^{19}}{1.6}$

D. $\frac{10^{-19}}{1.6}$

Answer: C

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149. Find the kinetic energy if hv = 2.1 eV and work function is given as $5 \times 10^{-19} J$

A. $0.288 eV$

B. 0.288 J

C. 1.025eV

D. 5 eV

Answer: C

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150. Find the de-Broglie wavelength of an electron moving with a speed of $5.2 \times 10^5 m/s$

A. 72.81Å

B. 14Å

C. 15.5Å

D. 81.5Å

Answer: B

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151. Find the kinetic energy of an electron in (eV) if the de-Broglie wavelength of the radiation produced is 112Å

A. 150 eV

B. 120eV

C. 12.2 eV

D. 10 eV

Answer: B

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152. Find the radius of the orbit whose n =1 and $\lambda = 3.328\text{Å}$

A. 3.14Å

B. 3.328Å

C. 0.53Å

D. 6Å

Answer: C

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153. Find the accelerating potential of an electron whose de Broglie wave length is 3Å

A. 150.5 V

B. 6.63V

C. 37.53V

D. 16.73 V

Answer: D

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154. The wavelength of de-Broglie waves doesn't depend on _____.

A. mass

B. velocity

C. momentum

D. change

Answer: D

 Watch Video Solution

155. If the potential difference is increased by 9 times, the de-Broglie wavelength becomes _____ times the original.

A. $\frac{1}{3}$

B. 3

C. 9

D. $\frac{1}{9}$

Answer: A

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156. A particle has mass $10^{-27}kg$. This is moving with a speed of $107m/s$. The wavelength associated with the particle is _____.

A. 5m

B. $6.6 \times 10^{-14}m$

C. 6.66Å

D. $6.2nm$

Answer: D

View Text Solution

157. Find the energy released when 5.5g of matter is used.

A. $1.6 \times 10^8 J$

B. $4.95 \times 10^{15} J$

C. $49.5 \times 10^{16} J$

D. $1.6 \times 10^{19} J$

Answer: B

View Text Solution

158. The momentum for a wavelength of 0.01Å is _____

A. $6.626 \times 10^{-22} kgm/s$

B. $5 \times 10^{-24} kgm/s$

C. $6.5 \times 10^{-23} kgm/s$

D. $7.2 \times 10^{-34} kgm/s$

Answer: A

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159. The length of a moving scale is 6m, whose velocity is $2 \times 10^7 m/s$. Find its rest length

A. 7.6 m

B. 15m

C. 3m

D. 6.013 m

Answer: D

Watch Video Solution

160. The wavelength associated with electrons on acceleration is generally of the order of _____ metres.

A. 5×10^{-12}

B. 6×10^{-10}

C. 7×10^{-9}

D. 60

Answer: A

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161. The highest magnification order that can be achieved using optical microscope is _____

A. 60

B. 2000

C. 76×10^4

D. 10^5

Answer: B

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162. The de Broglie wavelength of electron accelerated with a potential V is _____

.

A. $\lambda = \frac{h}{\sqrt{Vem}}$

B. $\lambda = \frac{h}{\sqrt{2Vem}}$

C. $\lambda = \frac{h}{m\sqrt{2Vem}}$

D. $\lambda = \frac{h}{m\sqrt{\frac{Ve}{m}}}$

Answer: B

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163. The number of de Broglie wave of an electron in the nth orbit of an atom is _____

A. n

B. n-1

C. $n+1$

D. 2n

Answer: A

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164. At the threshold frequency, the velocity of the electrons is :

A. zero

B. maximum

C. minimum

D. infinite

Answer: A

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165. In photoelectric effect, a graph is drawn taking the frequency of incident radiation along X-axis and the corresponding stopping potential along the Y-axis. The nature of the graph is :

A. a straight line passing through origin

B. a straight line having positive Y - intercept

C. a straight line having negative Y - intercept

D. a parabola

Answer: C

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166. The unit of the number of electric lines of force passing through a given area is :

A. No unit

B. NC^{-1}

C. Nm^2C^{-1}

D. Nm

Answer: C

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167. The length of the rod placed inside a rocket is measured as 1m by an observer inside the rocket which is at rest. When the rocket moves with a speed of $36 \times 10^6 km/hr$ the length of the rod as measured by the same observer is :

A. 0.997

B. 1.003m

C. 1m

D. 1.006m

Answer: C

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168. In the photoelectric phenomenon if the ratio of the frequency of incident radiation

incident on a photosensitive surface is 1:2:3 the ratio of the photoelectric current is

A. $1:2:3$

B. $1:4:9$

C. $1:1:1$

D. $\sqrt{1}:\sqrt{2}:\sqrt{3}$

Answer: D

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169. The number of waves in a distance l is equal to :

A. frequency

B. 3×10^8

C. wave number

D. 1

Answer: B

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Assertion Reason

1. Assertion : Electromagnetic radiations are regarded as waves.

Reason : Because they exhibit interference, diffraction and polarization under some suitable circumstances.

A. Assertion and Reason are correct and Reason is the correct explanation of Assertion.

B. Assertion and Reason are true but Reason is the false explanation of the Assertion.

C. Assertion is true but Reason is false

D. Assertion is false but Reason is true

Answer: A

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2. Assertion : Thermionic emission occurs in metals when they are heated to a very high temperature.

Reason : Electrons emitted due to the electromagnetic radiation.

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Choose The Correct Statements

1. (I) Cadmium show photoelectric emission for ultraviolet light.

(II) Photosensitive materials eject photo electrons

(III) The photocurrent becomes zero at a particular negative potential

(IV) The liberation of electrons fromany surface of a substance is electron emission

A. I,II,III and IV

B. I and II only

C. I and III only

D. I, II and III only

Answer: A

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2. (I) Metal selected for electron emission should have low work function.

(II) Potential barrier presents leaving free electron from the metallic surface

(III) Potential barrier created by the positive nuclei of the metal.

(IV) Electron in the outermost shells are tightly pound to the nucleus.

A. I and II only

B. II and III only

C. I, II and III only

D. I, II , III and IV

Answer: C

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Choose The Incorrect Statements

1. Choose the odd one:

(a) Photo cells are used for reproduction of sound in motion picture.

(b) Photo cells used as timers to measure the speeds of athletes during a race.

(c) Photo cell converts light energy into thermal energy.

(d) Photo cells used to measure the intercity of the light in photography.

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2. (a) The threshold frequency of photoelectric effect supports the particle nature of sunlight.

(b) The specific charge of positive rays is constant.

(c) Photosensitive of a metal is high of its work function is small.

(d) The stopping potential is independent of intensity of the incident light.

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Very Short Answer

1. What is meant by surface barrier ?

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2. Give example for photosensitive materials. Why is called so ?

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3. What is photo emissive cells ?

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4. What is photo voltaic cell ?

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5. What is photo conductive cell ?

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6. What is meant by de Broglie waves ?

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7. Work function of aluminium is 4.2 eV.If two photons, each of energy 2.5 eV, are incident on it surface, will the emission of electrons take place? Justify your answer.

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8. What is a photon?

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9. Define the term 'stopping potential ' in relation to photoelectric effect.

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10. In photoelectric effect, why should the photoelectric current increase as the intensity of monochromatic radiation as the intensity of monochromatic radiation incident on a photosenstive surface is increased ? Explain.

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11. The stopping potential in an experiement on photoelectric effect is 2V. What is the maximum kinetic energy of the photoelectrons emitted ?

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12. Name the phenomenon which shows the quantum nature of electromagnetic radiation.

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13. Define intensity of radiation on the basis of photon picture of light. Write its SI unit.

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

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15. If the intensity of radiatioin in a photocell is increased how does the stopping potential vary ?

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16. How does the maximum kinetic energy of electrons emitted vary with the work function of the metal?

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17. Two beams, one of red light and the other of blue light, of the same intensity are incident on a metallic surface to emit photoelectrons. Which one of the two beams emits electrons of greater kinetic energy ?

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18. Does the stopping potential in photoelectric emission depend upon

the intensity of the incident radiation in a photocell ?

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19. Does the stopping potential in photoelectric emission depend upon the frequency of the incident radiation?

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20. Ultraviolet light is incident on two photosensitive materials having work functions W_1 and $W_2(W_1 > W_2)$. In which

case will the kinetic energy of the emitted electrons be greater ? Why ?

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21. With what purpose was famous Davisson-Germer experiment with electrons performed ?

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22. If the potential difference used to accelerate electrons is tripled, by what factor does de Broglie wavelength of electrons beam change ?

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23. Bremsstrahlung radiation is

A. breaking radiation

B. polarization

C. carbon

D. nature of light

Answer:

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24. Which of the two :

moving material particle is concerned with de-

Broglie hypothesis ?

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25. A proton and a deuteron have the same velocity, what is the ratio of their de Broglie wavelengths ?

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26. If the intensity of light falling on a metal plate is doubled, what will be the effect on photocurrent and maximum kinetic energy of emitted photoelectrons ?

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27. If the potential difference used to accelerate electrons is tripled, by what factor does the de Broglie wavelength of the electron beam change ?

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28. The de Broglie wavelength associated with an electron accelerated through a potential differenece V is λ. What will be its wavelength

when the accelerating potential is increased to 4V ?

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Short Answer

1. Derive an expression for De Broglie wavelength.

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2. Define intensity of radiation on the basis of photon picture of light. Write its SI unit.

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3. Two monochromatic beams , one red and the other blue, have the same intensity. In which case

the number of photons per unit area per second is larger.

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4. Two beams, one of red light and the other of blue light, of the same intensity are incident on a metallic surface to emit photoelectrons. Which one of the two beams emits electrons of greater kinetic energy ?

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5. Write three characterists features in photoelectric effect which cannot be explained

on the basis of wave theory of light, but can be explained only using Einstein's equation.

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6. A proton and an electron have same velocity. Which one has greater de Broglie wavelength and why ?

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7. When the electron orbiting in hydrogen atom in its ground state moves to the third excited state, show how the de Broglie wavelength associated with it would be affected.

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8. The graph shows the variation of stopping potential with frequency of incident radiation for two photosensitive metals A and B.Which

one of the two has higher value of work function ?Justify your answer.

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9. A proton and an electron have same kinetic energy. Which one has greater de Broglie wavelength. Justify.

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10. Draw a graph showing variation of photoelectric current (I) with anode potential (V) for different intensities of incident radiation. Name the characteristic of incident radiation that is kept constant in this experiment.

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11. If the potential difference used to accelerate electrons is doubled, by what factor

does the de-Broglie wavelength associated with the electrons change ?

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12. Plota graph showing the variation of photo current vs collector potential for three difference intensities $I_1 > I_2 > I_3$ two of which $(I_2$ and $I_2)$ have the same frequency v and the third has frequency $v_1 > v$.

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13. The frequency v of incident radiation is greater than threshold frequency (v_0) in a photocell. How will the stopping potential vary if freqquency (v) is increased, keeping other factors constant ?

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14. Two metals A and B have work functions 4eV and 10eV respectively. Which metal has the higher threshold wavelength ?

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15. The de Broglie wavelength associated with an electron accelerated through a potential differenece V is λ. What will be its wavelength when the accelerating potential is increased to 4V ?

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16. Red light however bright it is,cannot produce the emission of electrons from a

clean zinc surface , but even weak ultraviolet radiation can do so, why ?

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Long Answer

1. Write the characteristics of photons.

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2. Write the application of photo cells.

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3. Explain the production of x-rays.

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4. Write a note on continuous x-ray spectra.

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5. Write a note on characteristic x-ray spectra

:

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6. Write the application of x-rays.

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