# PHYSICS

## BOOKS - CHETANA PUBLICATION

## Dual Nature of Radiation and Matter

**Example**

**1.** What is electromagnetic waves?

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**2.** What are the characteristics of electromagnetic waves?

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**3.** What do you mean by frequency and wave number associated with a wave?

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**4.** How do we define momentum of particle? State its S.I unit.

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**5.** What is a photon?

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**6.** What is photoelectric effect? What are photoelectrons?

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**7.** Define threshold frequency, threshold wavelength and photosensitive material.

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**8.** Write short note on: Observations of Hallwachs and Lenard regarding photoelectric effect

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**9.** With a neat labelled circuit diagram, describe the experiment to study the characteristics of photoelectric effect.

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**10.** It is observed in an experiment on photoelectric effect that an increase in the intensity of the incident radiation does not change the

maximum kinetic energy of the electrons. Where does the extra energy of the incident radiation go? Is it lost? State your answer with explanatory reasoning

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**11.** State the characteristics of photoelectric effect

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**12.** Why does the wave theory of light fail to explain the photoelectric effect.

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**13.** State Planck's quantum theory.

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**14.** State characteristics of photon.

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**15.** Using the values of work function given in Table, tell which metal will require the highest frequency of incident radiation to generate photocurrent.

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**16.** What will be the energy of each photon in monochromatic light of frequency $5 \times 10^{14}$ Hz?

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**17.** A particular metal used as a cathode in an experimentonphotoelectric effect does not show photoelectric effect when it is illuminated with

green light. Which of the colours in the visible spectrum are likely to generate photocurrent?

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**18.** Calculate the energy of a photon, in joule and eV, in a light of wavelength $5000\overset{\circ}{A}$.

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**19.** Photoelectric work function of photosensitive material is 3 eV. Calculate threshold frequency and threshold wavelength

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**20.** Radiation of intensity$0.5 \times 10^{-4} W/m^2$ falls on the emitter in a photoelectric set-up. The emitter (cathode) is made up of potassium and has an area of$5cm^2$. Let us assume that the electrons from only the

surface are knocked off by the radiation. According to the wave theory,what will be the time required to notice some deflection in the microammeter connected in the circuit? (Given the metallic radius of potassium atom is 230 pm and work function of potassium is 2.3 eV.)

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**21.** Determine the wavelength and frequency of a photon having energy of 3.2 eV

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**22.** The photoelectric work function of tungsten is 4.5 eV. Calculate its threshold wavelength.

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**23.** The wavelength and intensity of the incident light is $4000\mathring{A}$ and 0.1 W respectively. What is the minimum change in the light energy? What is the number of incident photons?

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**24.** Calculate the energies of photons corresponding to ultraviolet light and red light, given that their wavelengths are $3000\mathring{A}$ and $7000\mathring{A}$ respectively.(Remember that the photon are not coloured. Colour is human perception for that frequency range.)

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**25.** A typical FM radio station has its broadcast frequency 98.3MHz. What is the energy of an FM photon of this frequency?

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**26.** Calculate the energy associated with photon of wavelength $5400 \overset{\circ}{A}$.

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**27.** Calculate the energy of a photon in a light of wavelength `5000overset@ A.

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**28.** Find the wave number of a photon having energy of 2.072 eV.

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**29.** Determine the wavelengths and frequencies for photons of energies : $10^{-18} J$.Accordingly prepare a chart (along a horizontal line) of various regions of electromagnetic spectrum and identify these regions in categories that you know.Compare your results with a standard chart from any reference book or from Internet. You would notice that y

photons are the most energetic photons and their energies are ~ $10^{13} - 10^{-12} J$. This is a very small amount of energy on the human scale and therefore we do not notice individual photons along their passage.

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**30.** Determine the wavelengths and frequencies for photons of energies : $10^{-21} J$.Accordingly prepare a chart (along a horizontal line) of various regions of electromagnetic spectrum and identify these regions in categories that you know.Compare your results with a standard chart from any reference book or from Internet. You would notice that y photons are the most energetic photons and their energies are ~ $10^{-13} - 10^{-12} J$. This is a very small amount of energy on the human scale and therefore we do not notice individual photons along their passage.

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**31.** Determine the wavelengths and frequencies for photons of energies : $10^{-24}J$.Accordingly prepare a chart (along a horizontal line) of various regions of electromagnetic spectrum and identify these regions in categories that you know.Compare your results with a standard chart from any reference book or from Internet. You would notice that y photons are the most energetic photons and their energies are ~ $10^{-13} - 10^{-12}J$. This is a very small amount of energy on the human scale and therefore we do not notice individual photons along their passage.

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**32.** In the graph of kinetic energy verses frequency, the intercept gives

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**33.** Explain the inverse linear dependence of stopping potential on the incident wavelength in a photoelectric effect experiment.

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**34.** If a light of wavelength $5000\overset{\circ}{A}$ is incident on a metal surface of work function 6 eV, emission of photoelectrons is possible or not? $\left[h = 6.63 \times 10^{-34} J - S, C = 3 \times 10^{8} m/\sec\right]$.

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**35.** The energy required to remove electron from sodiumis2.3eV.Does sodium show photoelectric effect for orange light of wavelength $6800\overset{\circ}{A}$?

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**36.** Observations from an experiment on photoelectric effect for the stopping potential by varying the incident frequency were plotted. The slope of the linear curve was found to be approximately $4.1 \times 10^{-15} Vs$. Given that the charge of an electron is $1.6 \times 10^{-19} C$, find the value of the Planck's constant h.

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**37.** The threshold wavelength of tungsten is $2.76 \times 10^{-5} cm$: Explain why no photoelectrons are emitted when the wavelength is more than $2.76 \times 10^{5} cm$.

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**38.** The threshold wavelength of tungsten is $2.76 \times 10^{-5} cm$.What will be the maximum kinetic energy of electrons ejected in each of the following cases: if ultraviolet radiation of wavelength $\lambda = 1.80 \times 10^{-5} cm$.

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**39.** The threshold wavelength of tungsten is $2.76 \times 10^{-5} cm$.What will be the maximum kinetic energy of electrons ejected in each of the following cases: radiation of frequency $4 \times 10^{15} Hz$ is made incident on the tungsten surface.

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**40.** The work function for potassium and caesium is 2.25 eV and 2.14 eV, respectively. Will the photoelectric effect occur for either of these elements, With incident light of wavelength $5650\overset{\circ}{A}$

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**41.** The work function for potassium and caesium is 2.25 eV and 2.14 eV, respectively: with light of wavelength `5180overset@ A?

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**42.** Photoelectric work function of a metal is 3 eV. Find the maximum speed of photoelectrons emitted when radiation of wavelength$4000\overset{\circ}{A}$ is incident on the metal surface. (Given: mass of electron = $9.1 \times 10^{-31} kg$)

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**43.** Photocurrent recorded in the micro ammeter in an experimental set-up of photoelectric effect vanishes when the retarding potential is more than 0.8 V if the wavelength of incident radiation is $4950\overset{\circ}{A}$. If the source of incident radiation is changed, the stopping potential turns out to be 1.2 V. Find the work function of the cathode material and the wavelength of the second source.

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**44.** The threshold wavelength for silver is $3800\overset{\circ}{A}$. Calculate maximum kinetic energy in eV of photoelectrons emitted when ultraviolet light of wavelength$2600\overset{\circ}{A}$ falls on it. Also calculate stopping potential ( $1eV = 1.6 \times 10^{-19} J$, Planck's constant = $h = 6.63 \times 10^{-34} Js$, speed of light in vacuum = $3 \times 10^{8} m/s$).

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**45.** Photoelectric threshold wavelength of Tungsten is $2730\overset{\circ}{A}$. Calculate its work function in electron volts. ( $C = 3 \times 10^{8} m/\text{sec.}$ , $h = 6.63 \times 10^{-34} Js$)

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**46.** A photon of wavelength $3315\overset{\circ}{A}$ falls on photosensitive material and eject electron of maximum energy$3 \times 10^{-19} J$. Calculate the work function of the material in eV.

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**47.** Photoelectric work function for a metal surface is 3 eV. Find maximum K.E., maximum speed of photoelectron emitted when radiation of wavelength$4000\overset{\circ}{A}$ is incident, (mass of electron=$9.1 \times 10^{-31} kg$).

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**48.** A photon of wavelength $3315\overset{\circ}{A}$ falls on photosensitive material and eject electron of maximum energy$3 \times 10^{-19} J$. Calculate the work function of the material in eV.

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**49.** Find the maximum kinetic energy of electrons ejected from a certain material if materials work function is 2.3eVand the frequency of the incident radiation is $3 \times 10^{15} Hz$

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**50.** Radiation of wavelength $4500\overset{\circ}{A}$ is incident on a metal having work function 2.0 eV. Due to the presence of a magnetic field B, the most energetic photoelectrons emitted in a direction perpendicular to the field move along a circular path of radius 20 cm. What is the value of the magnetic field B?

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**51.** The work function of tungsten is 4.50 eV. Calculate the speed of fastest electron ejected from tungsten surface when light whose photo energy is 5.80eV shines on the surface.

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**52.** If the work function for a certain metal is 1.8eV: What is the stopping potential for electrons ejected from metal when light of wavelength $4000\overset{\circ}{A}$ shines on metal

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**53.** If the work function for a certain metal is 1.8eV: What is the maximum speed of the electron?

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**54.** By stopping potential of 2 V, photoelectric current in photocell reduces to zero when cathode is exposed to light of wavelength $4000\mathring{A}$. Calculate the work function of cathode surface..

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**55.** Light of wavelength$2 \times 10^{-7} m$ incident on the cathode of a photocell. The current in the photocell is reduced to zero by a stopping potential of 2V. Find the threshold avelength of a cathode.

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**56.** The photoelectric threshold wavelength of a metal is 230 nm. Determine the maximum kinetic energy in joule and eV of the ejected electron from metal surface when it is exposed to a radiation of wavelength 180 nm. (Planck's constant h = $6.63 \times 10^{-34} J - S, C = 3 \times 10^{8} m / \sec.$)

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**57.** Describe construction and working of photoelecric cell.

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**58.** Draw a well labelled diagram of photoelectric cell.

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**59.** What is the principle used in photocell? State any two applications of photocell.

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**60.** What do you understand by photo-voltaic effect and photo emissive effect.

Watch Video Solution

**61.** State de-Broglie Hypothesis

Watch Video Solution

**62.** Explain the de Broglie concept of matter waves. Find expression for de Broglie wavelength of matter wave.

Watch Video Solution

**63.** State properties of de Broglie wavelength.

Watch Video Solution

**64.** Derive an expression for the de Broglie wavelength of an electron under a potential difference V.

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**65.** On the basis of de Broglie hypothesis, obtain the relation of wavelength of an electron accelerated by a p.d. of V volt.

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**66.** Derive an expression for the de Broglie wavelength of an electron moving under a potential difference of V volt.

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**67.** Explain what do you understand by the de Broglie wavelength of an electron. Will an electron at rest have an associated de Broglie wavelength? Justify your answer.

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**68.** What is Compton effect?

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**69.** What are the main observations, which can be made from Compton effect

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**70.** State Characteristics of photon.

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**71.** What do you understand by the term waveparticle duality? Where does it apply?

Watch Video Solution

**72.** What do you understand by the phrase 'dual nature of radiation?

Watch Video Solution

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**73.** Why is the wave nature of matter not apperent to our daily observations?

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**74.** The particle wave de-Broglie principle is not noticeable in daily life. Why?

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**75.** Describe Davisson and Germer experiment to explain the wave nature of electron.

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**76.** Draw a neat labelled diagram of Davisson and Germer experiment for diffraction of electron wave.

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**77.** State the importance of Davisson and germer experiment.

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**78.** Find momentum of the electron having de Broglie wavelength of $0.5\circ$.

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**79.** Calculate the de Broglie wavelength associated with an electron moving with a speed of $6 \times 10^5 m/s$

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**80.** Find the momentum of the electron having de Broglie wavelength $1.457^{A}$

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**81.** Calculate the wavelength associated with an electron , its momentum and speed: when it is accelerated through a potential of 54 V.

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**82.** Calculate the wavelength associated with an electron , its momentum and speed: when it is moving with kinetic energy of 150 Ev.

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**83.** The de Broglie wavelength associated with an electron and aproton are same. What will be the ratio of: Their momenta.

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**84.** The de Broglie wavelength associated with an electron and aproton are same. What will be the ratio of: Their Kinetic energies?

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**85.** Two particles have the same de Broglie wavelength and one is moving four times as fast as the other. If the slower particle is an `alpha-particle, what are the possibilities for the other particle?

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**86.** Find the wavelength of a proton accelerated by a potential difference of50 V,$h = 6.63 \times 10^{-34} JS$ (Given :$mp = 1.673 \times 10^{-27} kg$)

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**87.** The moving electron and aphoton have same de Broglie wavelength. Show that the elevtron possesses more energy than carried by the photon.

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**88.** A cracker of mass M at rest explodes in two parts of masses $m_1$ and $m_2$ with non-zero velocities. Find the ratio of the de Broglie wavelengths of two particles.

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**89.** Calculate the de Broglie wavelength of proton, if it is moving with a speed of $2 \times 10^5 m/s$.

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**90.** What is the speed of a proton having de Broglie wavelength of $0.08\overset{\circ}{A}$?

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**91.** In nuclear reactors,neutrons travel withenergies of $5 \times 10^{-21} J$. Find their speed and wavelength.

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**92.** Find the ratio of the de Broglie wavelengths of an electron and a proton when both are moving with the : same energy . State which of the two will have the longer wavelength in each case?

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**93.** Find the ratio of the de Broglie wavelengths of an electron and a proton when both are moving with the : same energy . State which of the

two will have the longer wavelength in each case?

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**94.** Find the ratio of the de Broglie wavelengths of an electron and a proton when both are moving with the : same momentum. State which of the two will have the longer wavelength in each case?

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**95.** An electron is accelerated through a potential of 120 V. Find its de-Broglie wavelength.

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**96.** Estimate the de-Broglie wavelength associated with the motion of earth orbiting around the sum at a speed of $3 \times 10^6 m/s$.

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**97.** A student, weighing 45 kg, is running with a speed of 8 km per hr on a foot path 2m wide. A small car, weighing 1200 kg, is moving with a speed of 60 km per hr on a 20 m wide road. Calculate their de Broglie wavelengths.

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**98.** Calculate the de Broglie wavelength of anelectron moving with kinetic energy of 100 eV passing through a circular hole of diameter $2\overset{\circ}{A}$

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**99.** Distinguish between Solar Cell and Photo diode.

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**100.** Distinguish between Photo voltaic effect & Photo electric effect.

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## Exercise

**1.** Determine frequency and wavelength of a photon having energy 1.3eW.

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**2.** Calculate the energy associated with a photon of wavelength $4000\overset{\circ}{A}$

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**3.** Aluminium metal has a threshold frequency corresponding to wavelength $4770\overset{\circ}{A}$. Calculate the photoelectric work function for aluminium and express it in eV.

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**4.** The threshold wavelength for silver is $3800\overset{\circ}{A}$.Calculate the photoelectric work function for silver in eV.

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**5.** Photoelectric work function for silver is 3.315 eV. Calculate the threshold frequency of silver.

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**6.** The photoelectric work function for a metal surface is 2.4eV.If a light of wavelength 5000Ais incident on the surface of the metal, find the threshold frequency and incident frequency. Will there be emission of photoelectrons or not?

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**7.** The wavelength corresponding to the threshold frequency for a certain metal is $5000\overset{\circ}{A}$. $Calc\underline{a}tetheMax.\ K.\ E.\ ofthepho \to e \leq ctronemi$edwhen$\underline{t}ravio$ 2500overset@A` falls on it.

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**8.** The photoelectric work function of the emitter of photoelectric cell is 2 eV.Whenemitter is irradiated by monochromatic light of certain wavelength, the photoelectric current can just be reduced to zero by applying stopping potential of 1.5 V. Find the wavelength of incident light.

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

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**10.** The longest wavelength that can eject photo electrons from pt is $1950\overset{\circ}{A}$. Calculate its work function in electron volt.

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**11.** What is the wave number of a beam of light in air if its frequency is $14 \times 10^{14} Hz$.

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**12.** Energy of a photon is 2 eV. Find its frequency and wavelength.

Watch Video Solution

**13.** Calculate the momentum and Energy of a photon of wavelength$4000\overset{\circ}{A}$

.

Watch Video Solution

**14.** The energy of a photon is $10 \times 10^{-19} J$.Calculate its wavelength.

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**15.** The work function of silver is $5.26 \times 10^{-19} J$. Calculate its threshold wavelength.

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**16.** The work function of a metal is $1.6 \times 10^{-19} J$. The metal surface is illuminated by light of wavelength $6400 \overset{\circ}{A}$. What will be the maximum kineticenergy of photoelectrons emitted.

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**17.** When light of wavelength$6000 oerset \circ A$ falls on a metal surface, photoelectrons are emitted from it with a velocity of $2 \times 10^{5} ms-1$ .Calculate the work function of the metal in eV.

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**18.** Calculate the de Broglie wavelength of proton, if its speed is $10^{7} cm / s$. Given: mass of proton = $1.67 \times 10^{-27} kg$.

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**19.** Calculate the de Broglie wavelength of wave associated with a mass of 1000 gm and moving with speed of 100 cm/s.

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**20.** Calculate the de Broglie wavelength of wave associated with a mass of 1000 gm and moving with speed of 100 cm/s. $[h = 6.63 \times 10^{-34} Js, m = 1.67 \times I0^{-27} kg]$

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**21.** The kinetic energy of an electron is 500 eV. Calculate the de-Broglie wavelength associated with it.

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**22.** Calculate the momentum of electron, if their wavelength is $2\overset{\circ}{A}$.

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**23.** What is de-Broglie wavelength of a 3 kg object moving with a speed of $2ms^{-1}$

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**24.** Find the wavelength for a beam of neutrons, whose kinetic energy is 100 eV. Given mass of neutron = $1.676 \times 10^{-24} g$.

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**25.** Calculate de-Broglie wavelength of an electron beam accelerated through a potential difference of 60 V.

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**26.** What voltage must be applied to an electron microscope to produce electron of wavelength $0.4\overset{\circ}{A}$.

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**27.** Find the number of photons emitted per second by a 25 W source of monochromatic light of wavelength $6000\overset{\circ}{A}$.

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**28.** Choose the correct answer from option given and write it with its corresponding alphabet: Electron volt is a unit of

A. potential

B. charge

C. power

D. energy

**Answer:**

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**29.** The mass of moving photon is

A. $\frac{V}{h\nu}$

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

C. $h\nu$

D. $\frac{h\nu}{C^2}$

**Answer:**

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**30.** In thermionic emission, the transformation of energy is

A. from electrical energy to heat energy

B. from electrical energy to light energy

C. from heat energy to electrical energy

D. from heat energy to light energy

**Answer:**

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**31.** When a photon strikes a metal surface, a photoelectron in emission takes a time nearly

A. $10^{-10}s$

B. $10^{-16}s$

C. $10^{-1}s$

D. $10^{-4}s$

**Answer:**

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**32.** Photoelectric effect as explained by

A. Classical theory

B. Newton's Corpuscular Theory

C. Huygen's Theory of Light

D. Quantum Theory

**Answer:**

Watch Video Solution

**33.** The strength of photoelectric current depends upon

A. Intensity of light

B. Frequency of radiation

C. The distance between the anode and cathode

D. Nature of cathode

**Answer:**

Watch Video Solution

**34.** Thephotoelectric threshold wavelength of a certain metal is 3315 A.U.

Its work function is....

A. $6 \times 10^{-19} J$

B. $7.286 \times 10^{-19} J$

C. $9 \times 10^{-19} J$

D. $9.945 \times 10^{-19} J$

**Answer:**

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**35.** Correct form of Einstein's photoelectricequation is

A. $\phi_0 = h\nu + \frac{1}{2}\left(m\nu^2\right)_{\max}$

B. $h\nu = \lambda_0 + \frac{1}{2}\left(m\nu^2\right)_{\max}$

C. $\frac{1}{2}\left(m\nu^2\right)_{\max} = h\nu + \phi_0$

D. $h\nu = \phi_0 - \frac{1}{2}\left(m\nu^2\right)_{\max}$

**Answer:**

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**36.** The threshold wavelength for photoemission from molybdenum is $2960\overset{\circ}{A}$. Its threshold frequency is

A. $33.78 \times 10^5 Hz$

B. $1013 \times 10^{14} Hz$

C. $10.13 \times 10^{14} Hz$

D. $1.013 \times 10^{14} Hz$

**Answer:**

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**37.** The equation E = pc is valid

A. for all sub-atomic particles

B. is valid for an electron but not for a photon

C. is valid for a photon but not for an electron

D. is valid for both an electron and a photon

**Answer:**

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**38.** If $N_{red}$ and $N_{Blue}$ are the numbers of photons emitted by respective sources of equal power and equal dimensions in unit time, then

A. $N(red) < N(Blue)$

B. $N(red) = N(Blue)$

C. `N(red) gt N(Blue)

D. $N(red) \approx N(Blue)$

**Answer:**

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**39.** The threshold wavelength of a metal is 1243 nm its work function will be

A. 1.82 eV

B. 1.00 eV

C. 1.24 eV

D. 1.024 eV

**Answer:**

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**40.** In the graph of kinetic energy verses frequency, the intercept gives

A. the electron charge

B. the planck's constant

C. the photoelectric work function

D. the threshold frequency

**Answer:**

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**41.** When light of wavelength $4000\overset{\circ}{A}$ falls on photosensitive metal, a negative potential of 2 volt is needed to stop the electron emitted. The work function of metal will be nearly

A. 1.1 eV

B. 2.0 eV

C. 2.2 eV

D. 3.1 eV

**Answer:**

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

A. h

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

C. eh

D. e

**Answer:**

Watch Video Solution

**43.** Light of frequency$4\nu_0$ is incident on the metal of the threshold frequency $\nu_0$. The maximum kinetic energy of the emitted photoelectric is

A. $3h\nu_0$

B. $2h\nu_0$

C. $\frac{3}{2}(h\nu_0)$

D. $\frac{1}{2}(h\nu_0)$

**Answer:**

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**44.** If inside the photo cell instead of vaccum,an inert gas is filled, then the photoelectric current.

A. decreases

B. increases

C. remains same

D. it does not depend on the gas filled in the photo cell

**Answer:**

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**45.** Momentum of a photon of wavelength $500\overset{\circ}{A}$ is.....

A. $13.2 \times 10^{-27} kg - m/s$

B. $13.2 \times 10^{-26} kg - m/s$

C. $1.32 \times 10^{-27} kg - m/s$

D. $0.132 \times 10^{-27} kg - m/s$

**Answer:**

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**46.** Photoelectric cell is also called

A. Leclanche cell

B. Dry cell

C. Voltaic cell

D. Daniel cell

**Answer:**

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**47.** Which of the following phenomena exhibits particle nature of light

A. Diffraction

B. Interference

C. Polarization

D. Photoelectric Effect

**Answer:**

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**48.** Polychromatic (containing many different frequencies) radiation is used in an experiment on photoelectric effect. The stopping potential.

A. will depend on the average wavelength

B. will depend on the longest wavelength

C. will depend on the shortest wavelength

D. does not depend on the wavelength.

**Answer:**

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**49.** The fast moving electrons are emitted by subjecting the metal surface to a very strongelectric field. This process is termed as

A. Field emission

B. thermionic emission

C. secondary emission

D. photoelectric emission

**Answer:**

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**50.** Threshold frequency for photoelectric effect on sodium corresponds to wavelength $5000\overset{\circ}{A}$ Its work function is

A. 15 J

B. $16 \times 10^{-14} J$

C. $4 \times 10^{-19} J$

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

**Answer:**

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**51.** The photoelectric work function of the emitter of a photocell is 3.63eV. The frequency of incident light radiation if the stopping potential of the emitter is 3 volt, is

A. $1.1 \times 10^{15} Hz$

B. $6.6 \times 10^{15} Hz$

C. `1.6xx10^15 Hz

D. $6.1 \times 10^{15} Hz$

**Answer:**

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**52.** Thede-Broglie wave corresponding to a particle of mass m and velocity $\nu$ has a wavelength associated with

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

B. hmv

C. $m \frac{h}{v}$

D. $\frac{m}{h} v$

**Answer:**

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**53.** The following particles are moving with the same speed. The shortest wavelength will be associated with

A. electron

B. proton

C. deutron

D. $\alpha$-particle

**Answer:**

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**54.** A photon and an electron have the same wavelength then, the velocity of photon is

A. less than that of electron

B. Greater than that of electron

C. equal to that of electron

D. none of the above.

**Answer:**

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**55.** The de-Broglie wavelength $\lambda$. of a particle isrelated to its kinetic energy$E_K$ as

A. $\lambda \alpha Ek$

B. $\lambda \alpha \frac{1}{E_K}$

C. $\lambda \alpha \sqrt{E} K$

D. $\lambda \alpha \frac{1}{\sqrt{E}} K$

**Answer:**

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**56.** The de Broglie wavelength of 1 mg grain of sand blown by a wind at the speed of $20m/s$ is

A. $33.15XX10^{-30}m$

B. $33.15 \times 10^{-33}m$

C. $33.15 \times 10^{-30}m$

D. $33.15 \times 10^{30}m$

**Answer:**

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**57.** Ana-particle and$\alpha$- protonare accelerated through same p.d. The ratio of de Broglie wavelength of a proton to a-particle is given by

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

B. $\sqrt{2}:1$

C. $1:\sqrt{2}$

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

**Answer:**

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**58.** If $\alpha$-particle and a proton has same K.E. then the ratio of their wavelength is

A. $1:1$

B. $1:2$

C. $1:3$

D. $3:2$

**Answer:**

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**59.** Wavelength of an electron accelerated by potential difference of 'V' volt is given by

A. $\lambda = \frac{12.27}{\sqrt{V}}\overset{\circ}{A}$

B. $\lambda = \frac{\sqrt{V}}{12.27}\overset{\circ}{A}$

C. $\lambda = \frac{1}{SqrtV}\overset{\circ}{A}$

D. $\lambda = 12.27\overset{\circ}{A}$

**Answer:**

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**60.** An electron is accelerated through a potential difference of 150 V. Find the wavelength associated with it ?

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**61.** An electron is accelerated through a potential difference of 100,000 V.

The energy acquired by the electron is

A. `0.52xx10^-17J

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

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

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

**Answer:**

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**62.** The wavelength of a particle of mass m and energy $E_K$ will be

A. $\frac{h}{\sqrt{2} m E_k}$

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

C. $h \frac{E_K}{2mc}$

D. $h \frac{C}{2mE_k}$

**Answer:**

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**63.** A photocell is used to automatically switch on the street lights in the evening when the sunlight is low in intensity. Thus it has to work with visible light. The material of the cathode of the photocell is

A. zinc

B. aluminium

C. nickel

D. potassium

**Answer:**

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**64.** An electron, a proton, α -particle and a hydrogen atom are moving with the same kinetic energy. The associated de-Broglie wavelength will be longest for

A. electron

B. proton

C. $\alpha$-particle

D. hydrogen atom

**Answer:**

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**65.** The de-Broglie wavelength of a particle of kinetic energy $E_k$ is $\lambda$. What would be the wavelength of the particle, if its kinetic energy were $\frac{E_K}{4}$

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

B. $2\lambda$

C. $4\lambda$

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

**Answer:**

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**66.** The hypothesis that material particle in motion has dual properties of matter and wave was suggested by-

A. Newton

B. Bohr

C. einstein

D. de-brogile

**Answer:**

Watch Video Solution

**67.** The rest mass of photon of wavelength $\lambda$ is

A. Zero

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

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

D. $hc/\lambda$

**Answer:**

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**68.** If the wave properties of a particle are difficult to observe, it is probably due to particle of

A. Large momentum

B. Small size

C. Large mass

D. High charge

**Answer:**

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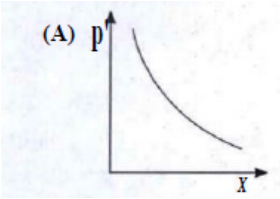
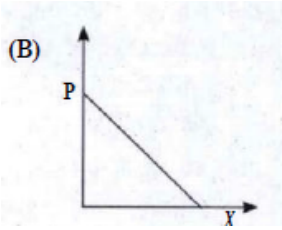
**69.** Which of the following graph represent the variation of particle momentem and the associated de Broglie wavelength

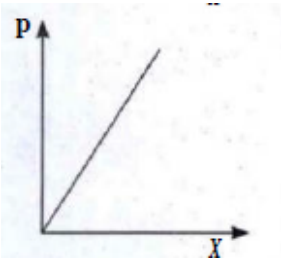
A. :



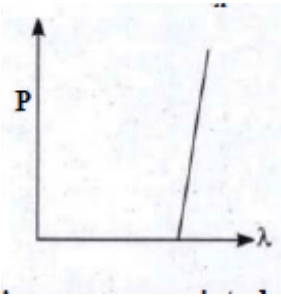

B. :



C. :




D. :




**Answer:**

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**70.** The wavelength X of de Broglie waves associated withan electronof massmand charge accelerated through a potential difference of V is

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

B. $\lambda \frac{=}{\sqrt{2}meV}$

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

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

**Answer:**

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**71.** In Davisson and Germer Experiment, maximum intensity is obtained at scattering angle and potential is

A. $54^\circ$ and at 50 volt

B. $60^\circ$ and at 50 volt

C. $50^\circ$ and at 54 volt

D. $50^\circ$ and at 60 volt

**Answer:**

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**72.** If the accelerating potential in Davisson and Germer's Experiment is 54 volt, the de Broglie wavelength of the electron is

A. $0.167\overset{\circ}{A}$

B. $0.167\overset{\circ}{A}$

C. $16.7\overset{\circ}{A}$

D. $16.7\overset{\circ}{A}$

**Answer:**

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**73.** An electron is accelerated under a potential difference of 54 V. The speed of electron will be

A. $4 \times 10^5 ms^{-1}$

B. $6.46 \times 10^5 ms^{-1}$

C. $4.36 \times 10^5 ms^{-1}$

D. $4.36 \times 10^6 ms^{-1}$

**Answer:**

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**74.** The momentum of a particle associated with de-Broglie is wavelength of$6\overset{\circ}{A}$ is

A. $1.1 \times 10^{-24} kgms^{-1}$

B. $39.6 \times 10^{-34} kgms^{-1}$

C. $1.1 \times 10^{-34} kgms^{-1}$

D. $39.6 \times 10^{-24} kgms^{-1}$

**Answer:**

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**75.** Electron beam is accelerated so that de-Broglie wavelength is $10\overset{\circ}{A}$. The accelarating potential is.

A. `1.227 volt

B. 1227 volt

C. 1.50 volt

D. 1500 volt

**Answer:**

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**76.** Select and write the correct answer: In photoelectric emission, the number of electrons ejected per second.

A. is proportional to the intensity of incident light.

B. is proportional to the wavelength of incident light

C. is proportional to the frequency of incident light

D. is proportional to the work function of metal.

**Answer:**

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**77.** The mass of moving photon is

A. $c/h\nu$

B. $h/\lambda$

C. $h\nu$

D. $h\nu/C^2$

**Answer:**

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**78.** The momentum of electron, if their wavelength is $10\overset{\circ}{A}$

A. $66.3 \times 10^{-25} kgms^{-1}$

B. $663 \times 10^{-25} kgms^{-1}$

C. $6.63 \times 10^{-25} kgms^{-1}$

D. `0.663xx10^-25kg ms^-1

**Answer:**

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**79.** In Davisson - Germer experiment, maximum intensity is obtained at

A. $59^{\circ}$ and $at 50vo <$

B. $50^{\circ}$ and $at 54vo <$

C. $54^{\circ}$ and $at 50vo <$

D. $54^{\circ}$ and $at 54vo <$

**Answer:**

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**80.** State the Einstein's equation for the photoelectric emission

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**81.** The work function of a material is $5.26 \times 10^{-19} J$. Calculate its threshold frequency.

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**82.** Draw a neat labelled diagram of Davisson and Germer experiment for diffraction of electron wave.

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**83.** The wave nature of matter is not visible in our daily life, why?

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**84.** Define : Work function

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**85.** Define:Stopping potential

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**86.** Calculate the work function in electron volt for indium metal, given that photoelectric threshold wavelength is $6800\overset{\circ}{A}$.

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**87.** What are de-broglie waves? Establish the de-Broglie wavelength equation.

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**88.** The work function for sodium and copper are 2.0 eV and 4.0 eV respectively. Find by calculation which of the two will be used for the photoelectric cell to work with light of wavelength $4000\mathring{A}$.

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**89.** State any four properties of de-Broglie wavelength. Calculate the potential required for the electron of de-Broglie wavelength $2000\mathring{A}$.

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