PHYSICS

BOOKS - JEEVITH PUBLICATIONS PHYSICS (KANNADA ENGLISH)

DUAL NATURE OF RADIATION AND MATTER

One Mark Questions With Answers

1. What is thermionic emission?

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2. What is field emission?

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3. What is secondary emission?

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4. What is photo emission?

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5. What is a photon?

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6. Write the expression for energy of a photon.

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7. What is the value of planck's constant?

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8. What is the speed of photon in free space?

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9. what is photoelectric effect?

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10. Name the scientists associated with the disceveries.

Photoelectric effect

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11. What is a photoemissive material?

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12. Does photo electric effect confirm the particle nature of light?

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13. Define the terms :

Threshold frequency

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14. What is threshold wavelength?

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15. Define the terms :

Stopping potential.

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16. On what factor does the stopping potential depend for a given photoemitter?

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17. Write Einstein's photoelectric equation.

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18. What is photo electric work function?

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19. What is the principle behind the working of photoconductive cell?

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20. Who introduced the concept of matter waves ?

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21. What are de-Brogli Waves ? How does the de-Broglie wavelength vary with momentum of moving particle ?

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22. Can wave like properties be associated with macroscopic particles experimentally?

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23. Can the wavelength associated with microscopic particles be detected?

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24. A particle is acceelerated bty applying an electric field how does its de broglic wave

length change ?

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25. How does the de Broglie wavelength of a proton change if its velocity increased?

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26. Write the expression for energy of a photon.

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27. Give the expression for energy of photon in terms of eV.

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28. Relate linear momentum of photon with wavelength.

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29. Give the expression for the moving mass of a photon.

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30. What the is rest mass energy of a photon?

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Two Mark Questions With Answers

1. Mention any two types of electron emission.

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2. Give any two applications of photo emission.

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3. Give the expression for (a) mass of a photon and (b) momentum of a photon.

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4. What was Hertz's observation of photoelectric effect.

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5. What is a photoelectric cell? Mention any two applications of photocells.

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6. Represent the variation of PEE v/s intensity of incident light above threshold frequency graphically.

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7. Represent the variation of kinetic energy of photoelectrons with respect to frequency graphically.

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8. Represent the variation of PEI v/s anode potential.

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9. The threshold wavelength for a metal is 4000 Å. A radiation of wavelength 5000 Å is incident on the metal. Can it cause P.E.E?

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10. What are matter waves? Write de Broglie's equation.

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11. Draw a neat labelled diagram of experimental arrangement of Davisson - Germer to study electron diffraction

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12. Give the expression for wavelength of matter in terms of absolute temperature along with the meaning of the symbols used.

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13. Give the expression for the wavelength of a charged particle in terms of accelerating potential and explain the meaning of the symbols used.

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14. Arrive at the expression for the wavelength of electron in terms of electric potential.

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Three Mark Questions With Answers

1. Mention any three properties of a photon.

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2. Distinguish between a photon and a material particle.

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3. State the laws of photo emission.

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4. Mention any three applications of photoelectric effect.

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5. Explain Hallwach's and Lenard's observation on photoelectric effect.

Define :

a.work function

b. Threshold frequency

c. Stopping potential

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Five Mark Questions With Answers

1. Write any three experimental observations of photoelectric effect

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2. Give Einstein's explanation of photoelectric effect.

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3. What are matter waves? Derive an expression for the de Broglie wave length.

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4. Draw a neat labelled diagram of experimental arrangement of Davisson - Germer to study electron diffraction

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5. Explain Werner Heisenberg's uncertainty principle (qualitative).

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Numericals With Solutions

1. A photo has a wavelength of 5000 Å. Calculate its momentum.

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2. Calculate de Broglie wave length of an object of mass 10 kg hurled with a speed of 10 ms^{-1}.

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3. The wave length of a photon is 5000 Å. Calculate its energy in electron volts.

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4. Calculate the frequency of light photon of energy 2.24 eV.

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5. Light of wavelength 2000 Å can just eject electrons from a metal surface. Calculate the work function of the metal.

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6. Calculate the longest wavelength of incident light on platinum for which photo electrons are just emitted from platinum (work function for platinum $= 6.2$ eV).

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7. The photo electric threshold for a metal surface is 5800 Å. Calculate the kinetic energy of a photoelectron, when a light of wavelength 4500 Å is incident on the metal surface.

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8. Calculate the retarding potential required to stop the photoelectrons emitted from a metal surface of work function $1.2eV$, when light of frequency 6.3×10^{14} Hz is incident on it

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9. The work function of copper is 4.57 eV. If radiation of 2500 Å is incident on copper,

calculate the maximum velocity of photo electrons.

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10. A certain sodium lamp radiates 400 W of yellow light of wave length 5896 Å. Calculate the number of photons emitted by this light in each second $\left(c = 3x10^{8} ms^{-1}\right)$.

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11. Calculate the velocity of the photoelectrons emitted when a light of frequency 3×10^{12}Hz is incident on a metal surface of threshold frequency equal to 2×10^{12} Hz.

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12. Ultraviolet radiations of wavelengths 800 Å and 700 Å when allowed to fall on Hydrogen atoms in their ground state, were found to liberate electrons with maximum kinetic

energies 1.96 eV and 4.18 eV respectively. Calculate Planck,s constant and work function or ionisation energy of the hydrogen atom.

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13. A photon of frequency 1.5×10^{15} Hz is incident on a metal surface of work function 1.672 eV. Calculate the stopping potential.

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14. Find the (a) maximum frequency and (b) minimum wavelength of X- rays produced by 30 kV electrons.

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15. The photo electric cut off voltage in a certain experiment is $1.5V$. What is the maximum kinetic energy of photoelectrons emitted?

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16. In an experiment on photo electric effect, the slope of cut - off voltage versus frequency, incident light is found to be 4.12×10^{-15} Vs. Calculate the of Planck's constant.

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17. The energy flux of sunlight reaching the surface of Earth is $1.388 \times 10^{3} Wm^{-2}$. How many photons per square meter are incident

on Earth per second? Assume the wavelength of photon at an average of 550 nm.

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18. Calculate the (1) de Broglie wavelength of electron (2) momentum & (3) speed which has kinetic energy = 120eV

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19. An electron and a photon each have a wavelength of 1.00 nm. Find (i) their momentum (ii) the energy of the photon and (iii) K.E of electron

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20. (a) For what K.E. of a neutron, will the associated de Broglie wavelength be $1.40 \times 10^{-10} m$?

(b) Also find the de - Broglie wavelength of a

neutron, in thermal equilibrium with matter, having an average kinetic energy of $(3/2)$ kT at 300K

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21. A monoenergetic electron beam with electron speed of $5.20 \times 10^{6} ms^{-1}$ is subject to a magnetic field of $1.30 \times 10^{-4} T$ normal to the beam velocity. What is the radius of the circle traced by the beam? Given $e/m = 1.76 \times 10^{11} kg^{-1}$.

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