

Model Question Paper
Dual nature of radiation and Matter - relativity - Part I

12th Standard

Physics

Reg.No. :

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I. Answer all the questions.

II. Use Blue pen only.

Time : 01:00:00 Hrs

Total Marks : 65

5 x 1 = 5

Part-A

- 1) A photon of frequency ν is incident on a metal surface of threshold frequency ν_0 . the kinetic energy of the emitted photoelectron is
(a) $h(\nu - \nu_0)$ (b) $h\nu$ (c) $h\nu_0$ (d) $h(\nu + \nu_0)$
- 2) The work function of a photoelectric material is 3.3 eV. the threshold frequency will be equal to
(a) 8×10^{14} (b) 8×10^{10} (c) 5×10^{20} (d) 4×10^{14}
- 3) The stopping potential of a metal surface is independent of
(a) frequency of incident radiation (b) intensity of incident radiation (c) the nature of metal surface (d) velocity of electrons emitted
- 4) At the threshold frequency, the velocity of electrons is
(a) zero (b) maximum (c) minimum (d) infinite
- 5) The photoelectric effect can be explained on the basis of
(a) corpuscular theory of light (b) wave theory of light (c) electromagnetic theory of light (d) quantum theory of light

Part-B

3 x 3 = 9

- 6) What is photoelectric effect?
- 7) Define stopping potential.
- 8) Define threshold frequency.

Part-C

5 x 5 = 25

- 9) The photoelectric threshold wavelength of a metal is 5000 Å. Find i) the work function in electron volts and ii) the kinetic energy of the photoelectrons in electron volts, ejected by the light of wave length 4000 Å
- 10) Red light of wavelength 670 nm produces photoelectrons from a certain metal which requires a stopping potential of 0.5 V. What is the work function and threshold wavelength of the metal?
- 11) Calculate the velocity of a photoelectron if the work function of the target material is 1.24 eV and the wave length of incident light is $4.36 \times 10^{-7} m$.

Part-D

4 x 10 = 40

- 12) Derive Einstein's mass energy relation.
- 13) Show that the de-Broglie wavelength of an electron moving under a potential difference of V volt is $\frac{h}{\sqrt{2eVm}}$
- 14) a) Draw a neat sketch of an electron microscope. Explain its working.

(OR)

- b) Derive Einstein's photo electric equation.
- 15) a) The rest mass of an electron is $9.1 \times 10^{-31} kg$. What will be its mass if it moves with $4/5^{th}$ of the speed of the light?
b) Calculate the threshold frequency of photons which can remove photoelectrons from (i) caesium and ii) nickel surface (work function of caesium is 1.8 eV and work function of nickel is 5.9 eV).
