BCM SCHOOL, BASANT AVENUE, DUGRI ROAD, LUDHIANA

ASSIGNMENT

CASE STUDY BASED QUESTIONS & SHORT ANSWER TYPE QUESTIONS

SUBJECT – PHYSICS

CLASS – XII

CHAPTER – DUAL NATURE OF MATTER & RADIATION

DATE: 22 – NOV – 2023

CASE STUDY BASED QUESTIONS

The photoelectric emission is possible only if the incident light is in the form of packets of energy, each having a definite value, more than the work function of the metal. This shows that light is not of wave nature but of particle nature. It is due to this reason that photoelectric emission was accounted by quantum theory of light.

Packet of energy are called

(a) electron (b) quanta (c)frequency (d)neutron

One quantum of radiation is called

(a) meter (b) meson (c) photon (d)quark

Energy associated with each photon

(a) hc (b) mc (c) hv (d)hk

Which of the following waves can produce photo electric effect

(a). UV radiation (b). Infrared radiation (c). Radio waves (d) .Microwaves

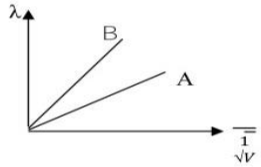
Work function of alkali metals is

(a) less than zero (b) just equal to other metals

(c) greater than other metals (d) quite less than other metals

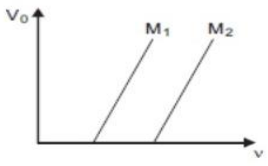
SHORT ANSWER QUESTIONS (2 MARKS)

The two lines marked A and B in the given figure show a plot of de-**Broglie wavelength** λ versus $\frac{1}{\sqrt{V}}$, where V is the accelerating potential for two nuclei ${}^{2}_{1}H$ *and* ${}^{3}_{1}H$.(i)What does the slope of the lines represent? (ii) Identify which of the lines corresponded to these nuclei.



Draw suitable graphs to show the variation of photoelectric current with collector plate potential for (i) a fixed frequency but different intensities $I_1 > I_2 > I_3$. (ii) a fixed intensity but different **frequencies** $\nu_1 > \nu_2 > \nu_3$.

Figure shows variation of stopping potential (V_o) **with the frequency (v) for two photo sensitive** materials M_1 and M_2. (i) Why is the slope same for both lines? (ii) For which material will the emitted electron have greater kinetic energy for the incident radiation of the same frequency? Justify your answer.



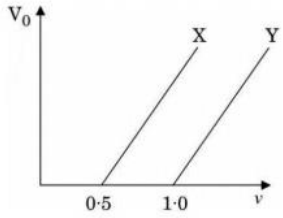
An electron is accelerated through a potential difference of 100 V. What is the de-Broglie wavelength associated with it? To which part of the electromagnetic spectrum does this value of wavelength correspond?

An α-particle and a proton are accelerated from rest by the same potential. Find the ratio of their de-Broglie wavelengths.

SHORT ANSWER QUESTIONS (3 MARKS)

Define the terms cut-off voltage and threshold frequency in relation to the phenomenon of photoelectric effect. Using Einstein's photoelectric equation show how the cut-off voltage and threshold frequency for a given photosensitivematerial can be determine with the help of a suitable graph.

The following graph shows the variation of stopping potential V_o with the frequency ν of the incident radiation for two photosensitive metals X and Y (i) Which of the metals has larger threshold wavelength? Give reason. (ii) Explain giving reason which metal gives out electrons having larger kinetic energy. For the same wavelength of the incident radiation. (iii) If the distance between the light source and metal X is halved how will the kinetic energy of electrons emitted from it change? Givereason.



Write two characteristic features observed in photoelectric effect which supports the photon pictures of electromagnetic radiation. Draw a graph between the frequency of incident radiation

(v) and the maximum kinetic energy of the electrons emitted from the surface of a photosensitive material. State clearly how this graph can be used to determine (i) Planck's constant and (ii) work function of the material?

An electron and a photon each have a wavelength 10^{-9} m. Find (i) Their momenta (ii) The energy of the photon and (iii) The kinetic energy of electron.

Draw a plot showing the variation of photoelectric current with collector plate potential for two different frequencies $\nu_2 > \nu_1$ of incident radiation having the same intensity. In which case will the stopping potential be higher? Justify your answer.