# CHAPTER-11

## Dual Nature of Radiation and Matter

## ASSIGNMENT- 3

**Directions:** These questions consist of two statements, each printed as Assertion and Reason. While answering these questions, you are required to choose any one of the following four responses.

(a) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.

(b) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.

(c)If the Assertion is correct but Reason is incorrect.

(d) If both the Assertion and Reason are incorrect.

I If the Assertion is false but Reason is correct

Q.40 **Assertion:** When the speed of an electron increases its specific charge decreases.

**Reason:** Specific charge is the ratio of the charge to mass.

Q.41 **Assertion:** Photosensitivity of a metal is high if its work function is small.

**Reason:** Work function $=hf_0$, where $f_0$ is the threshold frequency. [AIIMS 1997]

Q.42 **Assertion:** Though light of a single frequency (monochromatic) is incident on a metal, the energies of emitted photoelectrons are different.

**Reason:** The energy of electrons emitted from inside the metal surface, is lost in collision with the other atoms in the metal.

Q.43. **Assertion (A):** The photoelectrons produced by a monochromatic light beam incident on a metal surface have a spread in their kinetic energies.

**ReasonI:** The energy of electrons emitted from inside the metal surface, is lost in collision with the other atoms in the metal. (CBSE Sample paper 2022)

Q.44. A proton and an alpha particle are accelerated through the same potential difference. The ratio of their de-Broglie wavelengths will be…….

Q.45. The Davison and Germer experiment established the existence of…….

Q.46 The photoelectric current is unaffected by

1. incident light frequency

2.metal work function

3.stopping potential

4.incident light intensity

(a) (i) and (iv) only

(b) (ii) and (iii) only

I (iii) only

(d) (ii) only

Q.47. Which of the following will emit photoelectrons when it collides with a metal?

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

Q.48. What will be the de-Broglie wavelength of an electron accelerated from rest through a potential difference of 100 volts?

(a) 12.3 Å (b) 1.23 Å (c) 0.123 Å (d) None of these

Q.49. Two beams, one of red light and the other of blue light having the same intensity are incident on a metallic surface to emit photoelectrons. Which emits electrons of greater frequency?

(a) Both (b) Red light (c) Blue light (d) None

Q.50. In the Davisson and Germer experiment, the velocity of electrons emitted from the electron gun can be increased by

(a) Increasing the potential difference between the anode and filament

(b) Increasing the flame current

(c) Decreasing the flame current

(d) Decreasing the potential difference between anode and filament

Q.51. The work function for a metal surface is 4.14 eV. The threshold wavelength for this metal surface is:

(a) 4125 Å (b) 2062.5 Å (c) 3000 Å (d) 6000 Å

( CBSE Sample paper 2022)

## CASE STUDY BASED QUESTIONS

Q.52 Lenard observed that when ultraviolet radiations were allowed to fall on the emitter plate of an evacuated glass tube, enclosing two electrodes (metal plates), current started flowing in the circuit connecting the plates. As soon as the ultraviolet radiations were stopped, the current flow

also stopped. These observations proved that it was ultraviolet radiations, falling on the emitter plate, that ejected some charged particles from the emitter and the positive plate attracted them.

(I)Alkali metals like Li, Na, K and Cs show photo electric effect with visible light but metals like Zn, Cd and Mg respond to ultraviolet light. Why?

(a) Frequency of visible light is more than that for ultraviolet light

(b) Frequency of visible light is less than that for ultraviolet light

I Frequency of visible light is same for ultraviolet light

(d) Stopping potential for visible light is more than that for ultraviolet light

(II) Why do we not observe the phenomenon of photoelectric effect with non-metals?

(a)For non-metals the work function is high

(b) Work function is low

I Work function can't be calculated

(d) For non-metals, threshold frequency is low

(III) What is the effect of increase in intensity on photoelectric current?

(a)Photoelectric current increases

(b) Decreases

(c) No change

(d) Varies with the square of intensity

(IV) Name one factor on which the stopping potential depends

(a)Work function

(b) Frequency

© Current

(d) Energy of photon

(V) How does the maximum K.E of the electrons emitted vary with the work function of metal?

(a) It doesn't depend on work function

(b) It decreases as the work function increases

(c) It increases as the work function increases

(d) It's value is doubled with the work function

Q.53. Name the phenomenon which is used to establish the wave nature of electrons in the Davisson-Germer experiment. CBSE (2020)

Q.54. Calculate the kinetic energy of an electron having de Broglie wavelength of 1Å.

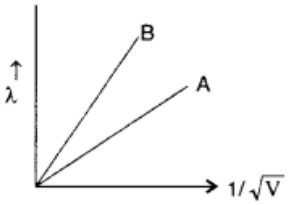
CBSE (2017)

Q.55. Name the three important features in photoelectric effect which can be explained by Einstein's photoelectric equation . CBSE (2017)

## TWO MARK's QUESTIONS

Q.56. The de-broglie wavelengths associated with an electron and proton are equal. Prove that the kinetic energy of the electron is greater than that of then proton.

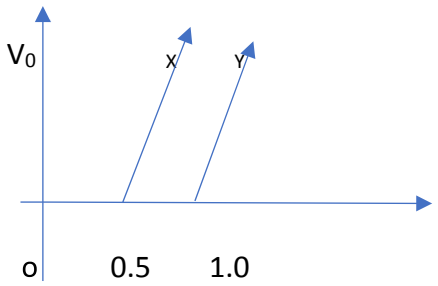
Q.57 Two lines, A and B, in the plot given below show the variation of de-Broglie wavelength, λ versus $1/\sqrt{V}$, Where V is the accelerating potential difference, for two particles carrying same charge. Which one of two represents a particle of smaller mass? (All India 2008)




### THREE MARK's QUESTIONS

Q.58. A proton and an alpha particle have the same de – Broglie wavelength. Determine the ratio of (i) their accelerating potentials (ii) their speeds. CBSE 2015

Q.59. The graph in figure, shows the variation of stopping potential with frequency v of the incident radiation for two photosensitive metals X and Y.




(i) which of the metals has large threshold wavelength? Give reason.

(ii) Explain giving reason, which metal gives out electrons, having large K.E. for the same wavelength of the incident radiation

(iii) If the distance between the light source and metal X is doubled, how will the K.E of electrons emitted from it change? Give reason. CBSE 2008

Q.60. a) State three important properties of photons which describe the particle picture of electromagnetic radiation.

(b) Use Einstein's photoelectric equation to define the terms. (i) stopping potential and

(ii) threshold frequency.