# CHAPTER-11
## Dual Nature of Radiation and Matter
# ASSIGNMENT-1
**1**                          **Mark Questions**

**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 Assertion is correct but Reason is incorrect.

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

(e) If the Assertion is false but Reason is correct

Q.1 **Assertion**: An electron is not deflected on passing through certain region of space. This observation confirms that there is no magnetic field in that region.

**Reason**: The deflection of electron depends on angle between velocity of electron and direction of magnetic field.

Q.2 **Assertion:** The photon behaves like a particle.

**Reason:** If E and P are the energy and momentum of the photon, then $p = E/c$.

Q.3 **Assertion:** Photoelectric effect demonstrates the wave nature of light.

**Reason:** The number of photoelectrons is proportional to the frequency of light.

Q.4 Photon is not a ……………., but it is a ………………..

Q.5 The minimum amount of energy required by an electron to just escape from a metal surface is called ......................... of the metal.

Q.6. Which of the following statements is true regarding the photoelectric experiment?

     a.   The stopping potential increases with the increase in the intensity of incident light.

     b.   The photocurrent increases with the intensity of light.

     c.   The photocurrent increases with the increase in frequency

     d.   All of the above

Q.7. De-Broglie equation states the:

(a) dual nature                   (b) particle nature      (c) wave nature      (d) none of these

Q.8 A metal's work function is:

a) The minimum current needed to remove an electron from a metal surface

b) The highest frequency needed to remove an electron from a metal surface

c) None of the mentioned

d) the least amount of energy required to remove an electron from a metal surface

Q.9. Only when the incident light exceeds a particular threshold……… does photoelectric emission occur.

(a) Power                          (b) Wavelength         (c)Intensity      (d) Frequency

Q.10. The photoelectric effect may be described using the following theories:

(a) wave theory of light       (b) Bohr's theory          (c) quantum theory of light

(d) corpuscular theory of light.

# CASE STUDY BASED QUESTIONS

Q.11. 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.

I. Packet of energy are called

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

II. One quantum of radiation is called

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

III. Energy associated with each photon

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

IV. Which of the following waves can produce photo electric effect?

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

V. 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

## 2                                                  Mark Questions

Q.12. Write the basic features of photon picture of electromagnetic radiation on which Einstein's photoelectric equation is based.

Q.13 Define the term stopping potential and Threshold frequency in relation to photoelectric effect.

Q.14. In photoelectric effect, why should the photoelectric current increase as the intensity ofmonochromatic radiation incident on a photosensitive surface is increased? Explain.

Q.15. Light of wavelength 3500 Å is incident on two metals A and B. Which metal will yield morephotoelectrons if their work functions are 5 eV and 2 eV respectively?

Q.16. The momentum of photon of electromagnetic radiation is 3.3 x$10^{-29}$ kg-m/s. Find out thefrequency and wavelength of the wave associated with it.

Q.17. What is meant by work function of a metal? How does the value of work function influencethe kinetic energy of electrons liberated during photoelectron emission?

Q.18. Why is photoelectric emission not possible at all frequencies?

## 3                                                  Mark Questions

**Q.19.** Define the terms threshold frequency and stopping potential in relation to the phenomenon of photoelectric effect. How is the photoelectric current affected on increasing the (i) frequency (ii)intensity of the incident radiation and why?     **CBSE2006**

Q.20 (i) State two important features of Einstein's photoelectric equation.
(ii) Radiation of frequency 1015 Hz is incident on two photosensitive surfaces P and Q. There is no photoemission from surface P. Photoemission occurs from surface Q but photoelectrons have zero kinetic energy. Explain these observations and find the value of work function for surface Q.Q21.Explain giving reasons for the following:

(a) Photoelectric current in a photocell increases with the increase in the intensity of the incident-radiation.

(b) The stopping potential ($V_0$) varies linearly with the frequency (v) of the incident radiation for a given photosensitive surface with the slope remaining the same for different surfaces.

(c) Maximum kinetic energy of the photoelectrons is independent of the intensity of incident radiation.