Chapter 11

Dual Nature of Radiation and Matter

(Assertion and Reason 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 the Assertion is correct but Reason is incorrect.

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

Q.1. Assertion: In process of photoelectric emission, all emitted electrons do not have same kinetic energy.
Reason: If radiation falling on photosensitive surface of a metal consists of different wave length then energy acquired by electrons absorbing photons of different wave lengths shall be different.

Q.2. 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.3. Assertion: The photoelectrons produced by a monochromatic light beam incident on a metal surface have a spread in their kinetic energies.
Reason: The work function of the metal is its characteristics property.

Q.4. Assertion: Photoelectric saturation current increases with the increase in frequency of incident light.
Reason: Energy of incident photons increases with increase in frequency and as a result photoelectric current increases.

Q.5. 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.

Q.6. 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.7. Assertion: In an experiment on photoelectric effect, a photon is incident on an electron from one direction and the photoelectron is emitted almost in the opposite direction. It violate the principle of conservation of linear momentum.
Reason: It does not violate the principle of conservation of linear momentum.

Q.8. Assertion: Two sources of equal intensity always emit equal number of photons in any time interval.
Reason: Two sources of equal intensity may emit equal number of photons in any time interval.

Q.9. Assertion: Two photons of equal wavelength must have equal linear momentum.
Reason: Two photons of equal linear momentum will have equal wavelength.

Q.10. Assertion: The kinetic energy of photoelectrons emitted from metal surface does not depend on the intensity of incident photon.
Reason: The ejection of electrons from metallic surface is not possible with frequency of incident photons below the threshold frequency.

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ANSWER KEY

Q.1: (b) Both statement I and II are true; but even it radiation of single wavelength is incident on photosensitive surface, electrons of different KE will be emitted.

Q.2: (a) When a light of single frequency falls on the electrons of inner layer of metal, then this electron comes out of the metal surface after a large number of collisions with atom of it's upper layer.

Q.3: (b) The kinetic energy of emitted photoelectrons varies from zero to a maximum value. Work function depends on metal used.

Q.4: (d) Photoelectric saturation current is independent of frequency. It only depends on intensity of light.

Q.5: (b) Less work function means less energy is required for ejecting out the electrons.

Q.6: (a) **Q.7:** (d)

Q.8: (d) Total number of emitted photons depends on energy of each photon. The energy of photons of two sources may be different.

Q.9: (d) To photons of equal wavelength will have equal momentum (magnitude), but direction of momentum may be different.

Q.10: (b)