UNIT – 25 QUANTUM PHYSICS

MULTIPLE CHOICE QUESTIONS

1 If h is the Planck constant, then $\hbar$ is:

(a) 2π h (b) 2h (c) h/2 **(d) h/2π** (e) 2h/π

2 In a photoelectric effect experiment, the stopping potential is:
(a) The energy required to remove an electron from the sample
(b) The kinetic energy of the most energetic electron ejected
(c) The potential energy of the most energetic electron ejected
(d) The electric potential that causes the electron current to vanish

3 The work function for a certain sample is 2.3 eV. The stopping potential for electrons ejected from the sample by 7.0 x 10^{14} Hz electromagnetic radiation is:

(a) 0 **(b) 0.60 V** (c) 2.3V (d) 2.9V (e) 5.2V

4 In Compton scattering from stationary particles, the maximum change in wavelength can be made smaller by using:
(a) Higher frequency radiation (b) Lower frequency radiation
(c) more massive particles (d) less massive particles

5. Which of the following, Compton scattering from electrons, is most easily observed for:
(a) Infrared light (b) visible light
(c) ultraviolet light **(d) X-rays**

6. In the Compton scattering from stationary electrons, the largest change in wavelength occurs when the photon is scattered through
(a).0° (b) 45° (C) 90° **(d) 180°**

7. A free electron has a 5.0 x 10^{-24} kg m/s momentum. The wavelength of its wave function is:
(a) 1.3 x10^{-8} m **(b) 1.3 x 10^{-10} m**
(c) 2.1 x 10^{-11} m (d) 2.1 x 10^{-13} m

8. In the Photoelectric Effect, when light falls on the surface of the metal, the material should emit
(a) Electrons (b) Protons
(c) Positrons (d) Neutrons

9. Threshold frequency is defined as the ..... frequency of incident light which can cause photoelectric emission
(a) Maximum (b) Minimum
(c) Average (d) Highest

10. The amount of energy that is necessary to start photoelectric emission is called:
(a) Maximum (b) Average
(c) Minimum (d) Littlest

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1 The kinetic energy of photo electrons emitted from a metal depends upon

(a) The frequency of the incident light (b) the wavelength of the incident light

(c) The color of the incident light (d) the intensity of the incident light

2 The formula for the momentum of a photon is:

(a) $\frac{h\,C}{\lambda}$ **(b)** $\frac{h}{\lambda}$ (c) $\frac{\lambda\,C}{h}$ (d) $\frac{C}{\lambda}$

3 If the frequency of light causing photoelectron emission is doubled, the kinetic energy of the photoelectron will be:

(a) doubled (b) increased by a factor $\frac{1}{\sqrt{2}}$

(c) **Increased by a factor less than 2** (d) increased by a factor greater than 2

4 A metal has a work function of 2.3 eV. What is the minimum frequency of light required to eject electrons?

(a) 5.6×10^{14} Hz (b) 6.9×10^{14} Hz

(c) 4.2×10^{14} Hz (d) 3.1×10^{14} Hz

5 The threshold frequency is the:

(a) Highest frequency that ejects electrons

(b) Minimum frequency that ejects electrons

(c) Frequency at which KE of electrons is maximum

(d) Frequency of light in a vacuum

6 Light of wavelength 300 nm falls on a metal with a work function of 2.5 eV. What is the maximum kinetic energy of emitted electrons?

(a) 1.64 eV (b) 2.14 eV

(c) 3.12 eV (d) 0.86 eV

7 The work function of a metal is 3.2 eV. Light of energy 2.5 eV is incident on it. What happens?

(a) Electrons are emitted with 2.5 eV energy

(b) No electrons are emitted

(c) Electrons are emitted with 5.7 eV energy

(d) Electrons are emitted with 0.7 eV energy

8 Which phenomenon cannot be explained by classical physics but is explained by quantum theory?

(a) Reflection **(b) Photoelectric effect**

(c) Refraction (d) Diffraction

9 If the threshold wavelength for a metal is 500 nm, what is its work function?

(a) 2.48 eV (b) 3.10 eV

(c) 1.24 eV (d) 4.96 eV

10 A photon of energy 10 eV is incident on a metal with a work function of 4 eV. What is the stopping potential?

(a) 14 V (b) 10 V

(c) 4 V **(d) 6 V**

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11 What is the Compton shift?
(a) Shift in frequency
(b) Shift in charges
(c) Shift in radiation
(d) Shift in wavelength

12 A radio station broadcasts its program at 219.3 metres wavelength. Determine the frequency of radio waves if the velocity of radio waves is 3×10^{8} m/s.
(a) 7.31×10^{-7} Hz
(b) 1.954×10^{-6} Hz
(c) 1.368×10^{6} Hz
(d) 6.579×10^{10} Hz

13 A perfect black body is:
(a) A theoretical ideal absorber/emitter
(b) Always black in color
(c) A perfect reflector
(d) Only emits visible light

14 Wien's Displacement Law describes the relationship between:
(a) Temperature and total emitted power
(b) Temperature and peak wavelength
(c) Wavelength and intensity
(d) Frequency and photon energy

15 Who first demonstrated the Compton Effect?
(a) Albert Einstein
(b) Louis de Broglie
(c) Arthur H. Compton
(d) Niels Bohr

16 The Compton Effect involves the scattering of which particle?
(a) positrons
(b) Neutrons
(c) Photons
(d) Protons

17 The relation $\lambda_{max}\, T = constant$ is known as
(a) Wein's Law
(b) Planck's Law
(c) Stephen Law
(d) None

18 The Stefan-Boltzmann Law states that total emitted power depends on:
(a) T
b) T^2
(c) T^3
(d) T^4

19 Photon 'A' has twice the energy of photon 'B'. What is the ratio of the momentum of 'A' to that of 'B'?
(a) 4 : 1
(b) 8 : 1
(c) 1 : 2
(d) 2 : 1

20 Stopping potential for a metal surface in case of photo electric emission depends on
(a) The threshold frequency for the metal surface
(b) The intensity of incident light
(c) The frequency of incident light and the work function for a metal surface
(d) None of these