**15 MULTIPLE CHOICE QUESTIONS ON MODERN PHYSICS – PHOTONS AND PHOTOELECTRIC EFFECT (fully solved and explained)**

1. The wavelength of a photon is 7 x10 – 7 m. Calculate the frequency of the photon. Also calculate the energy of the photon in Joules and e.V
2. 4.285 x 10 15 Hertz, 2.84 x 10 – 19Joules, 2.36 e.V
3. 4.285 x 10 15 Hertz, .84 x 10 – 19Joules, 1.77 e.V
4. 3.2365 x 10 15 Hertz , 3.42 x 10 – 19Joules, 2.36 e.V
5. 3.236 x 10 15 Hertz , 3.42 x 10 – 19Joules, 1.77 e.V
6. Which of the following statements is true about a photon? (Give reasons in support of your answer).
7. A photon has zero mass and zero momentum.
8. A photon has finite mass and a finite value of momentum.
9. A photon has zero mass but finite value of momentum
10. A photon has finite mass but zero momentum.
11. A photon of wavelength 350nm and intensity 1.00W/m2 is directed at a Potassium surface (Work Function = 2.2 e.V).
12. Will photoelectrons be emitted from the surface? (Give reasons in support of your answer).
13. If yes, then calculate the maximum Kinetic Energy (K.E. MAX) of the emitted photoelectrons.
14. If 50% of the incident photons produce photoelectrons, how many are emitted per sec if the Potassium surface has an area of 1cm2.
15. Calculate the Photoelectric Current generated.
16. No (φ greater than photon energy), 0, 0, 0.
17. No (φ less than photon energy), 0, 0, 0
18. Yes (φ less than photon energy), 1.3e. V, 8.8 x 10 11 photoelectrons/sec, 9.346 x 10 – 6 Ampere
19. Yes, (φ greater than photon energy), 1.3e.V, 8.8 x 10 11 photoelectrons/sec, 9.346 x 10 – 6 Ampere
20. The work function of Platinum is twice that of the work function of Calcium. If the minimum photon energy required to emit photoelectrons from the surface of Platinum is E, then that for the surface of Calcium would be
21. 2E
22. 3E/2
23. E/2
24. Cannot be determined.
25. The work function of Sodium is greater than that of Potassium. If both the surfaces are irradiated with photons of same wavelength, then the K.E. of the emitted photoelectrons in the Sodium surface as compared to the K.E. of the photoelectrons in the Potassium surface will be
26. Same
27. Less
28. More
29. Cannot be determined.
30. A metallic surface is first irradiated with Ultraviolet light and then with Infrared light. What will be the change in the K.E. of the emitted photoelectrons? What will be the change in the photoelectric current IP? (Give reasons in support of your answer).
31. K.E. will remain same. IP will remain same.
32. K.E. will increase. IP will increase.
33. K.E. will decrease. IP will decrease.
34. K.E. will increase. IP will remain same.
35. K.E. will decrease. IP will remain same.
36. The threshold frequency for photoelectric emission in Copper is 1.1x 10 15 Hz. Find the maximum K.E. of the photoelectrons emitted when light of frequency 1.5 x 10 15 Hz is directed on a Copper surface.
37. 1.66e.V
38. 1.32 e.V
39. 2.40e.V
40. 3.22e.V
41. The threshold wavelength for photoelectric emission in Tungsten is 240nm. What wavelength of light must be used in order that the emitted photoelectrons have a maximum K.E. of 1.2 e.V.
42. 200nm
43. 230nm
44. 350nm
45. 195nm
46. Photoelectric effect can take place only when photons strike bound electrons or electrons embedded in the metal surface, since it is impossible for a photon to give up all its energy and momentum to a free electron. This is in accordance with
47. Law of conservation of Energy
48. Law of conservation of Mass
49. Law of conservation of Momentum
50. Law of conservation of both Energy and Momentum
51. Which of the following statements is true about photoelectric effect?
52. There is no time lag ∆t between the arrival of light (photons) on the surface of a metal, and the emission of photoelectrons (within limits of experimental accuracy ~10- 9sec).
53. There is always a specific time lag ∆t, between the arrival of photons on the surface and emission of photoelectrons.
54. There is a specific time lag ∆t only in some exceptional cases, particularly in some specific metals.
55. There is a specific time lag ∆t only when the photon energy is very less.
56. The Stopping Potential (Extinction voltage) in a photoelectric chamber is 3V. The work function φ for the metal is 2.2e.V. Calculate the incident photon energy and frequency.
57. 8.33 x 10 – 19Joules, 1.256 x 1015 Hz.
58. 4.42 x 10 – 19Joules, 1.256 x 1015 Hz.
59. 8. 33 x 10 – 19Joules, 2.343 x 1015 Hz.
60. 4.42 x 10 – 19Joules, 2.343 x 1015 Hz.
61. Which of the following statements is true for photoelectric effect?
62. Photoelectric current is proportional to the frequency of the radiation used, for all retarding voltages.
63. Photoelectric current is proportional to the intensity of light used for all retarding voltages.
64. Photoelectric current is proportional to the wavelength of radiation used, for all retarding voltages.
65. Photoelectric current is proportional to energy of the radiation used for all retarding voltages.
66. Which of the following statements is false for photoelectric effect?
67. The Stopping Potential (Extinction voltage) depends on the incident photon frequency
68. The Stopping Potential depends on the incident photon energy.
69. The Stopping Potential depends on the incident photon intensity.
70. The Stopping Potential depends on the incident photon wavelength.
71. What are the frequency, wavelength and energy of an X-ray photon whose momentum is 1.2 x 10 –23 kg m/s?
72. 5.4 x 1018 Hz, 3.6 x 10 –15 Joules, 555 Fermi
73. 5.4 x 1018 Hz, 3.6 x 10 –15 Joules, 652 Fermi
74. 5.4 x 1018 Hz, 4.2 x 10 –15 Joules, 555 Fermi
75. 2.4 x 1018 Hz, 3.6 x 10 –15 Joules, 555 Fermi
76. If the energy of a photon is 4.2e.V, calculate its momentum.

a) 2.243 x 10 –24 kg m /s

b) 2.243 x 10 –27 kg m /s

c) 3.324 x 10 –27 kg m /s

d) 3.324 x 10 –24 kg m /s