EXERCISE – I

CONCEPTUAL QUESTIONS

PHOTO ELECTRIC EFFECT

1. The energy of photon of visible light with maximum wavelength in eV is
(1) 1 (2*) 1.6 (3) 3.2 (4) 7

2. What is the momentum of a photon having frequency 1.5×10^{13} Hz?
(1*) 3.3×10^{-29} kg m/s (2) 3.3×10^{-34} kg m/s
(3) 6.6×10^{-34} kg m/s (4) 6.6×10^{-30} kg m/s

3. The strength of photoelectric current is directly proportional to
(1) Frequency of incident radiation (2*) Intensity of incident radiation
(3) Angle of incidence of radiation (4) Distance between anode and cathode

4. When light is incident on surface, photo electron are emitted. For photoelectrons
(1) The value of kinetic energy is same for all
(2) Maximum kinetic energy do not depend on the wavelength of incident light
(3*) The value of kinetic energy is equal to or less than a maximum kinetic energy
(4) None of the above

5. When light falls on a photosensitive surface, electron are emitted from the surface. The kinetic energy of these electros does not depend on the
(1) wavelength of light (2) frequency of light
(3) type of material used for the surface (4*) intensity of light

6. The work function of a substance is 4.0 eV. The longest wavelength of light that can cause photoelectron emission from this substance is approximately
(1) 540 nm (2) 400 nm (3*) 310 nm (4) 220 nm

7. Photoelectric effect takes place in element A. Its work function is 2.5 eV and threshold wavelength is λ. A other element B is having work function of 5 eV. Then find out the maximum wavelength that can produce photoelectric effect in B
(1*) $\frac{\lambda}{2}$ (2) 2λ (3) λ (4) 3λ

8. When light of wavelength lesser than 6000 Å is incident on a metal, electrons are emitted. The approximate work-function of the metal is
(1) 1 eV (2*) 2 eV (3) 4 eV (4) 6 eV

9. Surface of sodium is illuminated by a light of 600 Å wavelength. Work function of sodium is 1.6 eV. Then minimum K.E. of emitted electrons is
(1*) 0 eV (2) 1.53 eV (3) 2.46 eV (4) 4.14 eV

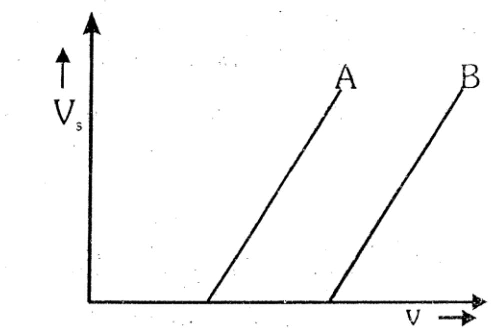
10. The maximum kinetic energy of photoelectrons emitted from a surface when photos of energy 6 eV fall on it is 4 eV. The stopping potential in volt is

(1*) 4 (2) 6 (3) 8 (4) 10

11. When a point source of monochromatic light is at a distance of 0.2 m from a photoelectric cell, the cut-off voltage and the saturation current are 0.6 volt and 18 mA respectively. If the same source is placed 0.6 m away from the photoelectric cell, then
(1) the stopping potential will be 0.2 V (2*) the stopping potential will be 0.6 V
(3) the saturation current will be 6 mA (4) the saturation current will be 18 mA

12. The maximum wavelength of light for photoelectric effect from a metal is 200 nm. The maximum kinetic energy of electron which is emitted by the radiation of wavelength 100 nm will be
(1) 12.4 eV (2*) 6.2 eV (3) 100 eV (4) 200 eV

13. The stopping potential as a function of frequency of incident radiation is plotted from two different surfaces A and B. The graphs show that the work function of A is



(1) Greater than that of B (2*) Smaller than that of B
(3) Same as that of B (4) No comparison can be done from given graphs

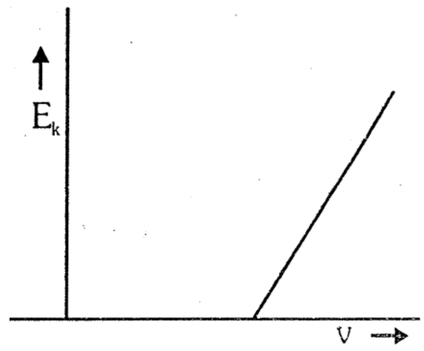
14. The slope of graph drawn between stopping potential and frequency of incident light for a given surface will be
(1) h (2*) h/e (3) eh (4) e

15. By photo electric effect, Einstein proved
(1*) $E = h\nu$ (2) $KE = \frac{1}{2}mv^2$ (3) $E = mc^2$ (4) $E = \frac{-Rhc^2}{n^2}$

16. Which one among shows particle nature of light?
(1*) P.E.E. (2) Interference (3) Refraction (4) Polarization

17. A photo-cell is illuminated by a source of light, which is placed at a distance d from the cell. If the distance become $\frac{d}{2}$, then number of electrons emitted per second will be
(1) remain same (2*) four times (3) two times (4) one-fourth

18. Graph is plotted between maximum kinetic energy of electron with frequency of incident photon in Photo electric effect. The slope of curve will be



(1) Charge of electron
(2) Work function of metal
(3*) Planck's constant
(4) Ratio of Planck constant and charge of electron

19. Photon of energy 6 eV incident on a metal surface of work function 4eV. Maximum KE of emitted photo electrons will be
(1) 0 eV (2) 1 eV (3*) 2 eV (4) 10 eV

20. Light of frequency v is incident on a metal of threshold frequency v_0. Then work function of metal will be
(1) hv (2*) hv_0 (3) $h(v - v_0)$ (4) $h(v + v_0)$

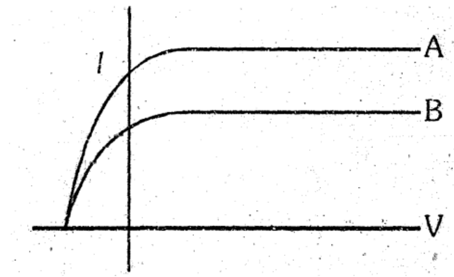
21. The work function of a photoelectric material is 3.3 eV. Its threshold frequency will be
(1) 4×10^{23} Hz (2) 8×10^{12} Hz (3) 4×10^{11} Hz (4*) 8×10^{11} Hz

22. The value of Planck's constant is
(1) 6.63×10^{-34} J/s
(2*) 6.63×10^{34} mg-m^2/s
(3) 6.63×10^{-34} kg-m^2
(4) 6.63×10^{-34} J-s^{-1}

23. When ultraviolet rays incident on metal plate then photoelectric effect does not occur, it occurs by incident of
(1) Infrared rays (2*) X-rays (3) Radio wave (4) Light wave

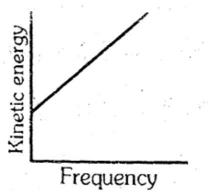
24. A photoelectric cell is illuminated by a point source of light 1 m away. When the source is shifted to 2 m then
(1) each emitted electron carries one quarter of the initial energy
(2) number of electrons emitted is half the initial number
(3) each emitted electron carries half the initial energy
(4*) number of electrons emitted is a quarter of the initial number

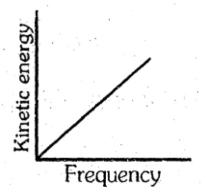
5. The graphs show the variation of current I (y-axis) in two photocell A and B as a function of the applied voltage V (x-axis) when light of same frequency is incident on the cell. Which of the following is the correct conclusion drawn from the data?

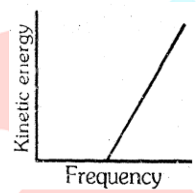


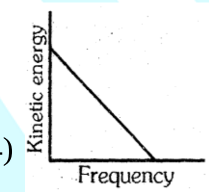
(1*) Cathodes of the two cells are made from the same substance, the intensity of light used are different
(2) Cathodes are made from different substance and the intensity of light is the same
(3) Cathode substances as well as intensity of light are different
(4) no conclusion can be drawn

26. According to Einsteins' photoelectric equation, the graph between the kinetic energy of photoelectrons ejected and the frequency of incident radiation is

(1) 

(2) 

(3*) 

(4) 

27. According to Einstein's photoelectric equation, the plot of the kinetic energy of the emitted photoelectrons from a metal v/s the frequency of the incident radiation gives a straight line whose slope
(1) depends on the intensity of the radiation
(2) depends of the nature of the metal used
(3) depends both on the intensity of the radiation and the metal used
(4*) is the same for all metals and independent of the intensity of the radiation

28. A photon of energy 4 eV is incident on a metal surface whose work function is 2eV. The minimum reverse potential to be applied for stopping the emission of electrons
(1*) 2 V (2) 4 V (3) 6 V (4) 8 V

MATTER WAVES

29. If E and P are the energy and the momentum of a photon respectively then on reducing the wavelength of photon
(1) P and E both will decrease (2*) P and E both will increase
(3) P will increase and E will decrease (4) P will decrease and E will increase

30. If the kinetic energy of a moving particle is E, then the De-Broglie wavelength is
(1) $h\sqrt{2mE}$ (2) $\sqrt{\frac{2mE}{h}}$ (3*) $\frac{h}{\sqrt{2mE}}$ (4) $\frac{hE}{\sqrt{2mE}}$

31. Electron has energy of 100 eV what will be its wavelength
(1*) 1.2 Å (2) 10 Å (3) 100 Å (4) 1 Å

32. The ratio of wavelength of deuteron and proton accelerated through the same potential difference will be

(1*) $\frac{1}{\sqrt{2}}$ (2) $\sqrt{\frac{2}{1}}$ (3) $\frac{1}{2}$ (4) $\frac{2}{1}$

33. An electron is accelerated from rest, between two points A and B at which the potentials are 20 V and 40 V respectively. The De-Broglie wavelength associated with the electron at B will be

(1) 0.75 Å (2) 7.5 Å (3*) 2.75 Å (4) 2.75 Å

34. An electron is moving with velocity 6.6×10^3 m/s. The De-Broglie wavelength associated with electron is (mass of electron = 9×10^{-31} Kg; Plank's Constant = 6.62×10^{-34} J-S)

(1) 1×10^{-19} m (2) 1×10^{-5} m (3*) 1×10^{-7} m (4) 1×10^{-10} m

35. The energy that should be added to an electron to reduce its De-Broglie wavelength from 10^{-10} m to 0.5×10^{-10} m will be

(1) four times the initial energy (2) equal to initial energy
(3) twice that initial energy (4*) thrice the initial energy

36. The magnitude of De-Broglie wavelength (λ) of electron (e), proton (p), neutron (n) and α-particle (α) all having the same kinetic energy of 1 MeV, in the increasing order will follow the sequence

(1) $\lambda_e, \lambda_p, \lambda_n, \lambda_\alpha$ (2) $\lambda_e, \lambda\nu, \lambda\pi, \lambda_\alpha$ (3*) $\lambda_\alpha, \lambda_n, \lambda_p, \lambda_e$ (4) $\lambda_p, \lambda_e, \lambda_\alpha, \lambda_n$

37. The accelerating voltage of an electron gun is 50,000 volt. De-Broglie wavelength of the electron will be

(1) 0.55 Å (2*) 0.055 Å (3) 0.077 Å (4) 0.095 Å

38. If the mass of neutron = 1.7×10^{-27} kg, then the De-Broglie wavelength of neutron of energy 3 eV is

(1) 1.6×10^{-10} m (2*) 1.6×10^{-11} m (3) 1.4×10^{-10} m (4) 1.4×10^{-11} m

39. A proton and an α-particle accelerated through same voltage. The ratio of their De-Broglie wavelength will be

(1) 1 : 2 (2*) $2\sqrt{2}:1$ (3) $\sqrt{2}:1$ (4) 2 : 1

40. The De-Broglie wavelength of an atom at absolute temperature T K will be

(1) $\frac{h}{mKT}$ (2*) $\frac{h}{\sqrt{3mKT}}$ (3) $\frac{\sqrt{3mKT}}{h}$ (4) $\sqrt{3mKT}$

41. The De-Broglie wavelength associated with electrons revolving round the nucleus in a hydrogen atom in good state, will be

(1) 0.3 Å (2*) 3.3 Å (3) 6.62 Å (4) 10 Å

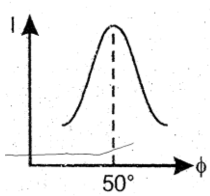
42. The wavelength of very fast moving electron $(v \approx c)$ is

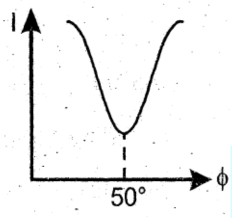
(1) $\lambda = \dfrac{h}{m_0 v}$ (2) $\lambda = \dfrac{h}{\sqrt{2mE}}$ (3) $\lambda^2 = \dfrac{h^2}{\sqrt{2mE}}$ (4*) $\lambda = \dfrac{h\sqrt{1-\dfrac{v^2}{c^2}}}{m_0 v}$

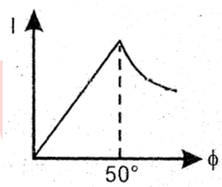
43. Which experiment explains the wave nature of electron?
(1) Michelson's experiment (2*) Davisson Germer experiment
(3) Roentgen experiment (4) Rutherford experiment

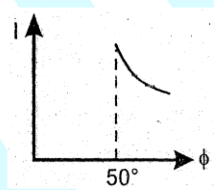
44. In Davisson–Germer experiment, the filament emits
(1) Photons (2) Protons (3) X-rays (4*) Electrons

45. The correct curve between intensity of scattering (I) and the angle of diffraction ϕ in Davision-Germer experiment is

(1*) 

(2) 

(3) 

(4) 

46. In Davission-Germer experiment, Nickel crystal acts as
(1) Perfect reflector (2*) Three dimensional diffraction grating
(3) Ideal absorber (4) Two dimensional diffraction grating

47. The diffracted waves in the Davisson-Germer experiment are
(1*) Electrons (2) X-Rays (3) Photons (4) Protons

48. The electron and a proton have the same De-Broglie wavelength. Then the kinetic energy of the electron is
(1) zero (2) Infinity
(3) Equal to kinetic energy of proton (4*) Greater than the kinetic energy of proton

49. De-Broglie equation for an electron shows is
(1) Particle nature (2) Wave nature (3*) Dual nature (4) None of these

50. What will happen to De-Broglie's wavelength if the velocity of electron is increased?
(1) It will increase (2*) It will decrease
(3) It will remain same (4) It will become twice

51. A photon of wavelength 4400 Å is passing through vaccum. The effective mass and momentum of the photon are respectively
(1*) 5×10^{-36} kg, 1.5×10^{-27} kg-m/s (2) 5×10^{-35} kg, 1.5×10^{-26} kg-m/s
(3) Zero, 1.5×10^{-26} kg-m/s (4) 5×10^{-36} kg, 1.67×10^{-43} kg-m/s

52. Which of the following is true for photon?

(1*) $E = \frac{hc}{\lambda}$ (2) $E = \frac{1}{2}mv^2$ (3) $P = \frac{E}{2V}$ (4) $E = \frac{1}{2}mc^2$

53. For a moving particle having kinetic energy E, the correct de-Broglie wavelength is

(1) It is not applicable for a particle (2*) $\frac{h}{\sqrt{2mE}}$

(3) $E\sqrt{\frac{h}{2m}}$ (4) $\frac{h}{2mE}$

54. The De-Broglie wavelength of an electron in the first bohr orbit is
(1*) equal to the circumference of the first orbit
(2) equal to twice the circumference of the first orbit
(3) equal to half the circumference of the first orbit
(4) equal to one fourth the circumference of first orbit

55. If given particles are moving with same velocity, then maximum de-Broglie wavelength for
(1) Proton (2) α-particle (3) Neutron (4*) β-particle

56. A proton is about 1840 times heavier than an electron. When it is accelerated by a potential difference of 1 kV, its kinetic energy will be

(1) 1840 keV (2) $\frac{1}{1840}$ keV (3*) 1 keV (4) 920 keV

57. If an electron and a photon propagate with same wavelength, it implies that can they have the same
(1) Energy (2*) Momentum (3) Velocity (4) Angular momentum

58. According to De-Broglie, wavelength of electron in second orbit is 10^{-9} metre. Then the circumference of orbit is
(1) 10^{-9} m (2*) 2×10^{-9} m (3) 3×10^{-9} m (4) 4×10^{-9} m

59. If the mass of a microscopic particle as well as its speed are halved, the de-Broglie wavelength associated with the particle will
(1*) increased by a factor more than 2 (2) increase by a factor of 1
(3) decrease by a factor of 2 (4) decrease by a factor more than 2

60. An electron and proton are accelerated through same potential, then $\frac{\lambda_e}{\lambda_p}$ will be

(1) 1 (2) $\frac{m_e}{m_p}$ (3) $\frac{m_p}{m_e}$ (4*) $\sqrt{\frac{m_p}{m_e}}$

61. An electron, proton and alpha particle have same kinetic energy. The corresponding de-Broglie wavelength would have the following relationship
(1*) $\lambda_e > \lambda_p > \lambda_\alpha$ (2) $\lambda_p > \lambda_e > \lambda_\alpha$ (3) $\lambda_\alpha > \lambda_e > \lambda_p$ (4) $\lambda_\alpha > \lambda_p > \lambda_e$

62. What is the de-Broglie wavelength of an electron with a kinetic energy of 120 eV?
(Given : $h = 6.63 \times 10^{-34}$ Js, $m_e = 9.11 \times 10^{-31}$ kg and $e = 1.6 \times 10^{-19}$ coulomb)
(1) 725 pm (2) 500 pm (3) 322 pm (4*) 112 pm

63. If λ_p and λ_α be the wavelength of protons and α-particles of equal kinetic energies, then
(1) $\lambda_p = \frac{\lambda_\alpha}{4}$ (2) $\lambda_p = \frac{\lambda_\alpha}{2}$ (3) $\lambda_p = \lambda_\alpha$ (4*) $\lambda_p = 2\lambda_\alpha$

EXERCISE-I (Conceptual Questions) Build Up Your Understanding

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	2	1	2	3	4	3	1	2	1	1	2	2	2	2	1
Que.	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Ans.	1	2	3	3	2	4	2	2	4	1	3	4	1	2	3
Que.	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
Ans.	1	1	3	3	4	3	2	2	2	2	2	4	2	4	1
Que.	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Ans.	2	1	4	3	2	1	1	2	1	4	3	2	2	1	4
Que.	61	62	63												
Ans.	1	4	4												