ALLEN CAREER INSTITUTE KOTA (RAJASTHAN)
path to success

TG: @Chalnaayaaar

PRE-MEDICAL

PHYSICS

ENTHUSIAST | LEADER | ACHIEVER

EXERCISE

Modern Physics-I

ENGLISH MEDIUM

EXERCISE-I (Conceptual Questions) Build Up Your Understanding

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

MP0001

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

MP0002

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

MP0003

4. When light is incident on surface, photo electrons are emitted. For photoelectrons :

(1) The value of kinetic energy is same for all

(2) Maximum kinetic energy do not depend on the wave length of incident light

(3) The value of kinetic energy is equal to or less than a maximum kinetic energy

(4) None of the above.

MP0004

5. When light falls on a photosensitive surface, electrons are emitted from the surface. The kinetic energy of these electrons 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

MP0005

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

MP0006

7. Photoelectric effect takes place in element A. Its work function is 2.5 eV and threshold wavelength is λ. An other element B is having work function of 5 eV. Then find out the maximum wavelength that can produce photoelectric effect in B :

(1) $\lambda/2$ (2) 2λ (3) λ (4) 3λ

MP0007

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

MP0008

9. Surface of sodium is illuminated by a light of 6000 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

MP0009

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

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

MP0010

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

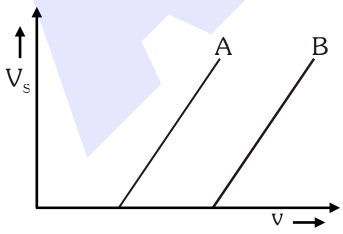
MP0011

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

MP0012

13. The stopping potential as a function of frequency of incident radiation is plotted for 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

MP0013

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

MP0014

15. By photo electric effect, Einstein proved :-

(1) $E = h\nu$ (2) $KE = \frac{1}{2}mv^2$

(3) $E = mc^2$ (4) $E = \frac{-Rhc^2}{n^2}$

MP0015

16. Which one among shows particle nature of light

(1) P.E.E. (2) Interference
(3) Refraction (4) Polarization

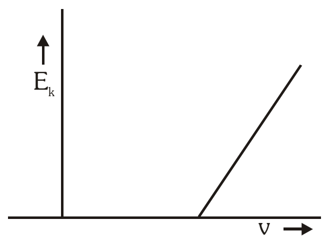
MP0016

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 d/2, then number of electrons emitted per second will be :-

(1) Remain same (2) Four times
(3) Two times (4) One-fourth

MP0017

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

MP0018

19. Photon of energy 6 eV is incident on a metal surface of work function 4 eV. Maximum KE of emitted photo electrons will be :-

(1) 0 eV (2) 1 eV (3) 2 eV (4) 10 eV

MP0019

20. Light of frequency ν is incident on a metal of threshold frequency ν_0. Then work function of metal will be:-

(1) $h\nu$ (2) $h\nu_0$

(3) $h(\nu - \nu_0)$ (4) $h(\nu + \nu_0)$

MP0020

21. The work function of a photo electric 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^{14} Hz

MP0021

22. The value of planck's constant is :–

(1) 6.63×10^{-34} J/s

(2) 6.63×10^{-34} kg–m^2/s

(3) 6.63×10^{-34} kg–m^2

(4) 6.63×10^{-34} J–s^{-1}

MP0022

23. When ultraviolet rays incident on metal plate then photoelectric effect does not occur, it occurs by incidence of :–

(1) Infrared rays (2) X–rays

(3) Radio wave (4) Light wave

MP0023

24. A photoelectric cell is illuminated by a point source of light 1 m away. When the source is shifted to 2m then

(1) each emitted electron carries one quarter of the initial energy

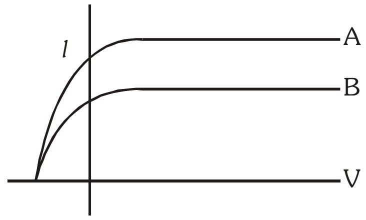
(2) number of electrons emitted is half the initial number

(3) each emitted electron carries half the initial energy

(4) number of electrons emitted is a quarter of the initial number

MP0024

25. The graphs show the variation of current I (y-axis) in two photocell A & 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

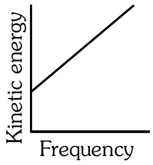
(2) Cathodes are made from different substances and the intensity of light is the same

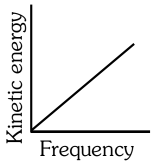
(3) Cathode substances as well as intensity of light are different

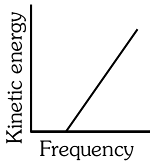
(4) no conclusion can be drawn

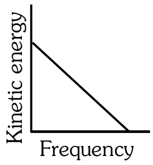
MP0025

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

(1) 

(2) 

(3) 

(4) 

MP0026

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.

MP0027

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 current is :-

(1) 2V (2) 4V (3) 6V (4) 8V

MP0028

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

MP0029

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) $\frac{hE}{\sqrt{2mE}}$

MP0030

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

MP0031

32. The ratio of wavelength of deutron 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) $\frac{2}{1}$

MP0032

33. An electron is accelerated from rest, between two points A and B at which the potentials are 20V 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 m

MP0033

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

MP0034

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 the initial energy

(4) Thrice the initial energy

MP0035

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 1MeV, in the increasing order will follow the sequence :

(1) $\lambda_e, \lambda_p, \lambda_n, \lambda_\alpha$ (2) $\lambda_e, \lambda_n, \lambda_p, \lambda_\alpha$

(3) $\lambda_\alpha, \lambda_n, \lambda_p, \lambda_e$ (4) $\lambda_p, \lambda_e, \lambda_\alpha, \lambda_n$

MP0036

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) 0.077Å (4) 0.095 Å

MP0037

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

MP0038

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

MP0039

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) $\sqrt{3mKT}$

MP0040

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

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

MP0041

42. The wavelength of very fast moving electron (v ≈ c) is :

(1) $\lambda = \frac{h}{m_0 v}$ (2) $\lambda = \frac{h}{\sqrt{2mE}}$

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

MP0042

43. Which experiment explains the wave nature of electron :-

(1) Michelson's experiment

(2) Davisson Germer experiment

(3) Roentgen experiment

(4) Rutherford experiment

MP0043

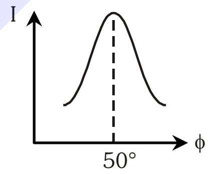
44. In davisson-Germer experiment, the filament emits :-

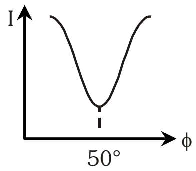
(1) Photons (2) Protons

(3) X - rays (4) Electrons

MP0044

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

(1)


(2)


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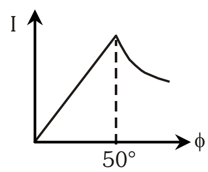

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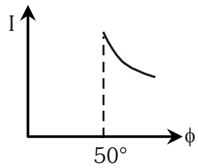


MP0045

46. In Davisson - Germer experiment, Nickel crystal acts as :-

(1) Perfect reflector

(2) Three dimensional diffraction grating

(3) Ideal absorber

(4) Two dimensional diffraction grating

MP0046

47. The diffracted waves in the Davisson-Germer experiment are :-

(1) Electrons (2) X - Rays

(3) Photons (4) Protons

MP0047

48. An 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

MP0048

49. De Broglie equation for an electron shows is :

(1) Particle nature (2) Wave nature

(3) Dual nature (4) None of these

MP0049

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

MP0050

51. A photon of wavelength 4400Å 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

MP0051

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) $E = \frac{1}{2}mc^2$

MP0052

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) $\frac{h}{2mE}$

MP0053

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

MP0054

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

MP0055

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) 1/1840 keV.

(3) 1 keV. (4) 920 keV.

MP0056

57. If an electron and a photon propagate with same wavelength, it implies that they can have the same:–

(1) Energy

(2) Momentum

(3) Velocity

(4)Angular momentum

MP0057

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

MP0058

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 2

(3) decrease by a factor of 2

(4) decrease by a factor more than 2

MP0059

60. An electron and proton are accelerated through same potential, then λ_e/λ_p will be

(1) 1 (2) m_e/m_p

(3) m_p/m_e (4) $\sqrt{m_p/m_e}$

MP0060

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) $\lambda_\alpha > \lambda_p > \lambda_e$

MP0061

62. What is the de Broglie wavelength of an electron with a kinetic energy of 120 eV ?

(Given : $h = 6.63 \times 10^{-34}$ J s, $m_e = 9.11 \times 10^{-31}$ kg and $e = 1.6 \times 10^{-19}$ coulomb)

(1) 725 pm (2) 500 pm

(3) 322 pm (4) 112 pm

MP0062

63. If λ_p and λ_α be the wavelengths of protons and α-particles of equal kinetic energies, then

(1) $\lambda_p = \dfrac{\lambda_\alpha}{4}$ (2) $\lambda_p = \dfrac{\lambda_\alpha}{2}$

(3) $\lambda_p = \lambda_\alpha$ (4) $\lambda_p = 2\lambda_\alpha$

MP0063

EXERCISE-I (Conceptual Questions) ANSWER KEY

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**												

EXERCISE-II (Previous Year Questions) AIPMT/NEET

AIPMT 2006

1. A photo-cell employs photoelectric effect to convert
(1) Change in the frequency of light into a change in electric voltage
(2) Change in the intensity of illumination into a change in photoelectric current
(3) Change in the intensity of illumination into a change in the work function of the photocathode
(4) Change in the frequency of light into a change in the electric current

MP0064

2. When photons of energy $h\nu$ fall on an aluminium plate (of work function E_0), photoelectrons on maximum kinetic energy K are ejected. If the frequency of the radiation is doubled, the maximum kinetic energy of the ejected photoelectrons will be:-
(1) $K + E_0$ (2) 2K
(3) K (4) $K + h\nu$

MP0065

3. The momentum of a photon of energy 1MeV in kg m/s, will be :-
(1) 0.33×10^6 (2) 7×10^{-24}
(3) 10^{-22} (4) 5×10^{-22}

MP0066

AIPMT 2007

4. A 5 watt source emits monochromatic light of wavelength 5000 Å. When placed 0.5 m away, it liberates photoelectrons from a photosensitive metallic surface. When the source is moved to a distance of 1.0 m, the number of photo electrons liberated will :
(1) be reduced by a factor of 2
(2) be reduced by a factor of 4
(3) be reduced by a factor of 8
(4) be reduced by a factor of 16

MP0068

5. Monochromatic light of frequency 6.0×10^{14} Hz is produced by a laser. The power emitted is 2×10^{-3} W. The number of photons emitted, on the average, by the source per second is :
(1) 5×10^{14} (2) 5×10^{15}
(3) 5×10^{16} (4) 5×10^{17}

MP0069

AIPMT 2008

6. The work function of a surface of a photosensitive material is 6.2 eV. The wavelength of the incident radiation for which the stopping potential is 5V lies in the :-
(1) Infrared region
(2) X-ray region
(3) Ultraviolet region
(4) Visible region

MP0070

AIPMT 2009

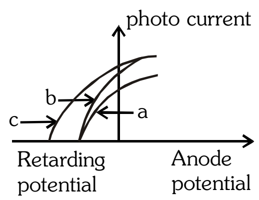
7. The number of photo electrons emitted for light of a frequency ν (higher than the threshold frequency ν_0) is proportional to :-
(1) Frequency of light (ν)
(2) $\nu - \nu_0$
(3) Threshold frequency (ν_0)
(4) Intensity of light

MP0071

8. Monochromatic light of wavelength 667 nm is produced by a helium neon laser. The power emitted is 9 mW. The number of photons arriving per sec. on the average at a target irradiated by this beam is :-
(1) 3×10^{19} (2) 9×10^{17}
(3) 3×10^{16} (4) 9×10^{15}

MP0072

9. The figure shows a plot of photo current versus anode potential for a photo sensitive surface for three different radiations. Which one of the following is a correct statement ?



(1) curves (b) and (c) represent incident radiations of same frequency having same intensity
(2) curves (a) and (b) represent incident radiations of different frequencies and different intensities
(3) curves (a) and (b) represent incident radiations of same frequency but of different intensities
(4) curves (b) and (c) represent incident radiations of different frequencies and different intensities

MP0073

AIPMT (Pre) 2010

10. A source S_1 is producing, 10^{15} photons per second of wavelength 5000 Å. Another source S_2 is producing 1.02×10^{15} photons per second of wavelength 5100 Å.
Then, (power of S_2)/(power of S_1) is equal to :-

(1) 0.98 (2) 1.00
(3) 1.02 (4) 1.04

MP0074

11. The potential difference that must be applied to stop the fastest photo electrons emitted by a nickel surface, having work function 5.01 eV, when ultraviolet light of 200 nm falls on it, must be -

(1) 1.2 V (2) 2.4 V (3) –1.2 V (4) –2.4V

MP0075

AIPMT (Mains) 2010

12. The electron in the hydrogen atom jumps from excited state (n = 3) to its ground state (n = 1) and the photons thus emitted irradiate a photosensitive material. If the work function of the material is 5.1 eV, the stopping potential is estimated to be (the energy of the electron in n^{th} state):-

(1) 12.1 V (2) 17.2 V (3) 7 V (4) 5.1 V

MP0076

AIPMT (Pre) 2011

13. Photoelectric emission occurs only when the incident light has more than a certain minimum:-

(1) Power (2) Wavelength
(3) Intensity (4) Frequency

MP0077

14. Light of two different frequencies whose photons have energies 1 eV and 2.5 eV respectively illuminate a metallic surface whose work function is 0.5 eV successively. Ratio of maximum speed of emitted electrons will be :

(1) 1 : 4 (2) 1 : 2
(3) 1 : 1 (4) 1 : 5

MP0078

15. In photoelectric emission process from a metal of work function 1.8eV, the kinetic energy of most energetic electrons is 0.5 eV. The corresponding stopping potential is :

(1) 1.8 V (2) 1.3V
(3) 0.5V (4) 2.3V

MP0079

16. A radioactive nucleus of mass M emits a photon of frequency ν and the nucleus recoils. The recoil energy will be :-

(1) $Mc^2 - h\nu$ (2) $h^2\nu^2 / 2Mc^2$
(3) Zero (4) $h\nu$

MP0080

17. In the Davisson and Germer experiment, the velocity of electrons emitted from the electron gun can be increased by :

(1) increasing the potential difference between the anode and filament
(2) increasing the filament current
(3) decreasing the filament current
(4) decreasing the potential difference between the anode and filament

MP0081

18. Electrons used in an electron microscope are accelerated by a voltage of 25 kV. If the voltage is increased to 100 kV then the de-Broglie wavelength associated with the electrons would :

(1) increase by 2 times (2) decrease by 2 times
(3) decrease by 4 times (4) increase by 4 times

MP0082

AIPMT (Mains) 2011

19. The threshold frequency for a photosensitive metal is 3.3×10^{14} Hz. If light of frequency 8.2×10^{14} Hz is incident on this metal, the cut-off voltage for the photoelectric emission is nearly :-

(1) 1 V (2) 2 V (3) 3 V (4) 5 V

MP0083

20. An electron in the hydrogen atom jumps from excited state n to the ground state. The wavelength so emitted illuminates a photosensitive material having work function 2.75 eV. If the stopping potential of the photoelectron is 10 V, then the value of n is :-

(1) 2 (2) 3 (3) 4 (4) 5

MP0084

AIPMT (Pre) 2012

21. Monochromatic radiation emitted when electron on hydrogen atom jumps from first excited to the grounds state irradiates a photosensitive material. The stopping potential is measured to be 3.57V. The threshold frequency of the material is :

(1) 1.6×10^{15} Hz (2) 2.5×10^{15} Hz
(3) 4×10^{15} Hz (4) 5×10^{15} Hz

MP0085

22. A 200W sodium street lamp emits yellow light of wavelength 0.6 µm. Assuming it to be 25% efficient converting electrical energy to light, the number of photons of yellow light it emits per second is :-

(1) 62×10^{20} (2) 3×10^{19}
(3) 1.5×10^{20} (4) 6×10^{18}

MP0086

23. An α-particle moves in a circular path of radius 0.83 cm in the presence of a magnetic field of 0.25 Wb/m^2. The de Broglie wavelength associated with the particle will be :

(1) 10Å (2) 0.1Å (3) 1Å (4) 0.01Å

MP0087

24. An electron of stationary hydrogen atom passes from the fifth energy level to the ground level. The velocity that the atom acquired a result of photon emission will be :

(1) $\frac{25m}{24hR}$ (2) $\frac{24m}{25hR}$ (3) $\frac{24hR}{25m}$ (4) $\frac{25hR}{24m}$

(m is the mass of the atom, R, Rydberg constant and h Planck's constant)

MP0088

AIPMT (Mains) 2012

25. If the momentum of an electron is changed by P, then the de Broglie wavelength associated with it changes by 0.5%. The initial momentum of electron will be :-

(1) $\frac{P}{200}$ (2) 100 P (3) 200 P (4) 400 P

MP0089

NEET-UG 2013

26. For photoelectric emission from certain metal the cutoff frequency is ν. If radiation of frequency 2ν impinges on the metal plate, the maximum possible velocity of the emitted electron will be (m is the electron mass) :-

(1) $2\sqrt{h\nu/m}$ (2) $\sqrt{h\nu/(2m)}$
(3) $\sqrt{h\nu/m}$ (4) $\sqrt{2h\nu/m}$

MP0091

27. The wavelength λ_e of an electron and λ_P of a photon of same energy E are related by:

(1) $\lambda_P \propto \frac{1}{\sqrt{\lambda_e}}$ (2) $\lambda_P \propto \lambda_e^2$
(3) $\lambda_P \propto \lambda_e$ (4) $\lambda_P \propto \sqrt{\lambda_e}$

MP0092

AIPMT 2014

28. Light with an energy flux of 25×10^4 Wm^{-2} falls on a perfectly reflecting surface at normal incidence. If the surface area is 15 cm^2, the average force exerted on the surface is :-

(1) 1.25×10^{-6} N (2) 2.50×10^{-6} N
(3) 1.20×10^{-6} N (4) 3.0×10^{-6} N

MP0094

29. When the energy of the incident radiation is increased by 20%, the kinetic energy of the photoelectrons emitted from a metal surface increased from 0.5 eV to 0.8 eV. The work function of the metal is :-

(1) 0.65 eV (2) 1.0 eV
(3) 1.3 eV (4) 1.5 eV

MP0095

30. If the kinetic energy of the particle is increased to 16 times its previous value, the percentage change in the de-Broglie wavelength of the particle is :-

(1) 25 (2) 75 (3) 60 (4) 50

MP0096

AIPMT 2015

31. A certain metallic surface is illuminated with monochromatic light of wavelength, λ. The stopping potential for photo-electric current for this light is $3V_0$. if the same surface is illuminated with light of wavelength 2λ, the stopping potential is V_0. The threshold wavelength for this surface for photoelectric effect is :-

(1) 4λ (2) $\frac{\lambda}{4}$ (3) $\frac{\lambda}{6}$ (4) 6λ

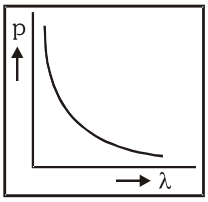
MP0097

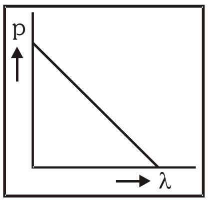
32. A radiation of energy 'E' falls normally on a perfectly reflecting surface. The momentum transferred to the surface is (C=Velocity of light):-

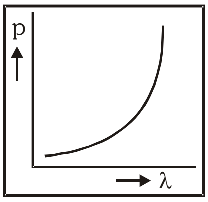
(1) $\frac{2E}{C}$ (2) $\frac{2E}{C^2}$ (3) $\frac{E}{C^2}$ (4) $\frac{E}{C}$

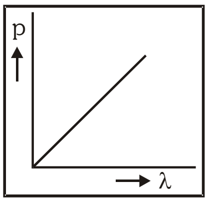
MP0098

33. Which of the following figures represent the variation of particle momentum and the associated de-Broglie wavelength ?

(1) 

(2) 

(3) 

(4) 

MP0099

RE-AIPMT 2015

34. Light of wavelength 500 nm is incident on a metal with work function 2.28 eV. The de Broglie wavelength of the emitted electron is :-

(1) $\le 2.8 \times 10^{-12}$m (2) $< 2.8 \times 10^{-10}$m

(3) $< 2.8 \times 10^{-9}$ m (4) $\ge 2.8 \times 10^{-9}$ m

MP0100

35. A photoelectric surface is illuminated successively by monochromatic light of wavelength λ and λ/2. If the maximum kinetic energy of the emitted photoelectrons in the second case is 3 times that in the first case, the work function of the surface of the material is :

(h = Plank's constant, c = speed of light)

(1) $\frac{hc}{3\lambda}$ (2) $\frac{hc}{2\lambda}$ (3) $\frac{hc}{\lambda}$ (4) $\frac{2hc}{\lambda}$

MP0101

NEET-I 2016

36. An electron of mass m and a photon have same energy E. The ratio of de-Broglie wavelengths associated with them is :

(1) $\frac{1}{c}\left(\frac{E}{2m}\right)^{\frac{1}{2}}$ (2) $\left(\frac{E}{2m}\right)^{\frac{1}{2}}$

(3) $c(2mE)^{\frac{1}{2}}$ (4) $\frac{1}{xc}\left(\frac{2m}{E}\right)^{\frac{1}{2}}$

MP0103

37. When a metallic surface is illuminated with radiation of wavelength λ, the stopping potential is V. If the same surface is illuminated with radiation of wavelength 2λ, the stopping potential is $\frac{V}{4}$. The threshold wavelength for the metallic surface is :-

(1) 4 λ (2) 5 λ (3) $\frac{5}{2}\lambda$ (4) 3 λ

MP0104

NEET-II 2016

38. Photons with energy 5 eV are incident on a cathode C in a photoelectric cell. The maximum energy of emitted photoelectrons is 2 eV. When photons of energy 6 eV are incident on C, no photoelectrons will reach the anode A, if the stopping potential of A relative to C is :-

(1) – 1 V (2) – 3 V

(3) + 3 V (4) + 4 V

MP0105

NEET(UG) 2017

39. The de-Broglie wavelength of a neutron in thermal equilibrium with heavy water at a temperature T (Kelvin) and mass m, is :-

(1) $\frac{h}{\sqrt{3mkT}}$ (2) $\frac{2h}{\sqrt{3mkT}}$

(3) $\frac{2h}{\sqrt{mkT}}$ (4) $\frac{2h}{\sqrt{mkT}}$

MP0107

40. The photoelectric threshold wavelength of silver is 3250 $\times 10^{-10}$m. The velocity of the electron ejected from a silver surface by ultraviolet light of wavelength 2536×10^{-10} m is :-

(Given h = 4.14×10^{-15} eVs and c = 3×10^{8} ms^{-1})

(1) $\approx 0.6 \times 10^{4}$ ms^{-1}

(2) $\approx 61 \times 10^{3}$ ms^{-1}

(3) $\approx 0.3 \times 10^{6}$ ms^{-1}

(4) $\approx 6 \times 10^{5}$ ms^{-1}

MP0108

NEET(UG) 2018

41. An electron of mass m with an initial velocity $\vec{V} = V_0\hat{i}(V_0 > 0)$ enters an electric field $\vec{E} = -E_0\hat{i}$ (E_0 = constant >0) at t = 0. If λ_0 is its de-Broglie wavelength initially, then its de-Broglie wavelength at time t is :-

(1) $\dfrac{\lambda_0}{\left(1+\dfrac{eE_0}{mV_0}t\right)}$ (2) $\lambda_0\left(1+\dfrac{eE_0}{mV_0}y\right)$

(3) $\lambda_0 t$ (4) λ_0

MP0109

42. When the light of frequency $2\nu_0$ (where ν_0 is threshold frequency), is incident on a metal plate, the maximum velocity of electrons emitted is v_1. When the frequency of the incident radiation is increased to $5\nu_0$, the maximum velocity of electrons emitted from the same plate is v_2. The ratio of v_1 to v_2 is :-

(1) 1 : 2 (2) 1 : 4
(3) 4 : 1 (4) 2 : 1

MP0110

NEET(UG) 2019

43. An electron is accelerated through a potential difference of 10,000 V. Its de Broglie wavelength is, (nearly): ($m_e = 9 \times 10^{-31}$ kg)

(1) 12.2×10^{-13} m (2) 12.2×10^{-12} m

(3) 12.2×10^{-14} m (4) 12.2 nm

MP0149

NEET(UG) 2019 (Odisha)

44. The work function of a photosensitive material is 4.0 eV. The longest wavelength of light that can cause photon emission from the substance is (approximately)

(1) 3100 nm (2) 966 nm

(3) 31 nm (4) 310 nm

MP0150

45. A proton and an α–particle are accelerated from rest to the same energy. The de Broglie wavelengths λ_p and λ_α are in the ratio,

(1) 2 : 1 (2) 1 : 1

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

MP0151

NEET(UG) 2020

46. Light with an average flux of 20 W/cm^2 falls on a non-reflecting surface at normal incidence having surface area 20 cm^2. The energy received by the surface during time span of 1 minute is :

(1) 48×10^3 J (2) 10×10^3 J

(3) 12×10^3 J (4) 24×10^3 J

MP0471

47. The energy required to break one bond in DNA is 10^{-20} J. This value in eV is nearly :

(1) 0.006 (2) 6 (3) 0.6 (4) 0.06

MP0472

48. An electron is accelerated from rest through a potential difference of V volt. If the de Broglie wavelength of the electron is 1.227×10^{-2} nm, the potential difference is :

(1) 10^4 V (2) 10 V

(3) 10^2 V (4) 10^3 V

MP0473

49. Light of frequency 1.5 times the threshold frequency is incident on a photosensitive material. What will be the photoelectric current if the frequency is halved and intensity is doubled ?

(1) zero (2) doubled

(3) four times (4) one-fourth

MP0474

NEET(UG) 2020 (COVID-19)

50. The de Broglie wavelength of an electron moving with kinetic energy of 144 eV is nearly

(1) 102×10^{-3} nm (2) 102×10^{-4} nm
(3) 102×10^{-5} nm (4) 102×10^{-2} nm

MP0475

51. The wave nature of electrons was experimentally verified by,

(1) de Broglie (2) Hertz

(3) Einstein (4) Davisson & Germer

MP0476

NEET(UG) 2021

52. The number of photons per second on an average emitted by the source of monochromatic light of wavelength 600 nm, when it delivers the power of 3.3×10^{-3} watt will be :

($h = 6.6 \times 10^{-34}$ Js)

(1) 10^{18} (2) 10^{17} (3) 10^{16} (4) 10^{15}

MP0477

53. An electromagnetic wave of wavelength 'λ' is incident on a photosensitive surface of negligible work function. If 'm' mass is of photoelectron emitted from the surface has de-Broglie wavelength λ_d, then :

(1) $\lambda = \left(\frac{2m}{hc}\right)\lambda_d^2$ (2) $\lambda_d = \left(\frac{2mc}{h}\right)\lambda^2$

(3) $\lambda = \left(\frac{2mc}{h}\right)\lambda_d^2$ (4) $\lambda = \left(\frac{2h}{mc}\right)\lambda_d^2$

MP0478

NEET(UG) 2021 (Paper-2)

54. In photoelectric effect experiment, the incident wavelength λ is decreases to λ/4, then ratio of final maximum kinetic energy to initial maximum kinetic energy of emitted electron will be ($\lambda > \lambda_0$) where λ_0 is threshold wavelength.

(1) Equal to 4 (2) More than 4

(3) Less than 4 (4) Equal to 2

MP0486

55. A particle of mass m is moving with velocity v and its de-Broglie wavelength is λ. If mass is increased by 20% and velocity is decreased by 50% then new de-Broglie wavelength will be

(1) $\frac{3\lambda}{4}$ (2) $\frac{3\lambda}{5}$ (3) $\frac{4\lambda}{3}$ (4) $\frac{5\lambda}{3}$

MP0487

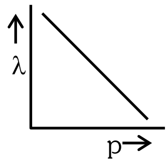
NEET(UG) 2022

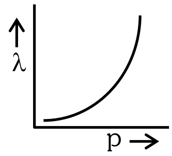
56. Let T_1 and T_2 be the energy of an electron in the first and second excited states of hydrogen atom, respectively. According to the Bohr's model of an atom, the ratio $T_1 : T_2$ is :

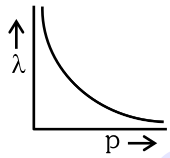
(1) 4 : 1 (2) 4 : 9 (3) 9 : 4 (4) 1 : 4

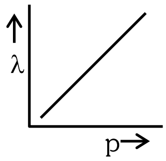
MP0488

57. The graph which shows the variation of the de Broglie wavelength (λ) of a particle and its associated momentum (p) is :

(1) 

(2) 

(3) 

(4) 

MP0489

58. When two monochromatic lights of frequency, υ and $\frac{\upsilon}{2}$ are incident on a photoelectric metal, their stopping potential becomes $\frac{V_s}{2}$ and V_s respectively. The threshold frequency for this metal is:

(1) 3υ (2) $\frac{2}{3}\upsilon$

(3) $\frac{3}{2}\upsilon$ (4) 2υ

MP0490

NEET(UG) 2022 (Overseas)

59. The de Broglie wavelength of a thermal electron at 27°C is λ. When the temperature is increased to 927°C, its de-Broglie wavelength will become:

(1) 4λ (2) $\frac{\lambda}{2}$

(3) $\frac{\lambda}{4}$ (4) 2λ

MP0491

60. In a photoelectric experiment, blue light is capable of ejecting a photoelectron from a specific metal while green light is not able to eject a photoelectron. Ejection of photoelectrons is also possible using light of the colour:

(1) Red (2) Violet

(3) Orange (4) Yellow

MP0492

Re-NEET(UG) 2022

61. The light rays having photons of energy 4.2 eV are falling on a metal surface having a work function of 2.2 eV. The stopping potential of the surface is :

(1) 2 eV (2) 2 V

(3) 1.1 V (4) 6.4 V

MP0493

62. The threshold frequency of a photoelectric metal is ν_0. If light of frequency 4 ν_0 is incident on this metal, then the maximum kinetic energy of emitted electrons will be :

(1) $h\nu_0$ (2) $2\ h\nu_0$

(3) $3\ h\nu_0$ (4) $4\ h\nu_0$

MP0494

EXERCISE-II (Previous Year Questions) ANSWER KEY

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

EXERCISE-III (Analytical Questions)

Master Your Understanding

1. A laser beam (λ = 633 nm) has an power of 3 mW. What will be the pressure exerted on a surface by this beam if the cross sectional area is 3 mm^2. (Assume perfect reflection and normal incidence)

(1) 6.6×10^{-3} N/m^2 (2) 6.6×10^{-6} N/m^2

(3) 6.6×10^{-9} N/m^2 (4) 6.6 N/m^2

MP0112

2. The frequency of the incident light falling on a photosensitive metal plate is doubled, the kinetic energy of the emitted photoelectrons is

(1) Double of the earlier value
(2) Unchanged
(3) More than double
(4) Less than double

MP0113

3. The threshold wavelength of tungsten is 2300 Å. If ultra violet light of wavelength 1800 Å is incident on it, then the maximum kinetic energy of photoelectrons would be.

(1) 1.5 eV (2) 2.2 eV (3) 3.0 eV (4) 5.0 eV

MP0114

4. The kinetic energy of most energetic electrons emitted from a metallic surface is doubled when the wavelength of the incident radiation is changed from 400 nm to 310 nm the work-function of the metal is :

(1) 0.9 eV (2) 1.7 eV

(3) 2.2 eV (4) 3.1 eV

MP0115

5. If the light of wavelength λ is incident on metal surface, the ejected fastest electron has speed v. If the wavelength is changed to $\frac{3\lambda}{4}$, the speed of the fastest emitted electron will be

(1) Smaller than $\sqrt{\frac{4}{3}}$ v

(2) Greater than $\sqrt{\frac{4}{3}}$ v

(3) 2 v

(4) Zero

MP0116

6. When a certain metallic surface is illuminated with mono-chromatic light of wave length λ, the stopping potential for photo electric current is 6 V_0. When the same surface is illuminated with light of wave length 2λ, the stopping potential is 2V_0. The threshold wavelength of this surface for photoelectric effect is :

(1) 6 λ (2) 4λ/3 (3) 4λ (4) 8λ

MP0117

7. Two separate monochromatic light beams A and B of the same intensity are falling normally on a unit area of a metallic surface. Their wavelength are λ_A and λ_B respectively. Assuming that all the incident light is used in ejecting the photoelectrons, the ratio of the number of photoelectrons from the beam A to that from B is

(1) $(\lambda_A/\lambda_B)^2$ (2) λ_A/λ_B

(3) λ_B/λ_A (4) 1

MP0118

8. Threshold wavelength for photoelectric emission from a metal surface is 5200 Å. Photoelectrons will be emitted when this surface is illuminated with monochromatic radiation from.

(1) 1 W IR lamp

(2) 50 W UV lamp

(3) 50 W IR lamp

(4) 10 W IR lamp

MP0119

9. The work functions for metals A, B and C are respectively 1.92 eV, 2.0 eV and 5eV. According to Einstein's equation, the metals which will emit photo electrons for a radiation of wavelength 4100Å is/are :-

(1) None
(2) A only
(3) A and B only
(4) All the three metals

MP0120

10. A photosensitive metallic surface has work function, $h\nu_0$. If photons of energy $2h\nu_0$ fall on this surface, the electrons come out with a maximum velocity of 4×10^6 m/s. When the photon energy is increased to $5h\nu_0$, then maximum velocity of photo electrons will be :-

(1) 2×10^7 m/s (2) 2×10^6 m/s

(3) 8×10^5 m/s (4) 8×10^6 m/s

MP0121

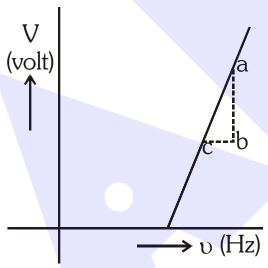
11. A 500 watt bulb is placed at the centre of a perfectly black sphere of radius R = 1 metre. The approximate pressure experienced by the walls of the sphere as it absorbs all the photon emited by the bulb is (take $4\pi = 12.6$)

(1) 1.3×10^{-7} N/m² (2) 2.5×10^{-7} N/m²

(3) 6.3×10^{-7} N/m² (4) 3.14×10^{-7} N/m²

MP0122

12. In a photoelectric experiment the graph of frequency υ of incident light (in Hz) and stopping potential V (in volt) is shown below. From figure the value of the Planck's constant is (e is the elementary charge)



(1) $e\frac{ab}{cb}$ (2) $e\frac{cb}{ab}$ (3) $e\frac{ac}{bc}$ (4) $e\frac{ac}{ab}$

MP0123

13. Light of frequency 10^{15} Hz falls on a metal surface of work function 2.5 eV. The stopping potential of photoelectrons in volts is :-

(1) 1.6 (2) 2.5

(3) 4.1 (4) 6.6

MP0124

14. Work function of potassium metal is 2.30 eV. When light of frequency 8×10^{14} Hz is incident on the metal surface, photoemission of electrons occurs. The stopping potential of the electrons will be equal to

(1) 0.1 V (2) 1.0 V

(3) 2.3 V (4) 3.3 V

MP0125

15. The threshold frequency for a certain photosensitive metal is υ_0. When it is illuminated by light of frequency $\upsilon = 2\upsilon_0$, the maximum velocity of photoelectrons is v_0. What will be the maximum velocity of the photoelectrons when the same metal is illuminated by light of frequency $\upsilon = 5\upsilon_0$?

(1) $\sqrt{2}v_0$ (2) $2v_0$

(3) $2\sqrt{2}v_0$ (4) $4v_0$

MP0126

16. A proton moves on a circular path of radius 6.6×10^{-3} m in a perpendicular magnetic field of 0.625 tesla. The De broglie wavelength associated with the proton will be :

(1) 1Å (2) 0.1Å

(3) 0.01Å (4) 0.001Å

MP0127

17. The velocity at which the mass of a particle becomes twice of its rest mass, will be -

(1) $\frac{2c}{3}$ (2) $\frac{c}{2}$

(3) $\frac{c\sqrt{3}}{2}$ (4) $\frac{3c}{4}$

MP0128

18. An electron with (rest mass m_0) moves with a speed of 0.8C. Its mass when it moves with this speed is :

(1) m_0 (2) $\frac{m_0}{6}$

(3) $\frac{5m_0}{3}$ (4) $\frac{3m_0}{5}$

MP0129

19. We wish to see inside an atom. Assuming the atom to have a diameter of 10 pm, this means that one must be able to resolve a width of say 10 pm. If an electron microscope is used, the minimum electron energy required is about

(1) 15 keV (2) 1.5 keV
(3) 150 keV (4) 1.5 Mev

MP0130

EXERCISE-III (Analytical Questions) ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	**2**	**3**	**1**	**3**	**2**	**3**	**2**	**2**	**3**	**4**	**1**	**1**	**1**	**2**	**2**
Que.	16	17	18	19											
Ans.	**3**	**3**	**3**	**1**											