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
PMD001

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
PMD002

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
PMD003

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.
PMD004

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
PMD005

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
PMD006

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
PMD007

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
PMD008

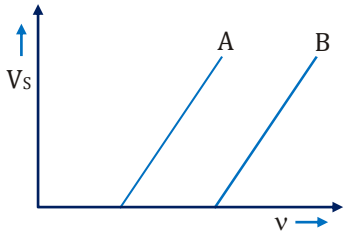
9. Surface of sodium is illuminated by a light of 6000 Å wavelength. Work function of sodium is 1.6 eV. Then minimum K.E. of emitted electrons is :
(1) 0 eV (2) 1.53 eV
(3) 2.46 eV (4) 4.14 eV
PMD009

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
PMD010

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
PMD011

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
PMD012

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

PMD013

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

PMD014

15. By photo electric effect, Einstein proved :-

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

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

PMD015

16. Which one among shows particle nature of light?

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

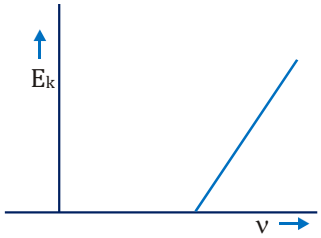
PMD016

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

PMD017

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

PMD018

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

PMD019

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) $h(\nu + \nu_0)$

PMD020

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

PMD021

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}

PMD022

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

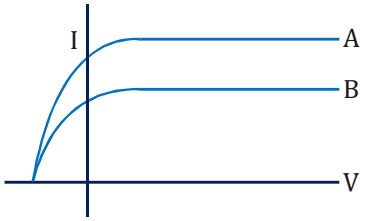
(1) Infrared rays (2) X–rays
(3) Radio wave (4) Light wave

PMD023

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

PMD024

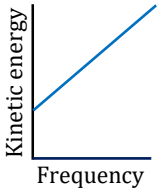
25. The graphs show the variation of current I (y-axis) in two photocell A & B as a function of the applied voltage V(x-axis) when light of same frequency is incident on the cell. Which of the following is the correct conclusion drawn from the data ?

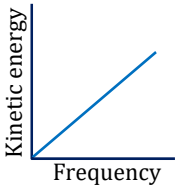


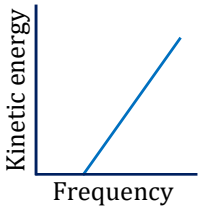
(1) Cathodes of the two cells are made from the same substance, the intensity of light used are different
(2) Cathodes are made from different substances and the intensity of light is the same
(3) Cathode substances as well as intensity of light are different
(4) no conclusion can be drawn

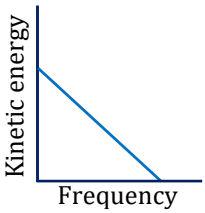
PMD025

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) 

PMD026

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.

PMD027

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

PMD028

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

PMD029

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

PMD030

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

PMD031

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) $\frac{2}{1}$

PMD032

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

PMD033

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

PMD034

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

PMD035

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) $\lambda_p, \lambda_e, \lambda_\alpha, \lambda_n$

PMD036

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

PMD037

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

PMD038

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

PMD039

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) $\sqrt{3mKT}$

PMD040

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

PMD041

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

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

PMD042

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

(1) Michelson's experiment
(2) Davisson Germer experiment
(3) Roentgen experiment
(4) Rutherford experiment

PMD043

44. 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

PMD044

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

PMD045

46. 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

PMD046

47. 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

PMD047

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

PMD048

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

PMD049

50. 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

PMD050

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

PMD051

52. 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.

PMD052

53. 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

PMD053

54. 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

PMD054

55. 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

PMD055

56. 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) $\sqrt{m_p/m_e}$

PMD056

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

PMD057

58. 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

PMD058

59. If λ_p and λ_∞ be the wavelengths 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) $\lambda_p = 2\lambda_\alpha$

PMD059

EXERCISE-I (Conceptual Questions) ANSWER KEY

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

Exercise - II (Previous Year Questions) AIPMT/NEET

AIPMT 2014

1. 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

PMD060

2. 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

PMD061

3. 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

PMD062

AIPMT 2015

4. 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

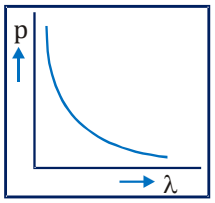
PMD063

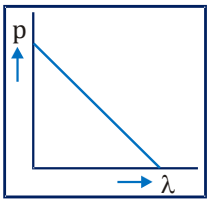
5. A radiation of energy 'E' falls normally on a perfectly reflecting surface. The momentum transferred to the surface is (C=Velocity of light):-

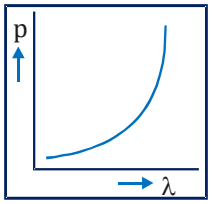
(1) $\frac{2E}{C}$ (2) $\frac{2E}{C^2}$ (3) $\frac{E}{C^2}$ (4) $\frac{E}{C}$

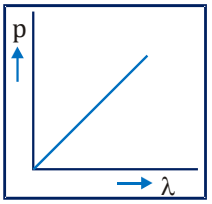
PMD064

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

(1) 

(2) 

(3) 

(4) 

PMD065

RE-AIPMT 2015

7. 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) $\leq 2.8 \times 10^{-12}$m (2) $< 2.8 \times 10^{-10}$m

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

PMD066

8. A photoelectric surface is illuminated successively by monochromatic light of wavelength λ and $\lambda/2$. 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) $\frac{2hc}{\lambda}$

PMD067

NEET-I 2016

9. 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) $\frac{1}{xc}\left(\frac{2m}{E}\right)^{\frac{1}{2}}$

PMD068

10. 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) 4λ (2) 5λ (3) $\frac{5}{2}\lambda$ (4) 3λ

PMD069

NEET-II 2016

11. 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

PMD070

NEET(UG) 2017

12. 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) $\frac{2h}{\sqrt{mkT}}$

PMD071

13. The photoelectric threshold wavelength of silver is 3250×10^{-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}

PMD072

NEET(UG) 2018

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

(3) $\lambda_0 t$ (4) λ_0

PMD073

15. 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

PMD074

NEET(UG) 2019

16. 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

PMD075

NEET(UG) 2019 (Odisha)

17. 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

PMD076

18. 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

PMD077

NEET(UG) 2020

19. 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

PMD078

20. 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

PMD079

21. 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

PMD080

22. 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

PMD081

NEET(UG) 2020 (COVID-19)

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

(1) $10^2 \times 10^{-3}$ nm (2) $10^2 \times 10^{-4}$ nm

(3) $10^2 \times 10^{-5}$ nm (4) $10^2 \times 10^{-2}$ nm

PMD082

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

(1) de Broglie

(2) Hertz

(3) Einstein

(4) Davisson & Germer

PMD083

NEET(UG) 2021

25. 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}

PMD084

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

PMD085

NEET(UG) 2022

27. When two monochromatic lights of frequency, ν and $\frac{\nu}{2}$ 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) 3ν (2) $\frac{2}{3}\nu$ (3) $\frac{3}{2}\nu$ (4) 2ν

PMD086

RE-NEET(UG) 2022

28. 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

PMD087

29. The threshold frequency of a photoelectric metal is ν_0. If light of frequency $4\nu_0$ 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) $4\ h\nu_0$

PMD088

NEET(UG) 2023

30. The work functions of Caesium (Cs), potassium (K) and Sodium (Na) are 2.14 eV, 2.30 eV and 2.75 eV respectively. If incident electromagnetic radiation has an incident energy of 2.20 eV, which of these photosensitive surfaces may emit photoelectrons ?

(1) Both Na and K (2) K only
(3) Na only (4) Cs only

PMD089

RE-NEET(UG) 2023

31. The de Broglie wavelength associated with an electron, accelerated by a potential difference of 81 V is given by:

(1) 13.6 nm (2) 136 nm
(3) 1.36 nm (4) 0.136 nm

PMD090

32. The maximum kinetic energy of the emitted photoelectrons in photoelectric effect is independent of :

(1) work function of material
(2) intensity of incident radiation
(3) frequency of incident radiation
(4) wavelength of incident radiation

PMD091

NEET(UG) 2024

33. If c is the velocity of light in free space, the correct statements about photon among the following are :

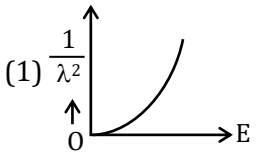
A. The energy of a photon is E = hν
B. The velocity of a photon is c.
C. The momentum of a photon, $p = \frac{h\nu}{c}$
D. In a photon-electron collision, both total energy and total momentum are conserved.
E. Photon possesses positive charge.

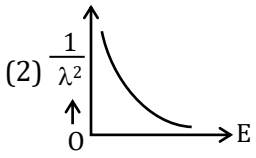
Choose the correct answer from the options given below :

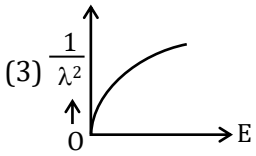
(1) A and B only (2) A, B, C and D only
(3) A, C and D only (4) A, B, D and E only

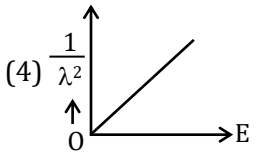
PMD092

34. The graph which shows the variation of $\left(\frac{1}{\lambda^2}\right)$ and its kinetic energy, E is (where λ is de Broglie wavelength of a free particle) :

(1) 

(2) 

(3) 

(4) 

PMD093

RE-NEET(UG) 2024

35. An electron and an alpha particle are accelerated by the same potential difference. Let λ_e and λ_α denote the de Broglie wavelengths of the electron and the alpha particle, respectively then :

(1) $\lambda_e > \lambda_\alpha$ (2) $\lambda_e = 4\,\lambda_\alpha$
(3) $\lambda_e = \lambda_\alpha$ (4) $\lambda_e < \lambda_\alpha$

PMD094

36. If ϕ is the work function of photosensitive material in eV and light of wavelength of numerical value $\lambda = \frac{hc}{e}$ metre, is incident on it with energy above its threshold value at an instant then the maximum kinetic energy of the photo-electron ejected by it at that instant (Take h - Planck's constant, c - velocity of light in free space) is (in SI units) :

(1) e + 2ϕ (2) 2e – ϕ (3) e – ϕ (4) e + ϕ

PMD095

EXERCISE-II (Previous Year Questions) ANSWER KEY

Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Answer	2	2	2	1	1	1	4	2	1	4	2	1	4	1	1
Question	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Answer	2	4	1	4	4	1	1	1	4	3	3	Bonus	2	3	4
Question	31	32	33	34	35	36									
Answer	4	2	2	4	1	3									

Exercise - III (Analytical Questions) Master Your Understanding

1. The work function of caesium (Cs) metal is 2 eV. When monochromatic radiation beam of intensity 60 kWm^{-2} and frequency 6×10^{14}Hz, is falling normally on Cs plate of 6.6 cm^2 in a photocell then
(a) Energy of a photoelectron may be 8×10^{-20} J
(b) Stopping potential is 0.48 V
(c) Saturation current is 16 A
Correct choices are
(1) Only b (2) Only b & c
(3) Only a & b (4) a, b, & c

PMD096

2. Two statements are given below :
Statement I : Photosensitivity of a metal is high, if its work function is low.
Statement II : Work function for a metal is given by hv_0, where v_o is threshold frequency.
Considering the above, choose the appropriate answer from the options given below :
(1) Both statement I and statement II are correct.
(2) Statement I is correct and statement II is incorrect.
(3) Statement I is incorrect and statement II is correct.
(4) Both statements I and statements II are incorrect.

PMD097

3. Given below are two statements: One is labelled as **Assertion (A)** and the other is labelled as **Reason (R).**
Assertion (A) : Two photons each of energy 3 eV, can't eject electrons from a surface of work function 5 eV.
Reason (R) : Only a photon of energy greater than work function may emit photoelectron.
In the light of the above statements, choose the most appropriate answer from the options given below:
(1) Both **(A)** and **(R)** are true and **(R)** is the correct explanation of **(A)**.
(2) Both **(A)** and **(R)** are true and **(R)** is NOT the correct explanation of **(A)**.
(3) **(A)** is true but **(R)** is false.
(4) **(A)** is false but **(R)** is true.

PMD098

4. On a photosensitive surface of threshold wavelength 5λ, two different monochromatic beams of wavelengths 3λ and λ are incident, one after another, then match the ratio of physical quantities specified in column – I to the ratio values given in column – II

	Column I		Column II
(a)	Maximum KE of photo electrons	(i)	1 : 3
(b)	Speed of incident photons	(ii)	1 : 6
(c)	Momentum of incident photons	(iii)	$1:\sqrt{6}$
(d)	Fastest speeds of photo electrons	(iv)	1 : 1

Choose the correct answer from the option given below :
(1) (a) – iii, (b) – ii, (c) – i, (d) – iv
(2) (a) – ii, (b) – iv, (c) – iii, (d) – i
(3) (a) – ii, (b) – iv, (c) – i, (d) – iii
(4) (a) – i, (b) – ii, (c) – iv, (d) – iii

PMD099

5. Match the column I with column II –

	Column-I		Column-II
(A)	Force between a proton and a proton inside nucleus	(P)	Gravitational force
(B)	Force between a proton and a neutron inside nucleus	(Q)	Electrostatic force
(C)	Force on an electron in an atom	(R)	Strong force
(D)	Conservative force	(S)	Weak force

Options :-
(1) A → PQR, B → PR, C → PQ, D → PQ
(2) A → R, B → R, C → Q, D → RS
(3) A → PQR, B → PQR, C → PQ, D → RS
(4) A → PQR, B → P, C → PQ, D → RS

PMD100

6. A proton and an electron both have energy 50 eV.

Statement I : Both have different wavelengths.

Statement II : Wavelength depends on energy, not on mass.

In light of above statement choose the most **appropriate** answer from the options given below:

(1) Both statement I and statement II are correct.

(2) Statement I is correct and statement II is incorrect.

(3) Statement I is incorrect and statement II is correct.

(4) Both statements I and statements II are incorrect.

PMD101

7. Match the following ratio of De–Broglie wavelengths of a proton and α particle, when both

	List-I		List-II
A	Have same speed	(p)	2 : 1
B	Have same potential difference	(q)	1 : 1
C	Have same kinetic energy.	(r)	4 : 1
D	Have same linear momentum	(s)	$2\sqrt{2}:1$

	A	B	C	D
1	p	q	r	s
2	r	s	p	q
3	p	r	q	s
4	r	q	s	p

PMD102

8. The wavelength of a photon is twice the de Broglie wavelength of an electron. The speed of the electron is $v_e = \frac{c}{100}$ then,

(a) $\frac{E_e}{E_p} = 10^{-4}$

(b) $\frac{E_e}{E_p} = 10^{-2}$

(c) $\frac{p_e}{m_e c} = 10^{-2}$

(d) $\frac{p_e}{m_e c} = 10^{-4}$

(1) a, c, d (2) b, c

(3) c, d (4) a, b, c

PMD103

EXERCISE-III (Analytical Questions) ANSWER KEY

Question	1	2	3	4	5	6	7	8
Answer	4	1	1	3	1	2	2	2

Exercise - I (Conceptual Questions) Build Up Your Understanding

NUCLEAR PHYSICS

1. Let F_{pp}, F_{pn} and F_{nn} denote the nuclear force between proton–proton, proton–neutron and neutron–neutron pair respectively. When separation is 1 fm :-

(1) $F_{pp} < F_{pn} = F_{nn}$ (2) $F_{pp} > F_{pn} = F_{nn}$

(3) $F_{pp} = F_{pn} = F_{nn}$ (4) $F_{pp} < F_{pn} < F_{nn}$

PMD127

2. A nuclear fission is given below

$$A^{240} \rightarrow B^{100} + C^{140} + Q(\text{energy})$$

Let binding energy per nucleon of nucleus A, B and C is 7.6 MeV, 8.1 MeV and 8.1 MeV respectively. Value of Q is :-(Approximately)

(1) 20 MeV (2) 220 MeV

(3) 120 MeV (4) 240 MeV

PMD128

3. How much energy will be released when 10 kg of U^{235} is completely converts into energy :-

(1) 5×10^{27} MeV (2) 5×10^{24} MeV

(3) 9×10^{17} J (4) All of these

PMD129

4. How much energy is released when 2 mole of U^{235} is fissioned :-

(1) 10^{24} MeV (2) 24×10^{25} MeV

(3) 10^{24} J (4) 10^{24} kWh

PMD130

5. As the mass number increases, binding energy per nucleon :-

(1) increases

(2) decreases

(3) remains same

(4) may increase or may decrease

PMD131

6. Possible forces on a proton by a proton in a nucleus is/are :-

(1) Coulomb force (2) Nuclear force

(3) Gravitational force (4) All of these

PMD132

7. The energy radiated by a red giant star produces by :-

(1) Fission process

(2) Fusion process

(3) Chemical burning of hydrogen

(4) Gravitational contraction

PMD133

8. In the process of atomic explosion, the most of fission energy is released in the form of :–

(1) γ - rays

(2) Kinetic energy of products

(3) Infra red rays

(4) Visible light

PMD134

9. Which of the following nucleus is fissionable by slow neutrons :-

(1) $_{92}U^{238}$ (2) $_{93}Np^{239}$

(3) $_{92}U^{235}$ (4) $_{2}He^{4}$

PMD135

10. The example of nuclear fusion is .

(1) formation of barium and krypton from uranium

(2) formation of helium from hydrogen

(3) formation of plutonium –235 from uranium –235

(4) formation of water from hydrogen and oxygen

PMD136

11. Electron - positron pair can be created by γ-rays. In this process the minimum energy of γ-rays should be :-

(1) 5.0 MeV (2) 4.02 MeV

(3) 15.0 MeV (4) 1.02 MeV

PMD137

12. For nuclear reaction :

$$_{92}U^{235} + {}_{0}n^{1} \rightarrow {}_{56}Ba^{144} + \ldots\ldots\ldots + 3\ {}_{0}n^{1}$$

(1) $_{26}Kr^{89}$ (2) $_{36}Kr^{89}$

(3) $_{26}Sr^{90}$ (4) $_{38}Sr^{89}$

PMD138

13. For the given reaction, the particle X is -

$_6C^{11} \rightarrow {}_5B^{11} + \beta^+ + X$

(1) Neutron (2) Anti neutrino
(3) Neutrino (4) Proton

PMD139

14. In a breeder reactor, useful fuel obtained from U^{238} is :

(1) Ac^{233} (2) Th^{238}
(3) U^{235} (4) Pu^{239}

PMD140

15. Boron used in Atomic Reactor for:-

(1) absorbption of neutrons
(2) absorbption of α - particles
(3) speed up the reaction
(4) change the reaction

PMD141

16. Who discovered the nuclear fission :-

(1) Otto Hahn and strassman
(2) Fermi
(3) Baithe
(4) Rutherford

PMD142

17. Which one is best neutron moderator in all respects:

(1) Barium oxide (2) Water
(3) Graphite (4) Heavy water

PMD143

18. X(n, α) ^7_3Li , then the element X will be :–

(1) $^{10}_5B$ (2) ^9_5B (3) $^{11}_4Be$ (4) ^4_2He

PMD144

19. M_n and M_p represent the mass of neutron and proton respectively. An element having nuclear mass M has N neutrons and Z-protons, then the correct relation will be :-

(1) $M<\{N.M_n+Z.M_p\}$ (2) $M>\{N.M_n+Z.M_p\}$
(3) $M=\{N.M_n+Z.M_p\}$ (4) $M=N\{M_n + M_p\}$

PMD145

20. Energy is released in nuclear fission is due to

(a) Few mass is converted into energy
(b) Total binding energy of fragments is more than the B.E. of parental element
(c) Total B.E. of fragments is less than the B.E. of parental element
(d) Total B.E. of fragments is equals to the B.E. of parental element is

(1) a,c (2) a,b (3) a,d (4) All

PMD146

21. Energy in an atom bomb is produced by the process of :

(1) nuclear fusion
(2) nuclear fission
(3) combination of hydrogen atoms
(4) combination of electrons and protons

PMD147

22. Assuming that 200 MeV of energy is released per fission of $_{92}U^{235}$ atom. Find the number of fission per second required to release 1 kW power :-

(1) 3.125×10^{13} (2) 3.125×10^{14}
(3) 3.125×10^{15} (4) 3.125×10^{16}

PMD148

23. 1 a.m.u. (1.66×10^{-27} kg) is equal to

(1) 139 MeV/c^2 (2) 39 MeV/c^2
(3) 93 MeV/c^2 (4) 931 MeV/c^2

PMD149

24. In nuclear fission the percentage of mass converted into energy is about :-

(1) 0.1% (2) 1%
(3) 10% (4) 0.01%

PMD150

25. Which of the following are suitable for the fusion process :-

(1) Light nuclei
(2) heavy nuclei
(3) Element must be lying in the middle of the periodic table
(4) Middle elements, which are lying on binding energy curve

PMD151

26. Which one of the following particle is unstable?

(1) α-particle (2) electron
(3) proton (4) neutron

PMD152

27. Which of the following is weakest force :-
(1) Gravitational force
(2) Electric force
(3) Magnetic force
(4) Nuclear force

PMD153

28. The volume occupied by an atom is greater than the volume of the nucleus by a factor of about :-
(1) 10^1 (2) 10^5 (3) 10^{10} (4) 10^{15}

PMD154

29. The mass of proton is 1.0073 u and that of neutron is 1.0087 u (u = atomic mass unit). The binding energy of $_2{}^4He$ is :-
(1) 0.0305 J (2) 0.0305 erg
(3) 28.4 MeV (4) 0.061 u
(Given:- mass of helium nucleus 4.0015 u)

PMD155

30. The mass number of a nucleus is
(1) always less than its atomic number
(2) always more than its atomic number
(3) may equal to its atomic number
(4) sometimes less than and sometimes more than its atomic number

PMD156

31. In the following reaction X is :–
$_{20}Ca^{40} + X \rightarrow {}_{21}Sc^{43} + {}_1H^1$
(1) Electron (2) Positron
(3) alpha particle (4) Proton

PMD157

32. Nuclear fusion is possible :–
(1) only between light nuclei.
(2) only between heavy nuclei.
(3) between both light and heavy nuclei.
(4) only between nuclei which are stable against β–decay.

PMD158

33. The order of nuclear density is
(1) 10^{13} kg/m^3 (2) 10^{15} kg/m^3
(3) 10^{17} kg/m^3 (4) 10^{19} kg/m^3

PMD159

34. Two light nuclei of masses m_1 and m_2 are fused to form a more stable nucleus of mass m_3 then:-
(1) $m_3 = |m_1 - m_2|$ (2) $m_3 < (m_1 + m_2)$
(3) $m_3 > (m_1 + m_2)$ (4) $m_3 = m_1 + m_2$

PMD160

35. A nucleus represented by the symbol $_Z^AX$ has :-
(1) Z protons and A – Z neutrons
(2) Z protons and A neutrons
(3) A protons and Z – A neutrons
(4) Z neutrons and A – Z protons

PMD161

36. M_p denotes the mass of a proton and M_n that of a neutron. A given nucleus, of binding energy B, contains Z protons and N neutrons. The mass M (N, Z) of the nucleus is given by (c is velocity of light) :-
(1) $M(N, Z) = NM_n + ZM_p + Bc^2$
(2) $M(N, Z) = NM_n + ZM_p - B/c^2$
(3) $M(N, Z) = NM_n + ZM_p + B/c^2$
(4) $M(N, Z) = NM_n + ZM_p - Bc^2$

PMD162

37. Mass equivalent to energy 931 MeV is
(1) 6.02×10^{-27} kg (2) 1.66×10^{-27} kg
(3) 16.66×10^{-26} kg (4) 6.02×10^{-26} kg

PMD163

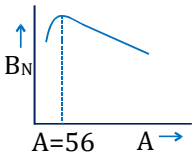
38. One milligram of matter converted into energy will give
(1) 9 J (2) 9×10^{13} J
(3) 9×10^5 J (4) 9×10^{10} J

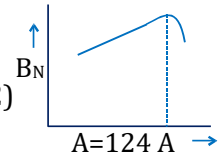
PMD164

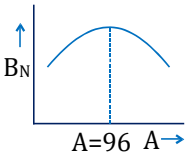
39. Force acting on proton-proton inside a nucleus is–
(1) Nuclear force > electric force
(2) Electric force > Nuclear force
(3) Gravitational force > Nuclear force
(4) None of the above

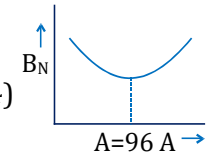
PMD165

40. The dependence of binding energy per nucleon (B_N) on the mass number (A), is represented by

(1) 

(2) 

(3) 

(4) 

PMD166

41. Which one of the following pairs of nuclei are isotones :-

(1) $_{34}Se^{74}$, $_{31}Ga^{71}$ (2) $_{38}Sr^{84}$, $_{38}Sr^{86}$

(3) $_{42}Mo^{92}$, $_{40}Zr^{92}$ (4) $_{20}Ca^{40}$, $_{16}S^{32}$

PMD167

42. Which one of the following is a possible nuclear reaction :-

(1) $^{10}_{5}B + {}^{4}_{2}He \longrightarrow {}^{13}_{7}N + {}^{1}_{1}H$

(2) $^{23}_{11}Na + {}^{1}_{1}H \longrightarrow {}^{22}_{10}Ne + {}^{4}_{2}He$

(3) $^{239}_{93}Np \longrightarrow {}^{239}_{94}Pu + \beta^- + \bar{\nu}$

(4) $^{11}_{7}N + {}^{1}_{1}H \longrightarrow {}^{12}_{6}C + \beta^- + \nu$

PMD168

43. In the reaction $^{2}_{1}H + {}^{3}_{1}H \rightarrow {}^{4}_{2}He + {}^{1}_{0}n$. If the binding energies of $^{2}_{1}H$, $^{3}_{1}H$ and $^{4}_{2}He$ are respectively a, b and c (in MeV), then the energy (in MeV) released in this reaction is

(1) a + b + c (2) c + a – b

(3) c – a – b (4) a + b + c

PMD169

44. In any fission process the ratio $\frac{\text{mass of fission products}}{\text{mass of parent nucleus}}$ is –

(1) Greater than 1

(2) Depends on the mass of the parent nucleus

(3) Equal to 1

(4) Less than 1

PMD170

45. Fission of nuclei is possible because the binding energy per nucleon in them –

(1) Decreases with mass number at low mass numbers.

(2) Increases with mass number at low mass numbers.

(3) Decreases with mass number at high mass numbers.

(4) Increases with mass number at high mass numbers.

PMD171

46. The main function of moderators in nuclear reactors is to :-

(1) decrease the energy of neutrons

(2) absorb the extra neutrons

(3) provide shield from nuclear radiations

(4) provide cooling

PMD172

RADIOACTIVITY

47. Which spectrum is continuous

(1) α–rays (2) β–rays

(3) γ–rays (4) All of these

PMD173

48. Which statement about radioactive radiations is true

(1) Speed of α-particles is a characteristic property.

(2) Speed of β-particles is a characteristic property.

(3) Speed of γ-photon is a characteristic property.

(4) All of these.

PMD174

49. Which one moves with greatest speed :-

(1) α-rays (2) β–rays

(3) γ–rays (4) cathode rays

PMD175

50. If a nucleus is emitting e^- particle, its neutron to proton ratio (n/p) will :–

(1) Increase.

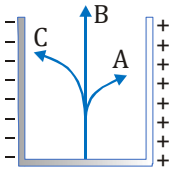
(2) Decrease

(3) Remain unchanged

(4) Can't be determined.

PMD176

51. A radioactive source is kept in an uniform electric field α, β and γ- particle are emitting. α,β,γ are respectively :-



(1) A,B,C (2) A,C,B (3) C,A,B (4) C,B,A

PMD177

52. A radioactive element $_{90}X^{238}$ decays in to $_{83}Y^{222}$. The number of β - particles emitted is:

(1) 2 (2) 4 (3) 6 (4) 1

PMD178

53. A radioactive reaction is $_{92}U^{238} \rightarrow {}_{82}Pb^{206}$. How many α and β particles are emitted ?

(1) 10α, 6β

(2) 4 proton, 8 neutron

(3) 6 electron, 8 proton

(4) 6β, 8α

PMD179

54. Which rays contain (+ Ve) charged particle:–

(1) α–rays (2) β–rays

(3) γ–rays (4) X–rays

PMD180

55. When $_{90}Th^{238}$ changes into $_{83}Bi^{222}$, then the number of emitted α and β-particles are :-

(1) 8α, 7β (2) 4α, 7β

(3) 4α, 4β (4) 4α, 1β

PMD181

56. A radioactive nucleus decay as follows :-

$X \xrightarrow{\alpha} X_1 \xrightarrow{\beta} X_2 \xrightarrow{\alpha} X_3 \xrightarrow{\gamma} X_4$,

if the atomic number and the mass number of X are 72 and 180 then the mass number and atomic number of X_4 are :-

(1) 172, 70 (2) 171, 69

(3) 172, 69 (4) 172, 68

PMD182

57. Which of the following ray are **not** electromagnetic waves :-

(1) X-rays (2) γ-rays

(3) β-rays (4) Heat rays

PMD183

58. A nuclear reaction given by

$_ZX^A \rightarrow {}_{Z+1}Y^A + {}_{-1}e^0 + \bar{\nu}$ represents.

(1) β-decay (2) γ-decay

(3) fusion (4) fission

PMD184

59. Which of the following radiations gets deflected by a magnetic field ?

(1) X-rays (2) γ-rays

(3) β-rays (4) radio waves

PMD185

60. α–Particles can be detected using :–

(1) Thin aluminium sheet

(2) Barium sulphate

(3) Zinc sulphide screen

(4) Gold foil

PMD186

EXERCISE-I (Conceptual Questions) ANSWER KEY

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

Exercise - II (Previous Year Questions) AIPMT/NEET

AIPMT 2014

1. The Binding energy per nucleon of $^{7}_{3}Li$ and $^{4}_{2}He$ nuclei are 5.60 MeV and 7.06 MeV, respectively. In the nuclear reaction $^{7}_{3}Li + {}^{1}_{1}H \rightarrow 2\,{}^{4}_{2}He + Q$, the value of energy Q released is:-

(1) 19.6 MeV (2) –2.4 MeV
(3) 8.4 MeV (4) 17.3 MeV

PMD187

AIPMT 2015

2. If radius of the $^{27}_{13}Al$ nucleus is taken to be R_{Al} then the radius of $^{125}_{53}Te$ nucleus is nearly :

(1) $\frac{5}{3}R_{Al}$ (2) $\frac{3}{5}R_{Al}$

(3) $\left(\frac{13}{53}\right)^{1/3}R_{Al}$ (4) $\left(\frac{53}{13}\right)^{1/3}R_{Al}$

PMD188

RE-AIPMT 2015

3. A nucleus of uranium decays at rest into nuclei of Thorium and Helium. Then :-

(1) The Helium nucleus has less kinetic energy than the Thorium nucleus
(2) The Helium has more kinetic energy than the Thorium nucleus.
(3) The Helium nucleus has less momentum than the Thorium nucleus.
(4) The Helium nucleus has more momentum than the Thorium nucleus.

PMD189

NEET(UG) 2019

4. α-particle consists of :

(1) 2 protons and 2 neutrons only
(2) 2 electrons, 2 protons and 2 neutrons
(3) 2 electrons and 4 protons only
(4) 2 protons only

PMD190

NEET(UG) 2020

5. When a uranium isotope $^{235}_{92}U$ is bombarded with a neutron, it generates $^{89}_{36}Kr$, three neutrons and:

(1) $^{103}_{36}Kr$ (2) $^{144}_{56}Ba$
(3) $^{91}_{40}Zr$ (4) $^{101}_{36}Kr$

PMD191

6. The energy equivalent of 0.5 g of a substance is:

(1) 0.5×10^{13} J (2) 4.5×10^{16} J
(3) 4.5×10^{13} J (4) 1.5×10^{13} J

PMD192

NEET(UG) 2020 (COVID-19)

7. What happens to the mass number and atomic number of an element when it emits γ-radiation?

(1) Mass number decreases by four and atomic number decreases by two.
(2) Mass number and atomic number remain unchanged.
(3) Mass number remains unchanged while atomic number decreases by one.
(4) Mass number increases by four and atomic number increases by two.

PMD193

NEET(UG) 2021

8. A nucleus with mass number 240 breaks into two fragments each of mass number 120, the binding energy per nucleon of unfragmented nuclei is 7.6 MeV while that of fragments is 8.5 MeV. The total gain in the Binding Energy in the process is :

(1) 0.9 MeV (2) 9.4 MeV
(3) 804 MeV (4) 216 MeV

PMD194

9. A radioactive nucleus $^{A}_{Z}X$ undergoes spontaneous decay in the sequence $^{A}_{Z}X \rightarrow {}_{Z-1}B \rightarrow {}_{Z-3}C \rightarrow {}_{Z-2}D$, where Z is the atomic number of element X. The possible decay particles in the sequence are :

(1) α, β^-, β^+ (2) α, β^+, β^-
(3) β^+, α, β^- (4) β^-, α, β^+

PMD195

NEET(UG) 2022

10. In the given nuclear reaction, the element X is:

$^{22}_{11}Na \rightarrow X + e^{+} + \nu$

(1) $^{23}_{10}Ne$ (2) $^{22}_{10}Ne$ (3) $^{22}_{12}Mg$ (4) $^{23}_{11}Na$

PMD196

11. A nucleus of mass number 189 splits into two nuclei having mass number 125 and 64. The ratio of radius of two daughter nuclei respectively is:

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

(3) 25 : 16 (4) 1 : 1

PMD197

NEET(UG) 2024

12. $^{290}_{82}X \xrightarrow{\alpha} Y \xrightarrow{e^{+}} Z \xrightarrow{\beta^{-}} P \xrightarrow{e^{-}} Q$

In the nuclear emission stated above, the mass number and atomic number of the product Q respectively, are :

(1) 280, 81 (2) 286, 80

(3) 288, 82 (4) 286, 81

PMD198

RE-NEET(UG) 2024

13. Select the correct statements among the following :

A. Slow neutrons can cause fission in $^{235}_{92}U$ than fast neutrons.

B. α-rays are helium nuclei

C. β-rays are fast moving electrons or positrons.

D. γ-rays are electromagnetic radiations of wavelengths larger than X-rays.

Choose the **most appropriate** answer from the options given below :

(1) A, B and C only

(2) A, B and D only

(3) A and B only

(4) C and D only

PMD199

EXERCISE-II (Previous Year Questions) ANSWER KEY

Question	1	2	3	4	5	6	7	8	9	10	11	12	13
Answer	4	1	2	1	2	3	2	4	3	2	2	4	1

Exercise - III (Analytical Questions) Master Your Understanding

1. Given below are two statements: One is labelled as **Assertion (A)** and the other is labelled as **Reason (R).**

Assertion (A) : Radioactive nuclei emits β^-particle.

Reason (R) : Electrons exist inside the nucleus

In the light of the above statements, choose the most appropriate answer from the options given below:

(1) Both **(A)** and **(R)** are true and **(R)** is the correct explanation of **(A)**.

(2) Both **(A)** and **(R)** are true and **(R)** is NOT the correct explanation of **(A)**.

(3) **(A)** is true but **(R)** is false.

(4) **(A)** is false but **(R)** is true.

PMD200

2. Match the following

	List-I		List-II
a	$n \rightarrow p +$	(p)	α–decay
b	$p \rightarrow n +$	(q)	Positron emission
c	x–ray emission	(r)	β^-emission
d	$^{226}_{88}Ra \rightarrow ^{222}_{86}Rn +$ ___	(s)	K electron capture

(1) $a \rightarrow r, b \rightarrow q, c \rightarrow q, d \rightarrow s$

(2) $a \rightarrow q, b \rightarrow r, c \rightarrow s, d \rightarrow p$

(3) $a \rightarrow r, b \rightarrow q, c \rightarrow s, d \rightarrow p$

(4) $a \rightarrow q, b \rightarrow s, c \rightarrow r, d \rightarrow p$

PMD201

3. When a nucleus with atomic number Z and mass number A undergoes a radioactive decay process:

(A) both Z and A will decrease if the process is α– decay

(B) Z will decrease but A will not change if process is β^+ decay

(C) Z will decrease but A will not change if process is β^- decay.

(D) Z and A will remain unchanged if process is γ–decay.

Choose the correct statement :

(1) Only A (2) B, C, D

(3) A, D (4) A, B, D

PMD202

4. Choose correct statement/statements :

(a) Nuclear force is independent of charge of nucleons.

(b) Nuclear force has saturation property.

(c) Nuclear force is always Attractive is nature.

(d) Nuclear force exists in range of femtometre.

(1) a,b,c (2) a,b,d

(3) b,c,d (4) a, c, d

PMD203

5. Match the following column:

For two nuclei having mass number 2 and 16

(i) Ratio of nuclear radii	(p) 1 : 8
(ii) Ratio of densities	(q) 1 : 2
(iii) Ratio of volumes	(r) 1 : 1
(iv) Ratio of masses	(s) 1 : 8

(1) (i) $\rightarrow$ q, (ii) $\rightarrow$ r, (iii) $\rightarrow$ s, (iv) $\rightarrow$ p

(2) (i) $\rightarrow$ r, (ii) $\rightarrow$ s, (iii) $\rightarrow$ p, (iv) $\rightarrow$ q

(3) (i) $\rightarrow$ p, (ii) $\rightarrow$ q, (iii) $\rightarrow$ r, (iv) $\rightarrow$ s

(4) (i) $\rightarrow$ r, (ii) $\rightarrow$ p, (iii) $\rightarrow$ s, (iv) $\rightarrow$ q

PMD204

6. Given below are two statements: One is labelled as **Assertion (A)** and the other is labelled as **Reason (R).**

Assertion (A) : Fission reactions are exothermic

Reason (R) : Total mass of fragments is lesser than the total mass of reactants.

In the light of the above statements, choose the most appropriate answer from the options given below:

(1) Both **(A)** and **(R)** are true and **(R)** is the correct explanation of **(A)**.

(2) Both **(A)** and **(R)** are true and **(R)** is NOT the correct explanation of **(A)**.

(3) **(A)** is true but **(R)** is false.

(4) **(A)** is false but **(R)** is true.

PMD205

7. Given below are two statements

Statement I : Binding energy per nucleon is more important than binding energy.

Statement II : Binding energy per nucleon is measurement of nuclear stability.

In light of above statement choose the most **appropriate** answer from the options given below:

(1) Both statement I and statement II are correct.

(2) Statement I is correct and statement II is incorrect.

(3) Statement I is incorrect and statement II is correct.

(4) Both statements I and statements II are incorrect.

PMD206

EXERCISE-III (Analytical Questions) ANSWER KEY

Question	1	2	3	4	5	6	7
Answer	3	3	4	2	1	1	1

Important Notes

Exercise - I (Conceptual Questions) Build Up Your Understanding

ATOMIC STRUCTURE

1. What is the wavelength of the least energetic photon emitted in the Lyman series of the hydrogen atom spectrum ?
(1) 150 nm (2) 122 nm
(3) 102 nm (4) 82 nm
PMD220

2. What is the ratio of the shortest wavelength of the Balmer series to the shortest wavelength of the Lyman series ?
(1) 4 : 1 (2) 4 : 3 (3) 4 : 9 (4) 5 : 9
PMD221

3. Kinetic energy for Hydrogen atom in first Bohr's orbit is–
(1) – 13.6 eV (2) 13.6 eV
(3) –27.2 eV (4) –6.5 eV
PMD222

4. According to Bohr Model for Hydrogen, energy is proportional to :
(1) $-Z^2 / n$ (2) $- n/Z^2$
(3) $-Z^2/n^2$ (4) $-n^2/Z$
PMD223

5. In above question radius is related as :-
(1) n^2 / Z (2) $\frac{n}{Z}$
(3) $\frac{n}{Z^2}$ (4) $\frac{n^2}{Z^2}$
PMD224

6. If ionization potential of Hydrogen atom is 13.6 V then what is ionization potential of He atom?
(1) 27.6 V (2) 13.6 V
(3) 54.2 V (4) None of these
PMD225

7. Which of the following statements is correct?
(1) Lyman series is continuous
(2) Balmer series lies in ultraviolet region
(3) Paschen series lies in infrared region
(4) Brackett series lies in visible region
PMD226

8. According to the Bohr theory of Hydrogen atom, the speed of the electron, its energy and the radius of its orbit varies with the principal quantum number n, respectively, as
(1) $\frac{1}{n}, \frac{1}{n^2}, n^2$ (2) $\frac{1}{n}, n^2, \frac{1}{n^2}$
(3) $n^2, \frac{1}{n^2}, n^2$ (4) $n, \frac{1}{n^2}, \frac{1}{n^2}$
PMD227

9. If the ionization potential of hydrogen atom is 13.6 eV, its energy in the n = 3 is approximately
(1) – 1.14 eV (2) – 1.51 eV
(3) –3.4 eV (4) – 4.53 eV
PMD228

EXERCISE-I (Conceptual Questions) ANSWER KEY

Question	1	2	3	4	5	6	7	8	9
Answer	2	1	2	3	1	3	3	1	2

Exercise - II (Previous Year Questions) AIPMT/NEET

AIPMT 2014

1. Hydrogen atom is ground state is excited by a monochromatic radiation of λ = 975 Å. Number of spectral lines in the resulting spectrum emitted will be :-

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

PMD229

AIPMT 2015

2. Consider 3rd orbit of He^+ (Helium), using non-relativistic approach, the speed of electron in this orbit will be [given K = 9×10^9 constant, Z = 2 and h (Planck's Constant) = 6.6×10^{-34} J s]

(1) 1.46×10^6 m/s

(2) 0.73×10^6 m/s

(3) 3.0×10^8 m/s

(4) 2.92×10^6 m/s

PMD230

RE-AIPMT 2015

3. In the spectrum of hydrogen, the ratio of the longest wavelength in the Lyman series to the longest wavelength in the Balmer series is :

(1) $\frac{5}{27}$ (2) $\frac{4}{9}$

(3) $\frac{9}{4}$ (4) $\frac{27}{5}$

PMD231

NEET-I 2016

4. When an α-particle of mass 'm' moving with velocity 'v' bombards on a heavy nucleus of charge 'Ze', its distance of closest approach from the nucleus depends on m as :

(1) $\frac{1}{m}$ (2) $\frac{1}{\sqrt{m}}$

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

PMD232

5. Given the value of Rydberg constant is $10^7 m^{-1}$, the wave number of the last line of the Balmer series in hydrogen spectrum will be :-

(1) 0.025×10^4 m^{-1} (2) 0.5×10^7 m^{-1}

(3) 0.25×10^7 m^{-1} (4) 2.5×10^7 m^{-1}

PMD233

NEET-II 2016

6. If an electron in a hydrogen atom jumps from the 3rd orbit to the 2nd orbit, it emits a photon of wavelength λ. When it jumps from the 4th orbit to the 3rd orbit, the corresponding wavelength of the photon will be :-

(1) $\frac{20}{7}\lambda$ (2) $\frac{20}{13}\lambda$

(3) $\frac{16}{25}\lambda$ (4) $\frac{9}{16}\lambda$

PMD234

NEET(UG) 2017

7. The ratio of wavelengths of the last line of Balmer series and the last line of Lyman series is:-

(1) 1 (2) 4 (3) 0.5 (4) 2

PMD235

NEET(UG) 2018

8. The ratio of kinetic energy to the total energy of an electron in a Bohr orbit of the hydrogen atom, is :-

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

PMD236

NEET(UG) 2019

9. The total energy of an electron in an atom in an orbit is –3.4 eV. Its kinetic and potential energies are, respectively:

(1) –3.4 eV, –3.4 eV

(2) –3.4 eV, –6.8 eV

(3) 3.4 eV, –6.8 eV

(4) 3.4 eV, 3.4 eV

PMD237

NEET(UG) 2019 (Odisha)

10. The radius of the first permitted Bohr orbit for the electron, in a hydrogen atom equals 0.51 Å and its ground state energy equals –13.6 eV. If the electron in the hydrogen atom is replaced by muon(μ^-) [charge same as electron and mass 207 m_e], the first Bohr radius and ground state energy will be :

(1) 0.53×10^{-13} m, –3.6 eV

(2) 25.6×10^{-13} m, –2.8 eV

(3) 2.56×10^{-13} m, –2.8 keV

(4) 2.56×10^{-13} m, –13.6 eV

PMD238

NEET(UG) 2020

11. For which one of the following, Bohr model in **not** valid ?

(1) Singly ionised neon atom (Ne^+)

(2) Hydrogen atom

(3) Singly ionised helium atom (He^+)

(4) Deuteron atom

PMD239

NEET(UG) 2020 (COVID-19)

12. The total energy of an electron in the n^{th} stationary orbit of the hydrogen atom can be obtained by

(1) $E_n = \frac{13.6}{n^2}$ eV (2) $E_n = -\frac{13.6}{n^2}$ eV

(3) $E_n = -\frac{1.36}{n^2}$ eV (4) $E_n = -13.6 \times n^2$ eV

PMD240

NEET(UG) 2021

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

PMD241

RE-NEET(UG) 2022

14. Let R_1 be the radius of the second stationary orbit and R_2 be the radius of the fourth stationary orbit of an electron in Bohr's model. The ratio $\frac{R_1}{R_2}$ is :

(1) 0.25 (2) 0.5

(3) 2 (4) 4

PMD242

NEET(UG) 2023

15. The radius of inner most orbit of hydrogen atom is 5.3×10^{-11} m. What is the radius of third allowed orbit of hydrogen atom ?

(1) 1.06 Å (2) 1.59 Å

(3) 4.77 Å (4) 0.53 Å

PMD243

RE-NEET(UG) 2023

16. The ground state energy of hydrogen atom is –13.6 eV. The energy needed to ionize hydrogen atom from its second excited state will be :

(1) 13.6 eV (2) 6.8 eV

(3) 1.51 eV (4) 3.4 eV

PMD244

17. The wavelength of Lyman series of hydrogen atom appears in:

(1) visible region

(2) far infrared region

(3) ultraviolet region

(4) infrared region

PMD245

NEET(UG) 2024

18. Given below are two statements :

Statement I : Atoms are electrically neutral as they contain equal number of positive and negative charges.

Statement II : Atoms of each element are stable and emit their characteristic spectrum.

In the light of the above statements, choose the *most appropriate* answer from the options given below :

(1) Both Statement I and Statement II are correct.
(2) Both Statement I and Statement II are incorrect.
(3) Statement I is correct but Statement II is incorrect.
(4) Statement I is incorrect but Statement II is correct.

PMD246

19. Match List I with List II.

List I (Spectral Lines of Hydrogen for transitions from)	**List II (Wavelengths (nm))**
A. $n_2 = 3$ to $n_1 = 2$	I. 410.2
B. $n_2 = 4$ to $n_1 = 2$	II. 434.1
C. $n_2 = 5$ to $n_1 = 2$	III. 656.3
D. $n_2 = 6$ to $n_1 = 2$	IV. 486.1

Choose the correct answer from the options given below :
(1) A–II, B–I, C–IV, D–III
(2) A–III, B–IV, C–II, D–I
(3) A–IV, B–III, C–I, D–II
(4) A–I, B–II, C–III, D–IV

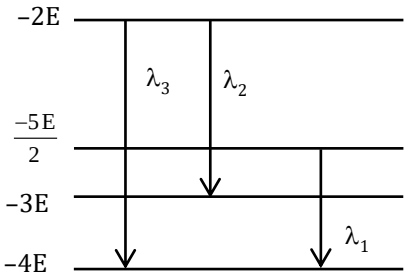
PMD247

RE-NEET(UG) 2024

20. The spectral series which corresponds to the electronic transition from the levels $n_2 = 5,6,...$ to the level $n_1 = 4$ is:
(1) Pfund series
(2) Brackett series
(3) Lyman series
(4) Balmer series

PMD248

21. Some energy levels of a molecule are shown in the figure with their wavelengths of transitions. Then :



(1) $\lambda_3 > \lambda_2, \lambda_1 = 2\lambda_2$
(2) $\lambda_3 > \lambda_2, \lambda_1 = 4\lambda_2$
(3) $\lambda_1 > \lambda_2, \lambda_2 = 2\lambda_3$
(4) $\lambda_2 > \lambda_1, \lambda_2 = 2\lambda_3$

PMD249

EXERCISE-II (Previous Year Questions) ANSWER KEY

Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Answer	3	1	1	1	3	1	2	2	3	3	1	2	3	1	3
Question	16	17	18	19	20	21									
Answer	3	3	3	2	2	4									