NEET ANSWER KEY & SOLUTIONS

SUBJECT :- PHYSICS

CLASS :- 12th **PAPER CODE :- CWT-10**

CHAPTER :- MODERN PHYSICS

ANSWER KEY

1.	(B)	**2.**	(D)	**3.**	(C)	**4.**	(D)	**5.**	(D)	**6.**	(C)	**7.**	(C)
8.	(C)	**9.**	(C)	**10.**	(A)	**11.**	(C)	**12.**	(B)	**13.**	(D)	**14.**	(D)
15.	(C)	**16.**	(A)	**17.**	(A)	**18.**	(A)	**19.**	(A)	**20.**	(C)	**21**	(C)
22.	(C)	**23.**	(A)	**24.**	(D)	**25.**	(A)	**26.**	(B)	**27.**	(B)	**28.**	(B)
29.	(C)	**30.**	(C)	**31.**	(B)	**32.**	(B)	**33.**	(A)	**34.**	(C)	**35.**	(D)
36.	(A)	**37.**	(C)	**38.**	(B)	**39.**	(D)	**40.**	(C)	**41.**	(C)	**42.**	(A)
43.	(A)	**44.**	(B)	**45.**	(C)	**46.**	(A)	**47.**	(C)	**48.**	(B)	**49.**	(D)
50.	(D)												

SOLUTIONS

SECTION-A

1. (B)

2. (D)

Sol. Because magnetic force always points perpendicular to the particle velocity. That is why velocity remains unchanged thereby keeping energy $\left(\frac{1}{2}mv^2\right)$ and momentum (*mv*) unchanged.

3. (C)

Sol. If the voltage given is *V*, then the energy of electron

$$\frac{1}{2}mv^2 = eV \Rightarrow v = \sqrt{\frac{2eV}{m}}$$

$$= \sqrt{\frac{2\times 1.6\times 10^{-19}\times 1000}{9.1\times 10^{-31}}} = 1.875\times 10^7$$

$$\approx 1.9\times 10^7 m/s$$

4. (D)

Sol. Shortest wavelength comes from $n_1 = \infty$ to $n_2 = 1$ and longest wavelength comes from $n_1 = 6$ to $n_2 = 5$ in the given case. Hence

$$\frac{1}{\lambda_{\min}} = R\left(\frac{1}{1^2} - \frac{1}{\infty^2}\right) = R$$

$$\frac{1}{\lambda_{\max}} = R\left(\frac{1}{5^2} - \frac{1}{6^2}\right) = R\left(\frac{36-25}{25\times 36}\right) = \frac{11}{900}R$$

$$\therefore \frac{\lambda_{\max}}{\lambda_{\min}} = \frac{900}{11}$$

5. (D)

Sol. $p = \frac{h\nu}{c} \Rightarrow \nu = \frac{pc}{h}$ $= \frac{3.3\times 10^{-29}\times 3\times 10^8}{6.6\times 10^{-34}}$

$= 1.5\times 10^{13} Hz$

6. (C)

Sol. $E = nh\nu \Rightarrow \nu \propto \frac{1}{n} \Rightarrow \frac{n_1}{n_2} = \frac{\gamma_2}{\gamma_1}$.

7. (C)

Sol. Angular momentum $L = n\left(\frac{h}{2\pi}\right)$

For this case *n*=2, hence $L = 2\times\frac{h}{2\pi} = \frac{h}{\pi}$

8. (C)

Sol. According to Einstein's photoelectric equation.

9. (C)

Sol. Energy of incident light

$$E(eV) = \frac{12375}{3320} = 3.72\ eV$$

$(332\ nm = 3320\ \text{Å})$

According to the relation $E = W_0 + eV_0$

$$\Rightarrow V_0 = \frac{(E-W_0)}{e} = \frac{3.72\ eV - 1.07\ eV}{e}$$

$= 2.65\ Volt.$

10. (A)

Sol. In nuclear reacter, nuclear fission can be carried out through a sustained and a controlled chain reaction.

11. (C)

Sol. In hydrogen atom, the lowest orbit (*n* = 1) corresponds to minimum energy (– 13.6 *eV*).

12. (B)

Sol. $K_{\max} = (h\nu - W_0)$; ν = frequency of incident light.

13. (D)

Sol. Retarding potential $V_0 = \frac{h}{e}(\nu - \nu_0)$

14. (D)

Sol. *B.E.* per nucleon $\propto$ stability.

15. (C)

Sol. Due to the production of neutrons, a chain of nuclear fission is established which continues until the whole of the source substance is consumed.

16. (A)

Sol. Intensity increases means more photons of same energy will emit more electrons of same energy, hence only photoelectric current increases.

17. (A)

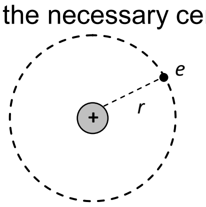
Sol. In atom bomb nuclear fission takes place with huge temperature.

18. (A)

Sol. $\lambda_r > \lambda_y > \lambda_g$. Here threshold wavelength $< \lambda_y$.

19. (A)

Sol. In the revolution of electron, coulomb force provides the necessary centripetal force



$\Rightarrow \frac{ze^2}{r^2} = \frac{mv^2}{r} \Rightarrow mv^2 = \frac{ze^2}{r}$

$\therefore$ K.E. $= \frac{1}{2}mv^2 = \frac{ze^2}{2r}$

20. (C)

Sol.

$E = h\nu = 6.6 \times 10^{-34} \times 8 \times 10^{15} = 5.28 \times 10^{-18}\,J = 33eV$ By using $E = W_0 + K_{max} \Rightarrow K_{max} = E - W_0$

$= 33 - 6.125 = 27eV$

21 (C)

Sol.

$E = \frac{hc}{\lambda} \Rightarrow \frac{E_1}{E_2} = \frac{\lambda_1}{\lambda_2} \Rightarrow \frac{3.32 \times 10^{-19}}{E_2} = \frac{4000}{6000}$

$\Rightarrow E_2 = 4.98 \times 10^{-19}\,J = 3.1\,eV$.

22. (C)

Sol. Both coulomb and nuclear force act inside the nucleus.

23. (A)

Sol. Nuclear force is charge independent, it also acts between two neutrons.

24. (D)

Sol. For first line in Lyman series $\lambda_{L_1} = \frac{4}{3R}$ ..... (i)

For first line in Balmer series $\lambda_{B_1} = \frac{36}{5R}$ ..... (ii)

From equation (i) and (ii)

$\frac{\lambda_{B_1}}{\lambda_{L_1}} = \frac{27}{5} \Rightarrow \lambda_{B_1} = \frac{27}{5}\lambda_{L_1} \Rightarrow \lambda_{B_1} = \frac{27}{5}\lambda$

25. (A)

Sol. For hydrogen and hydrogen like atoms

$E_n = -13.6\frac{z^2}{n^2}eV$

$U_n = 2E_n = -27.2\frac{z^2}{n^2}eV$ and

$K_n = |E_n| = 13.6\frac{z^2}{n^2}eV$

From these three relations we can see that as n decreases, K_n will increase but E_n and U_n will decreases.

26. (B)

Sol. If frequency of incident light increases, kinetic energy of photoelectron also increases.

27. (B)

Sol. ${}_zX^A = {}_{88}Ra^{226}$

Number of protons = Z = 88

Number of neutrons

$= A - Z = 226 - 88 = 138$.

28. (B)

Sol. Balmer series lies in the visible region.

29. (C)

Sol. For the ionization of second *He* electron.

He^+ will act as hydrogen like atom.

Hence ionization potential

$= Z^2 \times 13.6\,volt = (2)^2 \times 13.6 = 54.4\,V$

30. (C)

Sol.

$\frac{1}{\lambda} = R\left(\frac{1}{2^2} - \frac{1}{4^2}\right) = \frac{3R}{16} \Rightarrow \lambda = \frac{16}{3R} = \frac{16}{3} \times 10^{-5}\,cm$

Frequency $n = \frac{c}{\lambda} = \frac{3 \times 10^{10}}{\frac{16}{3} \times 10^{-5}} = \frac{9}{16} \times 10^{15}\,Hz$

31. (B)

Sol. Because atom is hollow and whole mass of atom is concentrated in a small centre called nucleus.

32. (B)

Sol. $r \propto n^2$ i.e. $\frac{r_f}{r_i} = \left(\frac{n_f}{n_i}\right)^2$

$\Rightarrow \frac{21.2 \times 10^{-11}}{5.3 \times 10^{-11}} = \left(\frac{n}{1}\right)^2 \Rightarrow n^2 = 4 \Rightarrow n = 2$

33. (A)

Sol. B.E.= Δmc^2

$= [2(1.0087 + 1.0073) - 4.0015] = 28.4\ MeV$

34. (C)

Sol. Mass of ${}_1H^2 = 2.01478\ a.m.u.$

Mass of ${}_2He^4 = 4.00388\ a.m.u.$

Mass of two deuterium $= 2 \times 2.01478 = 4.02956$

Energy equivalent to $2\,{}_1H^2$

$= 4.02956 \times 1.112\ MeV = 4.48\ MeV$

Energy equivalent to ${}_2H^4$

$= 4.00388 \times 7.047\ MeV = 28.21\ MeV$

Energy released $= 28.21 - 4.48 = 23.73\ MeV$

= 24 *MeV*

35. (D)

Sol. $mvr_n = \frac{nh}{2\pi} \Rightarrow pr_n = \frac{nh}{2\pi} \Rightarrow \frac{h}{\lambda} \times r_n = \frac{nh}{2\pi}$

$\Rightarrow \lambda = \frac{2\pi r_n}{n}$, for first orbit $n = 1$ so $\lambda = 2\pi r_1$

= circumference of first orbit

SECTION-B

36. (A)

Sol. In Lyman series $(\lambda_{\min})_L = \frac{1}{R}$ and $(\lambda_{\min})_B = \frac{4}{R}$

$\Rightarrow (\lambda_{\min})_B = 4 \times (\lambda_{\min})_L = 4 \times 912 = 3648\ Å$

37. (C)

Sol. K.E. = – (Total energy) = – (–13.6 *eV*) = + 13.6 *eV*

38. (B)

Sol. $\frac{1}{\lambda} = R\left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right] = R\left[\frac{1}{(2)^2} - \frac{1}{(4)^2}\right] \Rightarrow \lambda = \frac{16}{3R}$

39. (D)

Sol. *B.E.* = Δm *amu* = $\Delta m \times 931$ *MeV*.

40. (C)

Sol. $r \propto n^2$

41. (C)

Sol. According to Bohr's theory, angular momentum of electron in H-atom,

$L = \frac{nh}{2\pi}$

For minimum value of L, n = 1

∴ Minimum angular momentum,

$L_{min} = \frac{h}{2\pi}$

42. (A)

Sol. For all types of wave, sound wave, light wave, string wave the term related is frequency. Which is given only in one option. Other phenomenon are properly matching.

Photoelectric effect proves photon character of light.

γ rays can only be produced from nucleus.

In case of k capture x rays are emitted.

43. (A)

Sol. If R is the radius of the nucleus, the corresponding volume $\frac{4}{3}\pi R^3$ has been found to be proportional to A.

This relationship is expressed in inverse from as

$R = R_0 A^{1/3}$

The value of R_0 is 1.2×10^{-15} m, e.e., 1.2 fm

Therefore, $\frac{R_{Al}}{R_{Te}} = \frac{R_0(A_{Al})^{1/3}}{R_0(A_{Te})^{1/3}}$

$\frac{R_{Al}}{R_{Te}} = \frac{(A_{Al})^{1/3}}{(A_{Te})^{1/3}}$

$= \frac{(27)^{1/3}}{(125)^{1/3}} = \frac{3}{5}$

or $R_{Te} = \frac{5}{3} \times R_{Al} = \frac{5}{3} \times 3.6$

= 6 fm

44. (B)

Sol. Neutron is about 0.1 more massive than proton. But the unique thing about the neutron is that while it is heavy it has no charge (it is neutral). This lack of change gives it the ability to penetrate matter without interacting as compared to the beta particles or alpha particles.

45. (C)

46. (A)

Sol. momentum of photon = momentum of helium

$P_P = \frac{\lambda}{\lambda_P} = P_{He}$

$P_{He} = \frac{\lambda}{0.1 \ \ A^o} = \sqrt{2km}$

$k = \left(\frac{\lambda^2}{0.1 \ \ A^o \times 2m_{He}}\right)$

$= \frac{(\lambda C)^2}{0.1 \ \ A^o \times C^2 \times 2m_{He}}$

$= \frac{(12400 \ \ eVA^o)^2}{0.1 \ \ A^o \times (3\times10^8)^2 \times 2\times4\times10^{-3}}$ = 2.04 eV

47. (C)

Sol. The wavelength corresponding to transition from n = 4 to n = 3 in He^+ corresponds to visible region. Its wavelength is :

$\frac{hc}{\lambda} = 13.6 \times 4 \left[\frac{1}{9} - \frac{1}{16}\right]$

$\frac{4.1\times10^{-15}\times3\times10^8}{\lambda \ \ (m)} = 13.6\times4\times\frac{7}{9\times16} \Rightarrow$

$\lambda = \frac{4.1\times10^{-15}\times3\times10^8}{13.6\times4\times\frac{7}{9\times16}}$ m

$\lambda = 4.68 \times 10^{-7}$ m. So, **Ans (C).**

48. (B)

Sol. Using Mosley's law, for K_α line : $\sqrt{\upsilon} = a\,(z - b)$ where b = 1

$\upsilon \propto \frac{1}{\lambda}$ $\therefore$ $\frac{\sqrt{\frac{1}{\lambda_{cu}}}}{\sqrt{\frac{1}{\lambda_{mo}}}}$

$= \frac{a(29-1)}{a(42-1)} \Rightarrow \frac{\lambda_{cu}}{\lambda_{mo}} = \frac{41\times41}{28\times28}$

$= \frac{1681}{784} = 2.144$

49. (D)

Sol. Photoelectric effect demonstrates the particle nature of light. Number of emitted photoelectrons depends upon the intensity of light.

50. (D)

Sol. $E = \frac{hC}{\lambda} = \phi$

hc = 12400 Å

$\lambda = \frac{12400 \text{ Å eV}}{4eV} = 3100$ Å

$\lambda = 310$ nm