JEE MAIN ANSWER KEY & SOLUTIONS

SUBJECT :- CHEMISTRY
CLASS :- 11th **PAPER CODE :- CWT-2**
CHAPTER :- ATOMIC STRUCTURE

ANSWER KEY

1.	(B)	**2.**	(D)	**3.**	(A)	**4.**	(C)	**5.**	(D)	**6.**	(A)	**7.**	(C)
8.	(C)	**9.**	(B)	**10.**	(C)	**11.**	(C)	**12.**	(A)	**13.**	(B)	**14.**	(A)
15.	(A)	**16.**	(A)	**17.**	(C)	**18.**	(A)	**19.**	(B)	**20.**	(A)	**21.**	4
22.	28	**23.**	6	**24.**	14	**25.**	25	**26.**	759	**27.**	7	**28.**	0
29.	91	**30**	494										

SOLUTIONS

1. (B)

Sol. Volume of nucleus

$= \frac{4}{3}\pi r^3 = \frac{4}{3}\pi(10^{-13})^3\ cm^3$

Volume of atom $= \frac{4}{3}\pi(10^{-8})^3\ cm^3$

$\frac{V_N}{V_{Atom}} = \frac{10^{-39}}{10^{-24}} = 10^{-15}$

$V_{Nucleus} = \mathbf{10^{-15} \times V_{Atom}}$

2. (D)

Sol. Average atomic mass of Cl is 35.5. Due to isotopes.

3. (A)

Sol. Isoelectronic species should have same number of electrons.

4. (C)

Sol. It is fact.

5. (D)

Sol. It is fact.

6. (A)

Sol. Ionisation enthalpy decreases down the group.

7. (C)

Sol. Largest amount of energy is required in n = ∞ to n = 1.

8. (C)

Sol. (A) Energy of ground state of He^+
$= -13.6 \times 2^2 = -54.4$ eV (iv)
(B) Potential energy of I orbit of H-atom
$= -27.2 \times 1^2 = -27.2$ eV (ii)
(C) Kinetic energy of II excited state of He^+
$= 13.6 \times \frac{2^2}{3^2} = 6.04$ eV (i)
(D) Ionisation potential of He^+
$= 13.6 \times 2^2 = 54.4$ V (iii)

9. (B)

10. (C)

Sol. $\frac{1}{\lambda_{lyman}} = R_H\left(\frac{1}{1}\right)$

$\frac{1}{\lambda_{Balmer}} = R_H\left(\frac{1}{4}\right)$; $\Rightarrow \frac{\lambda_{Balmer}}{\lambda_{Lyman}} = 4$

11. (C)

Sol. $r_n = r_0 \times \frac{n^2}{Z}$

$r_{Li^{2+}} = \frac{r_H}{3} = \frac{0.53}{3} = 0.17$

12. (A)

Sol. n_1 = lyman series i.e. transition of the electron in hydrogen atom from the fourth to first energy shell emits a spectral line which falls in lyman series.

13. (B)

Sol. $\lambda = \frac{h}{mv} = 1.33 \times 10^{-3}$ Å

14. (A)

Sol. $\Delta X . \Delta P \cong \frac{h}{4\pi}$

$m(\Delta X . \Delta V) = \frac{h}{4\pi} \Rightarrow m = 0.099$ Kg

15. (A)

Sol. For a charged particle $\lambda = \frac{h}{\sqrt{2mqV}}$,

$\therefore \quad \lambda \propto \frac{1}{\sqrt{V}}$.

16. (A)

Sol. (A) This set of quantum number is permitted.
(B) This set of quantum number is not permitted as value of 's' cannot be zero.
(C) This set of quantum number is not permitted as the value of 'l' cannot be equal to 'n'.
(D) This set of quantum number is not permitted as the value of 'm' cannot be greater than 'l'.

17. (C)

18. (A)

Sol. Magnetic moment = $\sqrt{n(n+2)}$ = $\sqrt{24}$ B.M.

$\therefore$ No. of unpaired electron = 4.

X_{26} : $1s^2\ 2s^2 2p^6 3s^2 3p^6 3d^6 4s^2$.

To get 4 unpaired electrons, outermost configuration will be $3d^6$.

$\therefore$ No. of electrons lost = 2 (from $4s^2$).

$\therefore$ n = 2.

19. (B)

Sol. No two electrons in an atom can have identical set of all the four quantum numbers.

20. (A)

Sol. The electronic configuration must be $1s^2\ \ 2s^1$.

Hence, the element is lithium $(z = 3)$.

21. 4

Sol. An element has the electronic configuration $1s^2$, $2s^2\ \ 2p^6$, $3s^2\ \ 3p^2$, (Si) .It's valency electrons are four.

22. 28

Sol. $E = \frac{nhc}{\lambda}$ $\Rightarrow$ n = 28

23. 6

Sol. infrared lines = total lines – visible lines – UV lines = $\frac{6(6-1)}{2}$ – 4 – 5 = 15 – 9 = 6.

(visible lines = 4 6→2, 5→2, 4→2, 3→2)

(UV lines = 5 6→1, 5→1, 4→1, 3→1, 2→1)

24. 14

Sol. Radius = 0.529 $\frac{n^2}{Z}$ Å = 10 × 10^{-9} m

So, n^2 = 189 or, $n \approx 14$ **Ans.**

25. 25

Sol. $E_n = \frac{-13.6Z^2}{n^2}$

E_1 = –13.6Z^2 = 100 unit

$E2 = \frac{-13.6Z^2}{4}$ = 25 unit

26. 759

Sol. $E_{absorbed} = E_{emitted}$

$\therefore \quad \frac{hc}{300} = \frac{hc}{496} + \frac{hc}{\lambda}$.

$\therefore \quad \lambda$ = 759 nm.

27. 7

Sol. $1s^2\ 2s^2\ 2p^6\ 3s^1$

m = 0 is for 2 + 2 + 2 + 1 electrons = 7 e^-

28. 0

Sol. The value of ℓ (azimuthal quantum number) for s -electron is equal to zero.

Orbital angular momentum = $\sqrt{\ell(\ell+1)}.\frac{h}{2\pi}$

Substituting the value of l for s-electron = $\sqrt{0(0+1)}.\frac{h}{2\pi} = 0$

29. 91

Sol. $\frac{1}{\lambda} = R\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$ $\quad \frac{1}{\lambda}$ = 1.097 × 10^7 m^{-1} $\left(\frac{1}{1^2} - \frac{1}{\infty^2}\right)$ $\therefore \lambda$ = 91 × 10^{-9} m = 91 m.

30 494

Sol. Cl–Cl(g) $\longrightarrow$ 2Cl(g) ; ΔH = 242 KJ mol

$= \frac{242\times10^3}{6.02\times10^{23}}$ J molecule^{-1}

E = $\frac{hc}{\lambda}$

$\frac{242\times10^{-23}\times10^3}{6.02} = \frac{6.6\times10^{-34}\times3\times10^8}{\lambda}$

$\lambda = \frac{6.6\times10^{-34}\times3\times10^8}{242\times10^{-23}\times10^3} = \frac{6.6\times3\times6.02}{242}\times10^{-6}$

= 0.494 × 10^{-6}

= 494 × 10^{-9} m = 494 nm