ATOMIC STRUCTURE

Level-I

1. K.E. = –T.E. (Ans. 2)
2. Isobars have same mass no. with diff at no. (Ans. 2)
3. No two e^- of an atom can have same set of four quantum nos acc. To Pauli's Principle. (Ans. 3)
4. E.C. of Rubidium (Z = 37) is $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^{10}\ 4p^6\ 5s^1$. So set of quantum nos. 5, 0, 0, $\frac{+1}{2}$. (Ans. 1)
5. $E_n = \frac{-13.6}{n^2} eV$

   $E_n = -3.4\,eV$

   $3.4 = \frac{13.6}{n^2}$

   $n^2 = 4$

   n = 2

   So angular momentum = $\frac{2h}{2\pi} = \frac{h}{\pi}$ (Ans. 1)
6. $\nu = \frac{v}{2\pi r}$ (Ans. 4)
7. No. of spectral line = $\frac{n(n-1)}{2} = \frac{5\times 4}{2} = 10$ (Ans. 4)
8. Principal quantum no. – size

   Azimuthal quantum no. – shape

   Magnetic quantum no. – orientation (Ans. 1)
9. Bohr's model of atom can explain spectrum of uni electron species. (Ans. 3)
10. Electromagnetic spectrum cosmic rays < ν - rays < x-rays < u.v. < visible < I.R. < Microwaves < Radioswaves. (Ans. 2)
11. mvr = J

    $v = \frac{J}{mr}$

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

    $= \frac{1}{2}m\left(\frac{J}{mr}\right)^2 = \frac{1}{2}.\frac{J^2}{mr^2}$

    or $m = \frac{J}{vr}$

$$K.E. = \frac{1}{2}mv^2 = \frac{1}{2}\frac{J}{vr} \times v^2$$

$$= \frac{Jv}{2r}$$ (Ans. 1)

12. $$\frac{1}{\lambda} = R\left(\frac{1}{2^2} - \frac{1}{3^2}\right)$$

$$\frac{1}{\lambda} = R\frac{5}{36}$$

$$\lambda = \frac{36}{5R}$$ (Ans. 1)

13. $$\Delta E_{3-2} = E_3 - E_2$$

$$= \frac{-13.6}{9}.Z^2 - \left(\frac{-13.6}{4}.Z^2\right)$$

$$= 13.6.Z^2\left(\frac{1}{4} - \frac{1}{9}\right)$$

$$47.2 = 13.6 \times Z^2 \times \frac{5}{36}$$

$Z = 5$ (Ans. 2)

14. Definition of Heinsengerg uncertainty principle. (Ans. 1)

15. E.C. for At no. 16 is
$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^4$
So, total no. of s $e^{-s} = 6$ (Ans. 1)

16. $\frac{e}{m}$ for neutrom is zero. For others specific charge ratio $\propto \frac{1}{mass}$
So order will be $n < \infty < p < e^-$ (Ans. 4)

17. $$E_4 = \frac{-21.8 \times 10^{-19}}{4^2}$$

$$= \frac{-21.8 \times 10^{-19}}{16}$$

$$= -1.362 \times 10^{-19}\ J$$ (Ans. 4)

18. For last line $n_2 = \infty$

$$\frac{1}{\lambda_1} = R\left(\frac{1}{1^2} - \frac{1}{2^2}\right)$$ For first line (1)

$$\frac{1}{\lambda_2} = R\left(\frac{1}{1^2} - \frac{1}{\infty^2}\right)$$ Last line (2)

Divide (1) by (2)

$$\frac{\frac{1}{\lambda_1}}{\frac{1}{\lambda_2}} = \frac{\frac{3}{4}}{1}$$

$$\Rightarrow \lambda_2 = \frac{3}{4}\lambda$$

$$= \frac{3}{4} \times 1216$$

= 912 Å (Ans. 3)

19. Energy of orbit increases as we move away from nucleus. (Ans. (1)

20. 1s can only absorb photon . (Ans. 4)

21. $E_3 > E_2 > E_1$ (P.E. = 2T.E.) (Ans. 4)

22. $$\frac{\text{Circumference of Bohr's first orbit of H atom}}{\text{Circumference of Bohr's } 2^{nd} \text{ orbit of } He^+} = \frac{r_1}{r_2}$$

$$= \frac{r_0 \times 1}{r_0 \times \frac{4}{2}}$$

$$= \frac{1}{2}$$ (Ans. 2)

23. No. of circular sub orbits = 1

Nol. Of elliptical sub orbits = n – 1 (Ans. 1)

24. Ace to Paulli's principle no. two e^- can have the parallel spin in an orbit. (Ans. 2)

25. $$\Delta x \times \Delta v = \frac{h}{4\pi m}$$

$$10^{-10} \times \Delta v = \frac{6.626 \times 10^{-34}}{4 \times 3.14 \times 0.21}$$

$$\Delta v = 2.5 \times 10^{-24} \text{ m/s}$$ (Ans. 4)

26. Aufbau Principle got its name from German word Aufbau meaning "building up".

(Ans. 3)

27. At infinity energy of electron is zero which is maximum. (Ans. 4)

28. There is a node b/w 1s and 2s orbital. (Ans. 3)

29. $$r_3 = r_1 \times \frac{n^2}{z}$$

$$= 5 \times \frac{3^2}{3}$$

$\Rightarrow$ 15 pm. (Ans. 4)

30. $\Delta x \times \Delta p \geq \frac{h}{4\pi}$. (Ans. 2)

31. $\Delta x \times \Delta p \geq \frac{h}{4\pi}$

If $\Delta x = 0$

Then Δp will be infinity. (Ans. 4)

32. Frequency of Red colour is less than violet. (Ans. 1)

33. $\lambda = \frac{h}{\sqrt{2mK.E}} = \frac{6.626\times10^{-34}}{\sqrt{2\times9.1\times10^{-31}\times13.6\times1.6\times10^{-19}}} = 3.328\times10^{-10}\,m$ (Ans. 1)

34. $\lambda = \frac{h}{mv}$

$v = \frac{1}{100}\times3\times10^{8}$

$= 3 \times 10^{6}$ m/s

$m = \frac{1}{6.02\times10^{23}}\,g$

$\lambda = \frac{6.626\times10^{34}\times6.02\times10^{23}}{3\times10^{6}}$

$= 13.31 \times 10^{-3}$ Å (Ans. 1)

35. Paramagnetic character $\propto$ no. of unpaired e^-. (Ans. 1)

36. $\frac{1.E_H}{1.E_{Be^{3+}}} = \frac{Z_H^2}{Z_{Be^{3+}}^2} = \frac{1}{16}$. (Ans. 4)

37. No. of spectral line = $\frac{(n_2 - n_1)(n_2 - n_1 + 1)}{2}$

$= \frac{(6-2)(6-2+1)}{2} = 10$ (Ans. 2)

38. $Fe^{2+} = = 1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^6\,4s^0$

(four unpaired e^-)

$Mn^{+} = 1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^5\,4s^1$

(six unpaired e^-)

$Cr = 1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^5\,4s^1$

(six unpaired e^-)

So $Fe^{2+} < Cr = Mn^{+}$ (Ans. 2)

39. Total no. of e^{-s} = $\sum_{l=0}^{l=n-1} 2(2l+1)$ (Ans. 4)

40. $E = n\frac{hc}{\lambda}$

$10^{-17} = n \times \frac{6.626 \times 10^{-34} \times 3 \times 10^{8}}{550 \times 10^{-9}\,m}$

n = 28 (Ans. 2)

41. P.E. = $\frac{-kZe^2}{r}$

$P.E^{0}_{Li^{2+}} = \frac{-3e^2}{4\pi \in_0 r}$ (Ans. 3)

42. Radius of nucleus = $1.25 \times 64^{1/3} \times 10^{-13}$cm

$= 1.25 \times 4 \times 10^{-13}$cm

$= 5 \times 10^{-13}$cm

Radius of atom = 10^{-8} cm

$\frac{\text{volume of nucleus}}{\text{volume of atom}} = \frac{\frac{4}{3}\pi r^3}{\frac{4}{3}\pi R^3} = \frac{125 \times (10^{-13})^3}{(10^{-8})^3} = 1.25 \times 10^{-13}$ (Ans. 1)

43. $\lambda = \frac{h}{\sqrt{2mk.E}}$

K.E. = 1.5 I.E. – I.E.

= 0.5 I.E. = 0.5 × 13.6 × 1.6 × 10^{-19} J

= 10.88 × 10^{-19} J

$\lambda = \frac{6.626 \times 10^{-34}}{\sqrt{2 \times 9.1 \times 10^{-31} \times 10.88 \times 10^{-19}}}$

= 4.7 × 10^{-10} m = 4.7 Å (Ans. 1)

44. $E_3 = E_1 + E_2$

$\frac{hc}{\lambda_3} = \frac{hc}{\lambda_1} + \frac{hc}{\lambda_2}$

$\frac{1}{\lambda_3} = \frac{1}{\lambda_1} + \frac{1}{\lambda_2}$

$\lambda_3 = \frac{\lambda_1\lambda_2}{\lambda_1 + \lambda_2}$ (Ans. 2)

45. $\Delta x \times \frac{0.011}{100} \times 3 \times 10^2 = \frac{6.626 \times 10^{-34}}{4 \times 3.14 \times 9.1 \times 10^{-31}}$

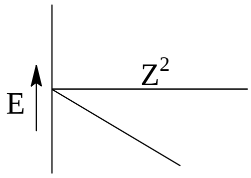
= 0.175 cm (Ans. 3)

46. $\frac{\lambda_A}{\lambda_B} = \frac{m_B v_B}{m_A v_A} = \frac{0.25 m_A \times 0.75 v_A}{m_A v_A}$

$\lambda_A = 0.1875 \lambda_B$

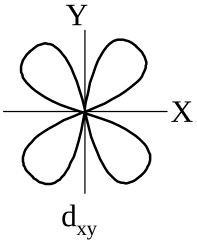
or $\lambda_B = 5.3 Å$ (Ans. 2)

47. $E \propto -Z^2$



(Ans. 4)

48. Isoelectronic means same no. of e^{-s}. (Ans. 4)

49. 

(Ans. 2)

50. Let z be 20

$20 = \frac{x \times 19 + (100 - x) \times 22}{100}$

2000 = 19 x + 2200 – 22 x

3x = 200

$x = \frac{2000}{3} = 66.6$

$\therefore$ % of heavier isotope = $33\frac{1}{3}$ (Ans. 2)

Level – II

1. Frequency = $\frac{1}{\text{Time} \times \text{period}}$

$\nu = \frac{1}{2} = 0.5\,\text{Hz}$ (Ans. None of given option is correct)

2. $E_{absorb} = n_a \frac{hc}{\lambda_a}$

$E_{emitted} = n_e \frac{hc}{\lambda_e}$

$\frac{E_e}{E_a} = \frac{\lambda_a}{\lambda_e} \times \frac{n_e}{n_a}$

$E_e = 0.5\,E_a$

$0.5 = \frac{4500}{5000} \times \frac{n_e}{n_a}$

$\frac{n_e}{n_a} = 0.5 \times \frac{50}{45} = 0.55$

3. K.E. = $\frac{-1}{2}$ P.E.

$\frac{x}{4} = -\frac{1}{2} P.E_2$

$x = -\frac{1}{2} P.E_1$

$P.E_2 = -\frac{x}{2}$

$P.E_1 = -2x$

$P.E_1 - P.E_2 = -2x + \left(\frac{-x}{x}\right)$

$= -2x + \frac{x}{2}$

$= \frac{-3x}{2}$

$P.E_2 - P.E_1 = \frac{3x}{2}$ (Ans. 1)

4. $T.E. = \frac{1}{2} P.E. = \frac{1}{2} \times -6.8 = -3.4\,eV$

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

$-3.4 = \frac{-13.6}{n^2}$

n = 2 i.e. first excited state. (Ans. 1)

5. $r_4 - r_3 = \frac{0.529}{2} \times (4^2 - 3^2)$

$= \frac{0.529}{2}(16 - 9)\text{Å}$

$= 1.851 \times 10^{-10}$ m (Ans. 3)

6. $V \propto Z$

$\propto \frac{1}{n}$ (Ans. 4)

7. Frequency = $\frac{v_n}{2\pi rn}$

$$\nu_2 = \frac{v_2}{2\pi r_2} = \frac{2.18\times10^6\times\frac{1}{2}}{2\times3.14\times0.529\times4} = 8.314\times10^{14}\ s^{-1}$$ (Ans. 4)

8. $E = n\frac{hc}{\lambda}$

$\frac{1}{\lambda} = \overline{v}$

$E = nhc\overline{v}$

10 = n h c x

$n = \frac{10}{hcx}$ (Ans. 3)

9. Angular momentum = mvr

$V \propto \frac{1}{\sqrt{r}}$

Angular momentum $\propto \frac{r_n}{\sqrt{r_n}}$

$\propto \sqrt{r_n}$ (Ans. 4)

10. $\frac{\nu_3}{\nu_2} = \frac{v_3}{2\pi r_3}\times\frac{2\pi r_2}{v_2}$

$= \frac{1}{\frac{3}{9}}\times\frac{4}{\frac{2}{\frac{2}{2}}} = \frac{1}{27}\times2 = \frac{2}{27}$

$\nu_2 = \frac{27}{2}\nu_3 = 13.5\,d$ (Ans. 2)

11. T.E.= - K.E.

= -E

$E_4 = -\frac{E_1}{16}$

$E_1 = 16E$

$E_{1H^{2+}} = -E_1\times Z^2$

= - 16 × 9

= – 144 E

12. $E_5 = -\frac{E_1}{25}$ (for H)

Energy supplied to H = $E_5 - E_1$

$$= \frac{-E_1}{5} - (-E_1)$$

$$= E_1\left(1 - \frac{1}{5}\right)$$

$$= \frac{4}{5}E_1$$

For He^+

$$\frac{4}{5}E_1 = E_x - E_1$$

$$= \frac{E_1}{x^2}.4 - (-E_1 \times 4)$$

$$= 4E.\left(1 - \frac{1}{x^2}\right)$$

$$\frac{1}{5} = \frac{x^2 - 1}{x^2}$$

$$x^2 = \frac{5}{4} = 1.1$$

$\Rightarrow$ x = 1 (Ans. 2)

13. Order of energy

$E_1 - E_2 > E_2 - E_3 > E_3 - E_4$ (Ans. 1)

14. $2n_2 + 3n_1 = 18$ (1)

$+2n_2 - 3n_1 = 6$ (2)

$4n_2 = 24$

$n_2 = 6$

$2 \times 6 - 3n_1 = 6$

$3n_1 = 6$

$n_1 = 2$

No. of spectral lines = 10 (Ans. 1)

15. $$\frac{1}{\lambda} = RZ^2\left(\frac{1}{n^2} - \frac{1}{(n+1)^2}\right)$$

$$= RZ^2\left[\frac{(n+1) - n^2}{n^2(n+1)^2}\right]$$

$$= RZ^2\left[\frac{2n}{n^4}\right] \qquad (n >> 1)$$

$$\frac{\nu}{c} = \frac{2RZ^2}{n^3}$$

or $\nu = \frac{2cRZ^2}{n^3}$ (Ans. 1)

16. $$\frac{1}{\lambda} = R\left(\frac{1}{1^2} - \frac{1}{n^2}\right)$$

$$\frac{1}{\lambda} = R\,\frac{n^2 - 1}{n^2}$$

$$n^2 = \lambda R n^2 - \lambda R$$

$$n^2(\lambda R - 1) = \lambda R$$

$n = \sqrt{\frac{\lambda R}{(\lambda R - 1)}}$ (Ans. 2)

17. $$\frac{1}{\lambda} = R\left(\frac{1}{n^2} - \frac{1}{49}\right)$$

$$\frac{1}{2170\times 10^{-7}} = 109677\left(\frac{49 - n^2}{49n^2}\right)$$

$$49n^2 = 109677 \times 2170 \times 10^{-2}(49 - n^2)$$

$n = 4$ (Ans. 3)

18. $$\frac{n(n-1)}{2} = 15$$

$$n^2 - n = 30$$

$$n^2 - n - 30 = 0$$

$$n^2 - 6n + 5n - 30 = 0$$

$$n(n-6) + 5(n-6) = 0$$

$$n = 6$$

$$\frac{1}{\lambda} = 109677\left(\frac{1}{1} - \frac{1}{36}\right)$$

$\lambda = 937.3Å$ (Ans. 1)

19.

20. For shortest wavelength $n_2 = \infty$

$$\frac{\frac{1}{x} = R\left(\frac{1}{1}\right)}{\frac{1}{\lambda} = R\left(\frac{1}{4} - \frac{1}{9}\right)}$$

$$\frac{\frac{1}{x}}{\frac{1}{\lambda}} = \frac{\frac{1}{5}}{36}$$

$$\frac{\lambda}{x} = \frac{36}{5}$$

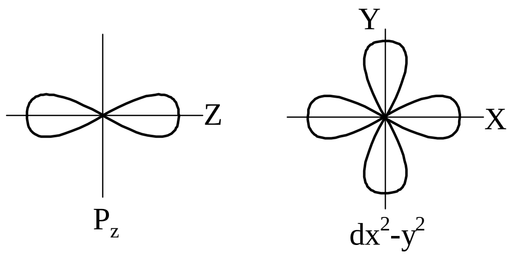
$$\lambda = \frac{36}{5}x$$ (Ans. 2)

21. $n\lambda = 2\pi r_3$

$3\lambda = 2\pi \times x \times 9$

$\lambda = 6\pi x$ (Ans. 2)

22. Gives orientation of orbital in space. (Ans. 3)

23. 

(Ans. 4)

24. g- subshell has n orbitals

$\therefore$ 18 e^{-s} (Ans. 4)

25.

26. Pauli's state that no two e^{-s} in an orbital can have same spin. (Ans. 3)

27. $\mu = \sqrt{n(n+2)}$ B.M.

$$\frac{\mu_{Fe^{3+}}}{\mu_{Co^{2+}}} = \frac{\sqrt{35}}{\sqrt{15}}$$ (Ans. 2)

28. $E = F.r_n$

$$F = \frac{E}{r_n}$$

$$F \propto \frac{Z^2}{n^2.\frac{n^2}{z}}$$

$$\propto \frac{Z^3}{n^4}$$ (Ans. 2)

29. $E_1 = -13.6 \times 9$

$= -122.4$ eV

I.E. = Binding energy

$= -E_1 = 122.4$ eV

30. $\lambda_{c-A} = \frac{\lambda_1\lambda_2}{\lambda_1 + \lambda_2}$ $\lambda_1 = 364.6\,\text{nm},\ \lambda_2 = 121.5\,\text{nm}$

$= \frac{364.6 \times 121.5}{364.6 + 121.5}$

$= \frac{364.6 \times 121.5}{486.1} = 91.13$ nm (Ans. 1)

31. s orbitals are non directional. (Ans. 1)

32. First Lyman series

$\bar{v} = R\left(\frac{1}{1} - \frac{1}{4}\right) = \frac{3}{4}R$

First Paschen series

$\bar{v} = R\left(\frac{1}{9} - \frac{1}{16}\right)$

$= R\frac{7}{144}$

$\frac{\bar{v}_{Lyman}}{\bar{v}_{Paschen}} = \frac{\frac{3}{4}}{\frac{7}{144}} = \frac{3 \times 144}{28} = \frac{108}{7}$ (Ans. 4)

33. $E_{III} - E_I = 2E - E = E$

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

$E_{II} - E_I = \frac{4E}{3} - E = \frac{E}{3} = \frac{hc}{3\lambda}$

$\frac{hc}{\lambda'} = \frac{hc}{3\lambda}$

or $\lambda' = 3\lambda$

34. First excited state n = 2

$r_2 = 0.529 \times \frac{4}{3}$ Å

= 0.705 Å (Ans. 2)

35. $\lambda = \frac{12.27}{\sqrt{v}} =$ Å

$\lambda_3 = \frac{12.27}{\sqrt{32}}$, $\lambda_2 = \frac{12.27}{\sqrt{19}}$

$$\lambda_1 = \frac{12.27}{\sqrt{100}}$$

$$\frac{\lambda_2 - \lambda_3}{\lambda_1} = \frac{\frac{1}{\sqrt{19}} - \frac{1}{\sqrt{32}}}{\frac{1}{\sqrt{100}}} = \frac{5.62 - 4.35 \times 10}{5.62 \times 4.32} = 0.5$$ (Ans. 1)

36. $E_\infty - E_2 = 0 - \left(\frac{-E_1}{4}\right)$

E_1 = 400 units

$E_\infty - E_2 = 100$ units (Ans. 2)

37. $$\frac{\frac{1}{\lambda_H} = R\left(\frac{1}{3^2} - \frac{1}{4^2}\right)}{\frac{1}{\lambda_{He^+}} = R \times 4\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)}$$

$$4\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right) = \frac{7}{144}$$

$$\frac{1}{n_1^2} - \frac{1}{n_2^2} = \frac{7}{576}$$

$\therefore \quad n_1 = 6$

$n_2 = 8$ (Ans. 2)

38. Absorption aways occurs from ground state. (Ans. 4)

39. $n + \ell \uparrow, E \uparrow$ (Ans. 3)

40. $\frac{h^2}{32\pi^2 m a_0}$ (Ans. 3)

Previous Years Problems

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

For p-orbital

$= \sqrt{1(1+2)}\frac{h}{2\pi} = \sqrt{3}\frac{h}{2\pi}$ (Ans. 1)

2. $E_1 = \frac{hc}{\lambda_1}$

$E_2 = \frac{hc}{\lambda_2}$

$$\frac{E_1}{E_2} = \frac{\lambda_2}{\lambda_1}$$

$$\Rightarrow \frac{\lambda_2}{\lambda_1} = \frac{25}{50} = \frac{1}{2}$$

or $\frac{\lambda_1}{\lambda_2} = 2:1$ (Ans. 3)

3. With $\uparrow$ in energy, lines converse

For Balmer series, n_1 =1 and for longest wavelength $n_2 = n_1 + 1$. (Ans. 3)

4. $\lambda = \frac{h}{mv} = \frac{6.626 \times 10^{-27}}{9.1 \times 10^{-28} \times v}$

$v = \frac{6.626 \times 10^{-27}}{9.1 \times 10^{-28} \times 0.15 \times 10^{-7}\,cm} = 4.85 \times 10^{8}\,cm/s$ (Ans. 1)

5. No. of orbitals = n^2 (Ans. 3)

6. Sequence is 6s, 4f, 5d, 6p. (Ans. 2)

7. No. of spectral lines

$= \frac{(n_2 - n_1)(n_2 - n_1 + 1)}{2}$

$\Rightarrow \frac{(4-1)(4-1+1)}{2} = 6$ (Ans. 3)

8. $\overline{v} = R\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$

$\overline{v} = \frac{8}{9}R$

$\frac{8}{9}R = R\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$

$\therefore$ $n_1 = 1$

$n_2 = 3$ (Ans. 1)

9. Lyman lies in U.V. region. (Ans. 1)

10. Bohr gave concept of stationary orbit. (Ans. 4)

11. E = 243 kJ /mol

Energy of photon required = $\frac{243 \times 10^{3}}{6.02 \times 10^{23}}$ J

$$\frac{hc}{\lambda} = \frac{243 \times 10^{3}}{6.02 \times 10^{23}}$$

$$\frac{6.626 \times 3 \times 10^{-26}}{\lambda} = 40.36 \times 10^{-20}$$

$\lambda = \frac{6.626 \times 3 \times 10^{-26}}{40.36 \times 10^{-20}} = 4.91 \times 10^{-7}$ m (Ans. 1)

12. $\nu = \frac{1}{T} = \frac{1}{2 \times 10^{-10}} = 0.5 \times 10^{10} = 5 \times 10^{9} s^{-1}$ (Ans. 3)

13. Cr = $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^1\ 3d^5$

For 19th electron

Electron no's are 4, 0, 0, $\frac{1}{2}$ (Ans. 1)

14. Ans. 2

15. Probability of finding an electron at nodal surface is zero.

16. $\frac{\lambda_A}{\lambda_B} = \frac{m_B v_B}{m_A v_A} = \frac{5 \times 0.05}{0.1} = \frac{5}{2}$ (Ans. 5)

17. $\frac{\lambda_A}{\lambda_B} = \sqrt{\frac{K.E_B}{K.E_A}}$

$\frac{3}{5} = \sqrt{\frac{K.E_B}{K.E_A}}$

$\frac{K.E_B}{K.E_A} = \frac{9}{25}$

$\frac{K.E_A}{K.E_B} = \frac{25}{9}$ (Ans. 1)

18. $\Delta x \times \frac{0.011}{100} \times 3 \times 10^4 = \frac{6.626 \times 10^{-27}}{4 \times 3.14 \times 9.1 \times 10^{-28}}$

$\Delta x = 0.175\,\text{cm}$ (Ans. 3)

19. $\Delta x \times \Delta p \geq \frac{h}{4\pi}$

$\Delta x = \Delta v$

$\Delta v \times m\Delta v \geq \frac{h}{4\pi}$

$m^2 \Delta v^2 \geq \frac{mh}{4\pi}$

$\Delta p \geq \frac{1}{2}\sqrt{\frac{mh}{\pi}}$ (Ans. 1)

20. No. of e^{-s} = 2 (l + 1)

= 4l + 2 (Ans. 1)

21. $n + \ell \downarrow,\ E \downarrow$ (Ans. 3)

22.

23. $\frac{1}{\lambda} = R \times 9\left(\frac{1}{1} - \frac{1}{4}\right)$

$\frac{1}{\lambda} = \frac{3}{4} \times R \times 9$

$\lambda = \frac{4}{27}R$ (Ans. 4)

24. For $dx^2 - y^2$, yz plane is a nodal plane. (Ans. 1)

25. $\frac{\Delta x_A}{\Delta x_B} = \frac{m_B v_B}{m_A v_A} = \frac{5 \times 0.02}{0.05} = 2$ (Ans. 1)

26. for n = 2, *l* can be 0, 1

for *l* = 0, m can only be 0

for *l* = 2, m can not be 3

So ans. 3 (Ans. 3)

27. Average atomic mass = $\frac{90 \times 200 + 8 \times 199 + 2 \times 202}{100}$ = 200u (Ans. 1)

28. $\lambda = \frac{h}{p}$

$2.2 \times 10^{-11} = \frac{6.6 \times 10^{34}}{P}$

P = $\frac{6.6 \times 10^{-34}}{2.2 \times 10^{-11}} = 3 \times 10^{-23} \text{kg ms}^{-1}$ (Ans. 1)

29. K^+, Cl^-, Ca^{2+} all are isoelectronic with 18 e^{-s} each. (Ans. 2)

30. $\bar{v} = \frac{1}{\lambda} = R\left(\frac{1}{2^2} - \frac{1}{3^2}\right)$

$\bar{v} = \frac{1}{\lambda} = \frac{5}{36}R$ (Ans. 1)

31. $\Delta E = E_2 - E_1$

= $\frac{-13.6}{4} - \left(\frac{-13.6}{1}\right)$

= $13.6\left(1 - \frac{1}{4}\right)$

= $13.6\left(1 - \frac{1}{4}\right)$eV

=10.2 (Ans. 4)

32. $\Delta v \times 0.1 \times 10^{-10} = \frac{6.626 \times 10^{-34}}{4 \times 3.14 \times 9.1 \times 10^{-31}}$

$\Delta v = 5.79 \times 10^{-6}$ m/s (Ans. 1)

33. $\frac{E_3}{E_2} = \frac{\frac{1}{9}}{\frac{1}{4}}$

$E_3 = \frac{4}{9} \times E_2$

$= \frac{4}{9} \times -328$

= – 148 kJ/mol

34. Cr $\longrightarrow$ $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^1\ 3d^5$

No. of e^{-s} in l = 1 i.e. P & l= 2 i.e. d are 12 & 5 (Ans. 2)

35. $r_{Be^{3+}} = r_H \times \frac{n^2}{2}$

$= r_H \times \frac{4}{4}$

$r_{Be^{3+}} = r_H$ (Ans. 2)

36. $C = \nu\lambda$

$3 \times 10^8 = 8 \times 10^{15} \times \lambda$

$\lambda = \frac{3 \times 10^8}{8 \times 10^{15}} = 0.375 \times 10^{-7}$

= 3.75×10^{-8} m/s

$\simeq$ 4 (Ans. 1)

37. For L shell, no. of orbitals = 4 (Ans. 4)

38. Cu & Cr have exception configuration due to half filled and fully filled electronic configuration.

(Ans. 4)

39. $\lambda = \frac{6.626 \times 10^{-34}}{60 \times 10^{-3} \times 10} = 10^{-33}$ m (Ans. 2)

40. $\frac{1}{\lambda} = R\left(\frac{1}{2^2} - \frac{1}{5^2}\right)$

So, n_2= 5, n_1 = 2 (Ans. 3)

41. K.E. = - T. E (Ans. 1)

42. (Ans. 1)

43. n = 3, l = 2, m = + 2, represent only one orbital. (Ans. 1)

44. Na = $1s^2\ 2s^2\ 2p^6\ 3s^1$

m = 0 for last e^- (Ans. 1)

45. (Ans. 3)

46. Aufbau principle based on (n + l) rule. (Ans. 2)

47. 2nd shell has only two subshell 2s & 2p. (Ans. 1)

48. $c = \nu\lambda$

$$\lambda = \frac{c}{\nu} = \frac{3\times10^{17}}{6\times10^{5}} = \frac{1}{2}\times10^{12}$$

$= 0.5 \times 10^{12}$

$= 50$ nm (Ans. 4)

49. 1 is incorrect. (Ans. 1)

50. n = 3, l = 1, m = - 1 represent $3p_x$ which has max. of 2 e^{-s} (Ans. 1)