# CHEMISTRY – SOLUTIONS

31. A) I, III, IV
32. D) 2.25R
33. A) -3.4 eV
34. C) n = 3 to n = 1
35. C) iii < ii < iv < i
36. A) $\frac{32}{27}$
37. Energy of one photon $= \frac{12400}{4000}$

    = 3.1 eV

    Energy supplied by one mole photon in KJ/mole

    $= 3.1 \times 1.6 \times 10^{-19} \times 10^{23} \times 10^{-3} = 297\, kJ\, mol^{-1}$

    $\therefore$ % of energy converted to $K.E = \frac{297 - 246.5}{297} = 17\%$
38. $\frac{hC}{\lambda_1} = W_0 + KE_1$

    $\frac{\lambda C}{\lambda_2} = W_0 + KE_2$

    $\therefore \quad W_0 = 2.3eV$
39. Total number of nodes = n–1
40. $\text{Mass} = \left[\frac{\text{m}}{\text{e}}\right] \times \text{e} = 1.5 \times 10^{-8}\,\text{kg/c} \times 1.6 \times 10^{-19}\,\text{c}$

    $= 2.4 \times 10^{-27}\,\text{kg} = 2.4 \times 10^{-24}\,\text{g}$
41. Change in $\text{KE} = \frac{\text{x}}{4} - \text{x} = \frac{-3\text{x}}{4}$

    Change in $\text{PE} = -2\left(\frac{-3\text{x}}{4}\right) = \frac{3\text{x}}{2}$
42. $\text{f} = 65.5 \times 10^{14} \times \frac{2^2}{\text{n}^3}$

    $\text{f} = 131 \times 10^{14}.1.31 \times 10^{16}$
43. Conceptual
44. $\text{n} \times \frac{\text{h}}{2\pi} = 4.2197 \times 10^{-34}$

    On solving n = 4
45. Since $l$ is having (n + 1) values $\therefore$ Electronic configuration of Fe will be

    Fe = $1s^2\ 1p^6,\ 2s^2\ 2p^6\ 3s^2\ 2d^8$

    $\therefore$ $Fe^{2+}$ ion = $1s^2\ 1p^6\ 2s^2\ 2p^6\ 2d^8$

    $\therefore$ $\mu_{\text{spin only}} = \sqrt{n(n+2)} = \sqrt{2(4)} = \sqrt{8}$ BM
46. $\lambda = \frac{\text{h}}{\sqrt{2\text{mKE}}}$ KE = eV

same mass $\frac{\lambda_1}{\lambda_2}=\sqrt{\frac{KE_1}{KE_1}}$

47. Plot I : $x = R^2$

Plot II : $y = R$

Plot III : z = $4\pi r^2 R^2$

48. $mvr_n = \frac{nh}{2\pi}$ ....(i)

deBroglie equation = $P = \frac{h}{\lambda} = mv$ ...(ii)

placing the value of mv from (ii) and (i) for 3rd orbit

$$\frac{h}{\lambda} r_3 = \frac{3h}{2\pi}$$

$$\Rightarrow \quad \frac{\lambda}{hr_3} = \frac{2\pi}{3h}$$

$$\lambda = \frac{2\pi r_3}{3}$$

or $r_3 = n^2 a_0 = 9a_0$

so $\lambda = \frac{2\pi.9a_0}{3} = 6\pi a_0$

49. $\frac{K.E_1}{K.E_2} = \frac{v_1 - v_0}{v_2 - v_0}$

$$\frac{y}{3y} = \frac{x - v_0}{2x - v_0}$$

$$2x - v_0 = 3(x - v_0)$$

$$v_0 = \frac{x}{2}$$

50. A

Hints: $\lambda_A = \frac{h_A}{p_A} \qquad \lambda_B = \frac{h_B}{p_B} \qquad p_B = \frac{1}{4} p_A$

$$\frac{8\times10^{-7}}{\lambda_B} = \frac{1}{4} \Rightarrow \lambda_B = 32\times10^{-7} m$$

51. D

Hints: $\frac{1}{\lambda} = \frac{1}{C_2}\left[\frac{n^2 - 2^2}{n^2}\right] = \frac{1}{C_2}\left[1 - \frac{2^2}{n_2^2}\right]$

$$= \frac{2^2}{C_2}\left[\frac{1}{2^2} - \frac{1}{n_2^2}\right]$$

$$R_H = \frac{2^2}{C_2} \Rightarrow C_2 = 4/R_H$$

52. C

Hints: $n = 3,\ l = 0,\ m = 0 \quad \Rightarrow -1/2, 0, +1/2 \quad \Rightarrow 3$

$l = 1,\ m = -1, 0, +1 \quad \Rightarrow 3 \times 3 \quad \Rightarrow 9$

$l = 2,\ m = -2, -1, 0, +1, +2 \quad \Rightarrow 5 \times 3 = 15 \quad \Rightarrow 27$

53. Conceptual

54. Conceptual

55. Azimutal gives shape of orbital.

56. Orbit angular momentum, $\frac{nh}{2\pi} = \frac{3h}{2\pi} \Rightarrow n = 3$

Orbital angular momentum, $\sqrt{l(l+1)}\,\frac{h}{2\pi} = \sqrt{\frac{3}{2}}\,\frac{h}{\pi} \Rightarrow l = 2$

Hence electron is in $3d$-orbital. For $3d$-orbital, radial nodes = $(n - l - 1) = 0$

Angular nodes = $l = 2$

57. $H - 1s^1$, one unpaired electron, $S = \frac{1}{2}$

$\therefore$ Spin angular moment $= \sqrt{S(S+1)}\,\frac{h}{2\pi}$

$= \sqrt{\frac{1}{2}\left(\frac{1}{2}+1\right)}\,\frac{h}{2\pi} = \frac{\sqrt{3}h}{4\pi}$

58. $r \alpha \frac{n^2}{Z}$

$\frac{r_1}{r_3} = \frac{n_1^2}{n_2^2} = \frac{1}{3^2} = \frac{1}{9}$

$r_1 = \frac{x}{9} \quad [\because r_3 = x]$

$\therefore 2\pi r = n\lambda$

$\therefore 2\pi \times \frac{x}{9} = 1 \times \lambda$

$\Rightarrow \lambda = \frac{2\pi x}{9}$

59. $\frac{3x}{2}$; Incase in the potential energy in two times when compared to the decrease in kinetic energy

60. de Broglie wave length, $\lambda = \frac{h}{mv}$