1. (c) The species CO, NO^+, CN^- and C_2^{2-} contain 14 electrons each.

2. (d) NaCl: No. of e^- in Na^+ = At. No. of Na–1 = 11 – 1 = 10

No. e^- in Cl^- = At. No. of Cl + 1 = 17 + 1 = 18

CsF : No. of e^- in Cs^+ = 55 – 1 = 54

No. of e^- in F^- = 9 + 1 = 10

NaI : No. of e^- in Na^+ = 11 – 1 = 10

No. of e^- in I^- = 53 + 1 = 54

K_2S: No. of e^- in K^+ = 19 – 1 = 18

No. of e^- in S^{2-} = 16 + 2 = 18

3. (c) For electron in the ground state,

$$mvr = \frac{h}{2\pi} \Rightarrow mv = \frac{h}{2\pi r}$$

Now, $mv = \frac{h}{\lambda}$

So, $\frac{h}{\lambda} = \frac{h}{2\pi r} \Rightarrow \lambda = 2\pi r$

$$\lambda = 2\times 3.14\times 0.53\text{Å} = 3.328\text{Å}$$
$$= 3.328\times 10^{-10}\text{m}$$
$$= 0.3328\times 10^{-9}\text{m} = 0.3328\text{ nm}$$

4. (a) For He^+,

$$\bar{v} = \frac{1}{\lambda} = R_H Z^2\left(\frac{1}{2^2}-\frac{1}{4^2}\right)$$
$$= R_H(2)^2\left(\frac{1}{2^2}-\frac{1}{4^2}\right) = R_H\left(\frac{1}{(1)^2}-\frac{1}{(2)^2}\right)$$

For H,

$$\bar{v} = \frac{1}{\lambda} = R_H\left(\frac{1}{n_1^2}-\frac{1}{n_2^2}\right)$$

For same frequency,

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

$$\therefore \quad \frac{1}{n_1^2}-\frac{1}{n_2^2} = \frac{1}{1^2}-\frac{1}{2^2}$$

$\therefore \quad n_1 = 1$ & $n_2 = 2$

5. (d) For Balmer $n_1 = 2$ and $n_2 = 3$;

$$\nu = R\left(\frac{1}{2^2}-\frac{1}{3^2}\right) = \frac{5R}{36}\text{ cm}^{-1}$$

6. (c) Series limit is the last line of the series, i.e. $n_2 = \infty$.

$$\therefore \bar{\upsilon} = \frac{1}{\lambda} = R\left[\frac{1}{n_1^2}-\frac{1}{n_2^2}\right] = R\left[\frac{1}{n_1^2}-\frac{1}{\infty^2}\right] = \frac{R}{n_1^2}$$

$$\because \bar{\upsilon} = 12186.3 = \frac{109677.76}{n_1^2}$$

$$\Rightarrow n_1^2 = \frac{109677.76}{12186.3} = 9 \Rightarrow n_1 = 3$$

$\therefore$ The line belongs to Paschen series.

7. (d) de Broglie wavelength, $\lambda = \frac{h}{mv}$

$$\frac{\lambda_1}{\lambda_2} = \frac{m_2v_2}{m_1v_1};\ \frac{1}{4} = \frac{1}{9}\times\frac{v_2}{v_1}$$

$$\frac{v_2}{v_1} = \frac{9}{4}$$

$$\frac{v_1}{v_2} = \frac{4}{9}$$

$$KE = \frac{1}{2}mv^2$$

$$\frac{KE_1}{KE_2} = \frac{m_1}{m_2}\times\frac{v_1^2}{v_2^2} = \frac{9}{1}\times\left(\frac{4}{9}\right)^2 = \frac{16}{9}$$

8. (c) Fe (III) = [Ar] $3d^5$ unpaired electrons = 5;

Magnetic moment = $\sqrt{5(5+2)}$;

Ratio = $\sqrt{7} : \sqrt{3}$

Co(II) = [Ar] $3d^7$ unpaired electrons = 3;

Magnetic moment = $\sqrt{3(3+2)}$

Ratio = $\sqrt{7} : \sqrt{3}$

9. (b) $E = h\upsilon = \frac{ch}{\lambda}$; and $\upsilon = \frac{c}{\lambda}$

$$8\times 10^{15} = \frac{3.0\times 10^8}{\lambda}$$

$$\therefore \lambda = \frac{3.0\times 10^8}{8\times 10^{15}} = 0.37\times 10^{-7} = 37.5\times 10^{-9}\text{ m} = 4\times 10^1$$

10. (d) $\lambda_p = \frac{h}{\sqrt{2eVm_p}}$; $\lambda_{Li} = \frac{h}{\sqrt{2\times 3eVm_{Li}}}$

$$= \frac{h}{\sqrt{2\times 3eV\times 9m_p}}$$

Hence, $\frac{\lambda_{Li^{3+}}}{\lambda_p} = \sqrt{\frac{2eVm_p}{2\times 3eV\times 9m_p}} = \frac{1}{3\sqrt{3}}$

11. (b) From the given data, we have

$$(E_C - E_B) + (E_B - E_A) = (E_C - E_A)$$

or $\left(\frac{hc}{\lambda_1}+\frac{hc}{\lambda_2}\right) = \frac{hc}{\lambda_3}$ $\quad\left[\text{or } \frac{1}{\lambda_1}+\frac{1}{\lambda_2} = \frac{1}{\lambda_3}\right]$

or $\boxed{\lambda_3 = \frac{\lambda_1\lambda_2}{\lambda_1+\lambda_2}}$ $\quad\left[\because \frac{\lambda_1+\lambda_2}{\lambda_1.\lambda_2} = \frac{1}{\lambda_3}\right]$