

**Daily Tutorial Sheet 1**

**JEE Main (Archive)**

**1.(AB)** Nucleus is composed of neutrons and protons.

**2.(C)** According to Heisenberg uncertainty principle,

$$\Delta x \cdot m\Delta v = \frac{h}{4\pi}$$

$$\Delta v = \frac{6.6 \times 10^{-34} \times 1000}{4 \times 3.14 \times 25 \times 10^{-5}}$$

$$\therefore \Delta v = 2.1 \times 10^{-28} \text{ m s}^{-1}$$

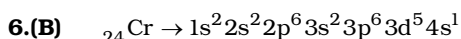
**3.(A)** 2<sup>nd</sup> excited state will be the 3<sup>rd</sup> energy level.

$$E_n = \frac{13.6}{n^2} \text{ eV or } E = \frac{13.6}{9} = 1.51 \text{ eV}$$

**4.(A)**  $\lambda = \frac{h}{mv} = \frac{6.63 \times 10^{-34} \times 1000}{60 \times 10} \text{ m}$

$$= 11.05 \times 10^{-34} \text{ m} = 1.105 \times 10^{-33} \text{ metres.}$$

**5.(B)** The electron has minimum energy in the first orbit and its energy increases as n increases. Here n represents number of orbit, i.e. 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup>.... The third line from the red end corresponds to yellow region i.e., 5. In order to obtain less energy electron tends to come in 1<sup>st</sup> or 2<sup>nd</sup> orbita. So jump involved may be either 5 → 1 or 5 → 2 .



We know for p, l = 1 and for d, l = 2.

For l = 1, total number of electrons = 12 [2p<sup>6</sup> and 3p<sup>6</sup>]

For l = 2, total number of electrons = 5[3d<sup>5</sup>]

**7.(C)** According to Heisenberg's uncertainty principle,

$$\Delta x \times \Delta p = \frac{h}{4\pi}$$

$$\Delta x \cdot (m \cdot \Delta v) = \frac{h}{4\pi} \Rightarrow \Delta x = \frac{h}{4\pi m \cdot \Delta v}$$

$$\text{Here } \Delta v = \frac{0.001}{100} \times 300 = 3 \times 10^{-3} \text{ m s}^{-1}$$

$$\therefore \Delta x = \frac{6.63 \times 10^{-34}}{4 \times 3.14 \times 9.1 \times 10^{-31} \times 3 \times 10^{-3}} = 1.92 \times 10^{-2} \text{ m}$$

**8.(C)** n = 3, l = 0 represents 3s orbital

n = 3, l = 1 represents 3p orbital

n = 3, l = 2 represents 3d orbital

n = 4, l = 0 represents 4s orbital

The order of increasing energy of the orbitals is

3s < 3p < 4s < 3d .

**9.(C)** Given, velocity of e<sup>-</sup>, v = 600 m s<sup>-1</sup>

Accuracy of velocity = 0.005%

$$\therefore \Delta v = \frac{600 \times 0.005}{100} = 0.03$$

According to Heisenberg's uncertainty principle,

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

$$\Rightarrow \Delta x = \frac{6.6 \times 10^{-34}}{4 \times 3.14 \times 9.1 \times 10^{-31} \times 0.03} = 1.92 \times 10^{-3} \text{ m}$$

**10.(B)** According to de-Broglie's equation,  $\lambda = \frac{h}{mv}$

Given,  $v = 1.0 \times 10^3 \text{ m s}^{-1}$

$$\therefore \lambda = \frac{6.63 \times 10^{-34}}{1.67 \times 10^{-27} \times 1.0 \times 10^3} = 3.9 \times 10^{-10} \text{ m}$$

or  $\lambda \approx 0.4 \text{ nm}$

**11.(C)** Ionisation energy of  $\text{He}^+ = 19.6 \times 10^{-18} \text{ J atom}^{-1}$ .

= Energy of first stationary state of  $\text{He}^+$

=  $-19.6 \times 10^{-18} \text{ J atom}^{-1}$ .

$$E_{n(\text{He}^+)} = \frac{-2\pi^2 Z_{\text{He}}^2 m e^4}{n^2 h^2}; E_{n(\text{Li}^+)} = \frac{-2\pi^2 Z_{\text{Li}}^2 m e^4}{n^2 h^2}$$

$$\frac{E_{n(\text{Li}^{2+})}}{E_{n(\text{He}^+)}} = \frac{Z_{\text{Li}}^2}{Z_{\text{He}}^2} = \frac{3^2}{2^2}$$

$$\text{or, } E_1(\text{Li}^{2+}) = \frac{3^2}{2^2} E_{1(\text{He}^+)} = \frac{9}{4} (-19.6 \times 10^{-18})$$

$$= -4.41 \times 10^{-17} \text{ J atom}^{-1}$$

**12.(C)** We know that,  $E = hv = hc / \lambda$

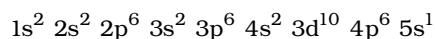
$$E = E_1 + E_2 \text{ or } \frac{hc}{\lambda} = \frac{hc}{\lambda_1} + \frac{hc}{\lambda_2}$$

$$\Rightarrow \frac{1}{\lambda} = \frac{1}{\lambda_1} + \frac{1}{\lambda_2} \Rightarrow \frac{1}{355} = \frac{1}{680} + \frac{1}{\lambda_2}$$

$$\therefore \lambda_2 = \frac{355 \times 680}{680 - 355} = 742.769 \text{ nm} \approx 743 \text{ nm}$$

**13.(A)** Higher is the value of  $(n+l)$  more is the energy level of orbital. If  $(n+l)$  is same lower value of  $n$  decides lower energy level.

**14.(A)** Electronic configuration of Rb (atomic no 37)



$$n = 5, l = 0, m = 0 \text{ \& } s = \pm \frac{1}{2}$$

$$\text{15.(A)} \quad \frac{1}{\lambda} = R_H Z^2 \left( \frac{1}{n_1^2} - \frac{1}{n_2^2} \right)$$

$$Z = 1, n_1 = 1 \text{ \& } n_2 = 2, R_H = 109677 \text{ cm}^{-1}$$

$$\lambda = 1.2 \times 10^{-7} \text{ m}$$