Assignment 2 Answer key

ANSWERS OF MCQ(1mark)

1.(a) Thomson's model failed to explain the scattering of alpha particles through large angles in Rutherford experiment.

2. (d) r=0.53 ^{0}A

3. (c) 4 → 3

4. (a)-0.54eV

5. (b)6

6. (d)angular momentum

Answers of Assertion Reason (1 mark)

7. Correct Answer: B

8. correct Answer B

9. Correct Answer: B

Case Study based question - Answers (5 marks)

10. (I) (d) infinity

(II) (d)Lyman Series

(III) (c)4861 ^{0}A

(IV) (a)Universal constant

(V) (c) 6

Short answer type questions (2M)- Answers

11. ΔE= Ei – Ef Ratio=3:4

12. Wave length decreases. P = $\sqrt{2mKE}$ = h/λ

E is proportional to 1/ λ

13. Distance of closest approach: It is the distance of charged particle from the centre of the nucleus, at which the whole of the initial kinetic energy of the (far off) charged particle gets converted into the electric potential energy of the system.

Distance of closest approach (r_c) is given by

$$r_c = \frac{1}{4\pi\varepsilon_0}\frac{2Ze^2}{K}$$

'K' is doubled and r_C becomes $\frac{r}{2}$

14. (i)

$$r = r_0 n^2$$

$$21.2\ X\ 10^{-11} = 5.3\ X\ 10^{-11}\ n^2$$

$$n = 2$$

(ii)

$$E = -\frac{13.6eV}{n^2}$$

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

15. (i) Energy of Photon $= \frac{hc}{\lambda}$

$$= \frac{6.64\times10^{-34}\times3\times10^{8}}{275\times10^{-9}\times1.6\times10^{-18}}\ \text{eV}$$

$$= 4.5\ eV$$

(ii) The transition is B.

16. $$\frac{1}{4\pi\varepsilon_0}\cdot\frac{e^2}{r^2} = \frac{mv^2}{r}$$

$$r = \frac{e^2}{4\pi\varepsilon_0 mv^2}$$

$$mv^2 r = \frac{e^2}{4\pi\varepsilon_0} \qquad \text{.............(1)}$$

According to the Bohr's Postulates,

$$mvr = \frac{nh}{2\pi}$$

$$m^2v^2r^2 = \frac{n^2h^2}{4\pi^2}$$

Using the value of mv^2r from eqn. (1)

$$\frac{e^2}{4\pi\varepsilon_0}mr = \frac{n^2h^2}{4\pi^2}$$

$$r = \left(\frac{n^2}{m}\right)\left(\frac{h}{2\pi}\right)\frac{4\pi\varepsilon_0}{e^2}$$

The above equation show that r is directly proportional to n^2

<u>Short answer type questions (3M)- Answers</u>

17. The corresponding to the given wavelength

$$E = \frac{12400}{\lambda} = \frac{12400}{975} = 12.71\, eV$$

The excited state

$$E_n - E_1 = 12.71$$

$$-\frac{13.6}{n^2} + 13.6 = 12.71$$

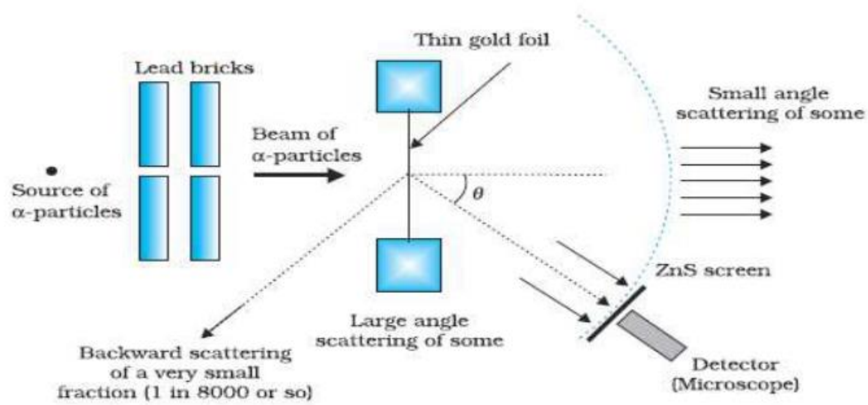
$$\therefore \quad n = 3.9 \approx 4$$

$$total\ no\ of\ spectral\ lines\ emitted : \frac{n(n-1)}{2} = 6$$

Longest wavelength will corresponding to the transition n=1 to n=4.

<u>Long answer type questions (5M)- Answers</u>

18. (i) Geiger-Marsden experiment: Alpha particles emitted by a ${}^{214}_{83}Bi$ radioactive source were collimated into a narrow beam by passing them through lead bricks. The beam was allowed to fall on a thin foil of gold of thickness 2.1×10^{-7} m. The scattered alpha particles were observed through a rotatable detector consisting of zinc sulphide screen and a microscope. The scattered alpha particles on striking the screen produced brief light flashes or scintillations. These flashes may be viewed through a microscope.



From the experiment, it was observed that only a small fraction of number of α-particles rebound back. This shows that the number of α-particles undergoing head on collision is very small. The conclusion is that the entire positive charge of atom is concentrated in a small volume called the nucleus.

(ii) The alpha particles those are incident directly on the gold nucleus, experience a very large force of repulsion and undergo maximum deflection as observed in the experiment. At the distance of head on approach, the entire kinetic energy of α-particle is converted into electrostatic potential energy. This distance of head on approach gives an upper limit of the size of nucleus (denoted by r_0) and is given by

$$E_k = \frac{1}{4\pi\varepsilon_0} \cdot \frac{(Ze)(2e)}{r_0}$$

$$r_0 = \frac{1}{4\pi\varepsilon_0} \cdot \frac{(Ze)(2e)}{E_k}$$

This is about 10^{-14} m.