Structure of Atom

One Mark Questions

1. Neutrons can be found in all atomic nuclei except in one case. Which is this atomic nucleus and what does it consists of?

Ans. Hydrogen atom. It consists of only one proton.

2. Calculate wave number of yellow radiations having wavelength of 5800 A^0.

Ans. Wave number = 1/ wavelength

   Wavelength = 5800 A^0 = 5800 x 10^{-10} m

   Wave number = 1/5800 x 10^{-10} m   = 1.72 x 10^6 m^{-1}

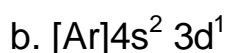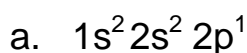3. What are the values of n and l for 2p orbital?

Ans. n=2 and l= 1

4. Which of the following orbitals are not possible?   1p, 2s, 3f and 4d

Ans. 1p and 3f are not possible.

5. Write the electronic configuration of the element having atomic number 24.

Ans. $1s^2$ $2s^2$ $2p^6$ $3s^2$ $3p^6$ $3d^5$ $4s^1$

6. What atoms are indicated by the following electronic configurations?

   a. $1s^2$ $2s^2$ $2p^1$ b. $[Ar]4s^2$ $3d^1$

Ans. a. Boron   b. Scandium

7. What is the relationship between frequency and wavelength of light?

Ans. velocity of light = frequency x wavelength. Frequency and wavelength are inversely proportional to each other.

8. State Pauli Exclusion Principle.

Ans. No two electrons in an atom can have the same set of four quantum numbers or an orbital can have maximum two electrons and these must have opposite spin.

9. When α- rays hit a thin foil of gold, very few α- particles is deflected back. What does it prove?

Ans. There is a very small heavy body present within the atom.

10. What is the difference between a quantum and a photon?

Ans. The smallest packet of energy of any radiation is called a quantum whereas that of light is called photon.

TWO MARKS QUESTIONS

1. Write the complete symbol for the atom with the given atomic number (Z) and mass number (A). (a) Z = 17, A = 35   (b) Z = 92 , A = 233

Ans. (a) $_{17}Cl^{35}$ (b) $_{92}U^{233}$

2. Using s, p, d and f notation, describe the orbital with the following quantum numbers-

(a) n=1,l=0   (b) n=3, l=1   (c) n=4, l=2   (d) n=4, l=3

Ans. (a) 1s   (b) 3p   (c)4d   (d) 4f

3. How many electrons in an atom have the following quantum numbers?

a.   n=4, m_s= -1/2   b. n =3 , l=o

Ans.   (a) 16 electrons   (b) 2 electrons.

4. An element with mass number 81 contains 31.7 % more neutrons as compared to protons. Assign the atomic symbol.

Ans. Mass number = 81, i.e., p + n = 81

If protons = x, then neutrons = x + $\underline{31.7}$ X x
                                                                100
= 1.317 x

x+1.317x = 81 or 2.317x = 81 i.e., x=35

Thus proton = 35, i.e., atomic no. = 35

Hence symbol is $_{35}Br^{81}$

5. (i) The energy associated with the first orbit in the hydrogen atom is -2.18 x 10^{-18}J/atom. What is the energy associated with the fifth orbit

(ii) Calculate the radius of Bohr's fifth orbit for hydrogen atom.

Ans. (i) $E_n = -2.18 \times 10^{-18}/n^2$ $E_5 = -2.18 \times 10^{-18}/5^2 = -8.72 \times 10^{-20}$ J

(ii) For H atom, $r_n = 0.529 \times n^2$ $r_5 = 0.529 \times 5^2 = 13.225$ A$^0 = 1.3225$ nm

6. Explain, giving reasons, which of the following sets of quantum numbers are not possible.

(a) n=0, l=0; $m_l = 0$, $m_s = +\frac{1}{2}$ (c) n=1, l=0; $m_l = 0$, $m_s = -\frac{1}{2}$

(b) n=1, l=1; $m_l = -0$, $m_s = +\frac{1}{2}$ (d) n=2, l=1; $m_l = 0$, $m_s = +\frac{1}{2}$

Ans. (a) Not possible because n≠ 0   (c) Not possible because when n=1, l≠1

(b) Possible   (d) Possible

7. (a)What is the lowest value of n that allows g orbitals to exist?

(b)An electron is in one of the 3d orbitals, Give the possible values of n, l and m_l for this electron.

Ans. (a) minimum value of n= 5   (b)n=3, l=2, m_l = -2, -1, 0, +1, +2

8. Calculate the total number of angular nodes and radial nodes present in 30 orbitals.

Ans. For 3p orbitals, n=3, l= 1

Number of angular nodes = l= 1

Number of radial nodes = n-l-1 = 3-1-1= 1

9. Mention the draw backs of Rutherford's atomic model.

Ans. 1. It could not explain the stability of an atom.

2. It could not explain the line spectrum of H- atom.

10. State de-Broglie concept of dual nature of matter. How do dual nature of electron verified?

Ans. Just as light has dual nature, every material particle in motion has dual nature (particle nature and wave nature). The wave nature has been verified by Davisson and Germer's experiment whereas particle nature by scintillation experiment.

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