	INDIAN SCHOOL AL WADI AL KABIR	
Class XI	**Department of Science 2020-2021** **SUBJECT : Chemistry**	**Date of completion :** **August 1st week**
Work sheet No.: 4 **With answers**	**Chapter: Structure of Atom**	**Note: A4 File format**
Name of the student:	**Class & Section:**	**Roll No.**

Objective type Questions (1 mark)

1. Among the various quantum numbers (n ,*l*,m,s) describing an electron, which can have the largest value?

   (a) n
   (b) l
   (c) m
   (d) s
2. What are the values of n and *l* for 2p orbital?
3. How many unpaired electrons are present in Ni^{2+}?
   A) 8 B) 3 C) 2 D) 0

4. What is the value of Azimuthal quantum number '*l*' for p sub-shell?
   A) 0 B) 1 C) 3 D) 4
5. Which of the following orbitals has the highest energy?
   A) 2s B) 4s C) 3p D) 3d
6. State Heisenberg's uncertainty principle.
7. Write the subshell electronic configuration of the element having atomic number 24.
8. Which of the following orbitals are not possible?
   (a) 1p (b) 2s (c) 3f (d) 4d

Assertion- Reasoning Questions

(A) Both assertion and reason are correct statements, and reason is the correct explanation of the assertion.
(B) Both assertion and reason are correct statements, but reason is not the correct explanation of the assertion.
(C) Assertion is correct, but reason is wrong statement.
(D) Assertion is wrong, but reason is correct statement.

9. **Assertion (A) :** It is impossible to determine the exact position and exact momentum of an electron simultaneously.
   Reason (R) : The path of an electron in an atom is clearly defined.

10. **Assertion** : Number of orbitals in 3rd shell is 9.
Reason : Number of orbitals for a particular value of n = n^2.

Two marks Questions

11. 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
12. How many electrons in an atom have the following quantum numbers?
a. n=4, m_s= -1/2 b n =3 , l=0
13. What is the wavelength of a ball of mass 0.2 kg moving with a velocity of 10ms $^{-1}$
14. a) Write all the four quantum numbers of the outermost electron of Al.
b) State Hund's Rule of Maximum Multiplicity
15. a. The following set of quantum numbers is not possible. Why?

$n = 1, \quad l = 1, \quad m_l = 0, \quad m_s = +½$

16. a. State Hund's Rule of Maximum Multiplicity.
b. Write all the quantum numbers of $4d^3$.
17. Write any two limitations of Bohr model of atom.
18. (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 fifth orbit for hydrogen atom

Three marks Questions

19. What is the wavelength of light emitted when the electron in a Hydrogen atom undergoes transition from an energy level with n = 4 to an energy level with n = 2?
20. a) How many electrons in an atom may have the following quantum numbers?
i) n = 4, m_l = -1, m_s = - ½ ii) n = 3, *l* = 2
b) Draw Boundary surface diagrams of: i) P_x ii) dz^2
21. a. Write the significance of Azimuthal quantum number.
b. Calculate the energy of the radiation emitted when an electron in a H atom makes a transition from a fourth energy level to first energy level.

Five marks Questions

22. What are the draw backs of Bohr 's atomic model?
Show that the circumference of the Bohr orbit for the hydrogen atom is an integral multiple of the de Broglie wavelength associated with the electron revolving around the orbit.
23. (a)The quantum numbers of six electrons are given below. Arrange them in order of increasing energies.
1. n= 4, *l* = 2, m_l= –2 , m_s= –1/2
2. n= 3, *l* = 2, m_l= 1 , m_s= +1/2
3. n= 4, *l* = 1, m_l= 0 , m_s= +1/2

4. n = 3, l= 2, m_l= –2 , m_s= –1/2
5. n = 3, l= 1, m_l= –1 ,m_s= +1/2
6. n = 4, l= 1, ml= 0 , m_s= +1/2

(b)Among the following pairs of orbitals which orbital will experience the larger effective nuclear charge? (i) 2s and 3s, (ii) 4d and 4f, (iii) 3d and 3p

A**nswers :**

1. (a) n
2. n=2 and l= 1
3. (c)
4. (B)
5. (D)
6. Heisenberg's uncertainty principle states that it is impossible to determine simultaneously, the exact position and exact momentum (or velocity) of an electron
7. $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^5\ 4s^1$
8. (c) 3f
9. (C) Assertion is correct, but reason is wrong statement.
10. (A) Both assertion and reason are correct statements, and reason is the correct explanation of the assertion.
11. (a) 1s (b) 3p (c)4d (d) 4f
12. (a) 8 (b) 2
13. $\lambda = h/mv = 6.626 \times 10^{-34} / 0.2 \times 10 = 3.313 \times 10^{-34}$
14. n=3 l=1 m=+1 s=+1/2
15. l value has to be n-1
16. (a) Pairing of electrons in the orbitals belonging to the same subshell (p, d or f) does not take place until each orbital belonging to that subshell has got one electron each i.e., it is singly occupied.
    (b) n=4 l= 2 m= 0 s = +1/2
17. a. Bohr's model failed to account for the finer details of the hydrogen spectrum.
    b. Bohr's model was also unable to explain spectrum of atoms containing more than one electron.

18. (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, $r = 0.529 \times n^2$ $r_5 = 0.529 \times 5^2 = 13.225\ A^0$

19. n_i= 4 n_f= 2,

$$E = 2.18 \times 10^{-18} \left[\frac{1}{n_i^2} - \frac{1}{n_f^2} \right]$$

$$E = 2.18\times10^{-18}\left[\frac{1}{4^2}-\frac{1}{2^2}\right]$$

$$= 2.18\times10^{-18}\left[\frac{1-4}{16}\right]$$

$$= 2.18\times10^{-18}\times\left(-\frac{3}{16}\right)$$

E =– 4.0875 × 10^{-19} J

$$(\lambda) = \frac{hc}{E}$$

$$\lambda = \frac{\left(6.626\times10^{-34}\right)\left(3\times10^{8}\right)}{4.0875\times10^{-19}}$$

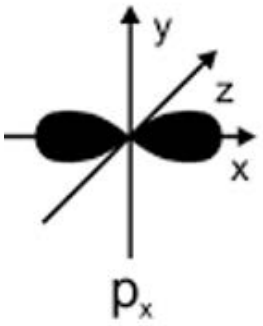
$$\lambda = 4.8631\times10^{-7}\ \text{m}$$

$$= 486.3\times10^{-9}\,\text{m}$$

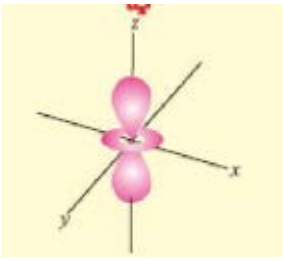
$$= 486\ \text{nm}$$

20. (a) (i) 3 (ii) 10 electrons

(b) (i)



(ii)



21 a. gives the angular momentum and three-dimensional shape of the orbital,

b. E = 2.18 × 10^{-18} (1/ni^2 – 1/ nf^2) = 2.18 × 10^{-18}(1/ 16 - 1) = - 2.043 × 10^{-18} J

22 1.Bohr‘s model failed to account for the finer details of the hydrogen spectrum.

2. Bohr‘s model was also unable to explain spectrum of atoms containing more than one

electron.

3. Bohr‘s model was unable to explain Zeeman effect and Stark effect

4. Bohr‘s model could not explain the ability of atoms to form molecules by chemical

bonds

According to Bohr‘s postulate, the angular momentum of that electron is given by:

$$mvr = n\frac{h}{2\pi} \ldots\ldots\ldots (1)$$

According to de Broglie ‘s equation:

$$\lambda = \frac{h}{mv} \quad \text{——————} \quad \boxed{2}$$

Rearranging eqn (1) $2\pi r = nh/mv$

$2\pi r = n\lambda$

23 (a) The orbitals given are (1) 4d, (2) 3d, (3) 4p, (4) 3d, (5) 3p, and (6) 4p orbitals

Therefore, the increasing order of energies is

5(3p) < 2(3d) = 4(3d) < 3(4p) = 6(4p) < 1 (4d).

(b) (i) The electron(s) present in the 2s orbital will experience greater nuclear charge (being closer to the nucleus) than the electron(s) in the 3s orbital.

(ii) 4d will experience greater nuclear charge than 4fsince 4d is closer to the nucleus.

(iii) 3p will experience greater nuclear charge since it is closer to the nucleus than 3f.

Prepared by : Ms. Jenesha Joseph	**CHECKED BY : HOD - SCIENCE**