INDIAN SCHOOL AL WADI AL KABIR

Class: XI	**DEPARTMENT: SCIENCE 2024-25** **SUBJECT: CHEMISTRY**	**Date of completion:** **III week of May, 2024**
Worksheet No:02 with answers	**TOPIC: STRUCTURE OF ATOM**	**Note:** **A4 FILE FORMAT**
NAME OF THE STUDENT	**CLASS & SEC:**	**ROLL NO.**

MULTIPLE CHOICE QUESTIONS

1. Indicate the number of unpaired electrons in F atom.

i) 0 ii) 5 iii) 3 iv) 1

2. How many unpaired electrons are present in Co^{2+}?

i) 5 ii) 6 iii) 3 iv) 2

3. On moving down the group, shielding effect

i) Increases ii) Decreases iii) Remains the same iv) None of these

4. According to Bohr's theory for hydrogen atom, the angular momentum of an electron is

i) $mvr = nh/2\pi$ ii) $mvr = nh/4\pi$ iii) $mvr = nh/\pi$ iv) $mvr = nh/4\pi^2$

5. Calculate the number of radial nodes present in 3d sub-shell.

i) 0 ii) 1 iii) 2 iv) 4

6. What is the total number of orbitals associated with the principal quantum number n = 4?

i) 10 ii) 16 iii) 12 iv) 8

7. Which of the following orbitals is not possible?

i) 5p ii) 6s iii) 4d iv) 3f

8. How many electrons are present in 3d orbitals of Fe^{3+}?

i) 6 ii) 4 iii) 5 iv) 3

9. Identify the sub-shell with highest energy?

i) 5s ii) 4d

iii) 5p iv) 4f

10. Spin quantum number of the outermost electron of Na is …….

i) + ½ ii) – ½

iii) +1 iv) -1

Read the given passage and answer the questions that follow:

A large number of orbitals are possible in an atom. Qualitatively these orbitals can be distinguished by their size, shape and orientation. An orbital of smaller size means there is more chance of finding the electron near the nucleus. Similarly shape and orientation mean that there is more probability of finding the electron along certain directions than along others. Atomic orbitals are precisely distinguished by what are known as quantum numbers. Each orbital is designated by three quantum numbers labelled as n, l and m_l.

11. Identify the quantum number which determines the size and energy of the orbital.

12. Using s, p, d notations, describe the orbital with the following quantum numbers.

(a) n=3, l=1; (b) n = 2; l=0

13. Write all 4 quantum numbers of the outermost electron of potassium.

Assertion – Reason Questions

14. **Assertion**: It is impossible to determine the exact position and exact momentum of an electron simultaneously.

Reason: The path of an electron in an atom is clearly defined.

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.

15. **Assertion**: There are 5 electrons in the 3d sub-shell of Cr.

Reason: Half filled sub-shells are more stable.

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.

Question – Answer Type:

16. Write the expression which is commonly known as Bohr's frequency rule. **1**

17. Write any 2 limitations of Bohr's model. **1**

18. State Heisenberg's uncertainty principle. **1**

19. Calculate the angular nodes and total nodes present in 4p sub-shell. **1**

20. What are degenerate orbitals? **1**

21. Calculate the energy associated with the first orbit of Li^{2+}. What is the radius of this orbit? **2**

22. Draw Boundary surface diagrams of: **2**

i) P_x

ii) d_z^2

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

i) n = 4, m_l = -1, m_s = - ½

ii) n = 3, l = 2

iii) n = 4, l = 3, m_s = + ½

24. State: **3**

i) Aufbau Principle

ii) Pauli Exclusion Principle

iii) Hund's Rule of Maximum Multiplicity.

25. Write sub-shell electronic configuration for the following: **3**

i) Cu

ii) Fe^{2+}

iii) Cl^-

26. a) A cricket ball has a mass of 150g and a speed of 50 ms^{-1}. If the speed can be measured within accuracy of 4%, calculate the uncertainty in the position. **5**

b) Calculate the wavelength of a ball of mass 200 g moving with a velocity of 15 m s^{-1}?

ANSWERS

1. iv) 1

2. iii) 3

3. i) Increases

4. i) $mvr = nh/2\pi$

5. i) 0

6. ii) 16

7. iv) 3f

8. iii) 5

9. iv) 4f

10. i) + ½

11. Principal quantum number

12. (a) 3p (b) 2s

13. n=4, l=0, m_l = 0, m_s = + ½

14. c) Assertion is correct, but reason is wrong statement

15. a) Both assertion and reason are correct statements, and reason is the correct explanation of the assertion.

16. $$\nu = \frac{\Delta E}{h}$$

17.
- Bohr's theory is unable to explain the splitting of spectral lines in the presence of magnetic field (Zeeman effect) or an electric field (Stark effect).
- It could not explain the ability of atoms to form molecules by chemical bonds.

18. It is impossible to determine simultaneously, the exact position and exact momentum (or velocity) of an electron.

19. Angular nodes = 1 and total nodes = 3

20. Orbitals having the same energy are called degenerate orbitals.

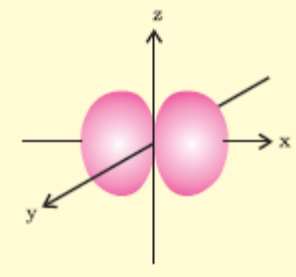
21.
$$E_n = -2.18 \times 10^{-18} \left(\frac{Z^2}{n^2}\right) \text{J}$$

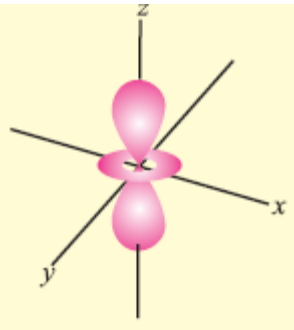
Z = 3, n = 1

E = - 19.62 x 10^{-18} J

$$r_n = \frac{52.9(n^2)}{Z} \text{pm}$$

r = 17.63 pm

22. i) 

ii) 

23. i) 3 ii) 10 iii) 7

24. i) In the ground state of the atoms, the orbitals are filled in order of their increasing energies.

ii) No two electrons in an atom can have the same set of four quantum numbers.

iii) Pairing of electrons does not take place until each orbital is singly occupied.

25. i) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1 3d^{10}$

ii) i) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^0 3d^6$

iii) i) $1s^2 2s^2 2p^6 3s^2 3p^6$

26. a) Uncertainty in velocity $= \frac{50 \times 4}{100}$

$= 2\ ms^{-1}$

Uncertainty in the position $= \frac{6.626 \times 10^{-34}}{4 \times 3.14 \times 0.15 \times 2}$

$= 1.75 \times 10^{-34}$ m

b)

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

$\lambda = 2.208 \times 10^{-34}$ m

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