

Atomic structure(1st sem) (G)

- Which of the following conclusions could not be derived from Rutherford's α particle scattering experiment?
 - Most of the space in the atom is empty.
 - The radius of the atom is about 10^{-10} m while that of nucleus is 10^{-15} m.
 - Electrons move in a circular path of fixed energy called orbits.
 - Electrons and the nucleus are held together by electrostatic forces of attraction.
- Which of the following options does not represent ground state electronic configuration of an atom?
 - $1s^2 2s^2 2p^6 3s^2 3p^6 3d^8 4s^2$
 - $1s^2 2s^2 2p^6 3s^2 3p^6 3d^9 4s^2$
 - $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^1$
 - $1s^2 2s^2 2p^6 3s^2 3p^6 3d^5 4s^1$
- Two atoms are said to be isobars if.
 - they have same atomic number but different mass number.
 - they have same number of electrons but different number of neutrons.
 - they have same number of neutrons but different number of electrons.
 - sum of the number of protons and neutrons is same but the number of protons is different.
- The number of radial nodes for $3p$ orbital is _____.
 - 3
 - 4
 - 2
 - 1
- Number of angular nodes for $4d$ orbital is _____.
 - 4
 - 3
 - 2
 - 1
- Which of the following is responsible to rule out the existence of definite paths or trajectories of electrons?
 - Pauli's exclusion principle.
 - Heisenberg's uncertainty principle.
 - Hund's rule of maximum multiplicity.
 - Aufbau principle.
- Total number of orbitals associated with third shell will be _____.
 - 2
 - 4
 - 9
 - 3
- Orbital angular momentum depends on _____.

- (i) l
- (ii) n and l
- (iii) n and m
- (iv) m and s

9. The pair of ions having same electronic configuration is _____.

- (i) Cr^{3+} , Fe^{3+}
- (ii) Fe^{3+} , Mn^{2+}
- (iii) Fe^{3+} , Co^{3+}
- (iv) Sc^{3+} , Cr^{3+}

10. For the electrons of oxygen atom, which of the following statements is correct?

- (i) Z_{eff} for an electron in a 2s orbital is the same as Z_{eff} for an electron in a 2p orbital.
- (ii) An electron in the 2s orbital has the same energy as an electron in the 2p orbital
- (iii) Z_{eff} for an electron in 1s orbital is the same as Z_{eff} for an electron in a 2s orbital.
- (iv) The two electrons present in the 2s orbital have spin quantum numbers m_s but of opposite sign.

11. If travelling at same speeds, which of the following matter waves have the shortest wavelength?

- (i) Electron
- (ii) Alpha particle (He^{2+})
- (iii) Neutron
- (iv) Proton

12. Out of the following pairs of electrons, identify the pairs of electrons present in degenerate orbitals :

- (i) (a) $n = 3, l = 2, m_l = -2, m_s = -1/2$
(b) $n = 3, l = 2, m_l = -1, m_s = -1/2$
- (ii) (a) $n = 3, l = 1, m_l = 1, m_s = +1/2$
(b) $n = 3, l = 2, m_l = 1, m_s = +1/2$
- (iii) (a) $n = 4, l = 1, m_l = 1, m_s = +1/2$
(b) $n = 3, l = 2, m_l = 1, m_s = +1/2$
- (iv) (a) $n = 3, l = 2, m_l = +2, m_s = -1/2$
(b) $n = 3, l = 2, m_l = +2, m_s = +1/2$

13. Which of the following sets of quantum numbers are correct?

	N	l	m_l
(i)	1	1	+2
(ii)	2	1	+1
(iii)	3	2	-2
(iv)	3	4	-2

14. Arrange s , p and d sub-shells of a shell in the increasing order of effective nuclear charge (Z_{eff}) experienced by the electron present in them.

15. Show the distribution of electrons in oxygen atom (atomic number 8) using orbital diagram.

16. Nickel atom can lose two electrons to form Ni^{2+} ion. The atomic number of nickel is 28. From which orbital will nickel lose two electrons
17. Calculate the total number of angular nodes and radial nodes present in $3p$ orbital.
18. The arrangement of orbitals on the basis of energy is based upon their $(n+l)$ value. Lower the value of $(n+l)$, lower is the energy. For orbitals having same values of $(n+l)$, the orbital with lower value of n will have lower energy.
- I. Based upon the above information, arrange the following orbitals in the increasing order of energy.
- (a) $1s, 2s, 3s, 2p$
 (b) $4s, 3s, 3p, 4d$
 (c) $5p, 4d, 5d, 4f, 6s$
 (d) $5f, 6d, 7s, 7p$
- II. Based upon the above information, solve the questions given below :
- (a) Which of the following orbitals has the lowest energy?
 $4d, 4f, 5s, 5p$
- (b) Which of the following orbitals has the highest energy?
 $5p, 5d, 5f, 6s, 6p$
19. What is the difference between the terms orbit and orbital?
20. Match the quantum numbers with the information provided by these.
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| Quantum number | Information provided |
| (i) Principal quantum number | (a) orientation of the orbital |
| (ii) Azimuthal quantum number | (b) energy and size of orbital |
| (iii) Magnetic quantum number | (c) spin of electron |
| (iv) Spin quantum number | (d) shape of the orbital |
22. Calculate the energy and frequency of the radiation emitted when an electron jumps from $n = 3$ to $n = 2$ in a hydrogen atom.
23. Why was a change in the Bohr Model of atom required? Due to which important development (s), concept of movement of an electron in an orbit was replaced by, the concept of probability of finding electron in an orbital? What is the name given to the changed model of atom?
24. What is photoelectric effect? State the result of photoelectric effect experiment that could not be explained on the basis of laws of classical physics. Explain this effect on the basis of quantum theory of electromagnetic radiations.
25. Match species given in Column I with the electronic configuration given in Column II.
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| Column I | Column II |
| (i) Cr | (a) $[\text{Ar}]3d^8 4s^0$ |
| (ii) Fe^{2+} | (b) $[\text{Ar}]3d^{10} 4s^1$ |
| (iii) Ni^{2+} | (c) $[\text{Ar}]3d^6 4s^0$ |
| (iv) Cu | (d) $[\text{Ar}] 3d^5 4s^1$ |
| | (e) $[\text{Ar}]3d^6 4s^2$ |