STRUCTURE OF ATOM
(Question bank with answers)

1. what will happen to wavelength associated with a moving particle if is velocity is reduced to half?
   ans: wavelength becomes double of the original value because $\lambda = \frac{h}{m v}$ or $\lambda \alpha \frac{1}{v}$.
2. can we apply Heisenberg's uncertainty principle to stationary state?
   ans: no, because velocity is zero and position can be measured accurately
3. What do you mean by saying that energy of the electron is quantized?
   ans : this means that the electrons in an atom have definite values of energies.
4. What is the difference between a quantum and photon ?
   ans : The smallest packet of any radiation is called *quantum* whereas that of light is called *photon.*
5. What is the experimental evidence in support of the idea that electronic energies in an atom are quantized?
   ans : The line spectrum of any element has lines corresponding to definite wavelengths. Lines are obtained as a result of electronic transitions between the energy levels. Hence , the electrons in these levels have fixed energy, i.e. quantized values.
6. an electron beam after hitting a nickel crystal produces a diffraction pattern. What do you conclude?
   ans: electron has wave nature
7. The 4f subshell of an atom contains 12 electrons. What is the maximum number of electrons having same spin?
   ans: seven
8. Which of the following sets of quantum numbers for orbitals in hydrogen atom has larger energy? :
   n=3, ι =2 , m_l=+1 n=3, ι =2, m_l=-1
   ans: both are orbitals of same subshell and therefore have same energy.
9. How many nodes are present in 3p orbital?
   ans: no. of nodes in an orbital= (n- ι -1) . therefore no. of nodes in 3p orbital = 3-1-1= 1
10. How many quantum are required to specify an orbital?
    ans: three (principal quantum number(n), azimuthal quantum number(l), and magnetic quantum number(m_l))
11. What is the number of orbital present in third principle shell?
    ans: 3s(one) + 3p(three) + 3d(five) = 9
12. what is the maximum number of electrons theoretically possible for a seventh principal shell?
    ans: no. of electrons in a shell = 2 n^2. Therefore electrons in 7^{th} shell = 2 x 7^2 = 98
13. how many unpaired electrons are present in P(Z=15)?
    ans: electronic configuration of P is $1s^2$ $2s^2$ $2p^6$ $3s^2$ $3p^3$. No. of unpaired electron is 3
14. explain the meaning of the symbol $4d^6$?
    ans: it means that 4d subshell has 6 electrons. 4 represents fourth energy shell and d is a subshell and 6 electrons are present in d orbital of subshell.
15. How many nodes are present in 4d orbital?
    ans: no. of nodes = (n- ι -1) = 4-2-1 = 1
16. What is the lowest shell which has an f-subshell
    ans: fourth
17. How are dxy and dx^2-y^2 orbitals related?
    ans: the dxy orbital is exactly like dx^2-y^2 orbital except that its lobes are at an angle of 45o to the lobes of dx^2-y^2.
    dxy orbital is between x and y axis on xy plane and dx^2-y^2 is exactly on x and y axis.
18. Which of the four quantum number (n, ι, m_l, m_s) determine:
    a) the energy of an electron in a hydrogen atom and multi electron atom **ans:** principal quantum number (n)
    b) the size of an orbital ? **ans:** principal quantum number (n)
    c) the shape of an orbital? **ans:** azimuthal quantum number (ι)
    d) the orientation of an orbital in space? **ans:** magnetic quantum numbers (m_l)
19. What is the difference between L and ι ?
    ans: the notation ι represents azimuthal quantum number, which can have values 0, 1, 2, 3,4…… etc whereas L represents second Bohr orbit for which n=2
20. What will be the maximum number of electrons present in an atom having n + ι =4?
    ans: the subshells which can have n +1 =4 are 4s (4+0) and 3p(3 +1). Therefore, these will accommodate maximum of 2 + 6 = 8 electrons.