QUESTION BANK

ELECTRONIC CONFIGURATION

Q1. Write down the electronic configurations of the elements having the following atomic numbers in s, p, d and f notation :
(i) 17 (ii) 18 (iii) 19 (iv) 24 (v) 25 (vi) 29 (vii) 30 (viii) 31 (ix) 39
(x) 47 (xi) 56

Q2. Write down the electronic configurations of the following ions :
(i) Cr^{3+} (ii) Mn^{4+} (iii) Ti^{2+} (iv) Cu^{2+}
Atomic number: Cr=24, Mn=25, Ti= 22, Cu= 29.

Q3. Arrange the electrons represented by the following sets of quantum numbers in the decreasing order of energy.

(i) $n = 4, l = 0, m_l = 0, m_s = +\frac{1}{2}$ (ii) $n = 3, l = 1, m_l = 1, m_s = -\frac{1}{2}$

(iii) $n = 3, l = 2, m_l = 0, m_s = +\frac{1}{2}$ (iv) $n = 3, l = 0, m_l = 0, m_s = -\frac{1}{2}$

Note : Magnetic and spin quantum numbers are denoted by m_l and m_s respectively in this question

Q4. How many unpaired electrons are there in each of the following in the ground state ?
(i) O, (ii) O^+, (iii) O^-, (iv) Fe, (v) Mn, (vi) S (vii) F, (viii) Ar.

Q5. State whether the following statements are true or false :
(i) The outer electronic configuration of the ground state chromium atom is $3d^4, 4s^2$. (If false, give the correct statement)

(ii) The electron density in the xy plane in $3d_{x^2-y^2}$ orbital is zero.

Q6. Explain the following with proper reasoning : Fe^{3+} is more stable than Fe^{2+}

Q7. The number of nodal planes in a P_x orbitals is
(A) one (B) one (C) three (D) zero

Q8. The electrons, identified by quantum by numbers n and l, (i) $n = 4, l = 1$ (ii) $n = 4, l = 0$ (iii) $n = 3, l = 2$ (iv) $n = 3, l = 1$ can be placed in order of increasing energy, from the lowest to highest, as
(A) (iv) < (ii) < (iii) < (i) (B) (ii) < (iv) < (i) < (iii)
(C) (i) < (iii) < (ii) < (iv) (D) (iii) < (i) < (iv) < (ii)

Q9. Krypton ($_{36}Kr$) has the electronic configuration $[Ar]4s^2, 3d^{10}, 4p^6$. The 37th electron will go into which of following subshells
(A) 4f (B) 4d (C) 3p (D) 5s

Q10. The electronic configuration of fluorine is
(A) $1s^2, 2s^2, 2p_x^1, 2p_y^1, 2p_z^1$ (B) $1s^2, 2s^2, 2p_x^2, 2p_y^1, 2p_z^1$
(C) $1s^2, 2s^2, 2p_x^2, 2p_y^2, 2p_z^1$ (D) $1s^2, 2s^2, 2p_x^2, 2p_y^2, 2p_z^2$

Q11. The number of unpaired electrons in chromic ion (Cr^{3+}) is (atomic number of Cr = 24)
(A) 6 (B) 4 (C) 3 (D) 1

Q12. The number of unpaired electrons in ground state of nickel atom is (Atomic number of Ni = 28)
(A) 2 (B) 3 (C) 4 (D) 5

Q13. Which of the following has maximum number of unpaired electrons

(A) Fe^{++} (B) Co^{++} (C) Mn^{++} (D) Cr^{++}

(Atomic numbers : Fe = 26, Co = 27, Mn = 25, Cr = 24,)

Q14. If the nitrogen atom had electronic configuration $1s^7$, it would have energy lower than of the normal ground state configuration $1s^2, 2s^2, 2p^3$, because the electron would be closer to the nucleus. Yet $1s^7$, is not observed because it violates

(A) Heisenberg's uncertainty principle (B) Hund's rule

(C) Pauli's exclusion principle (D) Bohr postulate of stationary orbit

Q15. Which one of the following is paramagnetic

(A) Zn^{2+} (B) Ni^{2+} (C) Cu^{+} (D) none of the above

Q16. Which of the following ions has the maximum magnetic moment

(A) V^{3+} (B) Mn^{3+} (C) Fe^{3+} (D) Cu^{2+}

Q17. The maximum number of permissible rotational orientations of the 2s electron of lithium atom in ground state is

(A) 1 (B) 2 (C) 3 (D) 4

Q18. Beryllium's fourth electron will have the four quantum numbers:

	n	l	m	s		n	l	m	s
(A)	1	0	0	1/2	(B)	1	1	1	1/2
(C)	2	0	0	-1/2	(D)	2	1	0	+1/2

Q19. For the energy levels in an atom which one of the following statements is correct?

(A) the 4s sub-energy level is at a higher energy that the 3d sub-energy level

(B) The M-energy level can have maximum of 32 electrons

(C) The second principal energy level can have four orbitals and contain a maximum of 8 electrons

(D) The 5th main energy level can have maximum of 50 electrons

Q20. For the energy levels in an atom which one of the following statements is(are) correct?

(A) There are seven principal electron energy levels

(B) The second principal energy level can have 4 subenergy levels and contain a max. of 8 electrons

(C) The M energy level can have a maximum of 32 electrons

(D) The 4s sub-energy level is at a lower energy that the 3d sub-energy level

Q21. The electronic configuration of a dipositive ion M^{2+} is 2,8, 14 and its atomic mass is 56. The number of neutrons in the nucleus would be:

(A) 30 (B) 32 (C) 34 (D) 42

Q22. Correct set of four quantum numbers for the outermost electron of rubidium (Z=37) is:

(A) 5, 0, 0, 1/2 (B) 5, 1, 0, 1/2 (C) 5, 1, 1, 1/2 (D) 6, 0, 0 1/2

Q23. The magnetic quantum number for valency electron of sodium atom is:

(A) 3 (B) 2 (C) 1 (D) zero

Q24. After filling the 4d-orbitals, an electron will enter in:

(A) 4p (B) 4s (C) 5p (D) 4f

Q25. The order of increasing energies of the orbitals follows:

(A) 3s, 3p, 4s, 3d, 4p (B) 3s, 3p, 3d, 4s, 4p

(C) 3s, 3p, 4s, 4p, 3d (D) 3s, 3p, 3d, 4p, 4s

Q26. How many of unpaired electron in carbon atom is:
(A) 2 (B) 4 (C) 1 (D) 4

Q27. The energy is lowest for the orbital:
(A) 3d (B) 4p (C) 4s (D) 4f

Q28. Consider the following statements:
(a) Electron density in the XY plane in $3d_{x^2-y^2}$ orbital is zero
(b) Electron density in the XY plane in $3d_{z^2}$ orbital is zero
(c) 2s orbital has one nodal surface
(d) For $2p_z$ orbital YZ is the nodal plane.
Specify True or False.

Q29. Consider the electronic configuration for neutral atoms:
(i) $1s^2 2s^2 p^6 3s^1$ (ii) $1s^2 2s^2 2p^6 4s^1$
Which of the following statements is/are false?
(a) Energy is required to change (i) to (ii)
(b) (i) represents 'Na' atom
(c) (i) and (ii) represent different elements
(d) More energy is required to remove one electron from (i) than (ii)

Q30. The set of quantum number for the 19th electrons in chromium is
(A) n = 4, l = 0, s = +1/2 or -1/2 (B) n = 3, l = 2, m = 1, s = +1/2 or -1/2
(C) n = 3, l = 2, m = -1, s = +1/2 or -1/2 (D) n = 4, l = 1, m = 0, s = +1/2 or -1/2

Q31. When 4 d orbital is complete, the newly entering electrons goes in to
(A) 5f (B) 5d (C) 5p (D) 6d orbital

Q32. Phosphorous is having three unpaired electrons according to
(A) Hund's rule (B) Aufbau principle
(C) Pauli's exclusion principle (D) Heisenberg's principle

Q33. The electronic configuration together with the quantum number of last electron for lithium is
(A) $1s^2 2s^1$ 2, 0, 0 + 1/2 (B) $1s^2 2s^1$ 2, 0, 0 + 1/2 or - 1/2
(C) $1s^2 2s^0 2p^1$ 2, 1, 0 $\pm$ 1/2 (D) $1s^2 2s^1$ 2, 1, 0 $\pm$ 1/2

Q34. The electronic configurations of Cr^{24} and Cu^{29} are abnormal
(A) Due to extra stability of exactly half filled and exactly fully filled sub shells
(B) Because they belong to d-block
(C) Both the above
(D) None of the above

Q35. Choose the correct altenatives. The number of unpaired electrons in an atom of
(A) $_{14}$Si is 2. (B) $_{14}$Si is 0 (C) $_{15}$P is 3 (D) $_{15}$P is 1

Q36. Which of the following ions are diamagnetic?
(A) He_2^+ (B) Sc^{3+} (C) Mg^{2+} (D) O_2^{2-}

Q37. Choose the pair whose ions have the similar electronic configuration
(A) Lithium and sodium (B) Potassium and calcium
(C) Sodium and potassium (D) Oxygen and chlorine

Q38. The electronic configuration of an element is $1s^2 2s^2 2p^6 3s^2 3p^6 3d^5 4s^1$. This represents its
(A) excited state (B) ground state (C) cationic form (D) anionic form

Q39. In potassium atom, electronic energy level is in the following order
(A) 4s > 3d (B) 4s < 2p (C) 4s < 3d (D) 4s > 4p

Q40. The subshell that arises after f is called g subshell.
(a) How many g orbital are present in the g subshell?
(b) In what principal electronic shell whould the g subshell first occur and what is the total number of orbitals in this principal shell?

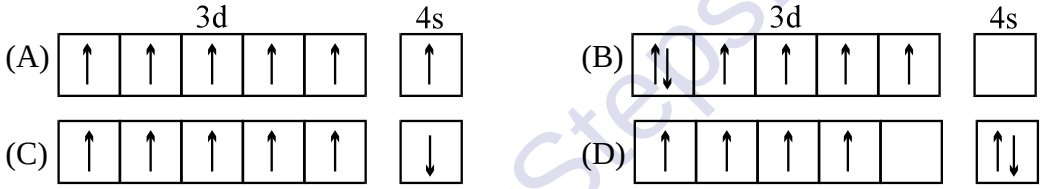
Q41. Write appropriate values of n & *l* quantum numbers for each of the following orbital designations. Also arrange in the increasing order of energy
(a) 4s (b) 3p (c) 5f (d) 6g (e) 3d (f) 7s

Q42. State the basic ideas that are violated by each of the following electron configuration and replace each by the correct configuration:
(a) B_5 - $1s^2 2s^3$ (b) Na_{11} - $1s^2 2s^2 2p^6 2d^1$
(c) K_{19} - $(Ar)3d^1$ (d) Ti_{22} - $(Ar)4s^2 4p^2$
(e) Hg_{80} - $(Xe)\ 4f^{10}5d^{10}6s^2 6p^4$

Q43. Which of the following will be coloured ion:
(A) Fe^{2+} (B) Cu^{+} (C) Sc^{3+} (D) Mn^{2+}

Q44. What would be the electronic configuration of Cs(Z=55) in each case.
(a) If there were three possibilities of the electron spin.
(b) If the quantum number, *l*, could have the value, n, and if all the rules governing electron configuration were otherwise valid.

Q45. Which of the following arrangements of electrons in mostly likely to be stable:



Q46. Which of the following orbitals has/have zero probability of finding the electron in xy plane:
(A) p_z (B) d_{yz} (C) d_{zx} (D) p_x

Q47. Each orbital has a nodal plane. Which of the following statements about nodal planes are not true:
(A) A plane on which there is zero probability that the electron will be found
(B) A plane on which there is maximum probability that the electron will be found
(C) both (D) none

Q48. Write the electronic configuration of S^{2-} and Ni^{2+}.

Q49. Write detailed electronic cofigurations for the following atoms and ions: Br^-, Ca, Fe^{2+}, P.

Q50. How many unpaired electrons are there in the Ni^{2+} ion?

Q51. Write the electronic configuration for each of the following ions: (a) Co^{3+}, (b) Ni^{4+}, (c) Zn^{2+}.

Q52. Write the electronic configurations of (a) Ti^{4+}, (b) V^{3+}.

Q53. Nickel has the electron configuration $[Ar]3d^8 4s^2$. How do you account for the fact that the configuration of the next element, Cu is $[Ar]3d^{10}4s$?

Q54. What would you predict for the atomic number of the noble gas beyond Rn, if such an element had sufficient stability to be prepared or observed? Assume that g orbitals are still not occupied in the ground states of the preceding elements?

Q55. (a) Write the electron configuration for the ground state of Pr^{3+}.
(b) How many unpaired electrons would there be?

Q56. What are the electron configurations of Re^{3+} and Ho^{3+}? How many unpaired electron spins are in each of these ions?

Q57. Which properties of the elements depend on the electronic configuration of the atoms and which do not?

The questions given below consist of an 'Assertion' (A) and the 'Reson' (R). Use the following key for the appropriate answer.
(A) If both (A) and (R) are correct and (R) is the correct reason for (A).
(B) If both (A) and (R) are correct but (R) is not the correct explanation for (A)
(C) If (A) is correct but (R) is not.
(D) If (A) is incorrect but (R) is correct
(E) If (A) & (R) both are incorrect

Q58. *Assertion :* Zn^{2+} is diamagnetic.
Reason : The electrons are lost from 4s orbital to from Zn^{2+}.

Q59. *Assertion :* The configuration of boron atom can not be $1s^{2,}\,2s^{3}$.
Reason : Hund's rule demands that the configuration should display maximum multiplicity.

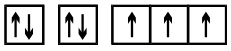
Q60. *Assertion :* The free gaseous Cr atom has six unpaired electrons.
Reason : Half filled s orbital has greater stability.

Q61. *Assertion :* An orbital cannot have more than two electrons
Reason : The two electrons in an orbital create opposite magnetic field.

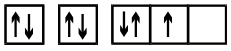
Q62. *Assertion :* Electronic configuraton of an element is $1s^2 2s^1$.
Reason : In 2s, 2 signifies the maximum capacity of s-subshell.

Q63. *Assertion :* Energy of the orbitals increases as
$1s < 2s = 2p < 3s = 3p < 3d < 4s = 4p + 4d = 4f < .....$
Reason : Energy of the electron depends completely on principal quantum number.

Q64. *Assertion :* The electronic configuration of nitrogen atom is represented as



and not as



Reason : The electronic configuration of the ground state of an atom is the one which has the greatest nultiplicity.

Q65. *Assertion :* There are two spherical nodes in 3s orbital.
Reason : There is no planar node is 3s orbital.