ATOMIC STRUCTURE
Computer Science (Section – B)
17 – 03 – 2021 (4th Period)

Electronic Configuration of Elements: The electronic configurations of the atoms of first thirty elements having atomic number 1 – 30 are given below.

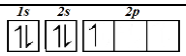
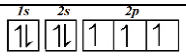
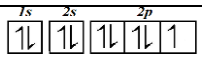
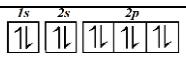
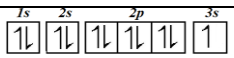
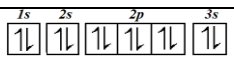
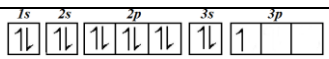
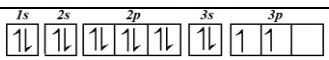
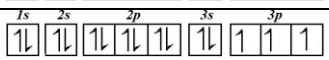
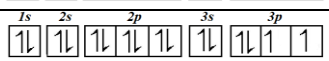
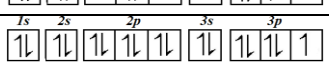
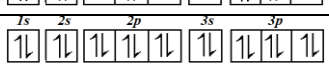
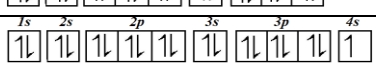
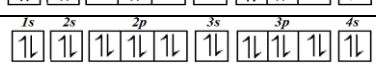
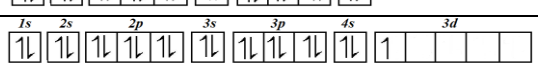
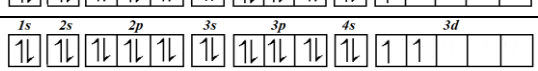
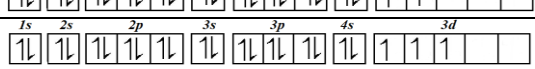
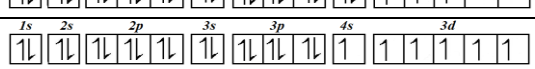
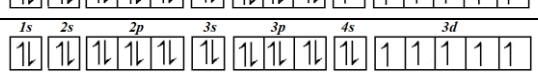
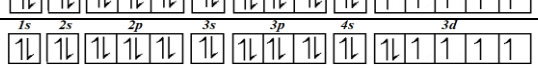
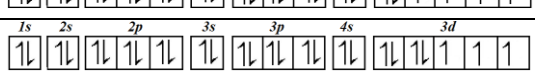
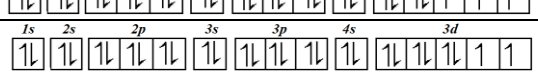
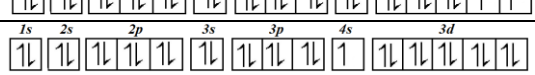
Name of element	Symbol	Atomic No. (z)	Electronic Configuration	
Hydrogen	H	1	$1s^1$	$1s^1$
Helium	He	2	$1s^2$	$1s^2$
Lithium	Li	3	$1s^2, 2s^1$	$[He], 2s^1$
Beryllium	Be	4	$1s^2, 2s^2$	$[He], 2s^2$
Boron	B	5	$1s^2, 2s^2, 2p^1$	$[He], 2s^2, 2p^1$
Carbon	C	6	$1s^2, 2s^2, 2p^2$	$[He], 2s^2, 2p^2$
Nitrogen	N	7	$1s^2, 2s^2, 2p^3$	$[He], 2s^2, 2p^3$
Oxygen	O	8	$1s^2, 2s^2, 2p^4$	$[He], 2s^2, 2p^4$
Fluorine	F	9	$1s^2, 2s^2, 2p^5$	$[He], 2s^2, 2p^5$
Neon	Ne	10	$1s^2, 2s^2, 2p^6$	$[He], 2s^2, 2p^6$
Sodium	Na	11	$1s^2, 2s^2, 2p^6, 3s^1$	$[Ne], 3s^1$
Magnesium	Mg	12	$1s^2, 2s^2, 2p^6, 3s^2$	$[Ne], 3s^2$
Aluminium	Al	13	$1s^2, 2s^2, 2p^6, 3s^2, 3p^1$	$[Ne], 3s^2, 3p^1$
Silicon	Si	14	$1s^2, 2s^2, 2p^6, 3s^2, 3p^2$	$[Ne], 3s^2, 3p^2$
Phosphorus	P	15	$1s^2, 2s^2, 2p^6, 3s^2, 3p^3$	$[Ne], 3s^2, 3p^3$
Sulphur	S	16	$1s^2, 2s^2, 2p^6, 3s^2, 3p^4$	$[Ne], 3s^2, 3p^4$
Chlorine	Cl	17	$1s^2, 2s^2, 2p^6, 3s^2, 3p^5$	$[Ne], 3s^2, 3p^5$
Argon	Ar	18	$1s^2, 2s^2, 2p^6, 3s^2, 3p^6$	$[Ne], 3s^2, 3p^6$
Potassium	K	19	$1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^1$	$[Ar], 4s^1$
Calcium	Ca	20	$1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^2$	$[Ar], 4s^2$
Scandium	Sc	21	$1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^2, 3d^1$	$[Ar], 4s^2, 3d^1$
Titanium	Ti	22	$1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^2, 3d^2$	$[Ar], 4s^2, 3d^2$
Vanadium	V	23	$1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^2, 3d^3$	$[Ar], 4s^2, 3d^3$
Chromium	Cr	24	$1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^1, 3d^5$	$[Ar], 4s^1, 3d^5$
Manganese	Mn	25	$1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^2, 3d^5$	$[Ar], 4s^2, 3d^5$
Iron	Fe	26	$1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^2, 3d^6$	$[Ar], 4s^2, 3d^6$
Cobalt	Co	27	$1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^2, 3d^7$	$[Ar], 4s^2, 3d^7$

Nickel	Ni	28	$1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^2, 3d^8$	$[Ar], 4s^2, 3d^8$
Copper	Cu	29	$1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^1, 3d^{10}$	$[Ar], 4s^1, 3d^{10}$
Zinc	Zn	30	$1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^2, 3d^{10}$	$[Ar], 4s^2, 3d^{10}$

Electronic Configuration of Ions: The electronic configuration of some of the cations and anions are given below.

Ions	No. of protons in the Ion	No. of electrons in the Ion	Electronic Configuration
Al^{3+}	13	10	$1s^2, 2s^2, 2p^6, 3s^0, 3p^0$
K^+	19	18	$1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^0$
Ca^{++}	20	18	$1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^0$
Sc^{3+}	21	18	$1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^0, 3d^0$
Cr^{3+}	24	21	$1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^0, 3d^3$
Mn^{2+}	25	23	$1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^0, 3d^5$
Fe^{2+}	26	24	$1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^0, 3d^6$
Fe^{3+}	26	23	$1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^0, 3d^5$
Co^{2+}	27	25	$1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^0, 3d^7$
Ni^{2+}	28	26	$1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^0, 3d^8$
Cu^+	29	28	$1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^0, 3d^{10}$
Cu^{2+}	29	27	$1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^0, 3d^9$
Zn^{2+}	30	28	$1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^0, 3d^{10}$
N^{3-}	7	10	$1s^2, 2s^2, 2p^6$
O^{2-}	8	10	$1s^2, 2s^2, 2p^6$
F^-	9	10	$1s^2, 2s^2, 2p^6$
Cl^-	17	18	$1s^2, 2s^2, 2p^6, 3s^2, 3p^6$
S^{2-}	16	18	$1s^2, 2s^2, 2p^6, 3s^2, 3p^6$
P^{3-}	15	18	$1s^2, 2s^2, 2p^6, 3s^2, 3p^6$

Electronic Configuration and Number of Unpaired Electrons: The electrical, magnetic and dielectric properties etc. of the atoms and ions deepens upon the electronic arrangement. The number of unpaired electrons in the atoms of first thirty elements and their magnetic properties are given below.

Element	At. No. (z)	Electronic Configuration	Unpaired electrons	Magnetic Nature
H	1		1	Paramagnetic
He	2		0	Diamagnetic
Li	3		1	Paramagnetic
Be	4		0	Diamagnetic
B	5		1	Paramagnetic
C	6		2	Paramagnetic
N	7		3	Paramagnetic
O	8		2	Paramagnetic
F	9		1	Paramagnetic
Ne	10		0	Diamagnetic
Na	11		1	Paramagnetic
Mg	12		0	Diamagnetic
Al	13		1	Paramagnetic
Si	14		2	Paramagnetic
P	15		3	Paramagnetic
S	16		2	Paramagnetic
Cl	17		1	Paramagnetic
Ar	18		0	Diamagnetic
K	19		1	Paramagnetic
Ca	20		0	Diamagnetic
Sc	21		1	Paramagnetic
Ti	22		2	Paramagnetic
V	23		3	Paramagnetic
Cr	24		6	Paramagnetic
Mn	25		5	Paramagnetic
Fe	26		4	Paramagnetic
Co	27		3	Paramagnetic
Ni	28		2	Paramagnetic
Cu	29		1	Paramagnetic
Zn	30		0	Diamagnetic

IMPORTANT QUESTIONS:

1. Define atom and write down the important characteristics of fundamental particles of the atom.
2. Define atomic number and atomic mass number.
3. What do you mean by isotopes and isobars? Explain with example.
4. Give difference between isotope and isobar.
5. What is down Bohr's atomic model? Write down its limitations.
6. Write down the shapes of different atomic orbitals.
7. Give difference between orbits and orbitals.
8. What do you mean by Bohr-Bury scheme? Explain.
9. What do you mean by Pauli's exclusion principle? Explain with example.
10. Define Hund's rule of maximum multiplicity.
11. Explain Aufbau principle and $(n+l)$ rule.
12. Write down the electronic configurations of the following and find the number of unpaired electrons.

    (i) Ca (ii) V (iii) Cr (iv) Mo (v) Fe

    (vi) Co (vii)Ni (viii) Cu (ix) Zn (x) Ag
13. Write down the electronic configuration of the following ions.

    (i) Ca^{++} (ii) Sc^{3+} (iii) Cr^{3+} (iv) Mn^{2+} (v) Fe^{2+}

    (vi) Fe^{3+} (vii) Co^{2+} (viii) Cu^{+} (ix) Cu^{2+} (x) Zn^{2+}
14. Find the atomic number and mass number of a neutral atom having 9 electrons and 10 neutrons.

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