CHAPTER-1

Periodic Table and Electronic Configuration

- In the periodic Table elements are arranged in the increasing order of their atomic number
- According to the Bohr atom model, each shell contains subshells (s,p,d,f.....) equal to the shell number.
- The electrons are filled in the increasing order of the energy of the subshells.
  1s<2s<2p<3s<3p<4s<3d<4p<5s.....
- The completely filled configuration or the half filled configuration of the subshell is more stable than the others.
- $_{24}Cr$ - $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^5\ 4s^1$ or [Ar] $3d^5\ 4s^1$
- $_{29}Cu$ - $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^1$ or [Ar] $3d^{10}\ 4s^1$
- Block to which an element belongs is the subshell to which the last electron was added
- The period number is same as the shell number of the outer most shell in the subshell electronic configuration.
- Group number of an s block element is the number of electrons in the outer s subshell.
- Group number of a p block element is obtained by adding 12h in the number of p electrons in the outer shell. Group Number of d block element is the sum of outer s subshell electrons and penultimate d subshell electrons.
- 'd' block elements show variable oxidation state because there is only a very small energy difference between outer s and penultimate d subshell electrons.
- d block elements (Transition elements) form coloured compunds.
- In f block elements (Inner transition elements) last electron is filled in the antipenultimate shell. They belongs to 6 & 7 periods.
- Most of the f block elements are radio active. U, Th and Pu are used as fuel in nuclear reactors Many f block elements act as catalyst in petroleum industry.

SECTION - 1 (Score - 1)

1, The subshell which is commonly present in all the shells is .....

2, Maximum number of electrons that can be accommodated in d subshell is .....
(2, 8, 10, 14)

3, Which subshell is not possible?
(1s, 3f, 3p, 4d)

4, How many subshells are present in M shell?

5, If the outer subshell electronic configuration of an element 'X' is $3s^2$ $3p^1$ then write the complete subshell electronic configuration.

6, If the outer subshell electronic configuration of an element is $3s^2$ $3p^3$, then find its group number?

7, The subshell electronic configuration of an element is $1s^2$ $2s^2$ $2p^5$, then find its valency?

8, Write the subshell electronic configuration of the element $_{24}Cr$, chromium in the short form using the symbol of nearest inert gas before it.

9, If $3s^2$ is the outer subshell electronic configuration of an element 'X', then what is the formula of its oxide?

10, Find the statements which are not related to that of 'd' block elements.
a) Forms coloured compounds
b) Used as fuel in nuclear reactors
c) Shows variable oxidation state.

11, In the element with subshell electronic configuration [Ar] $3d^1$ $4s^2$. Which is the subshell in which last electron was filled?

12, If p subshell in the M shell contains 5 electrons, find the group in which the element belongs?

13, Which is the subshell having higher energy?
(1s, 2p, 4s, 3d)

14, In which block does 15^{th} group element belongs to?

15, As distance from the nucleus increases energy of the shells.....(increases/decreases)

SECTON - B (Score - 2)

1, The subshell electronic configuration of an element is written in two different ways
(i) $1s^2$ $2s^2$ $2p^6$ $3s^2$ $3p^6$ $3d^9$ $4s^2$
(ii) $1s^2$ $2s^2$ $2p^6$ $3s^2$ $3p^6$ $3d^{10}$ $4s^1$
Among these which one is correct? why?

2, Fe Cl_2 and $FeCl_3$ are two different chlorides.
a) Write the oxidation states of Fe in these two compounds [oxidation state of Chlorine = $^-1$]
b) Write two other properties of elements belonging to the block in which Iron belongs?

3, Write the statements related to f block elements from the statements given below:

a) Elements are less stable.
b) They are not used as catalyst in petroleum industry.
c) Used as fuel in nuclear reactors
d) Includes metals, non metals and metalloids.

4, If 6 electrons are present in the third shell of an atom 'X'
a) Write the subshell electronic configuration
b) Write the chemical formula of the compound formed between X and a first group element A.

5, If 7 electrons are present in the third shell of an element 'R'
a) Write the subshell electronic configuration
b) Find the group and period of the element

6, Subshell electronic configuration of some elements are given below (Symbols are not real) Identify the wrong ones and correct them.

a) $_{10}P$ - Is^2 $2s^2$ $2p^6$

$_{19}Q$ - $1s^2$ $2s^2$ $2p^6$ $3s^2$ $3p^6$ $3d^1$

$_{6}R$ - $1s^2$ $2s^2$ $3s^2$

$_{15}S$ - $1s^2$ $2s^2$ $2p^6$ $3s^2$ $3p^3$

SECTION - C (Score - 3)

1, Group number and period number of two elements are given below:

X - Group - 17 Period - 3
Y - Group - 1 Period - 3

a) Write the subshell electronic configuration of X and Y (2)
b) Write the chemical formula of the compound formed between X and Y (1)

2, CuCl and $CuCl_2$ are the two different chlorides of copper, (atomic number of Cu-29) ?
a) Write the oxidation state of copper in these two compounds.
b) Write the subshell electronic configuration of the iron present in CuCl?
c) What is the reason for which copper shows variable oxidation state?

3, The subshell electronic configuration of an element 'X' is [Ar] $3d^7$ $4s^2$
a) What is the atomic umber of X ?
b) What is the block of the element?
c) Find the group and period in which the element belongs

4, The atomic number of Manganese is 25. MnO_2, $MnCl_2$, $KMnO_4$ are some compounds of Manganese.
[Oxidation state of K= $^+1$, O = $^-2$, Cl = $^-1$]

a) $KMnO_4$ is a coloured compound. The presence of which ion causes colour.

b) Name the compound in which Mn^{+2} Ion is present.

c) Write the subshell electronic configuration of Mn Ion present in MnO_2

5, The outer subshell electronic configuration of two elements are given below:

X - $3s^2$

Y - $3s^2\ 3p^5$

a) Which one has a valency of one?
b) Which one shows non-metallic character?
c) Which element has low ionisation energy?

6, The subshell electronic configuration of chromium element ($_{24}$ Cr) written by two students are given below

Student - 1 - $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^4\ 4s^2$

Student - 2 - $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^5\ 4s^1$

a) Which one is correct ? why?

b) Write the subshell electronic cfonfiguration of Cr^{2+} ion?

SECTION - D (Score - 4)

1, The subshell electronic configurtion of some elements are given below (symbols are not real)

A - $[He]2s^2$

B - $[Ne]\ 3s^2\ 3p^6$

C - $[Ar]\ 3d^4\ 4s^2$

D - $[Ne]\ 3s^1$

a) Forms coloured compounds
b) Element having low ionisation energy
c) element showing non-metallic nature
d) Oxides of which elements show basic nature.

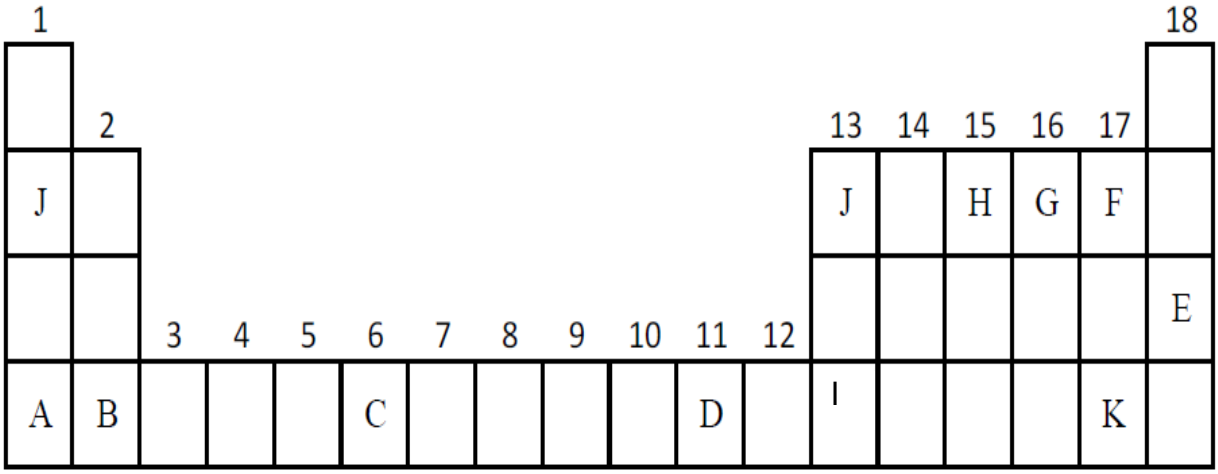
2, Complete the table

Subshell electronic configuration	Group	Period	Block
$1s^2\ 2s^2\ 2p^3$	(a)	2	(b)
$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^5\ 4s^2$	(c)	4	(d)
$1s^2\ 2s^2\ 2p^6\ 3s^2$	2	(e)	5 block
$1s^2\ 2s^2\ 2p^6$	18	(f)	P block

3, Match the suitable ones:

Subshell electronic configuration	Block	Characteristics
a) [He] $3s^1$	d	Radio active
b) [Ne] $3s^2\ 3p^5$	s	Shows variable oxidation state
c) [Ar] $3d^5\ 4s^2$	f	Highly reactive non-metal
d) [Xe] $4f^1\ 5d^1\ 6s^2$	p	Metallic nature

4, A part of the periodic table is given below (symbols are not real)



a) Element having 2 electrons in the 4s subshell?
b) Which is the biggest atom among these ?
c) elements which form coloured compounds ?
d) The element having higher ionisation energy

To remember

➲ Shells	K	L	M	N
➲ Subshells present	1s	2s,2p	3s,3p,d	4s, 4p, 4p, 4d, 4f
➲ Subshells	S	P	d	f
➲ Max no. of electrons	2	6	10	14

➲ Increasing order of energy in which subshells are being filled
1s<2s<2p<3s<3p<4s<3d<4p<5s<4d<5p<6s<4f<5d<6p<7s.....

➲ Subshell electronic configuration of

$_{24}Cr$ - $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^5\ 4s^1$

$_{29}Cu$ - $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^1$

➲ Block - The subshell to which last electron is filled

➲ Period - The outermost shell number.

➲ Group numbers

s block	p block	d block
⇩	⇩	⇩
Number of electrons in the outer S subshell	Number of outer P electrons +12	Outer S subshell electrons + penultimate d subshell electrons

➲ Charecteristics of :

◆ s block elements
- 1 & 2 group elements
- 1st group shows +1 and 2nd group +2 oxidation states
- Are metals
- Low ionisation energy
- Low electronegativity
- Forms ionic compounds, basic oxides

◆ p block
- Elements of group 13 to 18
- Exist in Solid, Liquid, and gaseous state.
- Metals, Nonmetals, metalloids, Inert gases
- Shows +ve and -ve oxidation states

◆ d block
- Elements of group 3 to 12
- Metals
- Shows same properties in groups as well as periods
- Shows variable oxidation state
- Forms coloured compounds

- ◆ f block
  - Inner transition elements
  - Seen in 6^{th} and 7^{th} period
  - Lanthanoids and Actinoids
  - Shows variable oxidation state
  - Radio active
  - Used as catalyst in petroleum industry
  - Used as fuel in nuclear reactors

Answers

Section A (Score - 1)

1, s subshell

2, 10

3, 3f

4, 3

5, X - $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^1$

6, 15 - (3+12)

7, 1

8, [Ar] $3d^5\ 4s^1$

9, XO

10, (b)

11, 3d subshell

12, 17 (5 + 12)

13, 3d

14, p block

15, Increases

Section B (Score - 2)

1, (ii) is correct, because subshell with half filled or completely filled subshell arrangement is more stable than others

2, a) Fe^{+2} in $FeCl_2$ and Fe^{+3} in $FeCl_3$
b) Forms coloured compounds
c) They are metals

3, (a), (c)

4, (a) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^4$
(b) A_2X

5, (a) R - $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^5$
(b) Group - 17, period - 3

6, $_{19}Q$ - $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^1$
$_6R$ - $1s^2\ 2s^2\ 2p^2$

SECTION - C (Score - 3)

1, a) X - $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^5$
Y - $1s^2\ 2s^2\ 2p^6\ 3s^1$
b) YX

2, a) InCuCl - Cu^+, +1 and in $CuCl_2$ Cu in $^+2$
b) 29 Cu^+ - $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}$
c) 'd' block elements show variable oxidation state as there is only a very small energy differ ence between outer s and penultimate 'd' subshell

3, a) 27 b) d block c) period - 4, group - 9

4, a) Mn^{+1} b) $MnCl_2$ c) Mn^{+4} -$15^2\ 25^2\ 2p^6\ 3s^2\ 3p^2\ 3d^3$

5, a) Y b) Y c) X

6, a) Student 2, The subshell electronic configuration in which subshells are half or fully filled are more stable than others
b) Cr^{2+} - $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^4$

SECTION - D (Score - 4)

1, a) C b) D c) B d) A & D

2, a) 15 b) p block c) 7 d) d block e) 3 f) -2

3, a) - S block - Metallic nature
b) - P block - Highly reactive non metal
c) - d block - Shows variable oxidation state
d) - f block - Radio active

4, a) B b) A c) C & D d) E