

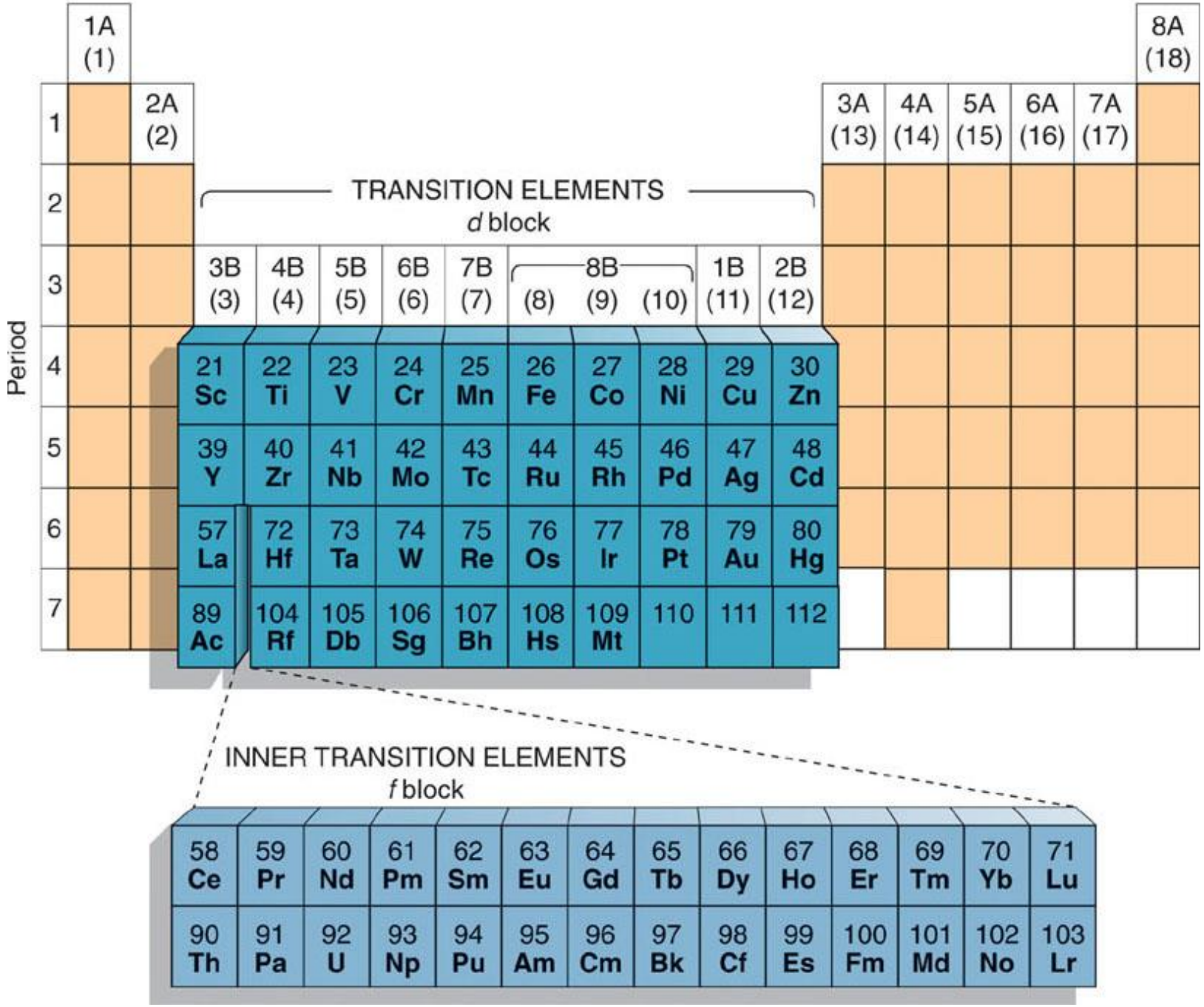
TRANSITION & INNER TRANSITION ELEMENTS



Lecture 1.

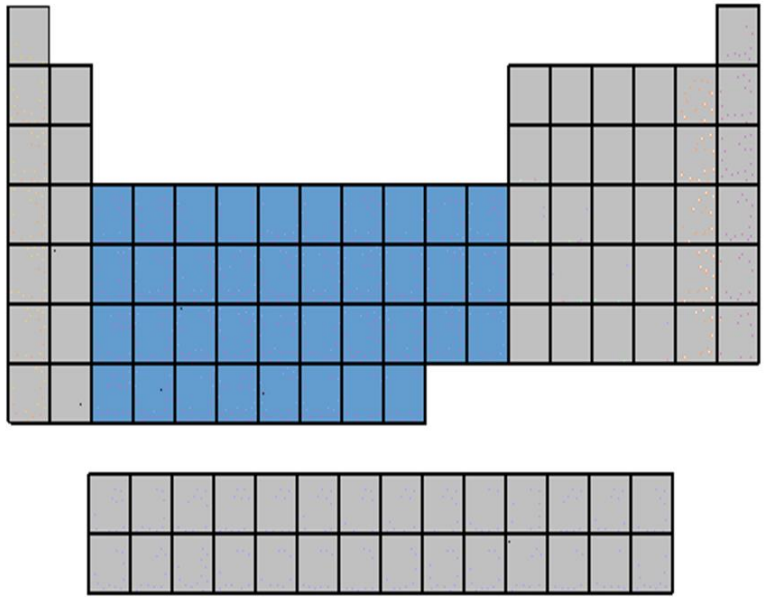


Q. 1 – Transition & Inner Transition elements lie in which block?


1A (1)
8A (18)
2A (2)
3A (13)
4A (14)
5A (15)
6A (16)
7A (17)
TRANSITION ELEMENTS
d block
3B (3)
4B (4)
5B (5)
6B (6)
7B (7)
8B
(8) (9) (10)
1B (11)
2B (12)
Period
1 2 3 4 5 6 7
21 Sc 22 Ti 23 V 24 Cr 25 Mn 26 Fe 27 Co 28 Ni 29 Cu 30 Zn
39 Y 40 Zr 41 Nb 42 Mo 43 Tc 44 Ru 45 Rh 46 Pd 47 Ag 48 Cd
57 La 72 Hf 73 Ta 74 W 75 Re 76 Os 77 Ir 78 Pt 79 Au 80 Hg
89 Ac 104 Rf 105 Db 106 Sg 107 Bh 108 Hs 109 Mt 110 111 112
INNER TRANSITION ELEMENTS
f block
58 Ce 59 Pr 60 Nd 61 Pm 62 Sm 63 Eu 64 Gd 65 Tb 66 Dy 67 Ho 68 Er 69 Tm 70 Yb 71 Lu
90 Th 91 Pa 92 U 93 Np 94 Pu 95 Am 96 Cm 97 Bk 98 Cf 99 Es 100 Fm 101 Md 102 No 103 Lr

D – BLOCK ELEMENTS

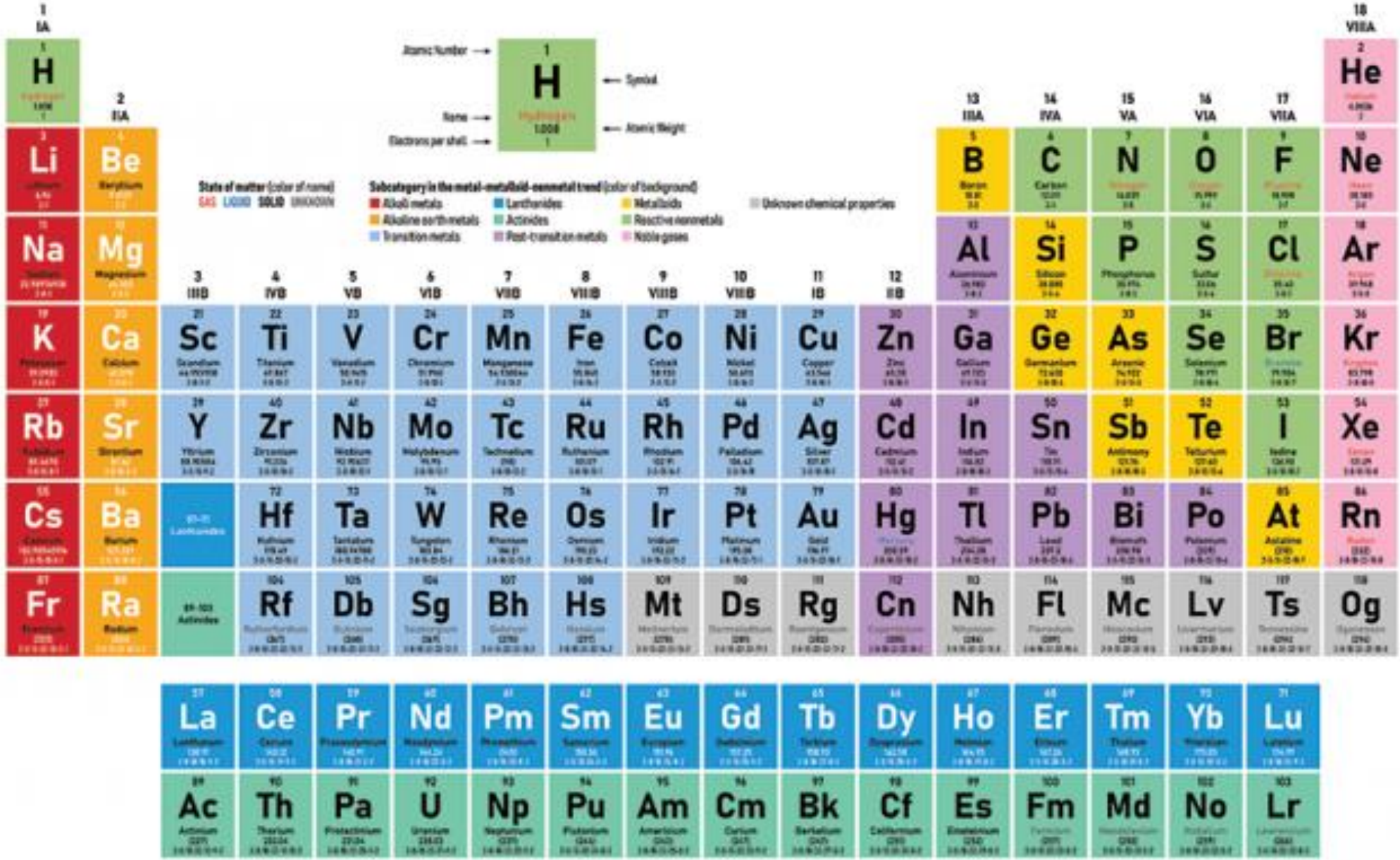
- D – Block includes those elements in the B families.
- They are classified in 4 series as 3d, 4d, 5d & 6d.
- They are good conductors of heat and electricity.
- They usually exhibit variable valencies.



D – BLOCK ELEMENTS

- The elements of periodic table belonging to group 3 to 12 are known as d-Block elements.
- They are placed in the Periods 4 – 7 & Groups 3 – 12.
- It comprises of 4 series – 3d, 4d, 5d & 6d.
- In these elements, valence (last) electron enters in d subshell or d orbital.
- The d -block elements lies in between s and p-block elements in the long form of periodic table.
- The d–block occupies the large middle section flanked by s and p– blocks in the periodic table.
- The very name ‘transition’ given to the elements of d-block due to their position between s and p– block elements.

Periodic Table of the Elements





Scandium, Sc; 3B(3)



Titanium, Ti; 4B(4)



Vanadium, V; 5B(5)



Chromium, Cr; 6B(6)



Manganese, Mn; 7B(7)



Iron, Fe; 8B(8)



Cobalt, Co; 8B(9)



Nickel, Ni; 8B(10)



Copper, Cu; 1B(11)



Zinc, Zn; 2B(12)

- $_{21}Sc = 1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^1$
- $_{22}Ti = 1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^2$
- $_{23}V = 1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^3$
- $_{24}Cr = 1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ \mathbf{4s^1\ 3d^5}$
- $_{25}Mn = 1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^5$
- $_{26}Fe = 1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^6$
- $_{27}Co = 1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^7$
- $_{28}Ni = 1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^8$
- $_{29}Cu = 1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ \mathbf{4s^1\ 3d^{10}}$
- $_{30}Zn = 1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^{10}$

They have general valence shell electronic configuration of $\mathbf{ns^{1-2}\ (n-1)d^{1-10}}$.

Element	Partial Orbital Diagram			Unpaired Electrons
	4*s*	3*d*	4*p*	
Sc	↑↓	↑		1
Ti	↑↓	↑ ↑		2
V	↑↓	↑ ↑ ↑		3
Cr	↑	↑ ↑ ↑ ↑ ↑		6
Mn	↑↓	↑ ↑ ↑ ↑ ↑		5
Fe	↑↓	↑↓ ↑ ↑ ↑		4
Co	↑↓	↑↓ ↑↓ ↑ ↑		3
Ni	↑↓	↑↓ ↑↓ ↑↓ ↑		2
Cu	↑	↑↓ ↑↓ ↑↓ ↑↓		1
Zn	↑↓	↑↓ ↑↓ ↑↓ ↑↓		0

The number of unpaired electrons increases in the first half of the series and decreases in the second half, when pairing begins.

TRANSITION ELEMENT

- A transition element is defined as the one which has incompletely filled d orbitals in its ground state or in any one of its oxidation states.
- A transition element should have partially filled (n-1)d orbital.
- Various precious metals such as silver, gold and platinum and industrially important metals like iron, copper and titanium form part of the transition metals.
- Metallic properties such as high tensile strength, ductility, malleability, high thermal and electrical conductivity and metallic lustre.
- The transition metals (with the exception of Zn,Cd &Hg) are very much hard and have low volatility.

- The d orbitals exhibit certain characteristic properties:
    a. variety of oxidation states,
    b. formation of colored ions
    c. complex formation with a variety of ligands
    d. catalytic property
    e. paramagnetic behaviour.

TRANSITION METALS

- The compounds of transition metals are usually brightly colored.
- Some transition elements can lose electrons in their next-to-outermost level.



Are D - BLOCK ELEMENTS & TRANSITION ELEMENTS same?

- All d block elements are not transition elements but all transition elements are d-block elements
- Elements like Zinc have completely filled d^{10} configuration in their ground state as well as in their common oxidation state which defies the definition of transition elements.

Next Lecture:

1. Trends in the properties of D-block elements.

Any Question



“It is not the answer that enlightens, but the question.”

- Eugene Ionesco