d-Block Elements

Class B.Sc-II Year

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INTRODUCTION:

- **According to periodic table elements have been divided into four blocks namely s, p, d & f-blocks.**
- **The s & p block elements are called as Representative elements and d & f-block elements are called Transition elements & Inner transition elements.**

INTRODUCTION:

- **Transition elements may be defined as," Elements in which d-subshell is partly filled in their elementary state. The d-block elements are also called as transition elements.**

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INTRODUCTION:

- **Definition:-The d-block elements are the elements in which the last electron enters in the d-orbital of the penultimate shell i.e. (n-1) d orbital where n is the outer most shell.**

INTRODUCTION:

- **E.g.:- Ti_{22} Titanium has electronic configuration $1s^2 2s^2 3s^2 3p^6 4s^2 3d^2$**
- **The outer most shell is n=4 & electrons are added in (n-1) d i.e. 3d-orbitals.**

General Characteristics of d-Block Elements

- They have Great tendency to Form Stable Complex Compounds
- They have High Melting and Boiling points
- Generally they forms colored compounds

General Characteristics of d-Block Elements

- They are good conductors of Heat and Electricity
- They Show variable oxidation states.
- All the transition metals having hard, and possess high densities
- They form alloys very readily.
- They and some of their compounds show catalytic properties
- The most of the transition metals are paramagnetic.

Properties of First Transition Elements

Color:

The complexes of the d-block metal ions are usually colored, except, very often, those of d^0 and d^{10} metal ions.

Properties of First Transition Elements

Color:

The colors are due to:

a) electronic transitions of d-electrons within the d sub-shell. These are known as d→d transitions. d^0 and d^{10} metal ions do not show these transitions.

Properties of First Transition Elements

b) electronic transitions from the metal ion to the ligand (M→L transitions) or ligand to the metal ion (L→M transitions), which are known as charge-transfer transitions, and these can occur for d^0 to d^{10} metal ions.

Properties of First Transition Elements

c) The ligands themselves may be colored, and this color may contribute to the color of the complex

Properties of First Transition Elements

Paramagnetism:

When there are unpaired electrons in the d sub-shell, these will lead to Para magnetism. Thus, in $[Cr(H_2O)_6]^{3+}$ the three d electrons (it is d^3) are unpaired.

Properties of First Transition Elements

Paramagnetism:

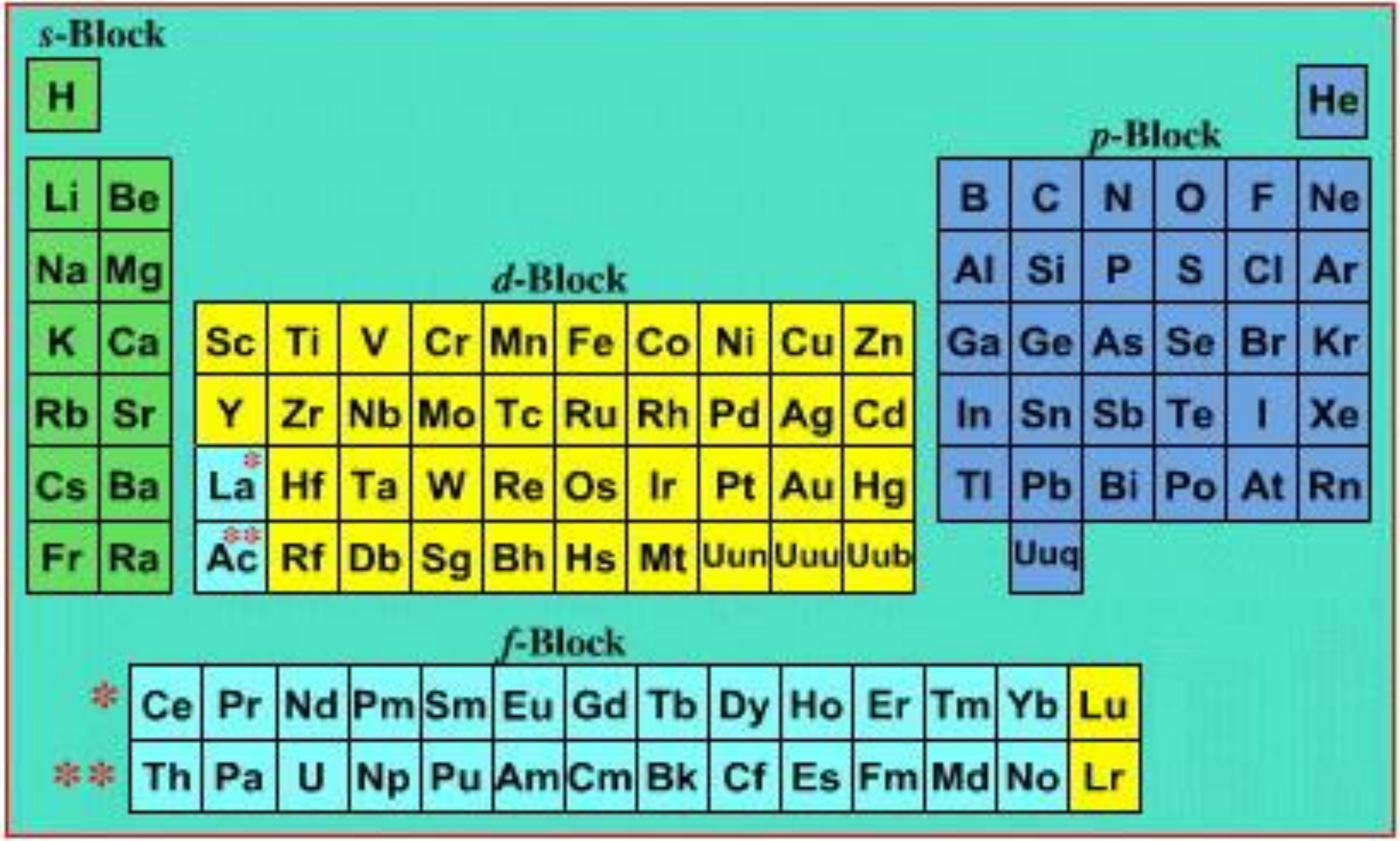
Thus, like the O_2 molecule which is paramagnetic, Cr(III) is paramagnetic.

A d^{10} metal ion (e.g. Zn(II)) has a filled d sub-shell, and a d^0 metal ion (e.g. Ti(IV)) has no d-electrons, so neither of these can be paramagnetic.

Properties of First Transition Elements

Complex-formation:

The d-block metal ions form a wide variety of complexes, of generally high stability, with ligands such as EDTA or F^-, Cl^-, and OH^-, or ethylene diamine (en)


s-Block
H
He
p-Block
Li Be
Na Mg
K Ca
Rb Sr
Cs Ba
Fr Ra
d-Block
Sc Ti V Cr Mn Fe Co Ni Cu Zn
Y Zr Nb Mo Tc Ru Rh Pd Ag Cd
* La Hf Ta W Re Os Ir Pt Au Hg
** Ac Rf Db Sg Bh Hs Mt Uun Uuu Uub
B C N O F Ne
Al Si P S Cl Ar
Ga Ge As Se Br Kr
In Sn Sb Te I Xe
Tl Pb Bi Po At Rn
Uuq
f-Block
* Ce Pr Nd Pm Sm Eu Gd Tb Dy Ho Er Tm Yb Lu
** Th Pa U Np Pu Am Cm Bk Cf Es Fm Md No Lr