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D-Block

	$3d^1 4s^2$	$3d^2 4s^2$	$3d^3 4s^2$	$3d^5 4s^1$	$3d^5 4s^2$	$3d^6 4s^2$	$3d^7 4s^2$	$3d^8 4s^2$	$3d^{10} 4s^1$	$3d^{10} 4s^2$
I T.S / 3d	Sc 21	Ti 22	V 23	Cr 24	Mn 25	Fe 26	Co 27	Ni 28	Cu 29	Zn 30
II T.S / 4d	Y 39	Zr 40	Nb 41	Mo 42	Tc 43	Ru 44	Rh 45	Pd 46	Ag 47	Cd 48
III T.S / 5d	La 57	Hf 72	Ta 73	W 74	Re 75	Os 76	Ir 77	Pt 78	Au 79	Hg 80
	Ac 89	Ku / Rf 104	Ha							

Ce 58 → Lu 71 : 4f series / Lanthanide

Th 90 → Lr 103 : 5f series / Actinide

} f-Block

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① Position ⇒ between s and p Block

Transition element ⇒ d-Block element which have partial filled d-orbital in G.s or in stable oxidation state.

$Cu = 1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^1\ 3d^{10}$

$Cu = 1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^1$

$Cu^{+} = 1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}$

$\boxed{Cu^{+2} = 1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^9}$

$Zn = 3d^{10}\ 4s^2$

$Zn^{+2} = \underline{3d^{10}}$

Zn, Cd, Hg } D-Block elements but not transition element

Note ⇒ all D Block elements are not transition element but all transition elements are d-Block element

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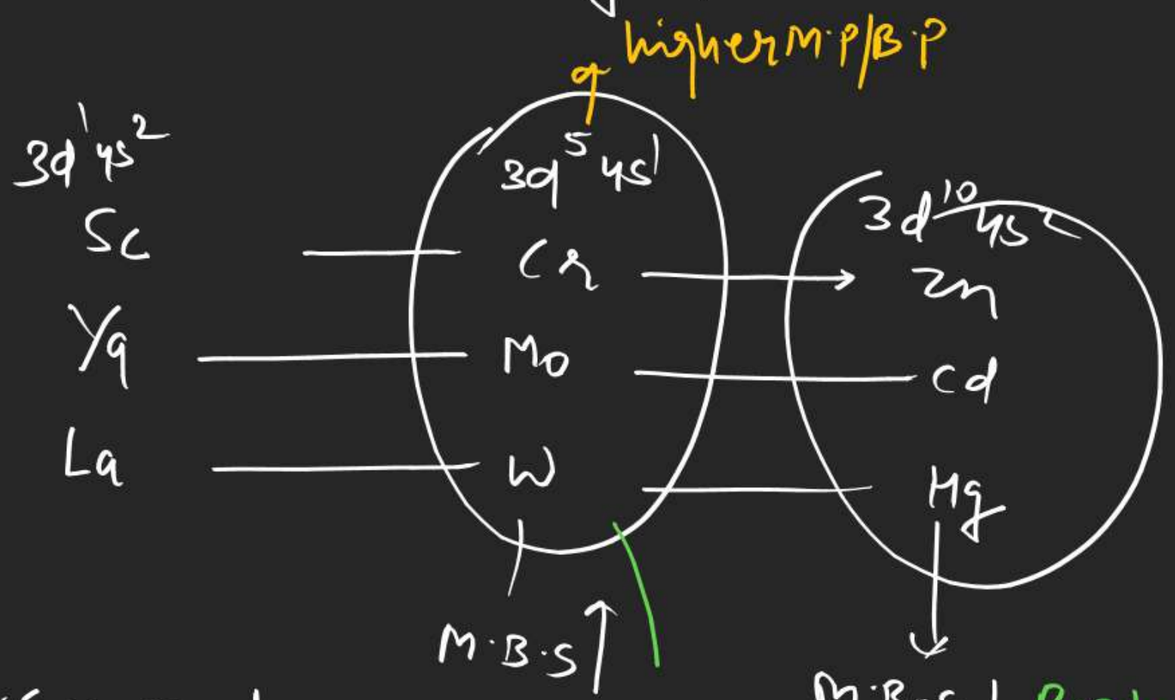
M.B.S ∝ no of u.p.e



M.B.S ∝ M.P/B.P

M.P/B.P ↑

M.B.S ↓ B.P/M.P ↓

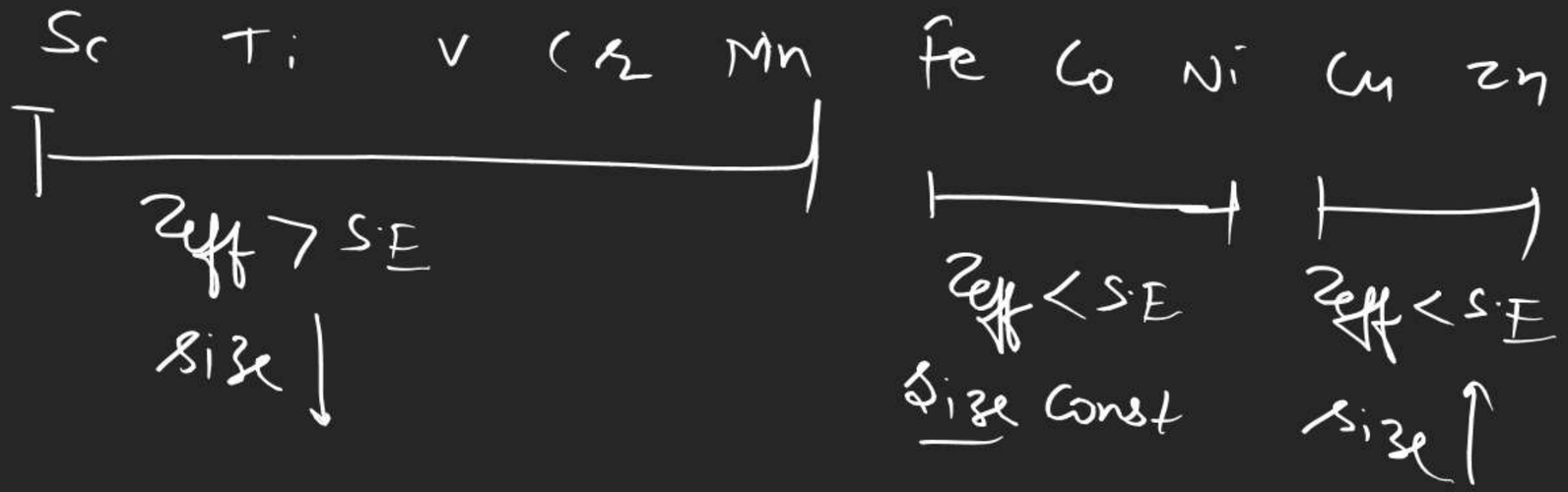
but Mn has lower M.P due to it's crystalline structure.

Que Which of the following metal can used in filament of X-Ray tube.

(1) Fe
(2) Zn
(3) Sc
(4) Mo ✓

→ they are good conductor of Heat and electricity

Size – along the period



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down the group | our order of Radii of Ti Zr Hf

$Ti < Zr \approx Hf$

due to Lanthanide Contraction.

3d series
4d series
5d series

$_{21}Sc$ Ti_{22} - - - - Zr - - - - Zn

$_{39}Y$ Zr_{40} - - - Mo - - - Cd

$_{57}La$ Hf_{72} - - - W - - - Hg

$_{89}Ac$ Ku/Rf_{104}

$Ce_{58} \longrightarrow Lu_{71}$ } 4f series | Lanthanide series

$Th_{90} \longrightarrow Lr_{103}$ } 5f series | Actinide series

f-Block

$3d < 4d \approx 5d$ series

Series series series

[due to poor SE of 4f & 5f Subshell (Lanthanide Contraction)

order of size

Sc Y La Ac

$Sc < Y < La < Ac$

oxidation state

d-Block elements show variable oxidation state due to less energy diff between $(n-1)d$ and ns e⁻

(1) higher oxidation state [+4 to +8]

(2) Comman oxidation state [+2, +3]

(3) lower oxidation state [−1, 0, +1]

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(1) higher oxidation state is found in their oxides, fluorides and oxyfluorides because F and oxygen both are strong oxidising agent due to their high E.N and small size

$^{+6}CrO_3$, $^{+4}MnO_2$ $^{+7}Mn_2O_7$

$^{+6}CrF_6$ $^{+7}MnO_4^-$

$^{+6}CrO_4^{-2}$ $^{+6}CrO_2F_2$

II/III II/III +2 I/II
Fe Co Ni Cu Zn^{+2}

1-10
$(n-1)d^{1-10}\ ns^2$

$3d^2 4s^2$ $3d^2 4s^2$ $3d^3 4s^2$ $3d^5 4s^1$ $3d^5 4s^2$
Sc Ti V Cr Mn

higher o.s +3 +4 +5 +6 +7

Higher o.s of Mn found with oxygen → MnO_4^- Mn_2O_7 (green oily liq.)

with fluorine

only $MnF_4 \longrightarrow \overset{+3}{Mn}F_3 + \frac{1}{2}F_2$

With F it can can exist with higher o.s in MnO_3F

Que Which of the following ion does not exist.

(a) VO^{+2}

$x + (-2) = +2$

$x = +4$

(b) VO_2^{+}

$x + 2(-2) = 1$

$x = 5$

(c) VO_2^{-}

$x + 2(-2) = -1$

$x = +3$

(d) VO_2^{-2}

$x + 2(-2) = -2$

$x = +2$

(e) VO_4^{-3}

$x + 4(-2) = -3$

$x = +5$

VO_2^{+2}

$x + 2(-2) = +2$

$x = +6$

+6 FeO_4^{-2} (ferrate ion) alkaline medium exist
otherwise it will decompose in ($Fe_2O_3 + O_2$)

Comman O.S ⇒ it is found in
Chlorides and sulphide
because both are reducing agent

$FeCl_2$ FeS NiS

$FeCl_3$ Cos

Note ⇒ More Comman = +3

lower oxidation state

it is found in

Carbonyl complex compond

$[Ni(CO)_4]$

$[V(CO)_6]^{\ominus}$

$[Mn(CO)_6]^{+}$

Stable ion

one Cu^{+} < Cu^{+2}

$3d^{10}$ $3d^{9}$

Cu^{+2} is more stable because of it's E°

(aq.)

$2Cu^{+} \longrightarrow Cu^{+2} + Cu^{\circ}$

(disproportionation)

Cr_2^{+6} — but CrO_3 decompose so it acts as oxidising agent.

Mo^{+6} — MoO_3

W^{+6} — WO_3

they are Stable

So they are Oxid. agent.

Cr^{+6} — CrO_3 CrO_4^{-2}

S.O.A

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Ques Which of the following ion is good R.A

Cr^{+2} or Fe^{+2}

$Fe^{+2} \longrightarrow Fe^{+3}$

$3d^6 \qquad 3d^5$

$[Fe(H_2O)_6]^{+2} \longrightarrow [Fe(H_2O)_6]^{+3}$

$Cr^{+2} \longrightarrow Cr^{+3}$

$3d^4 \qquad 3d^3$

$M \longrightarrow M^+ + e^-$ (oxid.)

(R.A)

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Colour in d-BLOCK element

d^0 or d^{10} → colourless

d^1 to d^9 — Colourful

except $[FeF_6]^{-3}$ → colourless

d^n and d^{10-n} ⇒ Same colour

Que Which of the following salt is colourless

(a) $ZnCl_2$

(b) $CrCl_3$

(c) $FeCl_3$

(d) all are colourless

$Zn^{+2} = 3d^{10}$

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Catalytic prop:

These metals and their compounds show catalytic prop due to variable oxidation station and less energy diff between $(n-1)d$ and ns e⁻

(Catalyst) Fe^{+3}

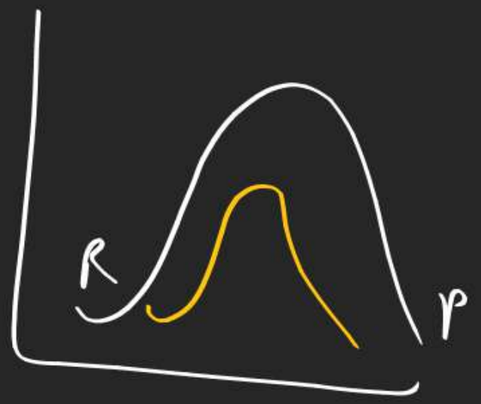
$$I^{\ominus} + S_2O_8^{-2} \longrightarrow X$$

(Peroxo Di sulphate)

$$Fe^{+3} + I^{\ominus} \longrightarrow I_2 + Fe^{+2}$$

$$Fe^{+2} + S_2O_8^{-2} \longrightarrow Fe^{+3} + SO_4^{-2}$$

$$I^- + S_2O_8^{-2} \longrightarrow I_2 + SO_4^{-2}$$



Zeiler Natta Cat ⇒ $TiCl_4 + Al(C_2H_5)_3$

active species ⇒ $TiCl_3$

Wacker — $PdCl_2$

$C_2H_4 + H_2O + PdCl_2 \longrightarrow CH_3CHO + Pd + HCl$

Ostwalds (NO/HNO_3) → Pt

Contact process — (H_2SO_4) — V_2O_5

Haber process (NH_3) — Fe/Mo

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Haber process (NH_3)

Fe / Mo → Promotor

↓

Catalyst

Note ⇒ $d^5 > d^3$ [In gaseous medium]

$d^5 < d^3$ [In aqeous medium]

Cr^{+2} is good R.A than Fe^{+2}

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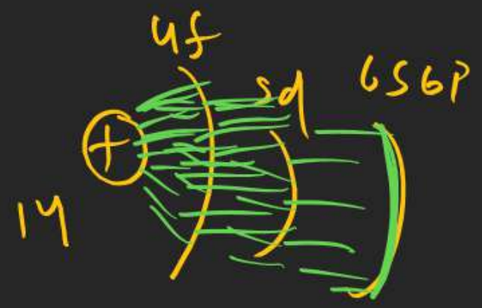

S.E

s > p > d > f