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fajan's Rule

experimently 100% Ionic bond is not possible Similar 100%. Covalent bond is not possible

Ionic character in Covalent bond is explain by dipole moment and Instantaneous Induce dipole

and Covalent character in Ionic bond is explained by fajan's Rule

acc. to fajan's Ionic bond is formed when cation and anion come close together in isolated condition then e^- cloud of anion is attracted by charge on cation simultaneously e^- cloud of cation is attracted by nucleus of anion as the result of this distortion creat in both ions distortion in e^- cloud of cation is negligible because e^- cloud of cation is strongly bonded with nucleus of cation due to it's small size. distortion in e^- cloud of anion is called polarization of anion.

distortion in e⁻ cloud of anion is called polarization of anion.

Polarisation ↑ Covalent ch. ↑ Ionic ch. ↓

Fajan's Rule

the tendency of cation to distort of anion is called polarisating Power of cation | charge density

degree of covalency | Ionic potential

$$\phi = \frac{\text{Charge}}{\text{Size}}$$

ϕ ↑ Pol. ↑ I.C ↓ Covlent Character ↑

factors affecting fajan's Rule

① Charge on cation ↑ ϕ ↑ Pol. ↑ Cov. ch. ↑ I-C ↓

Order of Covalent ch.

$Na^{+}Cl < Mg^{+2}Cl_2 < Al^{+3}Cl_3 < Si^{+4}Cl_4$

② Size of cation ↓ ϕ ↑ Pol. ↑ Cov. ch. ↑ I.C ↓

$LiCl > NaCl > KCl > RbCl > CsCl$

③ Charge on anion ↑ Pol. ↑ Cov. ch. ↑ I.C ↓

$Li^{-1}F < Li_2^{-2}O < Li_3^{-3}N$

④ Size of anion ↑ Pol. ↑ I-C ↓ Cov. ↑

LiF < LiCl < LiBr < LiI

Order of Covalent

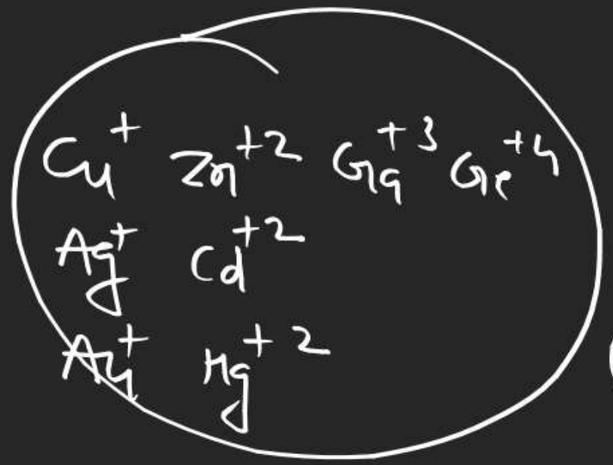
NaCl CuCl

$\gamma_{Na^+} \simeq \gamma_{Cu^+}$

(3) type of Cation

(i) inert gas conf. Cation = $\underline{ns^2np^6}$ (8 e⁻)

$Na^+ = 1s^2 2s^2 2p^6$ (8 e⁻)



(ii) Pseudo inert gas conf. = $\underline{ns^2np^6nd^{10}}$ (18 e⁻)

$Cu^+ = 1s^2 2s^2 2p^6 \underline{3s^2 3p^6 3d^{10}} 4s^0$ (18 e⁻)

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non inert gas conf.

$$\frac{ns^2 np^6 nd^{10} (n+1)s^2}{(18 + 2e^-)}$$

$_{81}Tl = 1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2 3d^{10} 4p^6\ 5s^2 4d^{10} 5p^6\ 6s^2 4f^{14} 5d^{10} 6p^1$

$_{81}Tl^+ = 1s^2\ 2s^2 2p^6\ 3s^2 3p^6\ 3d^{10}\ 4s^2 4p^6 4d^{10} 4f^{14}$ $\boxed{5s^2 5p^6 5d^{10} 6s^2}$

$(18 + 2e^-)$

$_{81}Tl^+$

$_{82}Pb^{+2}$

$_{83}Bi^{+3}$

} non inert gas conf. cation

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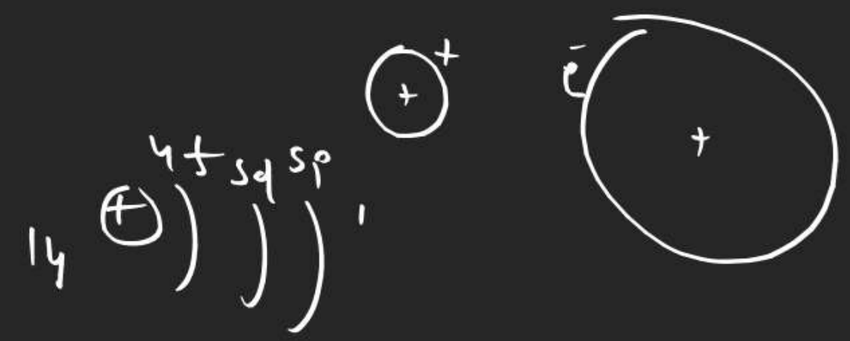
Inert gas

Pseudo

non inert gas



order of covalent

NaCl < CuCl

KCl < AgCl

RbCl < AuCl

$CaCl_2$ < $CdCl_2$

$CaCl_2$ < $PbCl_2$

S.F

s > p > d > f

Note ⇒ non inert gas configuration

Have more polarising power then Pseudo and inert gas

★ non inert > Pseudo > inert gas.

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order of Covalent

$ZnCl_2 < CdCl_2 < MgCl_2$

Zn = 3d

Cd = 3d 4d

Mg = 3d 4d 5d 4f