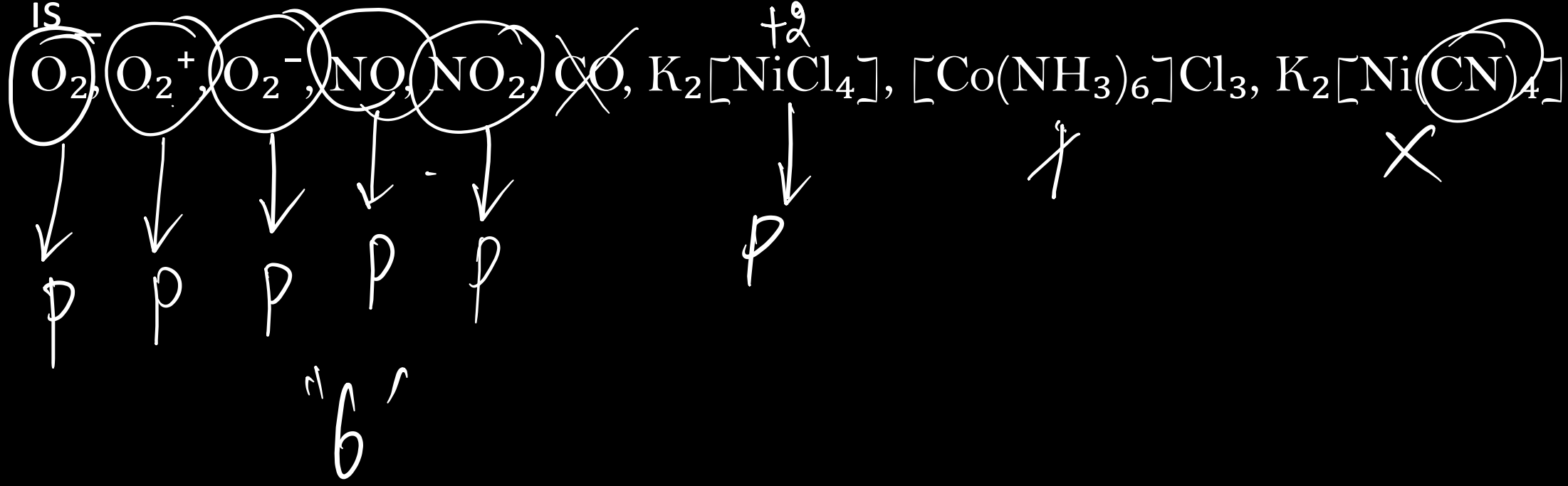
Inorganic Chemistry Questions

Total number of molecules/species from following which will be paramagnetic is



Inorganic Chemistry Questions

The spin-only magnetic moment value of M^{n+} ion formed among Ni, Zn, Mn and Cu that has the least enthalpy of atomisation is---------- Here n is equal to the number of diamagnetic complexes among $K_2[NiCl_4]$, $[Zn(H_2O)_6]Cl_2$, $K_3[Mn(CN)_6]$ and $[Cu(PPh_3)_3I]$. (in nearest integer)

Inorganic Chemistry Questions

The number of paramagnetic metal complex species among $[Co(NH_3)_6]^{3+}$, $[Co(C_2O_4)_3]^{3-}$, $[MnCl_6]^{3-}$, $[Mn(CN)_6]^{3-}$, $[CoF_6]^{3-}$, $[Fe(CN)_6]^{3-}$ and $[FeF_6]^{3-}$ with same number of unpaired electrons is

$t_{2g}^3 e_g^2$

'2'

$[Co(NH_3)_6]^{3+} - Co^{3+}$

$[Co(C_2O_4)_3]^{3-} - Co^{3+} - t_{2g}^6$

$[MnCl_6]^{3-} - t_{2g}^3 e_g^1$

$[Mn(CN)_6]^{3-} - t_{2g}^4 e_g^0$

$[CoF_6]^{3-} - t_{2g}^4 e_g^2$

$[Fe(CN)_6]^{3-} - t_{2g}^5 e_g^0$

Inorganic Chemistry Questions

The complex that shows Facial - Meridional isomerism is :

Ma_3b_3

$[Co(en)_2Cl_2]^+$

$[Co(NH_3)_3Cl_3]$ ✓

$[Co(NH_3)_4Cl_2]+$

$[Co(en)_3]^{3+}$

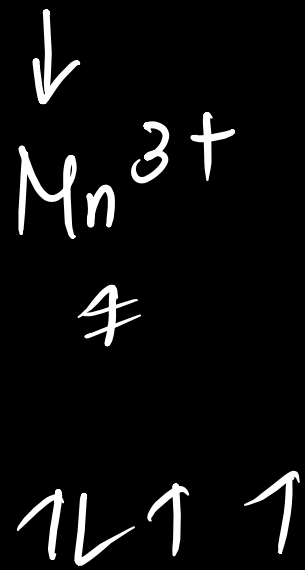
Inorganic Chemistry Questions

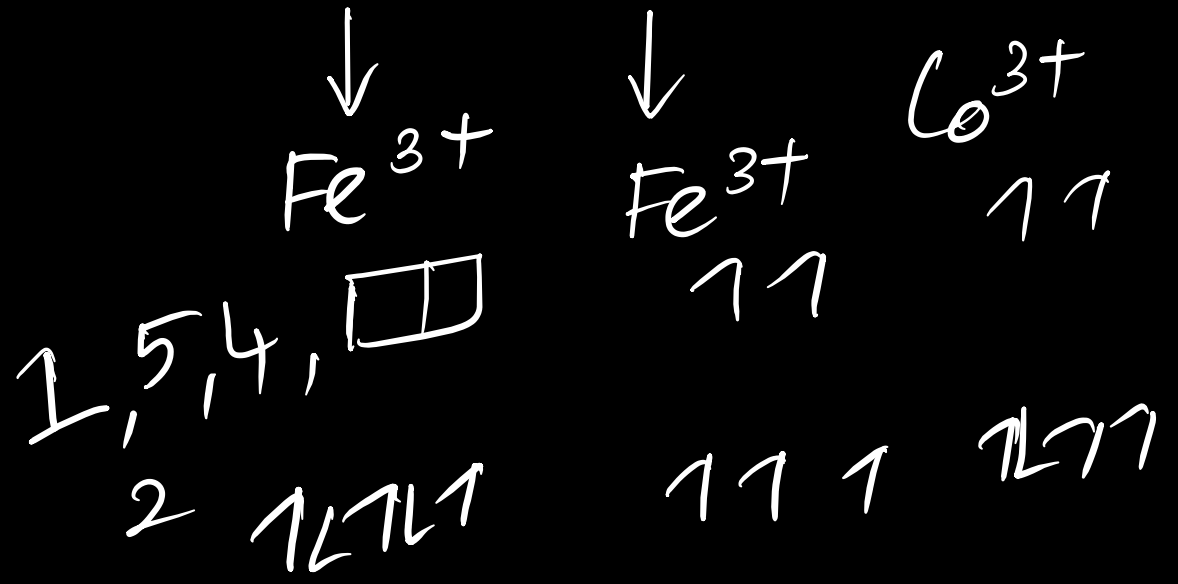
One mole of the octahedral complex compound $Co(NH_3)_5Cl_3$ gives 3 moles of ions on dissolution in water. One mole of the same complex reacts with excess of $AgNO_3$ solution to yield two moles of AgCl(s)The structure of the complex is:

$[Co(NH_3)_5Cl]Cl_2$

Inorganic Chemistry Questions

The number of unpaired electrons responsible for the paramagnetic nature of the following complex species are respectively :$[Fe(CN)_6]^{3-}$,$[FeF_6]^{3-}$,$[CoF_6]^{3-}$,$[Mn(CN)_6]^{3-}$





Inorganic Chemistry Questions

The homoleptic and octahedral complex of Co^{2+} and H_2O has 1 unpaired electrons(s) in the t_2g set of orbitals.

$3d^7$

↑ ↑ $Co(H_2O)_6$

↑↓ ↑↓ ↑

Inorganic Chemistry Questions

The ~~theory~~ that can completely and properly explain the nature of bonding in $[Ni(CO)_4]$ is:

back bonding

A. Werner's theory
B. Molecular orbital theory ✓
C. Crystal field theory
D. Valence bond theory

Inorganic Chemistry Questions

In which of the following complexes the CFSE, Del_0 will be equal to zero?

$K_3[Fe(SCN)_6]$

$[Fe(en)_3]Cl_3$

$[Fe(NH_3)_6]Br_2$

$K_4[Fe(CN)_6]$

$[Fe(SCN)_6]^{3-}$

$Fe^{3+} - 3d^5$

↑ ↑ ↑ ↑ ↑

$-0.4 \times 3 + 0.6 \times 2$

$= 0$

Inorganic Chemistry Questions

The correct order of the following complexes in terms of their crystal field stabilization energies is :

Options:

A. $[Co(NH_3)_4]^{2+} < [Co(NH_3)_6]^{2+} < [Co(NH_3)_6]^{3+} < [Co(en)_3]^{3+}$

B. $[Co(NH_3)_4]^{2+} < [Co(NH_3)_6]^{2+} < [Co(en)_3]^{3+} < [Co(NH3)_6]^{3+}$

C. $[Co(NH_3)_6]^{2+} < [Co(NH_3)_6]^{3+} < [Co(NH_3)_4]^{2+} < [Co(en)_3]^{3+}$

D. $[Co(en)_3]3^{+} < [Co(NH3)_6]^{3+} < [Co(NH_3)_6]^{2+} < [Co(NH3)_4]^{2+}$

$$CFSE = (0.4 \times t_{2g} + 0.6 \times e_g)$$

Inorganic Chemistry Questions

The correct increasing order of stability of the complexes based on Del0 value is :

I. $[Mn(CN)_6]^{3-}$ II. $[Co(CN)_6]^{4-}$ III. $[Fe(CN)_6]^{4-}$ IV. $[Fe(CN)_6]^{3-}$

Mn^{3+} Co^{2+} Fe^{2+} Fe^{3+}

CFSE = −2.4 CFSE = −2.0

$CFSE = -0.4 \times 4 + 0.6 \times 0 = -1.6\,\Delta_o$

$CFSE = -0.4 \times 5 + 0.6 \times 1 = -1.8$

III > IV > II > I

Inorganic Chemistry Questions

The d-orbital electronic configuration of the complex among $[Co(en)_3]^{3+}$, $[CoF_6]^{3-}$, $[Mn(H_2O)_6]^{2+}$ and$[Zn(H_2O)_6]^{2+}$ that has the highest CFSE is :

Inorganic Chemistry Questions

Which one of the following complexes will have $\Delta_o = 0$ and $\mu = 5.96$ B.M?

JEE Main 2025 (Online) 4th April Morning Shift

Options:

A. $[FeF_6]^{4-}$ — $Fe^{2+} - 3d^6 - t_{2g}^4\, e_g^2$

B. $[Mn(SCN)_6]^{4-}$ — $Mn^{2+} - 3d^5 - t_{2g}^3\, e_g^2$

C. $[Co(NH_3)_6]^{3+}$

D. $[Fe(CN)_6]^{4-}$

5

Inorganic Chemistry Questions

Identify the homoleptic complex(es) that is/are low spin.

(A) $[Fe(CN)_5NO]^{2-}$

(B) $[CoF_6]^{3-}$ — Co^{3+} — $t_{2g}^4 e_g^2$

(C) $[Fe(CN)_6]^{4-}$ — Fe^{2+} — $t_{2g}^6 e_g^0$

(D) $[Co(NH_3)_6]^{3+}$ — Co^{3+} — $t_{2g}^6 e_g^0$

(E) $[Cr(H_2O)_6]^{2+}$ — Cr^{2+} — $t_{2g}^3 e_g^1$

Inorganic Chemistry Questions

The number of optical isomers exhibited by the iron complex obtained from the following reaction is

2

$$FeCl_3 + KOH + H_2C_2O_4 \rightarrow A$$

d/l.

$K_3[Fe(C_2O_4)_3]$

Inorganic Chemistry Questions

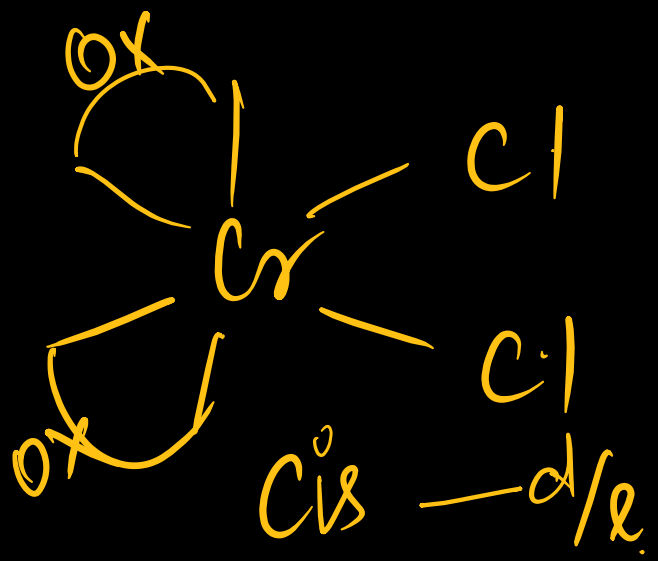
Number of stereoisomers possible for the complexes, $[CrCl_3(py)_3]$ and $[CrCl_2(ox)_2]^{3-}$ are respectively(py = pyridine,ox = oxalate)

a_3b_3

fac — mer.

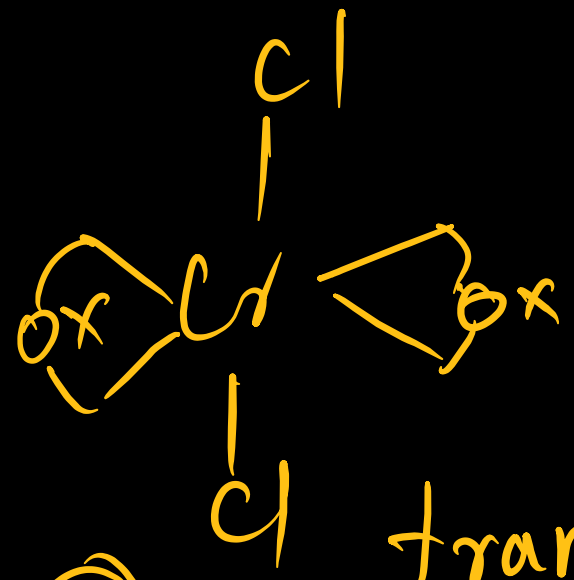
(2)

$a_2(AA)_2$



cis — d/l.

(3)



trans

Inorganic Chemistry Questions

Number of complexes which show optical isomerism among the following is

cis $-[Cr(ox)_2Cl_2]^{3-}$, $[Co(en)_3]^{3+}$

cis $-[Pt(en)_2Cl_2]^{2+}$, cis $-[Co(en)_2Cl_2]^{+}$

trans $-[Pt(en)_2Cl_2]^{2+}$, trans $-[Cr(ox)_2Cl_2]^{3-}$

[30-Jan-2024 Shift 2]

'4'

Inorganic Chemistry Questions

The set which does not have ambidentate ligand (s) is [11-Apr-2023 shift 1]

CN

NC

Options:

A. $C_2O_4^{2-}$, NO_2^-, NCS^-

B. $EDTA^{4-}$, NCS^-, $C_2O_4^{2-}$

C. NO_2^-, $C_2O_4^{2-}$, $EDTA^{4-}$

D. $C_2O_4^{2-}$, ethylene diamine, H_2O

Inorganic Chemistry Questions

From the magnetic behaviour of $[NiCl_4]^{2-}$ (paramagnetic) and $[Ni(CO)_4]$ (diamagnetic), correct geometry and oxidation state.

JEE Main 2025 (Online) 22nd January Morning Shift

Options:

A. $[NiCl_4]^{2-}$: Ni(0), tetrahedral $[Ni(CO)_4]$: Ni(0), square planar

B. $[NiCl_4]^{2-}$: Ni^{II}, tetrahedral $[Ni(CO)_4]$: Ni(0), tetrahedral

C. $[NiCl_4]^{2-}$: Ni^{II}, tetrahedral $[Ni(CO)_4]$: Ni^{II}, square planar

D. $[NiCl_4]^{2-}$: Ni^{II}, square planar $[Ni(CO)_4]$: Ni(0), square planar

Inorganic Chemistry Questions

(A) $[CoF_6]^{3-}$ Co^{3+}	(I) d^2sp^3
(B) $[NiCl_4]^{2-}$ Ni^{2+}	(II) sp^3
(C) $[Co(NH_3)_6]^{3+}$ Co^{3+}	(III) sp^3d^2
(D) $[Ni(CN)_4]^{2-}$ Ni^{2+}	(IV) dsp^2

Inorganic Chemistry Questions

The type of hybridization and the magnetic property of $[MnCl_6]^{3-}$ are,

JEE Main 2025 (Online) 2nd April Evening Shift

Options:

A. sp^3d^2, paramagnetic with four unpaired electrons.

B. d^2sp^3, paramagnetic with four unpaired electrons.

C. $sp^3\ d^2$, paramagnetic with two unpaired electrons.

D. d^2sp^3, paramagnetic with two unpaired electrons.

Mn^{3+}

$3d^4$

↑ ↑ ↑ ↑

Inorganic Chemistry Questions

3

The number of species from the following that are involved in sp^3d^2 hybridization is

$[Co(NH_3)_6]^{3+}$, SF_6, $[CrF_6]^{3-}$, $[CoF_6]^{3-}$, $[Mn(CN)_6]^{3-}$, and $[MnCl_6]^{3-}$

Inorganic Chemistry Questions

Consider the following reactions

$$K_2Cr_2O_7 \xrightarrow[-H_2O]{KOH} [\,A\,] \xrightarrow[-H_2O]{H_2SO_4} [\,B\,] + K_2SO_4$$

The products $[A]$ and $[B]$, respectively are :

K_2CrO_4 $K_2Cr_2O_7$

Inorganic Chemistry Questions

Potassium dichromate acts as a strong oxidizing agent in acidic solution. During this process, the oxidation state changes from

Inorganic Chemistry Questions

In neutral or alkaline solution, MnO_4^- oxidises thiosulphate to :

[27-Jul-2022-Shift-2]

Options:

A. $S_2O_7^{2-}$

B. $S_2O_8^{2-}$

C. SO_3^{2-}

D. SO_4^{2-} ✓

MnO_4^- → MnO_2

$S_2O_3^{2-}$ → SO_4^{2-}

Inorganic Chemistry Questions

Lanthanoid ions with $4f^7$ configuration are :

(A) Eu^{2+}

(B) Gd^{3+}

(C) Eu^{3+}

(D) Tb^{3+}

(E) Sm^{2+}

$Eu - [Xe]\ 4f^7\ 6s^2$

$Gd^{\circ} - [Xe]\ 4f^7\ 5d^1\ 6s^2$

$Tb - [Xe]\ 4f^8\ 6s^2$

$Sm - [Xe]\ 4f^6\ 6s^2$

Inorganic Chemistry Questions

The pair of lanthanides in which both elements have high third - ionization energy is:

[13-Apr-2023 shift 1]

Options:

A. Dy, Gd

B. Eu, Gd

C. Lu, Yb

D. Eu, Yb

Gd - $[Xe]\ 4f^7\ 5d^1\ 6s^2$

Lu - $[Xe]\ 4f^{14}\ 5d^1\ 6s^2$

Eu - $[Xe]\ 4f^7\ 6s^2$

Inorganic Chemistry Questions

The correct order of atomic radii is :
[Jan. 12, 2019 (II)]
Options:

A. N >Ce> Eu> Ho
B. Ho>N > Eu>Ce
C. Ce> Eu>Ho> N
D. Eu>Ce>Ho>N

Eu > Ce > Ho > N

Inorganic Chemistry Questions

$CrCl_3 \cdot xNH_3$ can exist as a complex. 0.1 molal aqueous solution of this complex shows a depression in freezing point of $0.558^\circ C$. Assuming 100% ionisation of this complex and coordination number of Cr is 6 , the complex will be (Given $K_f = 1.86\ K\ kg\ mol^{-1}$)

$$\Delta T_f = i\, K_f\, m$$

$$0.558 = i \times 1.86 \times 0.1$$

$$i = 3$$

JEE Main 2025 (Online) 23rd January Morning Shift

Options:

A. $[Cr(NH_3)_5Cl]Cl_2$ ✓

B. $[Cr(NH_3)_4Cl_2]Cl$ × → 2

C. $[Cr(NH_3)_6]Cl_3$ × → 4

D. $[Cr(NH_3)_3Cl_3]$ → 1

Inorganic Chemistry Questions

(A) $[Co(en)_2Cl_2]Cl$	(I) 3, 6
(B) $[Pt(NH_3)_2Cl(NO_2)]$	(II) 3, 4
(C) Hg $[Co(SCN)_4]$	(III) 2, 6
(D) $[Mg\ (EDTA)]^{2-}$	(IV) 2, 4

Inorganic Chemistry Questions

' X ' is the number of electrons in t2g orbitals of the most stable complex ion among $[Fe(NH_3)_6]^{3+}$, $[FeCl_6]^{3-}$, $[Fe(C_2O_4)_3]^{3-}$ and $[Fe(H_2O)_6]^{3+}$. The nature of oxide of vanadium of the type V_2O_x is :

V_2O_5

Amphoteric

$Fe^{3+} - t_{2g}^5 e_g^0$

$CFSE = -0.4 \times 5$

$= -2.0$

$Fe^{3+} - t_{2g}^3 e_g^2$

$CFSE = -0.4 \times 3 + 0.6 \times 2$

$= 0$

Inorganic Chemistry Questions

Choose the correct statements about the hydrides of group 15 elements.

A. The stability of the hydrides decreases in the order
$NH_3 > PH_3 > AsH_3 > SbH_3 > BiH_3$

B. The reducing ability of the hydrides increases in the order
$NH_3 < PH_3 < AsH_3 < SbH_3 < BiH_3$

C. Among the hydrides, NH_3 is strong reducing agent while BiH_3 is mild reducing agent.

D. The basicity of the hydrides increases in the order
$NH_3 < PH_3 < AsH_3 < SbH_3 < BiH_3$

Choose the most appropriate from the option given below:

M–H decreases

Inorganic Chemistry Questions

Which of the following oxoacids of sulphur contains "S" in two different oxidation states?
[28-Jun-2022-Shift-2]

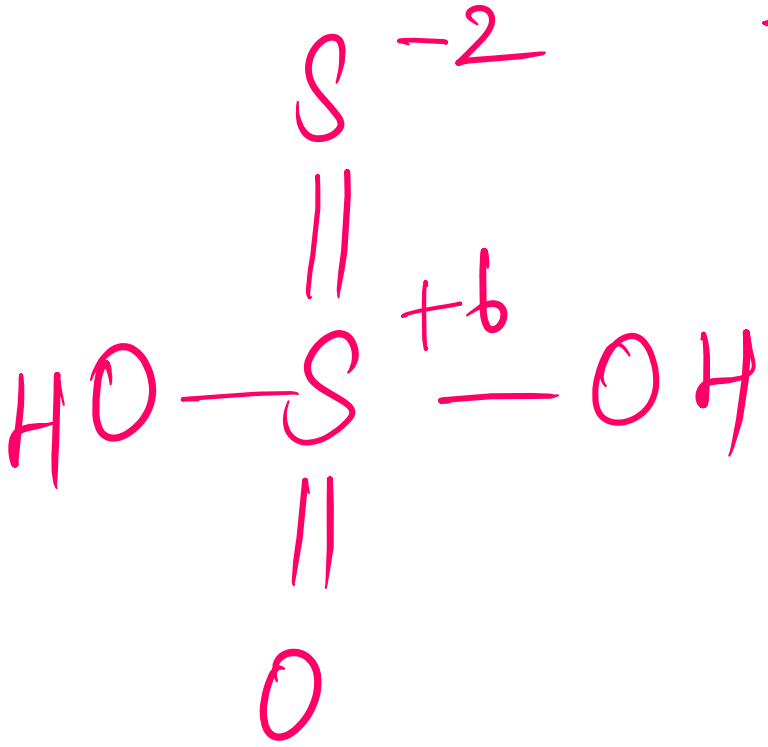
Options:

A. $H_2S_2O_3$

B. $H_2S_2O_6$

C. $H_2S_2O_7$

D. $H_2S_2O_8$



Inorganic Chemistry Questions

Arrange the following species in order of increasing ionic radii and explain the trend: Al^{3+}, Mg^{2+}, Na^{+}, F^{-}, O^{2-}, N^{3-}

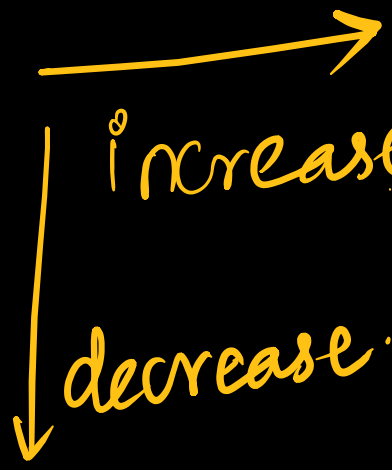
11 9 8 7

For isoelectronic species $\Rightarrow$ radius $\propto \frac{1}{Z}$

$Al^{3+} < Mg^{2+} < Na^{+} < F^{-} < O^{2-} < N^{3-}$

Inorganic Chemistry Questions

Arrange the following elements in order of increasing first ionization enthalpy and explain ALL anomalies:Li, Be, B, C, N, O, F



$Li - 1s^2 2s^1$

$Be - 1s^2 2s^2$

$B - 1s^2 2s^2 2p^1$

$C - 1s^2 2s^2 2p^2$

$N - 2s^2 2p^3$

$O - 2s^2 2p^4$

$F - 2s^2 2p^5$

Inorganic Chemistry Questions

Arrange F, Cl, Br, I in order of electron gain enthalpy (most negative to least negative)

F < Cl

↓

Smaller Size

Cl > F > Br > I

Inorganic Chemistry Questions

An element has successive ionization energies (kJ/mol): IE_1 = 800, IE_2 = 2427, IE_3 = 3658, IE_4 = 25024, IE_5 = 32824

Determine:

(a) Number of valence electrons — 3

(b) Group number — 13

(c) Explain the large jump

Al - [Ne] $3s^2 3p^1$

Inorganic Chemistry Questions

Identify the INCORRECT electronegativity order:

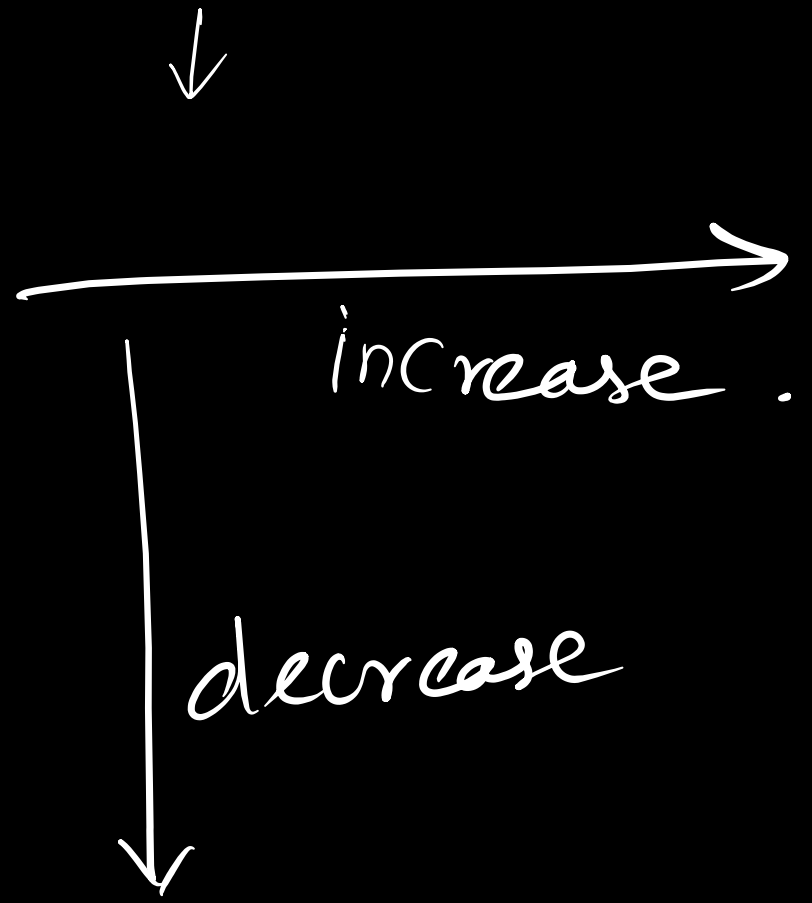
(a) S < Cl < O < F

(b) Al < Si < C < N

(c) Al < Mg < B < N

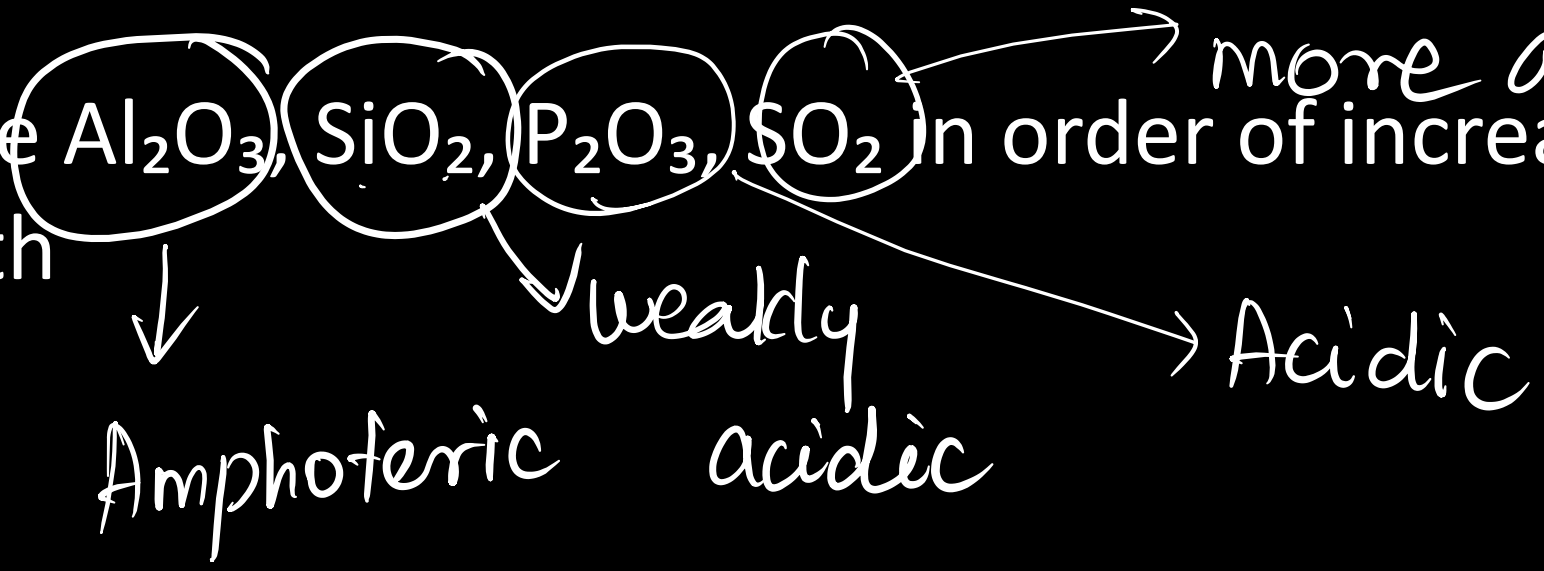
(d) Mg < Be < B < N

12 4 5 7



Inorganic Chemistry Questions

Arrange Al_2O_3, SiO_2, P_2O_3, SO_2 in order of increasing acidic strength



$Al_2O_3 < SiO_2 < P_2O_3 < SO_2$

Inorganic Chemistry Questions

Identify the INCORRECT trend in atomic radii:

(a) Si > P > Cl > F

(b) Mg > Al > C > O

(c) Al > B > N > F

(d) Be > Mg > Al > Si

Inorganic Chemistry Questions

An element E has electronic configuration [Rn] $5f^{14}$ $6d^{1}$ $7s^{2}$

(a) Determine its atomic number

(b) Name the element (IUPAC nomenclature)

(c) Identify its block, group, and period

(d) What type of element is it?

d 3

7

86
14
1
2

103

Unnilltrium