# CHEMISTRY

# BOOKS - BETTER CHOICE PUBLICATION

# CO-ORDINATION COMPOUNDS

## Question Bank

**1.** Discuss the main postulates of Werner's coordination theory.

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**2.** Discuss the main postulates of Werner's coordination theory.


**3.** Write two difference between double salt and complex compound.

**4.** Explain with two examples each of the following: coordination entity, ligand, coordination number, coordination polyhedron, homoleptic and heteroleptic.

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**5.** Explain with two examples the following Central atom or ion.

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**6.** Explain with two examples the following ligands.

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**7.** What is meant by the term 'coordination number' ?

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**8.** Explain with two examples the following Coordination sphere.

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**9.** Explain with two examples each of the following: coordination entity, ligand, coordination number, coordination polyhedron, homoleptic and heteroleptic.

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**10.** Explain with two examples the following oxidation number of central atom.

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**11.** Explain with two examples the following homoleptic and heteroleptic complexes.

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**12.** What is meant by unidentate and ambidentate ligands ? Give two examples for each.

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**13.** Define chelate and chelating ligand. Give one example of chelate complex.

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**14.** Specify the oxidation numbers of the metals in the following coordination entities:

$\left[Co(H_2O)(CN)(en)_2\right]^{2+}$

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**15.** Specify the oxidation numbers of the metals in the following coordination entities:

$[PtCl_4]^{2-}$

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**16.** Specify the oxidation numbers of the metals in the following coordination entities:

$[Cr(NH_3)_3Cl_3]$

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**17.** Specify the oxidation numbers of the metals in the following coordination entities:

$[CoBr_2(en)_2]^+$

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**18.** Specify the oxidation numbers of the metals in the following coordination entities:

$K_3\left[Fe(CN)_6\right]$

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**19.** Define ionisation isomerism. Give example. How can you distinguish between the two isomers ?

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**20.** The complex $\left[Co(NH_3)_5Br\right]SO_4$ give white precipitates with $BaCl_2$ solution while $\left[CO(NH_3)_5SO_4\right]Br$ give yellow precipitate with $AgNO_3$ solution. Explain.

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**21.** Define ionisation isomerism and write one ionisation isomer of : $\left[CoSO_4(NH_3)_5\right]Br$.

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**22.** Define linkage isomerism and write one linkage isomer of $\left[Co(ONO)(NH_3)_5\right]Cl_2$.

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**23.** Explain hydrate isomerism with the help of an example.

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**24.** Write a note on Co-ordinate isomerism.

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**25.** Write a note on geometrical isomerism.

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**26.** Write a note on optical isomerism.

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**27.** Why is geometrical isomerism not possible in tetrahedral compounds having two different types of unidentate ligands with the central metal ion ?

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**28.** Draw structures of geometrical isomers of $\left[Fe(NH_3)_2(CN)_4\right]$

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**29.** Is the following compound chiral (optically active)? $cis - \left[CrCI_2(ox)_2\right]^3 -$

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**30.** How many geometrical isomers are possible in the following coordination entities:

`[Cr(C_2O_4)_3]^3-

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**31.** How many geometrical isomers are possible in the following co-ordination entity?

$[Co(NH_3)_3Cl_3]$

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**32.** What are inner and outer orbital complexes ?

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**33.** On the basis of valence bond theory explain the shape and magnetic character of $K_4\left[Fe(CN)_6\right]$ or $\left[FeCN_6\right]^{4-}$ ion.

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**34.** Onthe basis of valencebondtheory explain the structure andmagnetic nature of $\left[Ni(CN)_4\right]^{2-}$ complex ion.

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**35.** Write the structure and the hybridisation of the central atom in $\left[Ni(CO)_4\right]$

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**36.** How does valence bond theory account for: $[Ni(Cl_4)]^{2-}$ is diamagnetic and tetrahedral (At number of Ni = 28)

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**37.** Explain: $\left[Ni(CN)_4\right]^{2-}$ is diamagnetic while $\left[Ni(Cl)_4\right]^{2-}$ is paramagnetic.

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**38.** Explain: $\left[Ni(CN)_4\right]^{2-}$ is diamagnetic while $\left[Ni(Cl)_4\right]^{2-}$ is paramagnetic.

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**39.** Explain: $\left[Ni(CN)_4\right]^{2-}$ is diamagnetic while $\left[Ni(Cl)_4\right]^{2-}$ is paramagnetic.

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**40.** Using valence bond theory of complexes, explain the geometry and diamagnetic nature of the ion $\left[Cr(NH_3)_6\right]^{3+}$. Given the atomic number of Cr = 241.

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**41.** Discuss structure of $\left[Co(NH_3)_6\right]^{3+}$ complex ion.

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**42.** On the basis of valence bond theory, explain the structure of $\left[Fe(CN)_6\right]^{3-}$ complex.

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**43.** Explain magnetic Behaviour of $[Fe(CN)_6]^{4-}$ and $[Fe(CN)_6]^{3-}$ anions.

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**44.** Explain magnetic Behaviour of $[Fe(CN)_6]^{4-}$ and $[Fe(CN)_6]^{3-}$ anions.

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**45.** Predict the shape of hexafluoroferrate(III) on the basis of valence bond theory.

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**46.** Explain the formation of H2 molecule on the basis of valence bond theory.

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**47.** Discuss the nature of bonding in the following coordination entity on the basis of valence bond theory :

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

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**48.** Discuss the nature of bonding in the following coordination entity on the basis of valence bond theory :

$[FeF_6]^{3-}$

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**49.** Discuss the nature of bonding in the following coordination entities on the basis of valence bond theory: $\left[Co(C_2O_4)_3\right]^{3-}$

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**50.** $\left[Fe(H_2O)_6\right]^{3+}$ is strongly paramagnetic whereas $\left[Fe(CN)_6\right]^{3-}$ is weakly paramagnetic. Explain.

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**51.** Explain $\left[Co(NH_3)_6\right]^{3+}$ is an inner orbital complex whereas $\left[Ni(NH_3))6\right]^{2+}$ is an outer orbital complex.

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**52.** Using valence bond theory predict the geometry and magnetic behaviour of $\left[Pt(CN)_4\right]^{2-}$.

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**53.** The hexaquo manganese(II) ion contains five unpaired electrons, while the hexacyanoion contains only one unpaired electron. Explain using Crystal Field Theory.

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**54.** NiCl4 2- is paramagnetic while NiCO4 is diamagnetic though both are tetrahedral why

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**55.** A solution of $\left[Ni(H_2O)_6\right]^{2+}$ is green but a solution of `[Ni(CN)_4]^(2-) is colourless.Explain.

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**56.** $\left[Fe(CN)_6\right)]^{4-}$ and $\left[Fe(H_2O)_6\right)]^{2+}$ are of different colours in dilute solutions. Why ?

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**57.** Discuss the nature of bonding in metal carbonyls.

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**58.** What is meant by stability of a coordination compound in solution? State the factors which govern

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**59.** What is meant by the chelate effect? Give an example.

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**60.** Discuss briefly giving an example in each case the role of coordination compunds in: biological systems

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**61.** Write short note on the importance of complex compounds in different fields.

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## Question From Previous Board Examination

**1.** Write the IUPAC name of corordination compound $\left[Co(NH_3)_3ONO\right]Cl_2$.

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**2.** How many isomers are possible for the netural complex $\left[Co(NH_3)_3Cl_3\right]$? Draw their structures.

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**3.** Discuss the nature of bonding in the following coordination entities on the basis of valence bond theory: $\left[Fe(CN)_6\right]^{4-}$

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**4.** Write the IUPAC name for the corordination compound.

[Zn(NH3)4]2+

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**5.** Explain: $\left[Ni(CN)_4\right]^{2-}$ is diamagnetic while $\left[Ni(Cl)_4\right]^{2-}$ is paramagnetic.

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**6.** Write IUPAC name of the following

$K_2\left[Zn(OH)_4\right]$

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**7.** Write IUPAC name of the following

$K_3[Al(C_2O_4)]_3$

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**8.** Write IUPAC name of the following

$K_2[Cu(CN_4)]$

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**9.** Write IUPAC name of the following

$[Co(NH_3)_3Cl]Cl_2$

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**10.** Write IUPAC name of the following

$[Co(en)_2Br_2Cl$

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**11.** Write IUPAC name of the following

$[Co(NH_3)_5Br]Cl_2$

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**12.** Write IUPAC name of the following

$K_3\left[Fe(C_2O_4)_3\right]$

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**13.** Write IUPAC name of the following

$Na\left[Au(CN)_2\right]$

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**14.** Write IUPAC name of the following

$K_2\left[Fe(CN)_6\right]$

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**15.** Write IUPAC name of the following

$K_2\left[Fe(CN)_6\right]$

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**16.** Write the IUPAC name of the following :

$K_3\left[Fe(CN)_5NO\right]$

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**17.** Write IUPAC name of the following

$K_3\left[Cr(C_2O_4)_3\right]$

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**18.** Write IUPAC name of the following

$K_3\left[Cr(C_2O_4)_3\right]$

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**19.** Write IUPAC name of the following

$K[PtCl_3(NH_3)]$

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**20.** Write IUPAC name of the following

$K_2\left[Fe(CN)_6\right]$

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**21.** Write IUPAC name of the following

$K_2\left[Fe(CN)_6\right]$

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**22.** Write the IUPAC name of the following :

$Na_3\left(Co(NO_2)_6\right]$

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**23.** Write the IUPAC name of the following:

$\left[Ni(H_2O)_2(NH_3)_4\right]SO_4$

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**24.** Write IUPAC name of the following

$K_3\left[Co(NO_2)_6\right]$

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**25.** Write the IUPAC name of the following :

$Na_3\left(Co(NO_2)_6\right]$

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**26.** Write IUPAC name of the following:

$Na_3\left[Cr(OH)_2F_4\right]$

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**27.** Write IUPAC name of the following:

'[Pt(NH_3)_3 Br(NO_2)Cl]Cl`

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**28.** Write IUPAC name of the following:

$[Cu(H_2O)(NH_3)_4SO_4$

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**29.** Write the IUPAC name of the following:

$[Ni(H_2O)_2(NH_3)_4]SO_4$

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**30.** Write IUPAC name of the following:

$[PtCl(NO_2)(NH_3)_4]SO_4$

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**31.** Namethetype of isomerism exhibited bythe following pair of isomers.

$[Co(NH_3)_5(NO_2)]Cl_2$ and $[Co(NH_3)_5(ONO)]Cl_2$

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**32.** Namethe type of isomerism exhibited bythe following pair of isomers. $\left[Cr(H_2O)_6\right]Cl_3$ and $\left[Cr(H_2O)_5Cl\right]Cl_2.H_2O$

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**33.** Namethe type of isomerism exhibited bythe following pair of isomers. $\left[Pt(NH_3)_4Cl_2\right]Br_2$ and $\left[Pt(NH_3)_4Br_2\right]Cl_2$.

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**34.** Write the formula of ferrocyanide ion.

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**35.** Give one example of hinge joint?

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**36.** Give one example of linkage isomer.

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**37.** What is the state of hybridisation and geometry in `[Fe(CN)_6]^(3-) ?

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**38.** What is the state of hybridisation and geometry in $\left[Cr(CO)_6\right]$?

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**39.** What is the state of hybridisation and geometry in `[Ni(CN)_4]^(-2_)

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**40.** Discuss structure of $\left[Co(NH_3)_6\right]^{3+}$ ion the basis of V.B.T.

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**41.** What is the state of hybridisation and geometry in `[Ni(CN)_4]^(-2_)

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**42.** What is the state of hybridisation and geometry in `[Ni(CN)_4]^(-2_)

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**43.** Explain $\left[Fe(H_2O)_6\right]^{3+}$ is paramagnetic.

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**44.** With the help of crystal field theory, predict the number of unpaired electrons in $\left[Fe(CN)_6\right]^{4-}$ and $\left[Fe(H_2O)_6\right]^{2+}$.

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**45.** predict the number of unpaired electrons in $\left[CoF_6\right]^{3-}$ and $\left[Co(NH_3)_6\right]^{3+}$

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**46.** With the help of the crystal field theory predict the number of unpaired electrons in $\left[Fe(CN)_6\right]^{3-}$ and $\left[FeF_6\right]^{3-}$.

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**47.** Account for the different magnetic behaviour of hexacyanoferrate (III) and hexafluoroferrate(III).

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**48.** Explain : $\left[Co(CN)_6\right]^{3-}$ is diamagnetic while $\left[CoF_6\right]^{3-}$ is paramagnetic.

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**49.** Draw the geometrical isomers of $\left[Co(en)_2CI_2\right]^{+}$ ion.Which of these is optically active ?

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**50.** Draw the geometrical isomers of $\left[Co(en)_2CI_2\right]^+$ ion.Which of these is optically active ?

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**51.** Discuss the main postulates of valence bond theory.

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**52.** Write the name of ionisation isomer of the compound $\left[Co(NH_3)_5Br\right]SO_4$.

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**53.** Draw the geometrical isomers of $\left[Co(en)_2CI_2\right]^+$ ion.Which of these is optically active ?

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**54.** Write the name of ionisation isomer of the compound $\left[CO(NH_3)_4Cl_2\right]NO_2$

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**55.** Draw the geometrical isomers of $\left[Pt(NH_3)_2.CI_2\right]$. Which of these is optically active.

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**56.** Draw the geometrical isomers of $\left[Pt(NH_3)_2.CI_2\right]$. Which of these is optically active.

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**57.** Explain the difference between a weak field ligand and a strong field ligand.

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**58.** Write the structure and hybridisation of the central atom in $\left[CoCl_2(NH_3)_4\right]$

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**59.** $\left[Ti(H_2O)_6\right]^{3+}$ is coloured while $\left[Sc(H_2O)_6\right]^{3+}$ is colourless. Explain.

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