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Register Number:

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**ST. JOSEPH’S COLLEGE (AUTONOMOUS), BENGALURU-27**

**B.Sc. CHEMISTRY- VI SEMESTER**

**SEMESTER EXAMINATION – APRIL 2017**

**CH 6112 – Inorganic Chemistry**

**Time: 3 hours Maximum Marks: 100**

*This question paper has* ***three*** *printed pages and* ***three*** *parts*

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Element | Sc | Ti | V | Cr | Mn | Fe | Co | Ni | Cu | Zn |
| At.number | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |

**PART A**

Answer any **TEN** of the following: 2 × 10 = 20 marks

1. Which of the following ions will give a coloured aqueous solution and why?: Ti3+, Cu+.
2. The magnetic moment values of transition metal compounds are calculated using

spin-only formula. Why?

1. Many transition metals and their compounds show catalytic properties. Give reason.
2. What are ambidentate ligands? Give an example.
3. Draw the structure of the octahedral complex, [Cu(en)3]2+.
4. Give (i) the oxidation state of the central metal ion and (ii) the coordination number of the complex, [Ni(EDTA)]-.
5. Calculate the EAN of Cr in K3 [Cr(C2O4)3].
6. What is hapticity? Give an example for a trihapto ligand.
7. Write the formula of Wilkinson’s catalyst. What is its use?
8. Mention any two roles of Mg2+ in biological systems.
9. Draw the partial structure of haem.
10. Why do actinides show variable oxidation states?

**PART B**

Answer any **TEN** of the following: 6 ×10 = 60 marks

1. Give the important postulates of Werner’s thory of coodination compounds. How does Werner’s theory account for the non- ionic nature of CoCl3.3NH3?
2. a) Write the IUPAC names of the following complexes:

i) [PtCl(NH3)4(NO2)]SO4

ii) [Co(en)3]2(SO4)3

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iii) NH4[Cr(NCS)4(NH3)2]

b) Write the formulae of the following complexes:

i) Calcium hexacyanidoferrate(II)

 ii) μ-amido-μ-nitrito-κNoctaamminedicobalt(III) nitrate

 iii) Tetraammineaquabromidocobalt(III) nitrate

1. Illustrate the following types of isomerism in coordination compounds with an example each: (a) ionization isomerism (b) geometrical isomerism.
2. Ni(CO)4 is diamagnetic. Predict is geometry using valence bond theory. Give any two limitations of valence bond theory.
3. What are the basic postulates of crystal field thoery? With proper explanation for the metal- ligand interactions draw the d- orbital splitting pattern in an octahedral ligand field.
4. Draw the electron distributions in t2g and eg orbitals of (i) high spin and (ii) low spin octahedral Co(II) complexes. Calculate (i) crystal field stabilization energy and (ii) magnetic moments in each case.
5. Give the structures of the following organometallic compounds and compute their valence electron counts: (i) Co2(CO)8 (ii) K[PtCl3(C2H4)].
6. Discuss the bonding in transition metal carbonyls. Explain the synergic effect in metal carbonyl bonding.
7. a) Give the classification of organometallic compounds according to the metal- carbon bond type. Give an example for each type.

b) What is lanthanide contraction? Zr and Hf have almost identical chemical properties. Give an explanation based on lanthanide contraction. (3+3)

1. Give the chemical composiion of monazite sand. Discuss the extraction of lighter and heavier lanthanide sulphates from monazite sand.
2. Discuss the following properties of lanthanides: (i) magnetic properties (ii) colour (iii) complex formation.
3. What is cooperativity effect in haemoglobin? Discuss its mechanism.
4. A Latimer diagram of O2 is given below:



Write the ionic equations for all the three reduction half reactions in the diagram. From the diagram with proper explanation predict whether H2O2 undergoes disproportionation.

**PART C**

Answer any **FOUR** of the following: 5 × 4 = 20 marks

1. There are five complex ions that can be prepared from a trivalent metal ion M3+ using both ‘en’ and Br- ligands. Draw their structures.
2. a) Amongst the two, [Co(NO2)6]4- ion and [Co(NO2)6]3- ion, which would absorb light of longer wavelength in the visible region and why?

b) A complex of Fe2+ is diamagnetic. With proper reasoning predict whether it is octahedral or tetrahedral. (2½ + 2½)

1. a) [Ir(H2O)6]2+ and [IrF6]3- possess approximately the same 10Dq values . Give an explanation.

b) Why does NH3 form complexes whereas the isoelectronic species CH4 does not? (3+2)

1. The following is the Latimer diagram of Mn in basic solution. Construct a Frost diagram of Mn in basic solution.



1. Answer the following questions based on the Pourbaix diagram of iron given below:



1. Identify the iron species that exists at highly reducing conditions at low pH.
2. Identify the iron species that are involved in (i) pure acid-base equilibrium and (ii) pure redox equilibrium. Give the chemical equations corresponding to both these equilibria. (1+4)