P.G. Semester-II Examination, 2023
CHEMISTRY

Course ID : 21451   **Course Code : CHEM201C**

Course Title : Inorganic Chemistry

Time : 2 Hours   Full Marks : 40

The figures in the right-hand margin indicate marks.

Candidates are required to give their answers in their own words as far as practicable.

1. Answer any **five** of the following questions :

$$2 \times 5 = 10$$

a) How many P-O-P and P-P-P bonds are present in P_4O_6?

b) Which of the following clusters having arachno type structure? Explain.

$$Sb_4^{2-}, Bi_5^{3+}, Os_3(CO)_{12}, [B_4H_4]^{6-}$$

c) Eu^{3+} has an f^6 electronic configuration yet the calculated value of μ_{eff} is zero. – Why?

d) What is the limiting radius ratio for octahedral lattice?

e) What are carboranes? Explain with suitable example.

[Turn over]

f) Predict the geometry of $(CH_2CHCHCH_2)Fe(CO)_3$ and $[Co_6(CO)_{14}]^{4-}$.

g) Give two examples of Phyllosilicates.

2. Answer any **four** of the following questions:

$$5 \times 4 = 20$$

a) i) $FeCr_2O_4$ is anti-ferromagnetic whereas $CoFe_2O_4$ is ferromagnetic.– Explain.

ii) What are the cell dimension and interfacial angle of orthorhombic crystal system?

iii) Write down the factors affecting the structure of spinels. $2+1+2=5$

b) i) What do you mean by Colour Centre? Give an example.

ii) A metallic element exists as a cubic lattice. Each edge of the unit cell is $2.88\overset{0}{A}$. The density of the Metal is 7.20 g/cc. How many units cell will be in 100 g of the metal?

$$2+3=5$$

c) i) $Re_2Cl_8^{2-}$ adopts an eclipsed structure while $Re_2(CO)_{10}$ adopts a staggered structure in solid state– Justify.

ii) Write the number of terminal and bridging CO in solid $Co_4(CO)_{12}$ and $Ir_4(CO)_{12}$.

$$3+2=5$$

d) i) Calculate the total number of valence shell electrons of the following cluster. Classify them as closo, nido, aracheno and hypo:

(I) $[Co_8(CO)_{18}C]^{2-}$

(II) $[Ru_5N(Co)_{14}]^{2-}$

(III) $C_2B_4H_6Pt[PEt_3]_2$
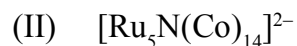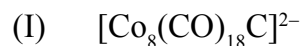
ii) What is the g value of Pr^{3+}?   3+2=5

e) i) Draw the structures of soro- and meta-silicate.

ii) Calculate the M-M bonds, bonding molecular orbitals and draw the correct geometries of the following complexes –

$Os_4(CO)_{15,} Co_4(CO)_{12}, Fe_3(CO)_{12}$
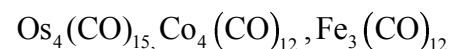
2+3=5

f) What are the consequences of lanthanide contraction? Describe ion-exchange method for the separation of lanthanides from one another.

2+3=5

3. Answer any **one** of the following questions:

10×1=10

a) i) Calculate the ground state term symbol of Ce^{3+}?

ii) $BaCeO_3$ has a perovskite structure. – Explain.

iii) Calculate μ_{eff} value of Yb^{3+}.

iv) Why the spin-only formula is not appropriate for estimating values of μ_{eff} for lanthanoid metal ions?

v) Write the differences between classical complex and cluster compounds.

2+2+2+2+2=10

c) i) How would you use the Lipscomb's model to find out the STYX code for B_6H_{10} and B_5H_{11} cluster system?   .

ii) Mention the primary, secondary and tertiary building unit of zeolites. How zeolites can act as Ion-exchanger? What are the use of zeolites in agriculture?

iii) Cyclohexane can be readily absorbed into zeolite Y but cannot be absorbed in to zeolite A.– Explain.

2+(2+2+2)+2=10

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