*Roll No.:*_____

M. Sc. CHEMISTRY
SCLS, JAMIA HAMDARD
SEMESTER II EXAMINATION 2019
PAPER TITLE: INORGANIC CHEMISTRY-II
PAPER CODE: MCHCC-203

Time: 3h **Max. Marks: 75**

(Write your Roll No. at the top immediately on receipt of this question paper)

Attempt all questions. All parts of a question must be attempted in continuation.

Q1 Answer ALL of the following: **15 X 1=15**

(i) Draw the structures of $Co_4(CO)_{12}$ and $Ir_4(CO)_{12}$.
(ii) $Rh_6(CO)_{16}$ can be reformulated as _____.
(iii) List the following carbonyl complexes in the increasing order of CO stretching frequencies: $[V(CO)_6]^-$, $[Mn(CO)_6]^+$, $[Ti(CO)_6]^{2-}$and $Cr(CO)_6$.
(iv) Terminal and bridging NO stretching frequencies are around _____and _____.
(v) Draw the structure of chromic acid.
(vi) Why do the oxides of Al(III) and Ga(III) form polymers rather than discrete isopoly anions?
(vii) Write the chemical equation for the reaction of borazine with Br_2.
(viii) How is boron nitride (BN) produced?
(ix) What is center of symmetry, "i" and describe it with an example.
(x) If the bond angles change, as from 107° in NH_3 to 102° in NF_3, does the symmetry change?
(xi) The symmetry of HCN is _____. and that of CO_2 is _____.
(xii) What is basic principle of resonance Raman spectroscopy?
(xiii) What are Overtones and combination bands?
(xiv) A molecule consisting of N atoms can vibrate in _____ different independent ways and a CO_2 molecule has _____modes of vibration.
(xv) When $\delta < 0$ the nucleus is said to be _____.and when $\delta > 0$ the nucleus is said to be _____.

Q2. Attempt ALL of the following:

I. Discuss different methods of preparation and different modes of coordination of nitrogen in transition metal dinitrogen complexes. **5**

OR

Discuss the methods of preparation, structure and characteristic features of Fischer carbenes.

II. Describe the mechanisms of homogeneous and heterogeneous Ziegler-Natta catalysis. **5**

OR

Correctly match the following isolobal fragments:

(i) CH_2----------$Fe(CO)_5$
(ii) CH----------$Fe(CO)_3$
(iii) CH_3----------CH^-
(iv) CH_4----------NiCp
(v) C----------H

III. Describe the structure of ferrocene with the help of a molecular orbital diagram and draw all of the LGOs and matching atomic orbitals of iron. 5

OR

What are triple deckers? Draw the structures of atleast four triple deckers.

Q3. Attempt ALL of the following:

I. Describe the application of oxygen-17 NMR spectroscopy in the structural elucidation of isopoly and heteropoly acids. 5

OR

Discuss the structure and reactions of tetrasulfur tetranitride S_4N_4.

II. How are phosphazene polymers prepared and describe their applications with proper diagrams. 5

OR

Describe the bonding in $(Re_2Cl_8)^{2-}$.

III. Describe the method of preparation of metal carboxylate clusters and draw their structures. 5

OR

What are Chevrel phases? Describe their structures and uses.

Q4. Attempt ALL of the following:

I. Draw the character table for H_2O and describe the various symbols present in the character table 5

OR

Find out all of the symmetry elements present in planar N_2O_4, $H_2C{=}C{=}CH_2$ and NH_3.

II. Derive Bragg's law and discuss its significance. 5

OR

Write short notes on scattering factor, structure factor and Fourier synthesis of electron density.

III. Discuss the seven crystal systems with their essential symmetries. 5

OR

IV. Write short notes on the fourteen Bravais lattices.

Q5. Attempt ALL of the following:

I. Describe the application of vibrational spectroscopy in the determination of the shape of AX_5 molecules. 5

OR

Draw the IR and Raman spectra of XeF_4 over the same range of wavenumbers and discuss the geometry of XeF_4.

II. Draw the layouts of EPR and NMR spectrometers. 5

OR

Draw and discuss the ^1H NMR and ^{19}F-NMR spectra of GeH_4 and ClF_3

III. Describe the application of coupling constant, J(Pt-P) in the determination of ci/trans geometries of square planar Pt(II) complexes. 5

OR

The isomer shifts of Fe(II) compounds relative to metallic iron, Fe(0), are generally in the range +1 to 1.5 mm s^{-1} whreas isomer shifts for Fe(III) compounds lie in the range +0.2 to +0.5 mm s^{-1}. Explain these values in terms of the electronic configurations of Fe(0), Fe(II) and Fe(III).

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