



H-003-001505

Seat No. _____

B. Sc. (Sem. V) (CBCS) Examination

May / June - 2017

Chemistry : Paper - C - 501

(Inorganic & Industrial Chemistry)

(New Course)

Faculty Code : 003

Subject Code : 001505

Time : $2\frac{1}{2}$ Hours]

[Total Marks : 70

- Instructions :** (1) Q. 1 carries 20 marks, Questions of one mark each and all questions are compulsory.
(2) Q. 2 and Q. 3 carries 25 marks each with internal options.

1 Answer the following questions : 20

- (1) Define zero point energy.
- (2) What is the degeneracy for a particle moving in a cubic box at energy $E = \frac{12h^2}{8ma^2}$?
- (3) Define addition of operators.
- (4) Give equation of CFSE for octahedral complexes.
- (5) Give high spin and low spin arrangement of d^7 electrons in octahedral field.
- (6) What is electron configuration of $[\text{Cr}(\text{CN})_6]^{4-}$?
- (7) What is the relation between splitting energy of octahedral and tetrahedral complexes ?
- (8) Draw structure of $\text{Fe}_2(\text{CO})_9$.
- (9) What is π -acid ligand ?
- (10) What are doubly bridging carbonyls ?
- (11) What is cement ?
- (12) What is used as floating agent in cement rock beneficiation ?

- (13) Name the principal constituents of cement.
- (14) What is complete fertilizer ?
- (15) Name any two natural inorganic fertilizers.
- (16) What is the effect of calcium deficiency on plant growth ?
- (17) Give examples of potassium containing fertilizers.
- (18) What is a petrochemical ?
- (19) Which are the constituents of synthetic gas ?
- (20) Give the chemical reaction for production of acrylonitrile.

2 (a) Answer any three : 6

- (1) Prove that $[\hat{A}, \hat{A}^2] = 0$ for $\hat{A} = \frac{d}{dx}$ and $f(x) = 3x^2$.
- (2) Prove that momentum also quantised like energy for a particle moving in one dimensional box.
- (3) List different methods used for preparation of metal carbonyls with one example of any one method.
- (4) Give electron configuration of $Ni(CO)_4$ with hybridization and structure.
- (5) Why Δ_o of $[Cr(H_2O)_6]^{2+}$ is greater than $[V(H_2O)_6]^{2+}$?
- (6) List the factors affecting splitting energy.

2 (b) Answer any three : 9

- (1) Derive Hamiltonian operator for a particle of mass 'm' moving in three dimensional box.
- (2) Explain 'degenerated energy levels'.
- (3) Give CFSE values for d^4 and d^6 systems in strong and weak ligand fields for octahedral complexes.
- (4) Give reason for the quenching of orbital angular momentum.
- (5) Explain polynuclear metal carbonyls with example.
- (6) Discuss types of NO group as ligand in metal nitrosyls.

(c) Answer any two : 10

- (1) Derive the energy equation for a particle moving in one dimensional box and explain terms involved in it with energy level diagram.
- (2) Discuss the splitting of d-orbitals and CFSE in tetrahedral crystal field.
- (3) Discuss the nature of linear M-CO bond on the basis of MO theory.
- (4) Calculate energy of 1s orbital where

$$\psi_{1s} = \frac{1}{\sqrt{\pi a_0^3}} e^{-r/a_0}$$

- (5) (i) For $[Fe(CN)_6]^{4-}$, splitting energy is 33000 cm^{-1} and pairing energy is 17600 cm^{-1} . Calculate CFSE for the compound in cm^{-1} and KJ mole^{-1} .
($83.7 \text{ cm}^{-1} = 1 \text{ KJ mole}^{-1}$).
- (ii) Give reason why M-C bond is weak and C-O bond is strong in $[Mn(CO)_6]^{+1}$ compared to $[V(CO)_6]^{-1}$.

3 (a) Answer any three : 6

- (1) What is Sorrel's cement ?
- (2) What is Portland cement ?
- (3) Give classification of fertilizers according to nutrients elements present in them.
- (4) List the properties of fertilizers.
- (5) Write only chemical reaction to obtain chloromethanes from methanes.
- (6) From which chemicals is ethylene obtained ? Give uses of ethylene.

- (b) Answer any three : **9**
- (1) Discuss setting and hardening of Portland cement.
 - (2) Discuss usage of cement.
 - (3) Give reactions involved in preparation of glycerol via acrolein.
 - (4) List the chemicals obtained from methane by chlorination and describe properties of any one of them.
 - (5) Draw flow chart diagram of production of NPK fertilizer.
 - (6) Describe the action of calcium cyanamide as fertilizer.
- (c) Answer any two : **10**
- (1) Discuss the manufacturing process of Ammonium Sulphate.
 - (2) Discuss about types of cement and raw materials of cement.
 - (3) Describe the manufacturing method of synthetic gas from methane.
 - (4) Discuss about plant nutrients and its role in plant growth.
 - (5) Describe the Wet process of cement manufacturing.
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