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RN-003-001505

Seat No. _____

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

February - 2019

C-501 : Chemistry

(Inorganic Chemistry & Industrial Chemistry)

(Old Course)

Faculty Code : 003

Subject Code : 001505

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

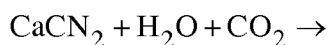
[Total Marks : 70

- Instructions :**
- (1) Question-1 carries 20 marks for 20 questions.
 - (2) Question-2 and 3 carry 25 marks each with internal option.
 - (3) Figures at right indicate marks.

1 Answer the following questions : **20**

- (1) "If $\hat{A}[f(x)+g(x)] = \hat{A}f(x) + \hat{A}g(x)$, then \hat{A} is a linear operator". Mark the statement with true or false.
- (2) What is Laplacian operator ?
- (3) When the particle is free it moves only _____. Fill in the blank.
- (4) The lowest value of kinetic energy for the particle in one dimensional box is called _____.
- (5) "Valance bond theory could not explain the structure of coordination compounds satisfactorily." Mark the statement with true or false.
- (6) The magnitude of crystal field splitting is given by _____.
- (7) What 'O' stands for in Δ_0 ?
- (8) What are metal carbonyls ?
- (9) What is π -acidity ?

- (10) The metal carbonyl $V(CO)_6$ is _____.
- (Diamagnetic, paramagnetic). Fill the correct option in the blank.
- (11) What is the use of sulphate resistant cement ?
- (12) What are the two essential raw material for cement manufacturing ?
- (13) Name the two processes for mixing of raw materials for cement manufacturing.
- (14) What are plant nutrients ?
- (15) What are micro nutrients for plants ?
- (16) What is the symptom of boron deficiency on plants ?
- (17) Write the formula of biuret.
- (18) Complete the reaction.



- (19) What is synthetic gas ?
- (20) Which is the latest preparation method of ethanol ?

2 (a) Answer any **three** of the following questions : 6

- (1) Explain commutative operator with example.
- (2) Calculate the lowest energy of a particle moving in one dimensional box of a length 12\AA , where
 $m = 9.1 \times 10^{-28}$ gm
 $h = 6.62 \times 10^{-27}$ ergs.sec
 $c = 3 \times 10^{10}$ cm.sec⁻¹.
- (3) What are the groups of five d-orbitals according to their orientation in space ? Draw the orbitals.
- (4) What is CFSE ? Give the formula for the calculation of CFSE for octahedral complexes.
- (5) Give formation of carbonyl halides.
- (6) What is doubly bridging CO group in metal carbonyls ?

(b) Answer any three of the following questions : 9

- (1) Write a note on polyenes as one dimensional box.
- (2) Discuss energy levels and corresponding wave functions in one dimensional box of length 'a'.
- (3) Calculate CFSE for $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$, where $\Delta_0 = 13700 \text{ cm}^{-1}$ and pairing energy is $30,000 \text{ cm}^{-1}$.
- (4) Write basic assumption in CFT given by Bathe.
- (5) Explain the consecutive decrease in CO stretching frequency for the following :
 $\text{Ni}(\text{CO})_4 \sim 2060 \text{ cm}^{-1}$
 $[\text{Co}(\text{CO})_4]^- \sim 1883 \text{ cm}^{-1}$
 $[\text{Fe}(\text{CO})_4]^{2-} \sim 1788 \text{ cm}^{-1}$.
- (6) Discuss metal complexes with neutral NO.

(c) Answer any two of the following questions : 10

- (1) Derive wave function and energy equation for particle in three dimensional cubic box with volume a^3 .
- (2) Calculate the wavelength of the absorbed energy when a particle is transferred from the lowest energy level of the next level, of a cubic box of length 0.2 \AA ; where
 $h = 6.62 \times 10^{-27} \text{ erg.Sec}$
 $m = 1.672 \times 10^{-24} \text{ gm,}$
 $c = 3 \times 10^{10} \text{ cm. sec}^{-1}$.
- (3) Discuss high spin and low spin complexes with pairing energy.
- (4) Discuss factors affecting splitting energy.
- (5) Discuss the structure of $\text{Fe}(\text{CO})_5$.

- 3 (a) Answer any three of the following questions : 6
- (1) What is Sorel's cement ? Write the formula also.
 - (2) What is hydraulic hydrated cement ?
 - (3) What are primary and secondary nutrients for plant ?
 - (4) What are the properties of fertilizers ?
 - (5) Write the chemical reactions for four chloromethanes from methane.
 - (6) List out the petrochemicals from C_2 .
- (b) Answer any three of the following questions : 9
- (1) Write the name and formula of the components of portland cement.
 - (2) What are high alumina cement and water proof cement ?
 - (3) What are direct, indirect and complete fertilizers ?
 - (4) What is the action of urea as a fertilizer ? Write the reactions involved.
 - (5) Write the chemical reactions for the preparation of ethylene glycol from ethylene via ethylene oxide.
 - (6) Write the chemical reactions involved in the preparation of glycerol from propylene via acrolein.
- (c) Answer any two of the following questions : 10
- (1) Discuss properties of cement.
 - (2) Discuss mortars, concrete and RCC.
 - (3) Write a note on potassium fertilizers.
 - (4) Discuss NPK fertilizers. Draw the flow diagram of the process.
 - (5) Discuss the manufacture of glycerol from propylene via allyl chloride. Draw the flow chart and write the reactions involved.