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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 $\hat{A}\left[f(x)+g(x)\right]=\hat{A}\,f(x)+\hat{A}\,g(x)$, 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.

$CaCN_2 + H_2O + CO_2 \rightarrow$

(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 $12\mathring{A}$, 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 $[Fe(H_2O)_6]^{2+}$, where $\Delta_0 = 13700\, cm^{-1}$ and pairing energy is 30,000 cm^{-1}.

(4) Write basic assumption in CFT given by Bathe.

(5) Explain the consecutive decrease in CO stretching frequency for the following :
$Ni(CO)_4$ ~ 2060 cm^{-1}
$[Co(CO)_4]^-$ ~ 1883 cm^{-1}
$[Fe(CO)_4]^{2-}$ ~ 1788 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 $\mathring{A}$; where

h = 6.62 $\times 10^{-27}$ erg.Sec

m = 1.672 $\times 10^{-24}$ gm,

c = 3 $\times 10^{10}$ 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 $Fe(CO)_5$.

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.