B.Sc. 2nd Semester (Honours) Examination, 2019 (CBCS)

Subject : Chemistry

Paper : CC-III

Time: 2 Hours **Full Marks: 40**

The figures in the margin indicate full marks.

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

1. Answer *any five* from the following questions: 2×5=10

(a) What do you mean by exchange energy? Give suitable example.

(b) Calculate the second ionization potential of helium (Given Ionization potential of hydrogen = 13.6 eV)

(c) Write the decreasing order of atomic, size of C, Al and Si, and explain.

(d) "Electron affinity of nitrogen is negative."—Explain.

(e) Compare the basic strength of NH_3, NF_3 and $(CH_3)_3N$ with proper reasons.

(f) Calculate the pH of 10^{-8}M HCl.

(g) Calculate the $e.m.f$ of a cell in which the following reactions take place at different electrodes:

(i) $Zn^{2+} + 2e^- \rightarrow Zn; E_0 = -0 \cdot 76V$

(ii) $Ag^+ + e^- \rightarrow Ag; E_0 = 0 \cdot 79V$

(h) Define comproportionation reaction with proper example.

2. Answer *any two* from the following questions: 5×2=10

(a) (i) Write down the limitations or drawbacks of Bohr's atomic theory.

(ii) Which quantum number is used to express the orbital angular momentum of the electron?

(iii) Deduce the ground state term symbol of Mn^{2+} ion. 2+1+2=5

(b) (i) Calculate the electronegativity of bromine in the Allred-Rochow scale. $r_{cov} = 1 \cdot 14Å$.

(ii) What is the effect of adding KNH_2 to liquid ammonia in respect of acidity? 3+2=5

(c) (i) What characteristics does an acid-base indicator must possess?

(ii) Explain the acid-base neutralization curve for the titration of a weak acid with strong base. Name the indicator used in such titration. 2+3=5

(d) (i) Write down the role of adding NH_4Cl to precipitate Fe^{3+}as hydroxide in presence of NH_4OH.

(ii) Write down the Frost diagram for O_2, H_2O_2 and H_2O in acidic medium. 2+3=5

3. Answer *any two* from the following questions: 10×2=20

(a) (i) What is Aufbau Principle? Give its limitations.

(ii) Calculate the uncertainty in position of a dust particle with mass equal to 1mg if the uncertainty in its velocity is $5 \cdot 5 \times 10^{-20}\ ms^{-1} (h = 6 \cdot 626 \times 10^{-34} Js)$.

(iii) What are super acids? Give suitable example. (1½+1½)+4+3=10

(b) (i) Define group electronegativity with appropriate example.

(ii) Explain size of isoelectronic ions with suitable examples.

(iii) What do you mean by levelling and differentiating solvent? Compare the acidity of strength of HCl, HNO_3 and H_2SO_4 in water. 3+3+4=10

(c) (i) $SOCl_2 + CaSO_3 = CaCl_2 + 2SO_2$ — this is an acid-base neutralization reaction in presence of liquid SO_2 solvent. Identify the acid and base of this reaction with the help of "solvent system definition" concept.

(ii) Suggest and justify the way through which the following reactions will go:

(I) $CF_4 + CH_4 \rightarrow CF_3H + CH_3F$

(II) $CaS + H_2O \rightarrow CaO + H_2S$

(iii) Define the "Lux-Flood concept" of acid and base. Predict how the acidity will change on adding SiO_2 to a molten mixture of Fe + FeO. Write down the conjugate acids of S^{2-} and PO_4^{3-}. 4+(1½×2)+(1+1+1)=10

(d) (i) Describe the effect of complex formation and precipitation on the value of redox potential.

(ii) Balance the following reaction by ion-electron method:

$HCl + KMnO_4 \rightarrow Cl_2 + MnCl_2 + KCl + H_2O$

(iii) What will be the solubility of silver chloride in a 0·1M NaCl solution?

($K_s = 1 \cdot 0 \times 10^{-10}$)

(iv) 'Electron affinity of Mn(III) is greater than that of Fe(III)'. —Explain. 4+2+2+2=10
