CARMEL COLLEGE OF ARTS, SCIENCE & COMMERCE FOR WOMEN,
SEMESTER END EXAMINATION, July 2020
SEMESTER: IV Physical Chemistry and Inorganic Chemistry: CHC104
TOTAL MARKS: 40 DATE: July, 2021 DURATION: 2HOURS

Q1. Answer **any five** from the following **(2×5 = 10 marks)**

i) Briefly describe Andrew's isotherms for CO_2 gas.

ii) At 20°C water formed 27 drops when flowing through the capillary of a stalagnometer, while an equal volume of ether formed 107 drops. If the densities of water and ether are 0.997 and 0.70 g/cc respectively. Find surface tension of ether, if that of water is 72.8 dynes/cm

iii) Convert the following Weiss Indices into Miller Indices: ½ : 2: ∞

iv) Explain briefly the half-life method to find the order of a reaction.

v) Write the configuration of Cm atom and Gd atom.

vi) Arrange the following transition elements in increasing order of their atomic size

Cu, Ti, Mn, Sc, Fe,

vii) What is the coordination number and oxidation state of Ni in the complex ion $[Ni(CN)_4(en)]^{3-}$

viii) Calculate the CFSE for the following complexes

a) $[CrBr_4]^{2-}$ b) $[Mn(H_2O)_6]^{2+}$

Q2: Answer **any 6** of the following **(5* 6 = 30 marks)**

a) (i)What is Critical Phenomena? 2 mks

(ii) Calculate the compressibility factor of a Van der Waal's gas at the critical point. Given that Z=Zc, P=Pc, V=Vc and T=Tc at the critical point. 3mks

b. i) In an experiment with Ostwald's viscometer the time of flow of water and ethanol are 1.5 min and 1.7 min at 20^0C. The density of water =0.998 g/cm^3 and that of

ethane =0.790g/cm^3. The viscosity of water at 20^{0}C is 0.0091 poise. Calculate the viscosity of ethanol. 2 mks

ii) A first order reaction is 35% complete in 20 minutes. Calculate the i) decay constant ii) half-life and iii) time required for 50% of reaction to be complete. . 3mks

c) i) Explain the factors affecting the viscosity of a liquid. 2mks

ii) Derive the rate equation for second order reaction with unequal initial concentration of the reactants. 3mks

d) i). The second order reflection of X-rays from (100) planes of NaCl occurs at 29.3°. If the wavelength used is 1.54° Å. Calculate the distance between two successive (100) planes in NaCl 3mks

ii) Draw the unit cell of NaCl 2 mks

e) List the geometric isomers of the chromium complex $[Cr(Cl)_2(en)(NH_3)_2]^{1+}$. Which of these isomers will be optically active? 2 mks

Write the formula of the complex from the names of the metal complex. 3 mks

a) Triamminedichlorocyanocobalt(III)
b) Potassium tetrathiocyanatonickelate(0)
c) Tetrammineplatinum(II)aminetrichloroplatinate(II)

f) i) Using VBT, deduce the structure of the complex $[MnCl_4]^{2-}$. 3 mks

ii) Among the pairs of complexes given below, select the complex with larger splitting of the d-orbitals. Give reasons for your choice. 2 mks

a) $[Cr(Cl)_6]^{3-}$ and $[Co(Cl)_6]^{3-}$
b) $[Sc(NH_3)_6]^{3+}$ and $[Sc(CN)_6]^{3-}$
c) $[Mn(en)_3]^{2+}$ and $[Mn(en)_2]^{3+}$
d) $[Co(H_2O)_6]^{3+}$ and $[Tc(H_2O)_6]^{3+}$

g) Give the splitting of the d-orbitals in the complex $[Cr(CN)_6]^{3-}$. Calculate the CFSE and comment on its stability. Predict the magnetic properties of the complex.

h) Answer the following

   a) List some of the consequences of lanthanide contraction. 1 mk

   b) The colour of lanthanide complexes are not affected by the ligand. Give reasons. 2 mks

   c) The melting point of Mn is lower than expected. Give reasons 2 mks