MAASAI MARA UNIVERSITY

REGULAR UNIVERSITY EXAMINATIONS
2021/2022 ACADEMIC YEAR
THIRD YEAR FIRST SEMESTER

SCHOOL OF PURE, APPLIED AND HEALTH SCIENCES (SPAHS)

BACHELOR OF SCIENCE IN CHEMISTRY

COURSE CODE: CHE 3123

COURSE TITLE: COORDINATION CHEMISTRY

DATE: XX MARCH, 2022 **TIME: XX - YY HRS**

INSTRUCTIONS TO CANDIDATES

1. Answer Question **ONE** and any other **TWO** questions in section **B**
2. No writing on the Question paper
3. Use of mobile phone in the exam room is prohibited

QUESTION ONE **[30 MARKS]**

a) Define the following terms;

i. Molecular orbital **[1 mark]**

ii. Effective atomic number **[1 mark]**

iii. Coordination compound **[1 mark]**

iv. Denticity of a ligand **[1 mark]**

b) Highlight three reasons that make it possible for d-block metals to form coordination compounds **[3 marks]**

c) State any three postulates of Alfred Werner **[3 marks]**

d) Name the following coordination compounds;

i. $[Pt(NH_3)_4Cl(H_2O)]SO_2$ **[2 marks]**

ii. $K_2[Mn(H_2O)_2(ox)_2]$ **[2 marks]**

e) Write the formulae of the following coordination compounds;

i. Dichloridobistriethylenetetramineplatinum(iv) nitrate **[2 marks]**

ii. Triaminodiaquoiodocobalt(iii) chloride **[2 marks]**

f) State Sigdwicks rule of effective atomic numbers **[1 mark]**

g) Describe Jahn Tellers distortion for octahedral complexes **[2 marks]**

h) Differentiate between;

i. Non-bonding and anti-bonding molecular orbitals **[2 marks]**

ii. Alloys from interstitial compounds **[2 marks]**

i) Give two factors that influence the splitting energy of complexes **[2 marks]**

j) Use crystal field theory (CFT) to determine whether $[Fe(NH_3)_6]^{2+}$ is paramagnetic or diamagnetic **[3 marks]**

QUESTION TWO [20 MARKS]

a) Differentiate the following;
   i. Spectrochemical series from electromagnetic spectra **[2 marks]**
   ii. Weak field ligands from strong field ligands **[2 marks]**

b) Using necessary examples, explain six types of isomerism exhibited by coordination compounds **[12 marks]**

c) Name the following coordination compounds;
   i. $Mg_2[V(H_2O)_2Cl_2]$ **[2 marks]**
   ii. $[Co(H_2O)_2(NH_3)_3F]Cl_2$ **[2 marks]**

QUESTION THREE [20 MARKS]

a) Explain the macrocyclic effect of ligands **[2 marks]**

b) Use Valence Bond Theory (VBT) to determine the hybridization, geometry and magnetic moment of $[Fe(CN)_6]^{3-}$ **[7 marks]**

c) State three assumptions of the CFT Theory **[3 marks]**

d) Use CFT theory to write the eg and t_2g configurations as well as determine the magnetic moment of;
   i. The octahedral compound $[Mn(H_2O)_6]^{2+}$ **[4 marks]**
   ii. The tetrahedral compound $[Cr(NH_3)_4]^{3+}$ **[4 marks]**

QUESTION FOUR [20 MARKS]

a) Using Crystal Field Theory, explain on the origin of colors (spectra) in co-ordination compounds **[3 marks]**

b) Calculate the crystal field stabilization energy (CFSE) in $[MnCl_4]^-$ **[4 marks]**

c) Draw the Molecular Orbital of the complex $[Cr(NH_3)_6]^{3+}$ and state whether the complex is diamagnetic or paramagnetic **[10 marks]**

d) State giving an example in each case the role of coordination compounds in:
   i. Biological compounds **[1 mark]**
   ii. Analytical chemistry **[1 mark]**
   iii. Extraction of metals (metallurgy) **[1 mark]**