THE PAPUA NEW GUINEA UNIVERSITY OF TECHNOLOGY

SECOND SEMESTER EXAMINATION

CH 222 – ADVANCED INORGANIC CHEMISTRY

FRIDAY 23rd OCTOBER 2020 8:20 AM

TIME ALLOWED: 2 HOURS

INFORMATION FOR CANDIDATES:

1. You will have 10 minutes to read the question paper. You **MUST NOT** begin writing in the answer book during this time.
2. **ANSWER ALL QUESTIONS.**
3. All answers **MUST** be written on the answer book provided
4. Calculators are permitted in the examination room. Lecture notes, notebooks plain papers and textbooks are **NOT** allowed.
5. Mobile phones are not allowed. **SWITCH OFF THE MOBILE PHONES.**
6. Show all workings and calculations in the answer book.
7. **DRAW the STRUCTURES** clear and visible.
8. **DO NOT** over write.
9. Write your name and number clearly on the front page. **DO IT NOW.**

MARKING SCHEME: Total 50 marks

1. (a) What are isotones? Give ONE example.

(b) Give any TWO factors (*with respect to the properties of ligands*) that govern the stability of the complexes.

(c) Square planar complexes do not exhibit optical isomerism. Why?

(d) What happens when the neutron/proton (N/P) ratio lies above the "zone of stability" curve?

(e) Distinguish between bite angle and bite distance.

(f) Most of the nuclear reactions involving α- and β- emissions are accompanied by gamma ray emissions. Why?

(g) Draw *cis*- and *trans*- geometrical isomer of $[Pd(NH_3)_2Br_2]$

(14 marks)

2. (a) Compare the velocities and ionizing powers of alpha, beta and gamma rays.

(b) Give any THREE limitations of Valence Bond Theory (VBT).

(c) What is meant by orbital capture? Give ONE example.

(d) Use VBT (Valence Bond Theory) to $[Fe(CN)_6]^{4-}$ and deduce the shape, hybridization and magnetic property. Identify whether the complex is inner orbital or outer orbital complex.

(e) How many α and β particles will be emitted when ${}^{241}_{94}Pu$ changes to ${}^{209}_{83}Bi$?

(f) Calculate the Crystal Field Stabilization Energy (CFSE) for Co^{3+} in an octahedral coordination complex (*No need of an entire crystal field splitting diagram*).

(g) Balance the following nuclear reactions:

(i) ${}^{27}_{13}Al + {}^{4}_{2}He \rightarrow {}^{30}_{15}P +$ ________

(ii) ________ $\rightarrow {}^{30}_{14}Si +$ positron

(iii) ${}^{87}_{36}Kr \rightarrow$ neutron + ________

(h) How would you structurally represent $CoCl_3.4NH_3$ and $CoCl_3.6NH_3$ according to Werner's Coordination Theory (WCT)?

(24 marks)

3. (a) Distinguish between valence isomers and coordination-position isomers with suitable example.

(b) Use the IUPAC rules and write the exact and proper formula for the following compounds:

(i) Sodium tetrachlorozincate(II)

(ii) Potassium pentabromonitridoosmate(VI)

(iii) Sodium amminetrichloroplatinate(II)

(iv) Diamminedifluoroplatinum(II)

(c) (i) Draw a NEAT and COMPLETE crystal field splitting diagram for $[Fe(H_2O)_6]^{3+}$ and fill the electrons.
(ii) Identify whether this complex is high or low spin.
(iii) Calculate the Crystal Field Stabilization Energy (CFSE) for this complex.

(12 marks)

DATA SHEET

Periodic Table of the Elements