JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

UNIVERSITY EXAMINATION 2012/2013

3RD YEAR 1ST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF EDUCATION SCIENCE WITH IT (SCHOOL BASED-MAIN)

COURSE CODE: SCH 306

TITLE: INORGANIC CHEMISTRY III.

DATE: 2/5/2013 **TIME: 14.00-16.00PM**

DURATION: 2HOURS

INSTRUCTIONS

1) **This paper contains FIVE [5] questions.**
2) **Answer question ONE [1] COMPULSORY and ANY other TWO [2] questions.**
3) **Write ALL answers in the booklet provided.**

Section A This section contains ONE COMPULSORY question

QUESTION 1 (Compulsory -30 marks)

a) By giving appropriate examples, briefly explain each of the following terms; (10 marks)

i. Lanthanide contraction
ii. Coinage metals
iii. Ferromagnetism
iv. Ligands
v. Effective atomic number
vi. Co-ordination complex
vii. Splitting the crystal field
viii. Energy of stabilization by the crystal field (ESCF)
ix. Strong field ligands
x. Racah's parameter

b) Differentiate between inner and outer orbital complexes (2 marks)

c) Briefly discuss the main limitations of the valency bond theory in explaining co-ordination complexes (4 marks)

d) Giving specific examples, briefly explain the importance of complexes in biological systems (4 marks)

e) Calculate the effective atomic number of the complexing agent in the complex:

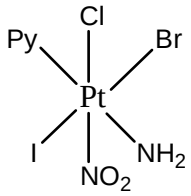
$(OC:)_5Mn\text{-}Mn(:CO)_5$ (2 marks)

a) Outline the main features of the ligand field theory (LFT) of complexes (4 marks)

f) Give the name of the following complexes:

i. $[Pt(NH_3)(NO_2)Cl]SO_4$ (1 mark)

ii.



(1 mark)

g) Draw the structure of a complex ion: *cis*-dibromotetraamminerhodium(III) ion (2 marks)

Section B: This section contains FOUR questions. Answer ONLY TWO questions.

QUESTION TWO (Optional, 20 marks)

a) Briefly discuss classifications of coordination complexes (8 marks)

b) The electronic spectra of $[V(H_2O)_6]^{3+}$ which is a d^2 configuration shows two absorption peaks at 17800 cm^{-1} and at 25700 cm^{-1}. Using d^2 Tunabe-Sugano diagram, determine the values of B and the splitting Δo and predict the position of third absorption peak of the complex. (12 marks)

QUESTION THREE (Optional, 20 marks)

a) By giving appropriate examples where necessary, briefly discuss different types of isomerism in co-ordination complexes (12 marks)

b) Briefly explain formation of each of the following types of complexes according to the crystal field theory (CFT):

i. Square planar (4 marks)

ii. Tetrahedral complexes (4 marks)

QUESTION FOUR (Optional, 20 marks)

a) Briefly discuss the factors that determine formation of high spin and low spin complexes according to the crystal field theory of complexes (12 marks)

b) Consider the complex ion $[CoF_6]^{3-.}$

iii. Give the name of the complex ion (1 MARK)

iv. Write the electronic configuration of the ion according to each of the following theories

I. Valency bond theory (VBT) (1 mark)

II. The crystal field theory (CFT) (1 mark)

III. Molecular orbital theory (1 mark)

v. Sketch a molecular orbital diagram for the ion (4 marks)

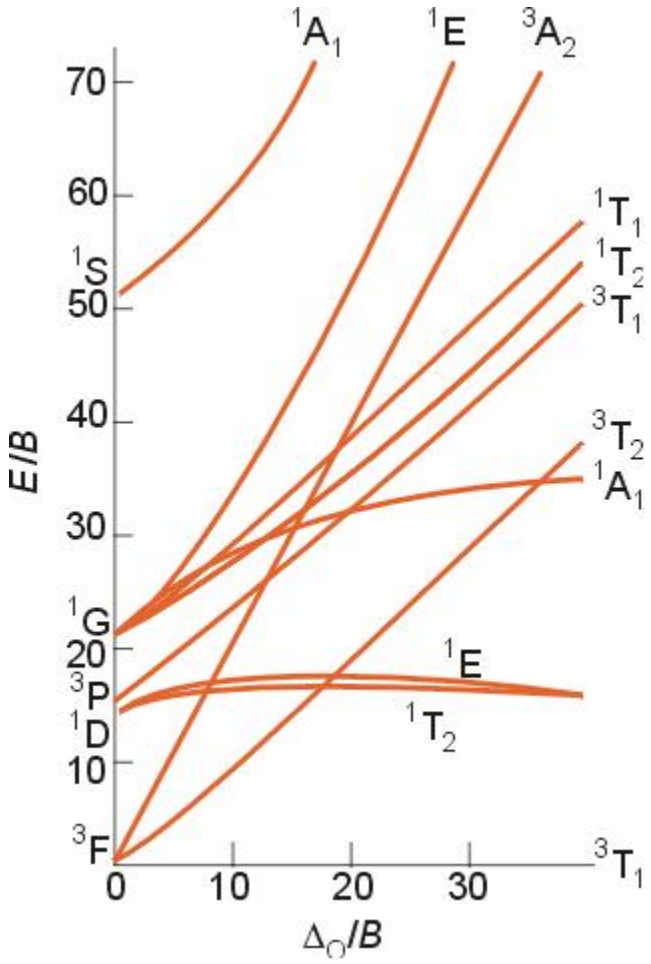
QUESTION FIVE (Optional, 20 marks)

a) Briefly discuss methods used in classification of co-ordination complexes (10 marks)

b) Draw a Russel-Saunders scheme for describing electronic states that arise from a $3d^2$ electronic configuration to indicate the effects in both strong field and weak field case. (10 marks)

=END=

A d^2 TUNABE-SUGANO DIAGRAM



LIST OF CHEMICAL ELEMENTS

Element	Symbol	Atomic no.	Atomic weight	Element	Symbol	Atomic no.	Atomic weight
Actinium	Ac	89	(227)	Mercury	Hg	80	200.59
Aluminium	Al	13	26.981 539	Molybdenum	Mo	42	95.94
Americium	Am	95	(243)	Neodymium	Nd	60	144.24
Antimony	Sb	51	121.75	Neon	Ne	10	20.179 7
Argon	Ar	18	39.948	Neptunium	Np	93	(237)
Arsenic	As	33	74.921 59	Nickel	Ni	28	58.69
Astatine	At	85	(210)	Niobium	Nb	41	92.906 38
Barium	Ba	56	137.327	Nitrogen	N	7	14.006 74
Berkelium	Bk	97	(247)	Nobelium	No	102	(255)
Beryllium	Be	4	9.012 182	Osmium	Os	76	190.2
Bismuth	Bi	83	208.980 37	Oxygen	O	8	15.999 4
Boron	B	5	10.811	Palladium	Pd	46	106.42
Bromine	Br	35	79.904	Phosphorus	P	15	30.973 762
Cadmium	Cd	48	112.411	Platinum	Pt	78	195.08
Caesium	Cs	55	132.905 43	Plutonium	Pu	94	(244)
Calcium	Ca	20	40.078	Polonium	Po	84	(209)
Californium	Cf	98	(251)	Potassium	K	19	39.098 3
Carbon	C	6	12.011	Praseodymium	Pr	59	140.907 65
Cerium	Ce	58	140.115	Promethium	Pm	61	(145)
Chlorine	Cl	17	35.452 7	Protactinium	Pa	91	231.035
Chromium	Cr	24	51.996 1	Radium	Ra	88	226.025 4
Cobalt	Co	27	58.933 20	Radon	Rn	86	(222)
Copper	Cu	29	63.546	Rhenium	Re	75	186.207
Curium	Cm	96	(247)	Rhodium	Rh	45	102.905 50
Dysprosium	Dy	66	162.50	Rubidium	Rb	37	85.467 8
Einsteinium	Es	99	(254)	Ruthenium	Ru	44	101.07
Erbium	Er	68	167.26	Samarium	Sm	62	150.36
Europium	Eu	63	151.965	Scandium	Sc	21	44.955 910
Fermium	Fm	100	(257)	Selenium	Se	34	78.96
Fluorine	F	9	18.998 403 2	Silicon	Si	14	28.085 5
Francium	Fr	87	(223)	Silver	Ag	47	107.8682
Gadolinium	Gd	64	157.25	Sodium	Na	11	22.989 768
Gallium	Ga	31	69.723	Strontium	Sr	38	87.62
Germanium	Ge	32	72.61	Sulphur	S	16	32.066
Gold	Au	79	196.966 54	Tantalum	Ta	73	180.947 9
Hafnium	Hf	72	178.49	Technetium	Tc	43	(97)
Helium	He	2	4.002 602	Tellurium	Te	52	127.60
Holmium	Ho	67	164.930 32	Terbium	Tb	65	158.925 34
Hydrogen	H	1	1.007 94	Thallium	Tl	81	204.383 3
Iodine	I	53	126.904 47	Thulium	Tm	69	168.934 21
Indium	In	49	114.82	Thorium	Th	90	232.038 1
Iridium	Ir	77	192.22	Tin	Sn	50	118.710
Iron	Fe	26	55.847	Titanium	Ti	22	47.88
Krypton	Kr	36	83.80	Tungsten	W	74	183.85
Lanthanum	La	57	138.905 5	Uranium	U	92	238.028 9
Lawrencium	Lr	103	(260)	Vanadium	V	23	50.941 5
Lead	Pb	82	207.2	Xenon	Xe	54	131.29
Lithium	Li	3	6.941	Ytterbium	Yb	70	173.04
Lutetium	Lu	71	174.967	Yttrium	Y	39	88.905 85
Magnesium	Mg	12	24.305 0	Zinc	Zn	30	65.38
Manganese	Mn	25	54.938 05	Zirconium	Zr	40	91.224
Mendelevium	Md	101	(258)				