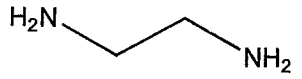
**Uva Wellassa University, Sri Lanka**
**End Semester Examination – March 2012**
**SCT 231-1 Inorganic Chemistry**

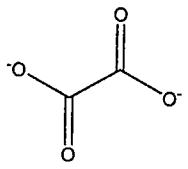
**Time: One (01) hour**

Total **three (03)** questions
Answer **all** questions.

*Avogadro constant,* $N_A = 6.022 \times 10^{23}\ mol^{-1}$
*Electron charge (e)* $= 1.6022 \times 10^{-19}\ C$
*Electron mass* $= 9.1095 \times 10^{-28}\ g$
*Universal gas constant,* $R = 8.314\ J\ K^{-1}\ mol^{-1}$
*Boltzmann constant,* $k = 1.3807 \times 10^{-23}\ J\ K^{-1}$
*Plank's constant,* $h = 6.626 \times 10^{-34}\ m^2\ kg\ s^{-1}$
*Faraday's constant,* $F = 9.6485 \times 10^{4}\ C\ mol^{-1}$
*Velocity of light,* $c = 2.998 \times 10^{-34}\ m\ s^{-1}$
Proton mass $= 1.67252 \times 10^{-24}\ g$
*Neutron mass* $= 1.67495 \times 10^{-24}\ g$

The abbreviations given are;

en = 


ox = 


01. a. Write the IUPAC names for the following coordination complexes.

i. $[Ni(CO)_4]$

ii. $[Mn(en)_2I_2]ClO_4$

iii. $[Co\ (NH_3)_4\ Cl_2]Cl$

b. Write the chemical formula for each of following complexes.

i. tris(ethylenediamine)chromium(III) chloride

ii. dichlorobis(ethylenediamine)platinum(IV) nitrate

c. Compounds containing the $SC^{+3}$ ion are colourless whereas those containing the $Ti^{+3}$ ion are coloured. **Explain briefly.**

d. i. Specify which of the following structures exhibit geometric isomerism:
(I) linear (II) square-planar (III) tetrahedral (IV) octahedral

ii. Draw all possible stereoisomers for each of the following complexes. Label the diastereoisomers as *cis* or *trans*. Clearly identify the cases where no stereoisomers are possible.

(I) $[Ni(NH_3)_2Cl_2]$ (square planar)

(II) traamminedichlorocobalt(III) ion.

e. A student has prepared a cobalt complex that has one of the following structures: $[Co(NH_3)_6]Cl_3$,$[Co(NH_3)_5Cl]Cl_2$, or $[Co(NH_3)_4Cl_2]Cl$. **Briefly explain** how the student would distinguish between these possibilities experimentally.

f. A student prepared three coordination compounds containing chromium, with the following properties:

| *Formula* | *Colour* | *$Cl^-$ ions in the solution per formula unit* |
|---|---|---|
| $CrCl_3.6H_2O$ | Violet | 3 |
| $CrCl_3.6H_2O$ | Light green | 2 |
| $CrCl_3.6H_2O$ | Dark green | 1 |

Write modern formula for these compounds and **suggest** a method to estimate the number of $Cl^-$ ions present in solution in each case.
(Hint: Some of the compounds may occur as hydrates.)

(50 marks)

02. a. Define following terms.

i. Atomic number

ii. Mass number

iii Isotope

ii. Radioactive decay

b. Complete the following nuclear equations and identify X in each case specifing special names if any:

i. $^{59}_{27}Co + {}^{2}_{1}H \rightarrow {}^{60}_{27}Co + X$

ii. $^{20}_{8}O \rightarrow {}^{20}_{9}F + X$

iii. $^{235}_{92}U + {}^{1}_{0}n \rightarrow {}^{160}_{62}Sm + {}^{72}_{30}Zn + X$

c. Strontium-90 is one of the products of the fission of uranium-235. The strontium-90 isotope is radioactive with a half-life of 28.1 yr. How long (in yr) will it take for 1.00 g of the isotope to be reduced to 0.200 g?

(30 marks)

03. Write a short account on <u>two</u> of the following topics.

i. Uses of Isotopes

ii. Coordination Compounds in Living Systems

iii Applications of organometallic complexes

(20 marks)

| 1 | | | | | | | | | | | | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 H 1.008 | 2 | | | | | | | | | | | | | | | | 2 He 4.0026 |
| 3 Li 6.94 | 4 Be 9.0122 | | | | | | | | | | | 5 B 10.81 | 6 C 12.011 | 7 N 14.007 | 8 O 15999 | 9 F 18.998 | 10 Ne 20.180 |
| 11 Na 22.990 | 12 Mg 24.305 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 Al 26.982 | 14 Si 28.085 | 15 P 30.974 | 16 S 32.06 | 17 Cl 35.45 | 18 Ar 39.948 |
| 19 K 39.098 | 20 Ca 40.078 | 21 Sc 44.956 | 22 Ti 47.867 | 23 V 50.942 | 24 Cr 51.996 | 25 Mn 54.938 | 26 Fe 55.845 | 27 Co 58.933 | 28 Ni 58.693 | 29 Cu 63.546 | 30 Zn 65.39 | 31 Ga 69.723 | 32 Ge 72.63 | 33 As 74.922 | 34 Se 78.96 | 35 Br 79.904 | 36 Kr 83.798 |
| 37 Rb 85.468 | 38 Sr 87.62 | 39 Y 88.906 | 40 Zr 91224 | 41 Nb 92.906 | 42 Mo 95.96 | 43 Tc (98) | 44 Ru 101.07 | 45 Rh 102.91 | 46 Pd 106.42 | 47 Ag 107.87 | 48 Cd 112.41 | 49 In 114.82 | 50 Sn 118.71 | 51 Sb 121.76 | 52 Te 127.60 | 53 I 126.90 | 54 Xe 131.29 |
| 55 Cs 132.91 | 56 Ba 137.33 | 57-71 * | 72 Hf 178.49 | 73 Ta 180.95 | 74 W 183.84 | 75 Re 186.21 | 76 Os 190.23 | 77 Ir 192.22 | 78 Pt 195.08 | 79 Au 196.97 | 80 Hg 200.59 | 81 Tl 204.38 | 82 Pb 207.2 | 83 Bi 208.98 | 84 Po (209) | 85 At (210) | 86 Rn (222) |
| 87 Fr (223) | 88 Ra (226) | 89-103 # | 104 Rf (265) | 105 Db (268) | 106 Sg (271) | 107 Bh (270) | 108 Hs (277) | 109 Mt (276) | 110 Ds (281) | 111 Rg (280) | 112 Cn (285) | 113 Uut (284) | 114 Fl (289) | 115 Uup (288) | 116 Lv (293) | 117 Uus (294) | 118 Uuo (294) |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| * Lanthanide series | 57 La 138.91 | 58 Ce 140.12 | 59 Pr 140.91 | 60 Nd 144.24 | 61 Pm (145) | 62 Sm 150.36 | 63 Eu 151.96 | 64 Gd 157.25 | 65 Tb 158.93 | 66 Dy 162.50 | 67 Ho 164.93 | 68 Er 167.26 | 69 Tm 168.93 | 70 Yb 173.05 | 71 Lu 174.97 |
| # Actinide series | 89 Ac (227) | 90 Th 232.04 | 91 Pa 231.04 | 92 U 238.03 | 93 Np (237) | 94 Pu (244) | 95 Am (243) | 96 Cm (247) | 97 Bk (247) | 98 Cf (251) | 99 Es (252) | 100 Fm (257) | 101 Md (258) | 102 No (259) | 103 Lr (262) |

Periodic Table of elements

From http:// http://www.chem.qmul.ac.uk/iupac/AtWt/table.gif, March 08, 2012





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