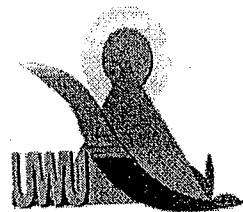




Uva Wellassa University, Sri Lanka
End Semester Examination – July 2010
SCT 234-2 Advanced Chemistry



Time: Two (02) hours

Total five (05) Questions

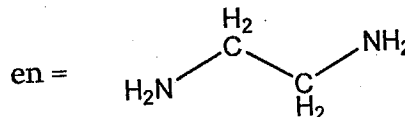
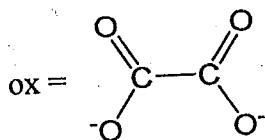
This paper consist of three parts (Part – A, Part – B and Part – C)

Answer one (01) question from Part - A, one (01) from Part - B and one (01) from Part - C

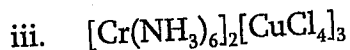
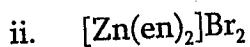
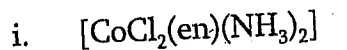
Universal gas constant, $R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1}$
Boltzmann constant, $k = 1.3807 \times 10^{-23} \text{ J K}^{-1}$
Plank's constant, $h = 6.626 \times 10^{-34} \text{ m}^2 \text{ kg s}^{-1}$
Avogadro constant, $N_A = 6.022 \times 10^{23} \text{ mol}^{-1}$
Faraday's constant, $F = 9.6485 \times 10^4 \text{ C mol}^{-1}$
Velocity of light, $c = 2.998 \times 10^8 \text{ m s}^{-1}$

Part – A

01)



a. Write the IUPAC names of the following coordination complexes.



(15 marks)

b. Draw all possible isomers for $[\text{CoCl}_2(\text{en})(\text{NH}_3)_2]$ and name the isomerism type.

(20 marks)

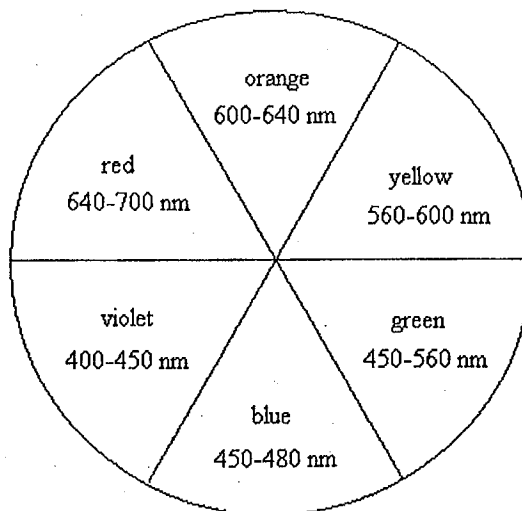
c. Using molecular orbital diagrams briefly explain the following observations.

i. Colour of a solution of $[\text{Cr}(\text{CN})_6]^{4-}$ ion appears in orange whereas a solution of $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$ appears in violet.

ii. $[\text{MnF}_6]^{4-}$ is found to have 5 unpaired electrons whereas $[\text{Co}(\text{NH}_3)_6]^{3+}$ found to be diamagnetic.

(20 marks)

- d. The colours observed for the four complexes of metal ion M^{3+} , $[M(en)_3]^{3+}$, $[M(ox)_3]^{3-}$, $[MF_6]^{3-}$, and $[MI_6]^{3-}$, are blue, green, violet, and yellow. Match the colour to the complex



(20 marks)

- e. A compound has a traditional formula $PtCl_2 \cdot 4NH_3$. When 1.0 mol of the compound is dissolved in water and $AgNO_3$ is added to the solution, 2.0 moles of $AgCl$ precipitate forms immediately.

- Write the structural formula of the complex.
- Write the IUPAC name of the compound.
- What is the coordination number of Pt?

(25 marks)

02. a. Write small accounts on any three of the following, giving examples.

- α - decay
- β - decay
- Nuclear fission reaction
- Applications of radioactive chemicals.

(30 marks)

- b. Draw a diagram to illustrate how binding energy per nucleon varies with the mass number.

(20 marks)

- c. Identify the missing nuclide form in the following reactions.

- ${}_{92}^{235}U + {}_0^1n \rightarrow {}_{42}^{103}Mo + ? + 2{}_0^1n$
- ${}_{13}^{27}Al + {}_2^4He \rightarrow ? + {}_0^1n$
- ${}_{92}^{235}U + {}_0^1n \rightarrow {}_{55}^{141}Cs + ? + 2{}_0^1n$
- ${}_{92}^{235}U + {}_0^1n \rightarrow {}_{39}^{95}Y + ? + 3{}_0^1n$

(20 marks)

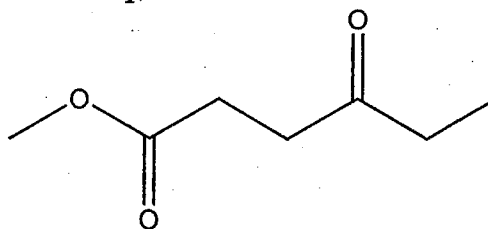
- d. The β - activity of 1 g of carbon from the wood of a recently fell tree is 0.26 Bq. If the activity of 1 g of carbon isolated from the wood of an Egyptian mummy case is 1.6 Bq under the same conditions, estimate the age of the mummy case. Half life of ^{14}C is 5730 years.

Becquerel (Bq) is a unit of radioactivity, defined as the quantity of a radionuclide that undergoes one decay per second (s^{-1}).

(30 marks)

Part - B

3. a. Sketch the ^1H -NMR of the *Compound A* showing the distance from TMS, relative areas (integration) and multiplicity of the signals.
b. Draw the ^{13}C -NMR for the *Compound A*



Compound A

(100 marks)

4. a. Deduce the Structure of *Compound B* ($\text{C}_5\text{H}_{11}\text{Br}$) having the following spectral data. ^1H -NMR 3.51 (t,2H), 1.75 (dt,2H), 1.62 (m,1H), 0.91 (d,6H); MS m/z 43, 71, 135, 137, 150 and 152.
b. Account for the MS peaks at m/z 135 and 137.

(100 marks)

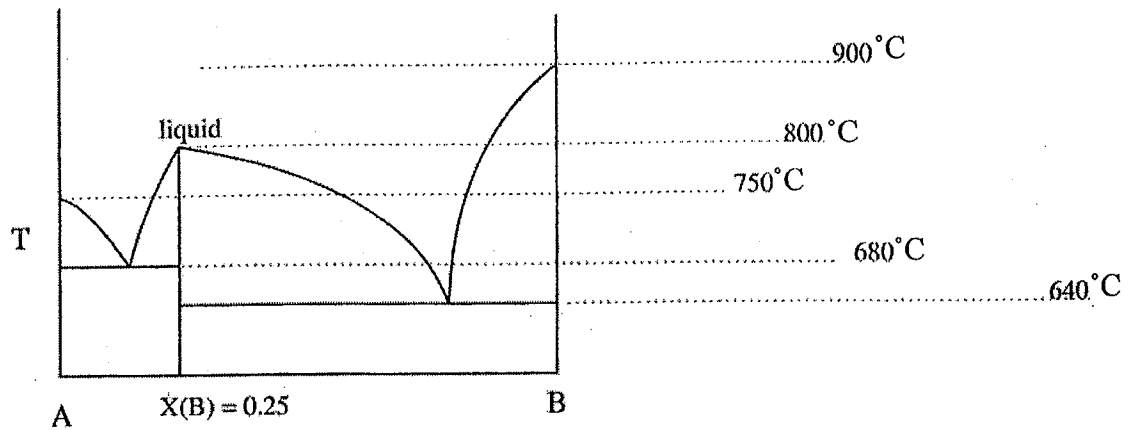
Part - C

05. a. A hypothetical compound *P* has following properties.
- Its boiling point is 300°C .
 - Its melting point is 100°C .
 - Solid *P* is denser than liquid *P*.
 - The triple point of *P* is 90°C .

- i. Sketch the phase diagram of *P*.
ii. Label the regions of the phase diagram.

(25 marks)

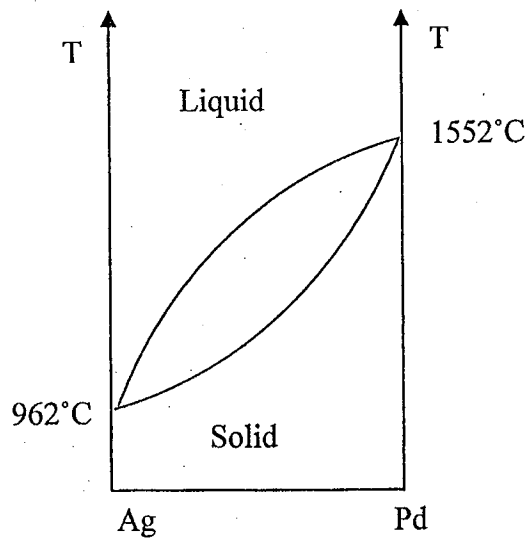
b. Use the following phase diagram to answer following questions.



- Label all the phases present in each regions.
- What is the melting point of A?
- What is the melting point of B?
- Write the formula of any compound formed.
- Are any eutectics formed by these compounds? If so, estimate the composition and eutectic temperature.

(20 marks)

c. A schematic representation of Ag-Pd alloy Phase diagram is as follows;



- Name each coexistence line and write the equilibrium it represents.
- With reference to the phase diagram explain how you purify 50:50 Ag - Pd alloy.

(55 marks)

Periodic Table

1 H																	2 He	
3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne	
11 Na	12 Mg											13 Al	14 Si	15 P	16 S	17 Cl	18 Ar	
19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr	
37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe	
55 Cs	56 Ba	57-70 *	71 Lu	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
87 Fr	88 Ra	89-102 **	103 Lr	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Uun	111 Uuu	112 Uub	114 Uuq					

* Lanthanide series

57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb
89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No

** Actinide series

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