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Assiut University
Faculty of Science
Chemistry Department

Date: 11/6/ 2015
Time allowed: Three hours.

Final Examination (Academic year 2014-2015)
Subject: Course C-324 (Inorganic Chemistry III)

(Section I) 34 marks

Answer the following questions:

1- a) Give reasons for **(four only)**:

i) $[Ni(CO)_4]$ is known but $[Ni(NH_3)_4]$ has never been prepared.

ii) $[Cr(NH_3)_6]^{3+}$ is prefect octahedron while $[Cr(NH_3)_6]^{2+}$

iii) $[Fe(CN_6)]^{4-}$ and $[Fe(H_2O)_6]^{2+}$ are different colours in dilute solutions.

iv) $[Ni(CN)_6]^{4-}$ has square planar structure and paramagnetic but $[NiCl_4]^{2-}$ ion has tetrahedral geometry.

v) The magnetic moment of a tetrahedral Co(II) complex is 4.0 B.M.

b) Draw the MO energy diagram for each of $[Co(NH_3)_6]^{2+}$ and $[Co(NH_3)_6]^{3+}$, the Δ_o values for these two complexes are approximately 120 kJ/mol and 270 kJ/mol respectively. The pairing energy of Co^{+2} is approximately 270 kJ/mol and of Co^{+3} is approximately 210 kJ/mol.

c) Compare the following complexes with respect to these shape, magnetic behavior and hybrid orbitals involved $[Co(H_2O)_6]^{3+}$, $[Cr(CN)_6]^{3-}$, $[Zn(NH_3)_4]^{2+}$

2- a) chose the correct answer and comment **(five only)**:

i) A magnetic moment of 1.73 BM will be shown by one among the following $[Cu(NH_3)_4]^{2+}$, $[Ni(CN)_4]^{2-}$, $[Cr(H_2O)_6]^{3+}$.

ii) In which of the following the magnetic behavior changes from paramagnetic to diamagnetic ($O_2 \longrightarrow O_2^+$, $C_2 \longrightarrow C_2^+$, $NO \longrightarrow NO^+$)

iii) A complex compound in which the oxidation number of a metal is zero is ($TiCl_4$, $[Ni(CO)_4]$, $[Pt(NH_3)]Cl_2$.

iv) Para magnetic complex $[NiX_4]^{-2}$. The number of unpaired electrons in the nickel and geometry of this complex ion are respectively (one – tetrahedral, two-tetrahedral, one-square planar).

v) Which is high-spin and how many the number of electrons in low and high level in each case $[Mn(H_2O)_6]^{+3}$ $\Delta_o \approx 250$kJ/mol or $[Mn(CN)_6]^{3-}$, $\Delta_o \approx 460$ kJ/mol]

vi) Which metal complex ion is expected to be subject to Jahn- Teller distortion ? [$Cr(H_2O)_6]^{2+}$, $[Cr(NH_3)_6]^{3+}$, $[Cr(CN)_6]^{4-}$.

b) Predict the number of unpaired electrons and magnetic moment for each the following (**Three only**).

a) Tetrahedral d^6 ion

b) $[Co(H_2O)_6]^{2+}$

c) A square – planar d^7

d) Tetrahedral $[Ni(CO)_4]$

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3- Answer **Two** of the following: (٢٠)

a) Draw the molecular orbital energy diagram for an octahedral complex between a metal ion and six ligands that do not possess π-orbitals and then comment.

b) Write on all types of ligand to ligand charge transfer (LLCT) in metal complexes.

c) "The d-orbital splitting affect the ionic radii of metal ions". Draw a graph showing the relation between ionic radii and divalent metal ions and then comment.

(Section II) 16 Marks

Give reason(s) for **eight only** of the following: (16 Marks)

1) It is not easy to separate the Ln^{3+} ions chemically.

2) The standard reduction potential of Ln^{3+} are highly negative.

3) The magnetic moment of Ln^{3+} ions is higher than the corresponding transition metal ions having the same number of unpaired electrons.

4) The colours of Ln^{3+} ions are faint.

5) It is easy to separate Ce^{3+} from monazite ore.

6) Ln^{3+} ions give sharp absorption spectral bands while transition metal ions give broad absorption spectral bands.

7) Heavier lanthanide (III) ions form more stable complexes than the lighter ones.

8) Upon oxidation of the lanthanide metals only cerium gives CeO_2 while other Lanthanides give Ln_2O_3.

9) Ion exchange method is the most efficient for Ln^{3+} ions separation.

10) For only few lanthanides oxidation states (+II) and (+IV) are stable.

Good Luck ,,,

Ti = 22 , Cr = 24 , Mn = 25 , Fe = 26 , Co =27 , Ni = 28 , Cu = 29 Zn = 30

Examiners : Prof. Dr. Aref A. M. Aly , Prof. Dr. Amna S. A. Zidan
Dr. Zaher Abdel Mohsen

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بسم الله الرحمن الرحيم

Assiut University **Time : 3 hours**
Faculty of Science **Date: 8 June, 2015**
Chemistry Department

Final Examination of Natural Products and Biochemistry 312C

Answer the following questions:

Section A: Natural Products Chemistry (33 Marks)

1.Write on *FOUR* of the following: **(11 Marks)**

a) Papaverine $\xrightarrow[\text{Conc.; hot}]{KMnO_4}$ (A) + (B) + (C) + (D)

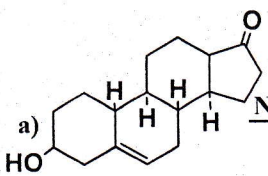
b) Cholesterol has C=C group between C-5 and C-6, prove this by equation?.

c) Discuss by equation, Normant synthesis of linalool?.

d) Conversion of DEA into Testosterone?.

f) Verateric acid is 3,4-dimethoxybenzoic acid, prove this by equation?.

2. Discuss *FOUR* of the following: **(12 Marks)**

a)  $\xrightarrow{Na/Hg}$ (A) $\xrightarrow[\text{Benzoyln.}]{\text{Control}}$ (B) $\xrightarrow[\text{ii) oxidn.}]{\text{i) } H_2}$ (C) $\xrightarrow{Br_2}$ (D) $\xrightarrow[\text{ii) hydrolysis}]{\text{i) KOH alc.}}$ (E) $\xrightarrow[(-CH_2)]{\text{Pyrolysis}}$ (F)

b) Coniine is 3-substituted pyridine, prove this by equation?.

c) Camphor has position of fused with other ring in 1,4, prove this by equation?.

d) Conversion of geranyl acetone into farnesol?.

e) Starting with 1,3-dibromopropane, synthesis of hygrinic acid.

3. Explain the following points: **(10 Marks)**

a) Ozonolysis of farnesol gives the following compounds:
   i) Formaldehyde, laevulic acid, acetone.
   ii) 2 Laevulic acid, acetone and gluconic acid.
   iii) 2 Laevulaldehyde, formaldehyde, acetone and gulcoaldehyde.
   iv) All the pervious.

b) Cholesterol has keto group flanked by two methylene group, prove this by equation?.

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c) IUPAC name for camphor, linalool and α-terpineol?.
d) Conversion of oestrone into oestriol.
e) Starting with protochatechuci aldehyde, synthesis of adrenaline.

Section B (Carbohydrates, Amino acids, Proteins and Lipids)

Answer the following questions: (17 Marks)

1) How can you synthesize *only three* of the following compounds from D- glucose? (6 Marks)

i) D-Fructose ii) D-Arabinose iii) L-Ascorbic iv) D-Mannose.

2) conversions *only three* of the following: (6 Marks)

i) D-Aribinose into D-Glucose
ii) Malonic ester into Methionine
iii) 4-Hydroxybenzaldehyde into Tyrosine
iv) Pyridine into Lysine.

3) Write briefly on *only three* of the following: (5 Marks)

i) Conjugated proteins
ii) The chemical structure of phospholipids, lecithins, cephalin and cerebrosides
iii) Difference between neutral lipids and waxes.
iv) Structural formula of cellulose, lactose and 1-palmito-2-oleo-3-stearin.

GOOD LUCK

Best wishes

أ.د. عبدالعال جابر
أ.د. ياسر أبوبكر

Assiut University
Faculty of Science
Chemistry Department

Final exam

Chem 334 (Corrosion chemistry) **second semester 2014-15** **Time: 3 hours**

Answer ***Five only*** from the following:

Q1 : State (✓) or (×) and give the right answer if any for the following *(10 marks)*

1- The galvanic couple between two different metals are beneficial in corrosion protection.

2- SCC is the pitting corrosion.

3- MIC is corrosion caused by scales.

4- Inhibitors decrease the corrosion by decreasing the cathodic or anodic polarization.

5- The exchange current is the passive current.

6- Regions of the same metal and electrolyte with different temperatures may have a different potential.

7- Activation polarization is caused by electrolyte resistance.

8- In the electrochemical series the more electropositive metals deposit first.

9- According to Faraday's law, the rate of corrosion per unit time is proportional to applied potential.

10- The corrosion rate can be calculated from the Pourbaix (E/pH) diagram.

Q 2: a) "mpy" is a corrosion rate unit, what is this unit meaning? The corrosion current for a pure iron in an acid solution is $5x10^{-4}$ mA cm^{-2}, calculate the corrosion rate in mpy (for iron; density = 7.85 g cm^{-3} , At .wt = 55.85). (5 marks)

b) If the hydrogen overvoltage (η_{H2}) for iron in (a) is 0.15 V, using Tafel equation calculate the exchange current density for h.e.r., assume $\beta_c = 0.1$. (5 marks)

Q3: Writ in: I) three forms of corrosion. (6 marks) II) Types of stainless steel. *(4 marks)*

Q4: Explain the protection against corrosion by change of metal potential. *(10 marks)*

Q5 a) If the standard free energy of Pb^{4+} is 197.0 kcal/mol, calculate E° for Pb/Pb^{4+} electrode. *(4marks)*
b) For oxygen electrode reaction: $O_2 + 2H_2O + 4\,e = 4\,OH^-$, calculate the concentration cell potential consists of two oxygen electrodes in aqueous solution at two different oxygen pressures 1 and 0.1 atm. E°_{O2/OH^-} = 0.401 V (F = 96485 C/mol, R = 8.314 JK^{-1} mol^{-1}, T 298 K) *(6marks)*

Q6: you are provided with the following anodic polarization diagram for a metal in a given corrosive medium:

i) Explain the points and lines represented by characters A, B, C,.... *(6 marks)*
ii) Define the potentials and currents appeared in the diagram. *(4 marks)*

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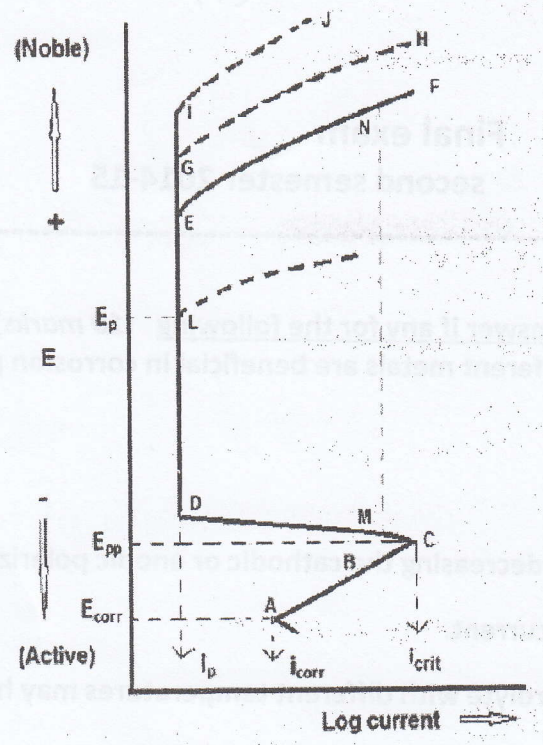

مع اطيب التمنيات بالتوفيق..

الاستاذ الدكتور/ أبوالحجاج عبدالعزيز هرماس

الدكتور/ مصطفى حسن وهدان

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Assiut University
Faculty of Science
Chemistry Department

Quantum Chemistry
Third Year (332 ch)

May 2015
Time 3 hr
Marks 50

Answer the following Three Questions

Question (I) Answer **Seven** From The Following: (17 marks)

1-Calculate force constant of HBr absorbing at 2560 cm^{-1} in infrared spectra.
2-Calculate the velocity of an electron around H nucleus at n=1.
3- The work function of an electron with v = 7.42 x 10^5 m s^{-1} is 7.43x10-^{19}J Calculate the λ required to release this electron from metal surface.
4-Calculate The bond length of HBr molecule absorbing radar wavelength 5.98x10^{-1}mm to be promoted from J=0 to J=1. (Br = 80, H=1)
5-Calculate the translational ground state energy of N_2 confined in a cube of side length 0.5 m at 27 ^{0}C then calculate its De-Broglie λ.
6-Calculate the wavelength emitted from H electron transition from n=5 to n=2.
7- Derive the Rotational Eigenfunction of a rigid rotator of diatomic molecule.
8- Derive the Spherical functions of 2P orbit and the radial function of 2S orbit.

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Question (II) **Answer the following Questions** (17 marks)

1- Derive the relative mean velocity of two different molecules.
2- Derive the kinetic energy of one molecule of gas from the following equation:

$$K.E = \int_0^{\infty} \frac{1}{2} mc^2 f_c \, dc$$

Where f_c is the molecular velocity distribution probability in the space. Using the following standard integration:

$$\int_0^{\infty} X^4 Exp(-ax^2).dx = \frac{3}{8}\sqrt{\frac{\pi}{a^5}}$$

3- Calculate the number of collisions per square centimeter per second of N_2 molecules with a wall under pressure of 1 bar and 28°C , and calculate its thermal conductivity if the heat capacity $C_v = \frac{3}{2}R$. (σ = 0.341 nm)
4- Calculate the mean free path of oxygen molecules and collision density under the STP condition as well calculate its viscosity and its fluidity. (σ = 0.361 nm)
5- Derive the collision densities of heterogeneous and homogeneous molecules starting from the mean free path of different molecules.

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h = 6.626 x 10^{-34}Js c = 3 x 10^8 m s^{-1} R_∞ = 109737.31 cm^{-1},
O= 16, N= 6.023 x 10^{23} mol^{-1}, R= 8.31 J mol^{-1}, a_0 = 0.53 A°

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Prof Dr Anwar El-Shahawy

⇒ Turn Over

Question (III):

Answer Four Only of the Following: **(4X4 =16 Marks)**

1-Briefly describe the following:

a) Fluorescence **b)** Internal conversion

2- Describe the Hollow Cathode Lamp (HCL) and explain how radiation is produced.

3- What are the advantages and disadvantages of the Graphite Furnace Technique.

4- A calibration curve was prepared for the determination of chromium by (FAAS).The following data were obtained for the calibration:

Con.(ppm)	1.0	2.0	4.0	6.0	8.0	10.0	12.0	13.0
Absorbance	0.04	0.080.17		0.25	0.34	0.41	0.49	0.51

Replicate1.0 gm amounts of thesample were weighed out and taken into solution and accurately made up to 100 cm^3. FAAS measurements were then made on these solutions without further dilution. Absorbances of 0.291 and 0.607 were obtained. Calculate the concentration of chromium in the original sample.

5-A $7.5x10^{-5}M$ solution of $KMnO_4$ has a transmittance of 36.4% when measured in a 1.05cm cell at a wavelength of 525nm. Calculate: **(a)** the absorbance of this solution .

(b)the molar absorptivity of $KMnO_4$.

6- (a)-Deduce the Lambert-Beer`s law and clearly define each term used.

(b)- What is the molecular weight of a compound has a molar absorptivity 850, and C= 0.052 g/40ml,T= 17% in a cell with a 1.0 cm path length?

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Good Luck

Prof. Dr. Elham Y. Hashem

Assiut University (١) **Date: 11/6/ 2015**
Faculty of Science **Time allowed: Three hours.**
Chemistry Department

Final Examination for 3rd Level Students
Inorganic Chemistry (3) (C-324) (Group1)

Answer the following questions:

A) Answer question no. (1) and **only three** from 2—5: (17 Marks)

1) On the basis of VBT and CFT predict the number of unpaired electrons and magnetic behavior of the following: $[Mn(CN)_6]^{3-}$ $[CoCl_4]^{2-}$

2) Write on the hypothesis and limitations of CFT.

3) "Cu^{2+} ion forms square planar complexes rather than tetrahedral or octahedral complexes in both strong and weak fields." [Explain]

4) Show how the symmetrical and asymmetrical electronic arrangements affect the stereochemistry of transition metal complexes.

5) Based on the ligand field theory, draw the diagrams for sigma and Pi bonding of the following $[Ni(CO)_6]^{\circ}$ $[NiBr_6]^{4-}$

B) Answer question no. (1) and **only three** from 2—5: (17 Marks)

1) Draw Orgel diagrams for the different d^n electronic configurations in O_h weak field complexes.

2) Correlate between the spectroscopic terms for d^1 and d^3 configurations in a weak octahedral field with the assignment of their resultant spectra.

3) Bis (dimethylglyoximato) nickel (II) is experimentally known to be diamagnetic. Show on the basis of VBT the geometrical structure of the complex.

4) Observed lattice energies (in KJ/mol) of O_h crystals of VO and FeO are – 3917 and - 3923 respectively, while the values in absence of CFSE are -3691 and -3856 KJ/ mol respectively. Calculate CFSE values of V^{2+} and Fe^{2+} ions in O^{2-} weak field.

5) Derive the relationship between stepwise formation constants and comulative formation constants of the complexes in solution.

(Atomic numbers) Mn = 25 , Co = 27 , Cu = 29 , Ni = 28 , V = 23 , Fe = 26

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C) Give reason(s) for **eight only** of the following: (16 Marks)

1) It is not easy to separate the Ln^{3+} ions chemically.
2) The standard reduction potential of Ln^{3+} are highly negative.
3) The magnetic moment of Ln^{3+} ions is higher than the corresponding transition metal ions having the same number of unpaired electrons.
4) The colours of Ln^{3+} ions are faint.
5) It is easy to separate Ce^{3+} from monazite ore.
6) Ln^{3+} ions give sharp absorption spectral bands while transition metal ions give broad absorption spectral bands.
7) Heavier lanthanide (III) ions form more stable complexes than the lighter ones.
8) Upon oxidation of the lanthanide metals only cerium gives CeO_2 while other Lanthanides give Ln_2O_3.
9) Ion exchange method is the most efficient for Ln^{3+} ions separation.
10) For only few lanthanides oxidation states (+II) and (+IV) are stable.

Good Luck ,,,

Examiners: Prof. Dr. Asmaa Ibrahiem Dr. Zaher Abdel Mohsen

Assiut University
Faculty of Science
Chemistry Department

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Date: June 2015
Time allowed: Two hours.

Analytical Chemistry (I) Final Examination (342-C)
For 3rd level Students

Section (I) (25 Marks)

I) Answer the following questions: (7 Marks)

1) What is Beer's law, define each term used? (2 Marks)

2) Fe (III) can be determined spectrophotometrically through it's complex with KCNS, ($FeSCN^{2+}$ complex, has a molar absorptivity of $7x10^3$ L $mol^{-1}cm^{-1}$ at 580 nm) A 2.5 ml aliquot of a solution containing 3.8 ppm iron (III) is treated with an appropriate excess of KCNS and diluted to 50 ml. What is the absorbance of the resulting solution at 580 nm in a 2.5 cm cell? (At. wt of Fe = 55.847) (5 Marks)

II) Answer three only : (18 Marks)

1) Describe the absorption phenomena taking place in the far-infrared, mid-infrared and visible – ultraviolet regions of the spectrum. (6 Marks)

2) Write briefly on: (6 Marks)
i) Isosbestic point. ii) Continuous variation method.

3) Give the theoretical bases of spectrophotometric quantification of binary mixtures. (6 Marks)

4) At a wavelength of 356 nm, the molar absorptivity of a phenolic compound in 0.1 M HCl is 400 and in 0.2M NaOH is 17000. Determined in pH 9.5 buffer the molar absorptivity is 9800. Calculate the pKa. (6 Marks)

Section II (25 Marks)

Answer ***Five only*** of the Following:

1) Define Adsorptive Stripping Voltammetry and how it differs from anodic and cathodic stripping methods.

2) Define:
Half-wave potential- Diffusion current- plateau- residual current.

3) What is the fundamental principal of amperometric titrations?

4) The polarographic Ilkovic equation is: .....
Where we can calculate the ..... Through the capillary, or the ..... , and the bulk analyte ..... .

5) The concentration of Pb(II) in water is determined by differential pulse voltammetry. The reduction of Pb(II) to Pb(0) gives rise to the following data:

[Pb(II)], 10^{-6} M	0.50	1.50	3.00	4.50
I_p, μA	0.15	0.51	0.99	1.40

What is the concentration of Pb(II) in a blood polluted sample if the peak current obtained under the same experimental conditions is 0.85 μA.

6) Explain when we use two electrodes in polarography and when we must use three electrodes. What is the third electrode to be used in this case?

Good Luck,,,

***Examiners*: Prof. Hassan Sedaira & Prof Nagwa Abo El-Maali**