Assiut University
Faculty of Science

Date: May 2017
Time Allowed: 3 hours

Chemistry Department

Final Exam of advanced synthetic Organic Chemistry - chemistry students (**314 C**)

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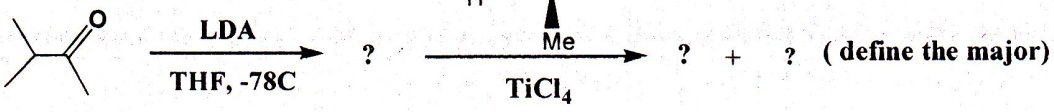
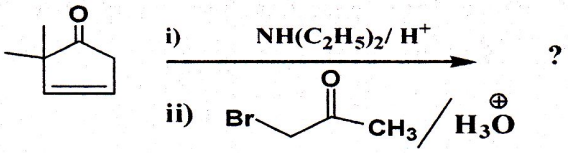
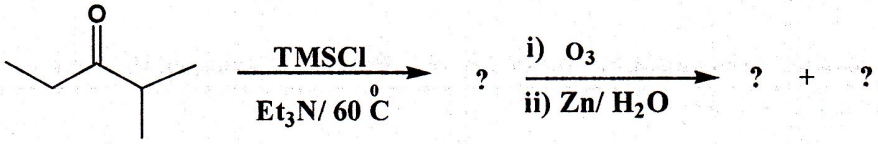
Answer the following questions:

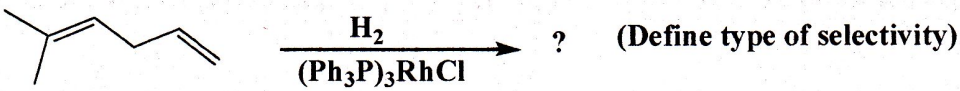
Q1) Complete the following equations **(10Marks)**

a) 

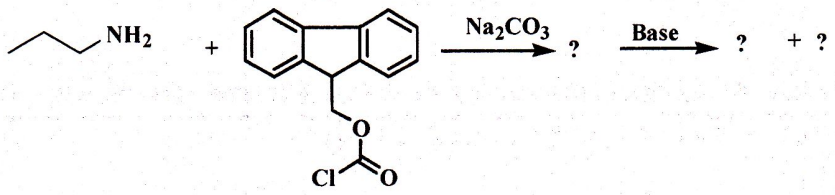
(define the major)

b) 

c). 

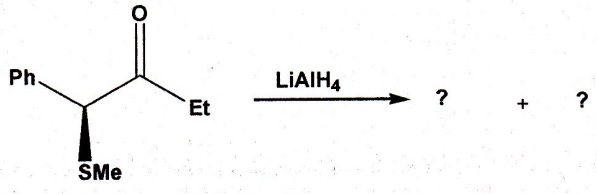
d) 

(Define type of selectivity)

e) 

Q2) Write by equations on the following: (**Only Four**) **(10 Marks)**

a- Define the regioselectivity in organic synthesis and give an example.
b- Swern method for oxidation of n-propanol
c- Reduction mechanism of 2-butyne using Na/ NH_3
d- Two methods for the protection of alcohol
e- By using Felkin-ahn model:
   i) Complete the following equation, give the **major** and **minor** products
   ii) Explain that de is equal **88%**
   iii) Show the effect of Zn^{++} ions in the reaction products



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Q3) Put the sign (√) in the front of correct statement and (X) in the front of wrong statement . **(10 Marks)**
(Correct the wrong statement)

a) Na/ NH_3 is a reagent to reduce alkyne to Z-alkene.
b) Aldol reation of achiral dicyclohexyl Boron enolate with benzaldehyde give the **Anti** adduct as Major.
c) Adams catalyst is a type of homogenous catalyst.
d) TMS enol ethers are much more electrophilic than boron or lithium enolates.
e) The reaction of aldehydes or ketones with primary amines give enamine
f) Kinetic enolate products were obtained by using strong base and protic solvent
g) In the addition to Ketones, the larger nucleophile give rise to greater distereoselectivity.
h) Fetizon's reagent give high selectivity to oxidation of 1^{ST} rather than 2^{nd} alcohols
i) Sodium benzoate is an inert compound to reduced using catalytic hydrogenation.
j) Methoxy ethyl ketone gives mainly trans lithium enolate

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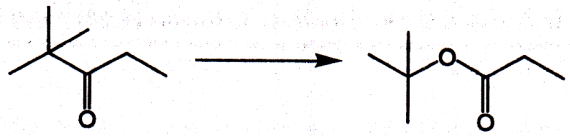
Q4) Write the satiable reagents for the following reactions and draw the mechanism (if any) for **(10 Marks)**

a)



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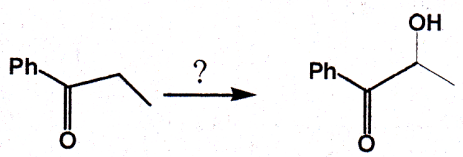

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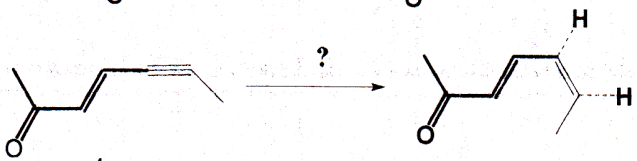

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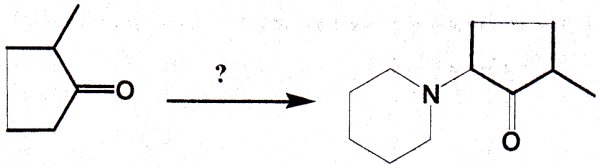
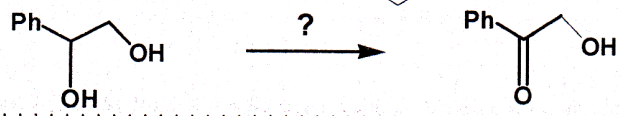


e)



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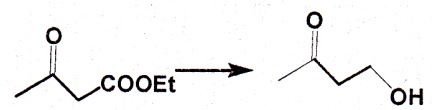
Q5) Write by equations and mechanism how you can carry the following transformations **(10 Marks)**

a)



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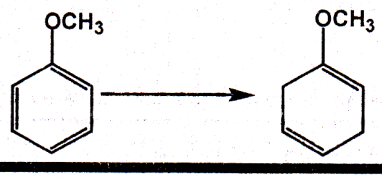

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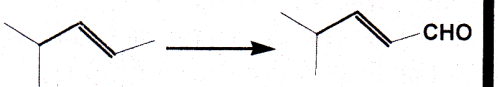

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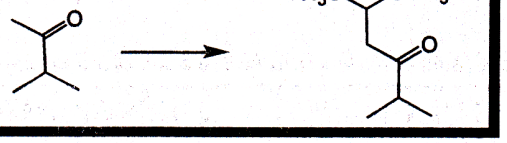

Good Luck

Prof. Dr. Shawkat

Assiut University Faculty of Science Chemistry Department	Second Semester Final Examination Analytical Chemistry (1) (C-342) Third Level (Credit Hours System)	May 2017 Time: 2 hour

Answer The Following Questions: (50 Marks)

First Question: Answer Only Three from the following: ***(12.5 Marks)***

1- Define and characterize the following:

(i) Absorptivity **(ii) Internal conversion** **(iii) Ringbom plot**

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2 - Describe the theory of molecular fluorescence.

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3 - Write on spectrophotometric determination of the stoichiometric ratio of metal chelate by Job's method.

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4 - The molar absorptivity of the complex formed between Bi^{+3} and thiourea is $9.32x10^3$ $Lmol^{-1}cm^{-1}$ at 470 nm. Calculate the range of permissible concentration for the complex if the absorbance is to be no less than 0.15 nor greater than 0.8 when measurements are made in 1.0 cm cell.

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Second Question: Answer Only Three from the following: (12.5 Marks)

1- Define and characterize the following:

(i) Sandell's sensitivity (ii) Stock shift (iii) Molar absorptivity

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2- Why is fluorescence generally more sensitive than the absorption measurements?

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3 – Write on photometric titration of p- nitrophenol and m- nitrophenol with NaOH, sketch the graph.

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4- The absorbance of a two- component mixture was measured at two wavelengths. If the molar absorptivity of component A was 240 at λ1 and 9748 at λ2, and the molar absorptivity of component B was 6450 at λ1 and 390 at λ2. Calculate the concentration of A and B in the mixture. The mixture had an absorptivity at λ1 of 0.452 and at λ2 of 0.863, all measurements were made in a 1.0 cm cell.

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***Third* Question: Answer *Only Two* from the following: (12.5 Marks)**

(1) Write on the following:

(a) Carbon electrodes (Give examples):

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(b) Randles-Sevcik equation

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(c) Ilkovic equation:

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(2) (a) A lead solution of unknown concentration yields a diffusion current of 1.00 µA. Then, to 10.00 mL of the unknown solution is added 0.50 mL of a standard solution of lead whose concentration is 0.04 M. The diffusion current with the spiked solution is 1.50 µA. Calculate the lead concentration of the unknown solution.

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(b) Write on advantages of stripping voltammetry

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(3) Sketch the relation between current and time for differential pulse voltammetry.

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Fourth Question: Answer Only Two from the following: (12.5 Marks)

(1) Mark (√) for the correct statement and (X) for the wrong statement

a) It is desirable to make electrochemical measurements without current flowing through the RE

b) Normal pulse is about 5-10 times more sensitive than differential pulse polarography

c) The half wave potential ($E_{½}$) can be used to identify the analyte concentration.

d) Current of polarizable electrode remains unchanged with changes in the electrode potential

e) Hg forms soluble amalgam with many metals hence lowers their reduction potentials

f) Non-faradaic currents exist in an electro- chemical cell are related to any redox reaction

g) In anodic stripping methods, the WE behaves as a cathode during the deposition step

a	b	c	d	e	f	g

(2) Write on the following:

(a) The principle of electrochemical biosensor (Give an example).

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(b) Role of auxiliary electrode : (with drawing)

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(3) Write on the following:

a) Amperometry.....

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b) Adsorptive stripping voltammetry:

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c) The reversible oxidation of dopamine (DA) is a $2e^-$ process. A cyclic voltammetric anodic peak current of 2.2 µA is observed for 0.4 mM solution of DA in phosphate buffer at a glassy carbon electrode of 2.6 mm^2 with a scan rate of 25 mV/s. What will I_p be for v =100 mV/s and 1.2 mM DA?

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Good Luck

Examiners: Prof. Dr. Elham Y. Hashem & Dr. Hossieny Ibrahim

Assiut University
Faculty of Science
Chemistry Department

Final exam

Chem 334 (Corrosion chemistry) **second semester 2016-17** **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 is used in anodic protection method.

2- SCC is the crevice corrosion.

3- The metals below the hydrogen in the electrochemical series can be liberate the hydrogen when placed in acid and therefore corrode.

4- Intergranular corrosions are caused due to velocity of fluid flow in pipes.

5- The exchange current is the critical current of anodic polarization.

6- The area of metal surface exposed to higher electrolyte velocity is cathodic to the rest of metal surface.

7- Activation polarization is caused by electrolyte resistance.

8- Activation polarization for anodic or cathodic reactions increases with current, in according with Nernst equation.

9- Annealed steel is anode to tempered steel.

10- Dry corrosion is the corrosion at high vacuum.

Q 2: a) Magnesium is often attached to the steel hulls of ships to protect the steel from rusting. Write balanced equations for the corrosion reactions that occur (i) in the absence of Mg and (ii) in the presence of Mg. **(4 marks)**

(b) Calculate the theoretical tendency of nickel to corrode with evolution of hydrogen when immersed in deaerated water of pH 6. Assume that Ni corrode to $Ni(OH)_2$ having a solubility product of 1.6×10^{-16}.

Given $E^{\circ}_{Ni^{2+}/Ni} = -0.25V$ **(6 marks)**

Q3:a) Define the polarization of a metal electrode and indicate its types. **(4 marks)**

b) On anodic polarization, the potential of a platinum electrode at which O_2 evolves in an electrolyte of pH = 11 is 1.35 V vs. SCE. Calculate the value of oxygen overvoltage (explain with Evan diagram). Given potential of oxygen electrode in alkaline solution is

$2\,H_2O + O_2 + 4\,e = 4\,OH^-$, $E^\circ = 0.401$ V vs. SHE

And $E_{sat,calomel} = 0.241$ V vs. SHE , consider $P_{O2} = 1$ atm **(6 marks)**

(باقى الأسئلة بالخلف)

Q4:a) H.E.R is one of important cathodic reaction in corrosion process, discuss the steps of this reaction. (4 marks)

b) The linear polarization slope at low current densities for iron in a corrosive solution is 2 mV/μA cm^{-2}. Calculate the corrosion rate in mdd (given that Tafel constants equal to 0.1 V and m_e of iron = 0.2893 mg/C) (6 marks)

Q5:a) Write about: (i) Intergranular corrosion (ii) Crevice corrosion (4 marks)

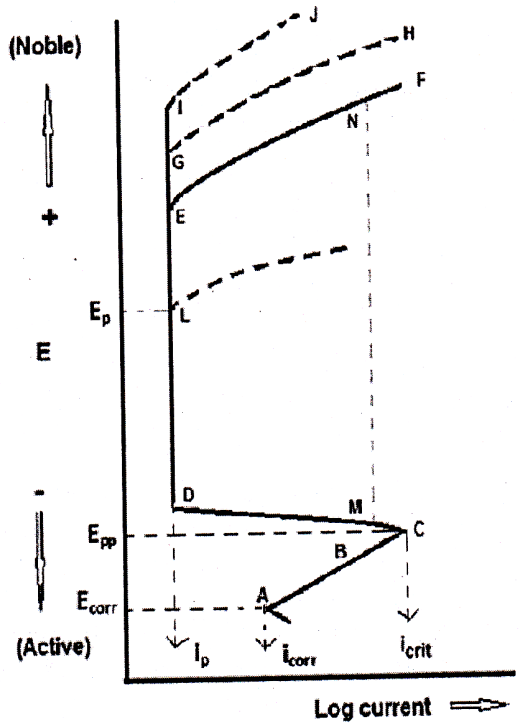
b) Describe three methods of metal protection (6 marks)

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)*

(انظـر بـالخلف)



مع اطيب التمنيات بالتوفيق..

الاستاذ الدكتور/ أبوالحجاج عبدالعزيز هرماس

الدكتور/ مصطفى حسن وهدان

Assiut University

Faculty of Science
Chemistry Department

Final Examination for 2nd (Industrial Program) Industrial Polymer Chemistry (304 C)

Date: Saturday, 27/05/2017 **Time: 2 hours.**

Answer Eight only from the following Questions: **(50 points)**

1) What is a peptide linkage? Illustrate your answer with 2-amino-ethanoic acid ?
2) How does urea-methanal differ from nylon, Kevlar and Dacron, even though all of them are condensation polymers?
3) Explain the term "vulcanization of rubber". What are the differences between natural rubber and vulcanized rubber?
4) Why is the structure of DNA called a double helix? Name its component structure?
5) Why would a hole appear when a dilute alkali is spilt on a fabric made of Kevlar, discuss by mechanism equations ?
6) Compare between Thermosets and Thermoplastics Materials, showing examples of thermoplastics?
7) What are the three main types of degradable plastics? Why are they degradable?
8) Write short note about the Bakelite, its properties, and uses?
9) What are the two types of polyethene? What is the structural difference between them?

Good Luck

Examiner:

Prof. Dr. Kamal I Aly

Chemistry Department
Faculty of Science
Assiut University

May, 2017
Time: 3hr.

Final examination for third level students (324 C) in inorganic Chemistry

Section (A) (33 Marks)

Answer the following questions:-

1. Give reasons for **(five only)** from the following:-
   1. A solution of $[Ni(H_2O)_6]^{2+}$ is green but a solution of $[Ni(CN)_4]^{2-}$ is colorless.
   2. $[Co(NH3)_6]^{3+}$ is perfect octahedral while $[Co(NH_3)_6]^{2+}$ is distorted.
   3. $[Ni(CN)_4]^{2-}$ square planar but $[Ni(CO)_4]$ tetrahedral.
   4. $[Fe(H_2O)_6]^{2+}$ paramagnetic but $[Fe(NH_3)_6]^{2+}$ diamagnetic.
   5. NH_3 acts as complexing agent but NH_4^+ does not .
   6. The hexaflouro Mn(II) ion contains five unpaired electrons, while the hexacyano Mn(II) ion contains only one unpaired electron. Explain usingLFT.

2. Choose the correct answer and comment **(five only)**:-
   1. Which one has the highest magnetic moment value:-
      $[Cr(H_2O)_6]^{3+}$, $[Fe(H_2O)_6]^{2+}$, $[Zn(H_2O)_6]^{2+}$
   2. Which metal complex ion is labile:-
      $[Cr(H_2O)_6]^{2+}$, $[Cr(NH_3)_6]^{2+}$, $[Cr(CN)_6]^{3-}$
   3. Which of the following is π-acceptor (Cl^-, NH_3, CO)
   4. CFSE for d^4 octahedral complex is (-0.6 Δ_o, -1.8 Δ_o, -1.2 Δ_o)
   5. Which of the following option are correct for $[Fe(CN)_6]^{3-}$ complex (d^2sp^3, sp^3d^2, diamagnetic)
   6. Which metal complex ion is inert $[Mn(H_2O)_6]^{3+}$ or $[Mn(CN)_6]^{3-}$.
3. Answer **three only** of the following:-
   1. Draw the MO energy level diagram for each $[Co(NH_3)_6]^{3+}$ and $[CoF_6]^{3-}$ and discuss the magnetic properties of them.
   2. Explain the Jahn-Teller distortion in $[Cu(H_2O)_6]^{2+}$.
   3. How does the valence bond theory account for the following facts:
      (a) $[FeCl_4]^-$ has five unpaired electrons.
      (b) $[Fe(NH_3)_6]^{2+}$ has four unpaired electrons.
   4. The magnetic moments of $[MnBr_4]^{2-}$ and $[Cr(CN)_4]^{2-}$ is 5.9 and 4.87 respectively, what is the geometry of these complexes.

(A.Wt. Cr = 24, Mn = 25, Fe = 26, Co, 27, Ni =28, Cu = 29, Zn = 30)

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Section(B)

1- Write the atomic number of each element in the following groups;
Sc ,Y , La and Ti , Zr , Hf.

- Discuss the change in the atomic radius of the above groups as electronic structures of the atoms and their nuclear charges change. (4 Marks)

2- Write chemical equations for four of the following reactions: (13 Marks)

a- Uranium hydride with Hcl , Cl_2 and F_2.

b- Lanthanide elements with H_2.

c- Lanthanide elements with oxygen.

d- Aqueous solution of the lanthanides with NaOH.

e- Cation exchange resin with lanthanides followed by citrate buffer.

Examinas: Prof.Dr.Amna.S.A.Ziden Dr.Zaher.Khafagy

Assiut University
Faculty of Science
Chemistry Department

May:2017
Time:3 hrs:

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

Answer the following questions:

A) Answer question no.(1) and Only Three from 2-5 (17 Marks)

1- $[Fe(CN_6)]^{3-}$ ion is weakly paramagnetic while $[Fe(H_2O)_6]^{3+}$ ion is strongly paramagnetic.(use MO theory).

2- i- Which complex of the following pairs has the larger value of Δ_0:
$[Co(NH_3)_6]^{3+}$ and $[Rh(NH_3)_6]^{3+}$
$[Co(NH_3)_6]^{3+}$ and$[CoF_6]^{3-}$

ii- $[Ni(CN)_4]^{2-}$ is diamagnetic but $[NiCl_4]^{2-}$ is paramagnetic (use CFT).

3-i- The magnetic moment value of$[Mn(CN)_6]^{3-}$ ion is 2.8 B. M.
Predict the type of hybridization and geometry of the ion.

ii-Which complex ion of the following pairs is more stable and why:
$[Co(H_2O)_6]^{2+}$ and $[Co(H_2O)^{3+}$
$[Co(NH_3)_6]^{2+}$ and $[Co(NH_3)_6]^{3+}$

4- Give the ground spectroscopic term of d^1 , d^6 , d^3 and d^5 electronic configuration and show their splitting in a weak octahedral field.

5- The enthalpy of hydration of Fe^{2+} ion is 11.4 Kcal./mol higher than that which expected in the absence of CFSE. Assuming that $[Fe(H_2O)_6]^{2+}$ ion is HS , estimate the value of Δ_0 for this ion.

B) Answer question no.(1) and Only Three from 2-5: (17Marks)

1- Draw Orgel diagrams for the different d^n electronic configurations in octahedral weak field.

2-i- Find out the number of unpaired electrons in strong and weak octahedral field for Cr^{2+} and Fe^{2+} ions.

ii- Calculate the total pairing energy for$[Pt(H_2O)_6]^{4+}$ ion in HS and LS states. Given the mean pairing energy =23,500 cm^{-1}.

3- Explain the difference between tetragonal elongation and tetragonal compression of complexes in a weak octahedral field.

4- How does the MO theory explain the relative strengths of H_2O and OH^- ligands.

5- Write on the important feature of CFT.

(Atomic numbers) Fe=26 Co=27 Rh=45 Ni=28 Cr=24 Pt=78

أنظر خلفه باقي الأسئلة

c) 1- Write the atomic number of each element in the following groups;

Sc ,Y , La and Ti , Zr , Hf.

Discuss the change in the atomic radius of the above groups as electronic structures of the atoms and their nuclear charges change. (4 Marks)

2- Write chemical equations for four of the following reactions: (12 Marks)

a- Uranium hydride with HCl , Cl_2 and F_2.

b- Lanthanide elements with H_2.

c- Lanthanide elements with oxygen.

d- Aqueous solution of the lanthanides with NaOH.

e- Cation exchange resin with lanthanides followed by citrate buffer.

Examinas: Prof.Dr.Asmaa.Ibrahim Dr.Zaher.Khafagy

Assiut University
Faculty of Science
Chemistry Department

Time: 3 hours
Date: 18 May, 2017

Final Examination of Natural Products and Biochemistry Course for 312 C Students

Answer the following questions:

Section A: Natural Products Chemistry **(33 Marks)**

1. Write on *FOUR* of the following: **(10 Marks)**

a) Starting with ethylacetoacetate, synthesis of β-farnesene.
b) Conversion of oestradiol into oestriol via Leeds method.
c) Prove by equation that oestrone has phenolic hydroxyl group.
d) The reaction of ephedrine with hot conc. HCl is known as hydramine fusion, explain by equation.
e) Prove by equation that ergosterol has methyl group at C_{24} and Δ^{22} unsaturation.

2. Discuss *FOUR* of the following: **(11 Marks)**

a) Conversion of myrcene into citral and prove by equation that citral is an open chain compound.
b) Conversion of cholesterol into 1,2-dimethylphantherene via B.W.D method.
c) Prove by equation that isoquinoline 6,7-dimethoxy-1-carboxylic acid as one of the products via papaverine oxidation with hot conc. KMnO4.
d) Ozonolysis of Vit.1 gave the following compounds:
   i. Glycolic acid, pyruvic acid, and oxalic acid.
   ii. Glycolic acid, pyruvic acid, and β-ionone.
   iii. Glycolic acid, 2 mole pyruvic acid, geronic acid and glycosal.
   iv. All the pervious.
e) Craig reaction for synthesis of nicotine.

3. Explain *FOUR* of the following points: **(12 Marks)**

a) Staring with p-toluic acid, synthesis of α-terpineol.
b) Conversion of cholesterol into DEA and Prove that the latter compound (DEA) is useful intermediate of sex hormones, give one example.

بقية الأسئلة خلف الورق

c) Prove by equation that adrenaline has two phenolic, secondary hydroxyl and one NH groups as well as aliphatic OH attached to α-carbon.
d) Prove by equation that hygrinic acid is N-methylpyrrolidine carboxylic acid and the COOH in the α–position not β.
e) Starting with catechol, synthesis of piperic acid.

Section B: Biochemistry I (17 Marks)

4. Write short notes on *FIVE only* of the following: (10 Marks)

a) The ninhydrin reaction.
b) Two different methods for estimation of amino acids.
c) Distinction between alanyl glycine and glycylalainine.
d) Distinction between 2-deoxyribose and 4-deoxyribose.
e) Distinction between sucrose and maltose.
f) Distinction between ordinary soap and synthetic detergents.

5. Answer *either (a) OR (b)* of the following: (7 Marks)

a) Write the structure of inulin which is a polysaccharide present in Dahlia roots that gives on methylation followed by hydrolysis β-3,4,6-trimethylfructofuranose mainly.

b) Write short notes on different methods for preparation of artificial silk.

GOOD LUCK

Best wishes

أ.د. مرسى محمد على
أ.د. عبدالعال محمد جابر

Chemistry Department
Faculty of Science
Assiut University

May, 2017
Time: 3 hours
50 Marks

Final Exam of Photochemistry (313 C) for the 3rd level students

Section (A): Photochemistry (25 Marks)

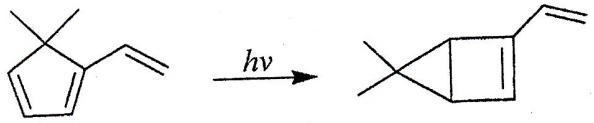
***Answer all of the following questions*:**

1- Give a brief account on THREE only of the following: (9 Marks)

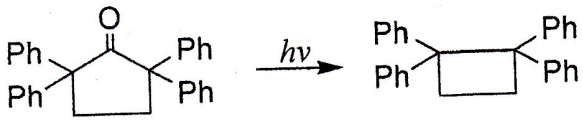
(a). Norrish types I & II reactions
(b). Sigmatropic rearrangements
(c). Primary photochemical processes undergone by excited molecules
(d). Electronic and molecular transitions for UV-visible absorptions

2- Write a complete mechanism for FOUR only of the following: (8 Marks)

(a)



(b)



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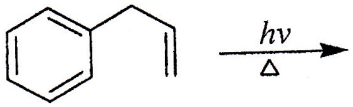
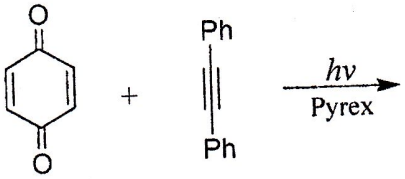


(d)



(e)

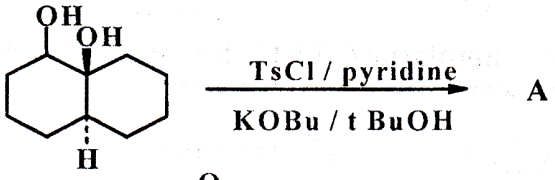
2- Answer TWO only of the following questions: (8 Marks)

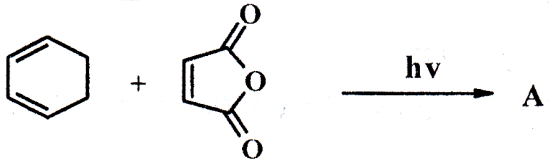
(a). Discuss in detail the selection rules and spin multiplicity? Give a brief description of singlet and triplet states?
(b). Write the reaction modes of singlet oxygen with different alkenes?
(c). Outline the photoreduction mechanism of carbonyl compounds to 1,2-diol in the presence of toluene and *iso*propanol?

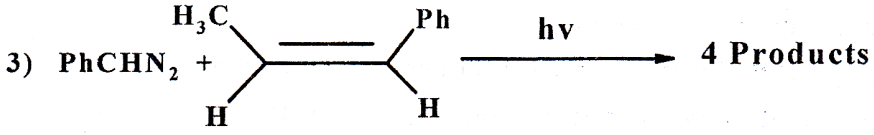
باقى الأسئلة فى الصفحة التالية

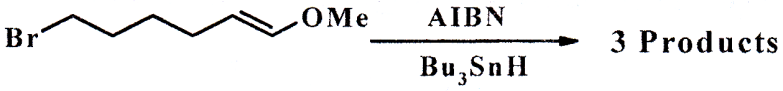
Section B: Reactive Intermediates: (25 Marks)

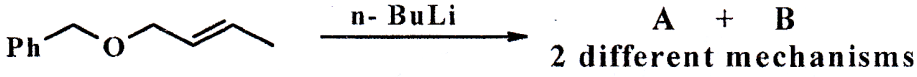
I) Suggest the suitable reaction mechanism and the products for <u>ONLY SIX</u> of the following. Write the name of the mechanism illustrating each step using arrows: (15 Marks)

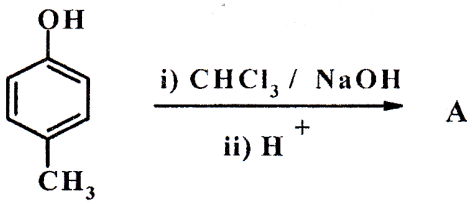
1) 

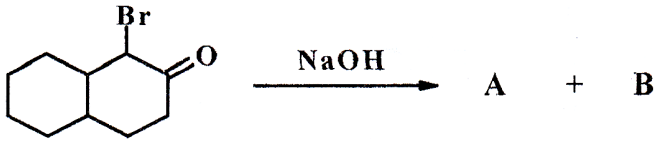
2) 

3) 

4) 

5) 

6) 

7) 

II) Write on <u>ONLY TWO</u> of the following: (10 Marks)

a) The factors affecting the stability and life time of free radicals. Give an example.

b) Oxidation of phenols afforded various dimers except the peroxide product. Explain this statement by using equations.

c) Compare between singlet and triplet carbenes according to:
i) Multiplicity ii) hybridization iii) reactions iv)stereochemistry. Illustrate your answer by giving one example.

Assiut University
Faculty of Science
Chemistry Department

Physical Chemistry
Third level 332 ch
Jun 2017

Time: 3hrs
Marks: 50

Answer The Following questions

Question (I): 17 Marks

(a)- Answer **Three** from the following:

If 2 moles of N_2 occupy 11.2 liters under STP and the collision diameter is 0.34 nm calculate:

i-The mean free path under the previous condition.

ii- Collision density. iii-The viscosity of the gas. iv- Calculate the most probable velocity and mean velocity in one dimension.

(b)-Calculate the probability density for u_{xy} of N_2 (N=14) molecules at 25C° at 400 ms^{-1}.

(c)-Calculate the mean free path, ℓ, and the collision density, z_{12} of molecules in air at 27°C under pressure 1 atm, considering the presence of N_2 and O_2 in air as (80% N2 and 20% O_2). The viscosity coefficients of O_2 and N_2 are 175 and 209 μ poise, respectively. (5 marks)

(d)- i-Air(80% N2 and 20% O_2) has pressure at the sea level 1 atm, calculate the pressure at the top of the mountain, h = 1600m at 25 °C.

ii- Derive Maxell-Boltzmann distribution law.

(e)- Derive the frequency factor for the reaction between H_2 and I_2 to produce HI using simple collision theory.

Question (II): Answer **Four** from the following: **17 Marks**

(a)-Calculate the force constant of $N^{14}O^{16}$ absorbing at 1876 cm^{-1} in the infrared spectrum. The bond length of this molecule being equal to 1.154 A°, calculate its moment of inertia and calculate the radar wavelength required to promote this molecule from the state J=0 to J=1 at 27 °C..

(b) Calculate the work function of an electron with v = 7.42 x 10^5 m s^{-1} using a photon of λ = 200 nm. (m_e = 9.11x10^{-31} kg)

© Calculate the effective nuclear charge of the 1s and 4s electrons in K (Z=19) if the ionization potentials of them are 4.58x10^5 and 3.96x10^2 kJ mol^{-1} respectively. Explain the reason of the results.

(d) 1-Calculate the number of emitted photons in 1 second from 400 W red lamp, (λ = 500 nm). 2-Define the oxidation according to MO theory. 3- Derive the spherical Eigenfunction of 4S orbital.

(e) What is the translational ground state energy for an electron that is confined to a potential well with a width of 0.2 nm? (m_e = 9.11 x 10^{-31} kg).

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h = 6.626x10^{-34}Js, k= 1.38x$10^{-23}$$JK^{-1}$, c=3x$10^8$ ms^{-1}, N=6.023 x 10^{23} mol^{-1}

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Prof Dr Anwar El-Shahawy

Turn Over ⇒

Question 3

Answer **Six Only** of the following questions: **(17 marks)**

1- Which of the following molecules can show pure rotational spectra and which can show pure vibrational spectra **HCl, H_2O, CO_2, Cl_2, CH_4, CCl_4, C_6H_6, BF_3**

2- Calculate the degrees of freedom for formate ion and draw its vibrational modes.

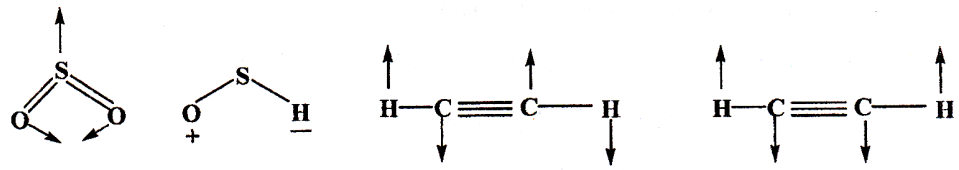
3- Draw the change in dipole moment during vibrations and the polarizability changes for the linear CO_2 molecule, and show when the CO_2 molecule will be infrared active and when Raman active.

4- The ESR spectrum of methyl radical occurs at 330 mT in a spectrometer operating at 9250 MHz. Calculate the g value of the radical, (Bohr magneton $\beta = 9.273 \times 10^{-24}$ JT^{-1}).

5- Show how the electron charge cloud is distorted when light is absorbed or emitted by an atom or molecule.

6- Show the relationship between the standard free energy (ΔG^o) and the equilibrium constant (K) for this reaction **$aA + bB \rightleftharpoons cC + dD$**

7- Are the following bending vibrations active or inactive in IR.



(a) (b) (c) (d)

With Our Best Wishes

Examiner:

Dr. Mostafa Farrag

Assiut University
Faculty of Science
Dept. of Mathematics

Date : May , 2017
Time allowad 3 hours

Second Semester Final Examination

Subject : Course No. 312 M **Name of Course : Real Analysis 1**
Students : Third Year Math.

Answer five question from the following:

First Question (10 Degree)

(a)(2 points). If r is rational and x is irrational ,then prove that r+x and r.x are irrational.

(b)(4 points) .Find Sup S ,inf S ,max S and min S when:

$$(i)\ S=\{x : x^2+x+1 \geq 0\} \qquad (ii)\ S=\{r \in Q, r^2<5\}$$

$$(iii)\ S=\left\{1+\frac{(-1)^n}{10^n}, n \in N\right\} \qquad (iv)\ S=\left\{\frac{n+2}{n}, n \in N\right\}$$

(c) (4 points). Let A and B be nonempty subsets of R which are bounded above .Prove that

(i) $\sup(A \cup B)=\max\{\sup A, \sup B\}$

(ii) Is $\sup(A \cap B)=\min(\sup A, \sup B)$, $A \cap B \neq \phi$.

Second Question (10)Degree)

(a) (3 points) .Find the limit points of the following sets:

$$(i)A=\left\{1+\frac{(-1)^n}{n} : n \in N\right\} \quad (ii)B=\left\{\frac{1}{n}+(-1)^n : n \in N\right\} \quad (iii)C=\left\{\sqrt{a}+\frac{1}{n} : n \in N\right\}$$

(b) (4 points) .Show that the supremum (infimum) of any nonempty set S is either a member of S or a limit point of S.

(c) (3 points).Use the definition of a limit of a sequence to establish the following limit

$$\lim_{n\to\infty}\left(\frac{n^2-1}{2n^2+3}\right)=\frac{1}{2}.$$

Third Question (10) Degree)

(a) (4 points) . Show that the sequence (a_n) defined by $a_1=8$ *and* $a_{n+1}=\frac{1}{2}a_n+2$ *for* $n \in N$.

Show that (a_n) **is bounded and monotone.Find** $\lim_{n\to\infty}(a_n)$.

(b) (3 points). Show that every Cauchy sequence is bounded.

(c) (3 points) . Let $(a_n),(b_n),(c_n)$ **be sequences such that:**

$a_n \leq b_n \leq c_n$ *for all* $n \geq 1$ *and* $\lim_{n\to\infty} a_n = L = \lim_{n\to\infty} c_n$. Prove that $\lim_{n\to\infty} b_n = L$.

Fourth Question (10) Degree)

(a)(3 points). Find the $\overline{\lim}\ a_n$ *and* $\underline{\lim}\ a_n$ **for a sequence (a_n) ,where**

$$(i)\ a_n=\sin\frac{n\pi}{3}, (n=1,2,3,4,\ldots) \qquad (ii)\ a_n=\left(1+\frac{1}{n}\right)^{n+1} \qquad (iii)\quad a_n=\frac{3n^2-3n}{2n^2+1}$$

(b)(4 points).Discuss the convergence of the following series:

$$(i)\ \sum_{n=1}^{\infty}\frac{1}{n(n+1)(n+2)} \qquad (ii)\ \sum_{n=1}^{\infty}\frac{n^{n^2}}{(n+1)^{n^2}}$$

(c)(3 points). Determine whether each of the following series converges absolutely, converges conditionally or diverges:

(i) $\sum_{n=1}^{\infty} \frac{(-1)^n}{\sqrt{n}}$ (ii) $\sum_{n=2}^{\infty} \frac{\sin n}{n(\ln n)^2}$ (iii) $\sum_{n=1}^{\infty} (-1)^n \frac{1}{n^p}$ (iv) $\sum_{n=1}^{\infty} \frac{(-1)^n x^n}{n}$

Fifth Question (10) Degree)

(a) (4 points). Define $f:R \to R$ *by* $f(x)=x^2$.

Show that f is continuous but not uniformly continuous on R .

(b) (2 points). Give an example for discontinuous functions f , g but f+9 is continuous.

(c) (4 points).State the intermediate value theorem and use this theorem to show that there is a solution of the equation: $x^5+3x+\sin x=\cos x+10$ **in (0,2).**

Six Question (10) Degree)

(a) (3 points). Let $a_n=\frac{1}{n\log n}$ *for* $n\geq 2$. **Show that** $a_n \to 0$ *as* $n \to \infty$.

(b) (4 points) Establish the convergence or divergence of the sequence (y_n)**,where**

$$y_n=\frac{1}{n+1}+\frac{1}{n+2}+\ldots\ldots\ldots+\frac{1}{2n} \quad \text{for } n \in N.$$

(c) (3 points) .Suppose (a_n) **is a Cauchy sequence. Prove that** (a_n^2) **is a Cauchy sequence.but the converse is not true.**

Prof.R.A.Rashwan **The End**