Faculty of Science

Chemistry Department (May 2017) Time: 2 hr.

Final Examination for Applied Industrial Chemistry Students (Chem 202, Organic Chemistry)

Section A (Aromatic Chemistry) (25 Marks)

1) a) Complete four only of the following equations: (8 Marks)

i) Aniline sulphate $\xrightarrow{180^{\circ}C}$? $\xrightarrow{conc.\ H_2SO_4}$?

ii) Azobenzene $\xrightarrow{Zn/NaOH}$? $\xrightarrow{H^+}$?

iii) Bromobenzene + Mg $\xrightarrow{ether}$? $\xrightarrow{CH_3Br}$?

iv) N,N-Dimethyl aniline $\xrightarrow[\Delta]{CH_3Cl}$? $\xrightarrow{^+NO_2}$?

v) Nitrobenzene $\xrightarrow[HNO_3/H_2SO_4]{fuming}$? $\xrightarrow[NaOH]{K_3Fe(CN)_6}$?

b) By equations only starting with benzene or toluene outline the syntheses of two only of the following compounds: (4 Marks)

i) m-Bromo toluene, ii) 1,2,3-tribromobenzene

iii) 1,3-Dichloronitro benzene

2) a) Predict the major product(s) would be obtained when three only from the following compounds are mono nitrated: (6 Marks)

i) o- Chloronitrobenzene, ii) p- Chloronitrobenzene,

iii) Benzal chloride, iv) p-Nitroacetanilide, v) Phenyl benzoate

b) Arrange the following compounds in the order of increasing:

i) Reactivity towards electrophilic substitution reactions: (2 Marks)

N-methylaniline, Cyanobenzene, Hydroxy benzene, Benzotriflouride.

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ii) Basicity : (3 Marks)

N,N-Dimethylaniline, Aniline, m-Nitroaniline, p-Nitroaniline

c) Write Resonance structures for arenium ions when methyl benzene undergoes electrophilic attack. (2 Marks)

Section B (Heterocyclic Chemistry) (25 Marks)

1- Answer the following:

a) Draw the structure of the following compounds: (7 Marks)
Pyrrole – thiophene – pyridine – pyrimidine - oxazole, benzofuran - thiazole.

b) Marks (only six) of the following as (√) or (X): (6 Marks)

i) Thiophene is stable to Lewis acids.

ii) 1,3-Azoles are not reactive towards electrophilic attack.

iii) 1,2 - Azoles are significantly less basic than 1,3- azoles.

iv) Isoxazole and isothiazole are non basic heterocycles.

v) Quinoline and isoquinoline are two isomeric heterocycles.

vi) Acetylene was reacted with NaN_3 to give 1,2,3-triazole.

vii) Pyrimidines are aromatic heterocycles.

2- a) Show by equations and mechanisms the preparation of the following : (6 Marks)

i) The Paal – Knorr synthesis of Pyrrole.

ii) Acroline from glycerol.

b) Complete (only six) of the following equations: (6 Marks)

i) Furan + acetyl nitrate --------> ----------

ii) 2,5- Dimethylthiophene + EtBr ($AlCl_3$) .....>

iii) Isoxazole + Br_2 → .....

iv) Pyridine + H_2O_2 (AcOH) → .....

v) Isoquinoline + HNO_3 / H_2SO_4 → .....

vi) 2- Pyridone + HNO_3 → .....

vii) Thiophene + CH_3COCl ($SnCl_4$) → .....

---------- Good Luck ----------

Prof. Abdo El Said Abdel Rahman, Prof. Ali Ahmed Abdel Hafez

Assiut University
Faculty of Science
Chemistry Department

May:2017
Time:3 hrs

Final Exam. of Organic Chemistry(Aromatic & Heterocyclic Chemistry ,212 C) for 2 nd Level Student (Group 3)

Section (A) Aromatic Chemistry. (25 marks)

Answer the following questions:

1-a) complete **Five Only** equations from the following: (10 marks)

i) phenol + CO/Hcl $\xrightarrow{Cu\,cl\,/\,AlCl_3}$? $\xrightarrow{H_2N\text{-}NH_2}$?

ii) aniline + $NaNo_2$ / Hcl $\xrightarrow{0c^\circ}$? $\xrightarrow{H_3pO_2}$?

iii) p-Toluene sulphonate + NaCN $\xrightarrow{\Delta}$? $\xrightarrow{H+\,/\,H_2O}$?

iv) 2,4- Dinitro chloro benzene + NH_3 $\xrightarrow{\Delta}$? $\xrightarrow{(O)}$?

v) p- chloro toluene +conc.HNO_3 / H_2SO_4 $\xrightarrow{\Delta}$? $\xrightarrow{cl_2\,/\Delta}$?

vi) benzene diazonium chloride + H_2O $\xrightarrow{\Delta}$? $\xrightarrow{Zn/\,\Delta}$?

vii) m- Chloro nitro benzene $\xrightarrow{Zn\,/\,Hcl}$? $\xrightarrow{NaNO_2\,/\,Hcl}$?

b) Amino group is an activating group in substituted electrophilic reaction and o –p – directors while cyanide group is a deactivated group and m- direator.
How can you explain this statement? (3 marks)

2-a) Give **Only Three** istructures and names of the principal organic products expected from the mono sulphonated of: (4 marks)

i) Anisole ii) benzene sulphonic acid
iii) m- xylene iv) o- Nitro phenol

b) by equations Only , prepare **Two Only** by One method for each one: (2 marks)

i) phenol ii) Toluene iii) Azobenzene

c) Illustrate by equations how can you prepare **Four Only** of the following: (6 marks)

i) Benzidine from nitrobenzene.
ii) p- Dinitrobenzene from benzene.
Iii) p,p-Dinitro diphenyl from aniline.
iv) 4- Nitro -2,6- dibromo anisole from anisole.
v) 3,5- Dibromo aniline from benzene.

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Section (B) Aromatic Heterocyclic Chemistry: **(25 marks)**

Answer the following questions:

(1) Using the chemical equations only show only Four of the following (Show the reaction mechanism as it is possible)**:** **(8 marks)**

1- Preparation of 1,2,5-trimethyl pyrrole by using Pool-Knorr synthesis method
2- Conversion of furan into furfural
3- Synthesis of 2,5-dimethyl furan from ethyl acetoacetate
4- Fisher synthesis of indole
5- Furoin from furfural

(2) Discuss three of the following points **(6 marks)**

1- Water solubility of pyridine and its electrophilic and nucleophilic reactions
2- The reactive position in pyrrole and indole in electrophilic reactions
3- Similarity between pyrrole and phenol (using chemical reactions only)
4- Mechanism of preparation of 3-chloropyridine from pyrrole

(3) (A) Write the chemical structure of the following compounds (6 marks)

1) 2,2-Dimethyl-2H-oxete
2) 2-phenylazetidine
3) 2H-azirine
4) 4-Phenyl-benzo[d]1,2,3triazine
5) Imidazo[2,1-b]thiazole
6) Isoxazolo[4,5-b]pyridine

(B) Put (√) for the correct statement and (X) for the wrong one **(5 marks)**

1- Quinolines are more reactive towards electrophilic substitution reactions to give 2-substitunets.
2- Diazine compounds are more basic than pyridine
3- Pyrrole has the highest aromaticity in comparing with furan and thiophene
4- Imidazole is easily undergoing electrophilic substitution reactions like pyrrole to give 2-substitunets.
5- Pyridine is easily oxidized by using week oxidizing agents.

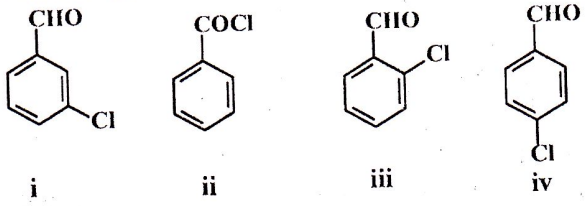
Assiut University
Faculty of Science
Chemistry Department
Final exam in 212 Course for second level students

May 2017
Time allowed: 3 hours

Answer the following questions :..... (Aromatic compounds) .....(25 marks)

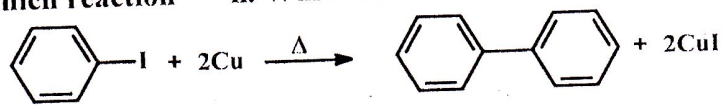
Question 1.Chose the correct answer:.....(10 marks)

a. Benzaldehyde reaction with Cl_2 gave:



i ii iii iv

b. The following reaction is called:
i. Mannich reaction ii. Wurtz reaction iii. Ullmann reaction



Iodo benzene Biphenyl

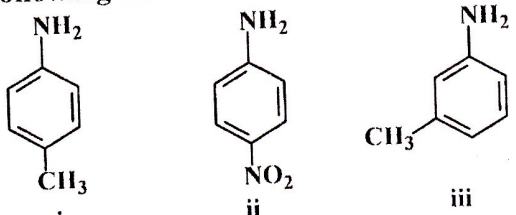
c. The reaction of toluene with CO/HCl-CuCl/$AlCl_3$ to give p-methyl benzaldehyde named: i. Riemer Tiemann reaction ii. Friderl-Craft Reaction iii. Gattarmann Koch reaction

d. Aromatic compounds mainly reacted according to:
i. Nucleophilic substitution reaction ii. Electrophelic addition reactions
iii Electrophelic substitution reactions

e. From the activating group and directing *o-p* in the mono substituted benzene reactions is: i. Br ii. NH_2 iii. NO_2

f. From the dactivating group and directing *o-p* in the mono substituted benzene reactions is: i. Br ii. OH iii. CN

g. The most basic of the following amines is:



i ii iii

h. The reaction of benzene with chlorine in the presence of sun light to give hexachlorocyclohexane was considered:
a. Electrophelic addition b. Nucleophelic addition c. Free radical addition

I. heating chlorobenzene with NaOH above 300 °C and 170 atmospheres of pressure affords phenol is this reaction: Nucleophilic substitution reaction
a. free radical substitution reactions b.Electrophelic substitution reactions
c. by elimination–addition reaction d. Nucleophilic Aromatic Substitution by Elimination–Addition

J. Hydrolysis of the benzenesulfonic acids with dilute HCl at 150°C, under pressure, yield:
a. phenol b. benzene c. diphenylsulfone.

Question 2: Complete (four only) the following equations with writing the structures of all compounds...(5 marks):

1. *m*-Dinitrobenzene $\xrightarrow{(NH_4)_2S}$? $\xrightarrow[H_2SO_4]{NaNO_2}$? $\xrightarrow[\Delta]{BF_4^-}$?

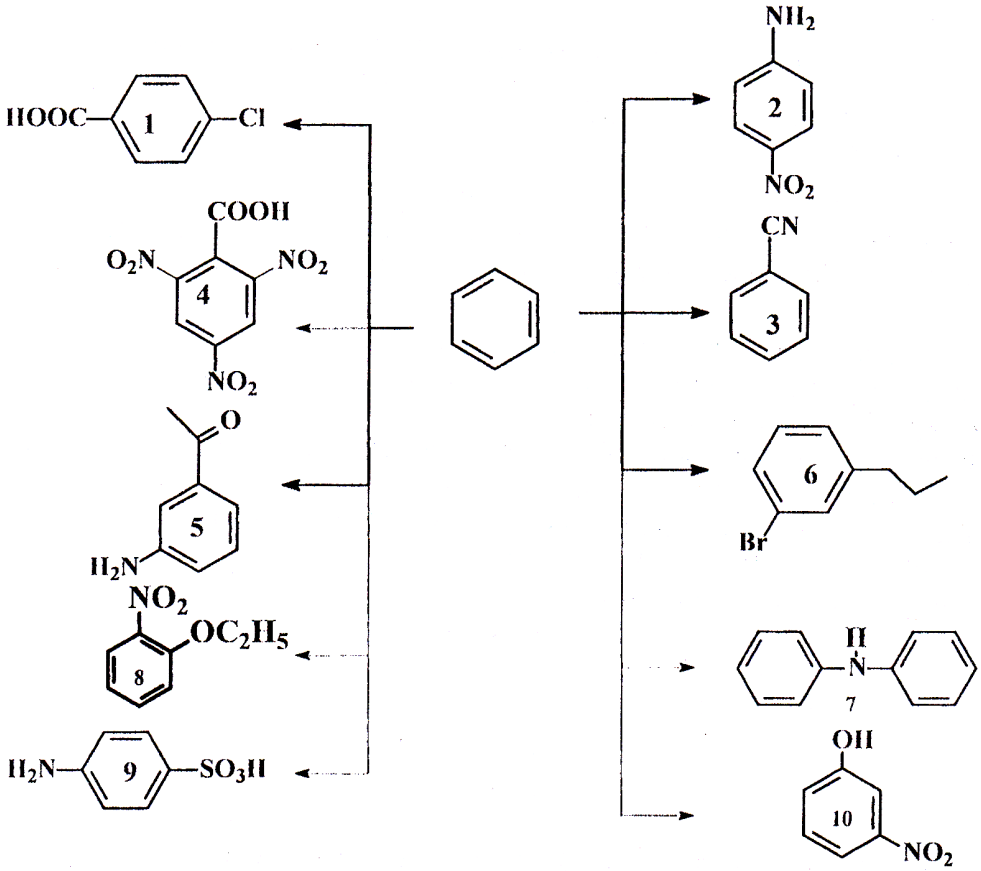
2. $H_3C-CH_3 \xrightarrow[h\nu]{Cl_2} ? \xrightarrow[AlCl_3]{} ? \xrightarrow{KMnO_4} ? \xrightarrow{CaO/NaOH} ?$

3. Sodium-*p*-toluene sulfonate $\xrightarrow{NaOH/fusion} ? \xrightarrow{Ac_2O/H_2SO_4} ? \xrightarrow[AlCl_3]{Cl_2} ?$

4. Aniline $\xrightarrow{(CH_3CO)_2O} ? \xrightarrow[AlCl_3]{CH_3COCl} ? \xrightarrow{H_3O^+} ?$

5- Benzene $\xrightarrow{H_2SO_4} ? \xrightarrow{NaOH} ? \xrightarrow[fusion]{NaCN} ?$

Question 3: In the following scheme starting with benzene show by equations how you can obtain the compounds (8 only) with writing the name for each one of these compounds...(10 marks).



Look to the Part B(Heterocyclic Compounds) in page 3

Heterocyclic Chemistry

Section B: Heterocyclic Chemistry **(25 Marks)**

Answer the following questions:-

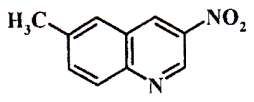
Question 1: **(11 Marks)**

(1) Electrophilic attacks on pyrrole occur more readily at 2- position while for indole at 3- postion. Explain this statement. (3 Marks)

(2) Which of the following pairs is more basic and why:(3 Marks)

a) Pyrrole or pyridine b) Imidazole or thiazole

3) Write the systematic IUPAC names for FIVE ONLY of the following structures: (5Marks)



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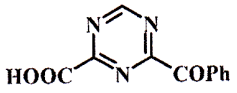

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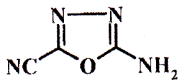

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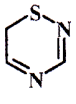

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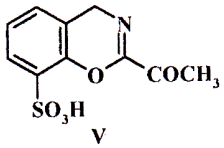

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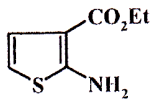


VI

Question 2:(14 Marks)

(1) Show by equations, how you can synthesize pyrrole by the reaction of α-amino ketone and carbonyl compound.(2 Marks)

(2) Write the full detailed mechanism for TWO ONLY of the following reactions: (6 Marks)

a) Mannich reaction for pyrrole

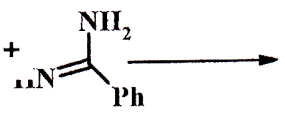
b) Vilsmeier reaction for thiophene

c) Fisher synthesis of indole

(3) CompleteTHREE ONLY of the following equations:(6 Marks)

I) Indole $\xrightarrow[\text{ii) } H_2O]{\text{i) } POCl_3 / DMF}$ A

II) Aniline $\xrightarrow[H_2SO_4/\ PhNO_2]{\text{glycerol}}$ A

III) $CH_3COCH_2COCH_3$ +  A

IV) $PhNHNH_2 + CH_3COCH_2SPh \longrightarrow$ A + B

GOOD LUCK

Examiners: Prof./ Adel M. Kamal, Prof./ Shaban M. Radwan, Prof. / Ahmed A. Geies and Dr/ Remon M. Zaki

Assiut University
Industrial Chemistry Program

Final exam:
Chemical Manufacturing processes

Faculty of Science
Date, 30/5/2017
Time: 2 hrs.

Answer the following questions supporting your answers with sketches

Question no. 1 (10 points)

One thousand kilograms per hour of a mixture of benzene (B) and toluene (T) containing 50% benzene by mass is separated by distillation into two fractions. The mass flow rate of benzene in the top stream is 450 kg B/h and that of toluene in the bottom stream is 475 kg T/h. The operation is at steady state. Write balances on benzene and toluene to calculate the unknown component flow rates in the output streams.

Question no. 2 (12+4=16 points)

a) Differentiate between:
   i) open and closed system
   ii) steady and unsteady state system
   iii) Batch process-Continuous process-Semi-batch process
   iv) Physical operations and chemical processes
   v) Block, Flow and P&ID Diagrams

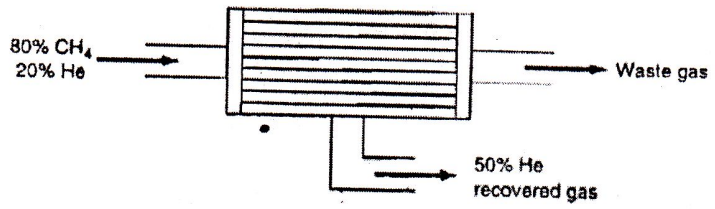
b) Read each one of the following scenarios. State what the system is. Draw the picture. Classify each as belonging to one or more of the following: open system, closed system, steady state process, unsteady state process.
   i) You fill your car radiator with coolant
   ii) You drain your car radiator.
   iii) You overfill the car radiator and the coolant runs on the ground
   iv) The radiator is full and the water pump circulates water to and from the engine while the engine is running

Question no. 3 (4+6+4=14 points)

a) What are the main challenges facing the industrial production?
b) Give a full flow sheet for the production of Aluminium from its ore Bauxite
c) What are the environmental and economical impacts for materials recycling?

Question no. 4 (4+6=10 points)

a) What are the main process variables?
b) A gas containing 80% CH4 and 20% He is sent through a quartz diffusion tube to recover the helium. Twenty percent by weight of the original gas is recovered, and its composition is 50% He. Calculate the composition of the waste gas if 100 Kg moles of inlet gas are processed per minute.



Best wishes *Ass.Prof. Dr. Gomma A. Elsayed, and Ass. Prof. Dr. M. S. Aboraia*

Faculty of Science **24 May 2017**

Chemistry Department **Time allowed: 2 hours**

Final Exam of Introductory Quantitative Analysis (C-240)

Second Level "Credit Hours System"

.....

Answer Four Only From the Following :

(12.5 marks for each question)

First Question:

a-Define: **i** - Adsorption indicators **ii** – Redox indicators,
b – AnEDTA solution is standardized against high- purity $CaCO_3$ by dissolving 0.3982 g $CaCO_3$ in hydrochloric acid , adjusting the pH to 10 with ammoniacal buffer, and titrating. If 38.26 ml of EDTA was required for the titration, What is the molarity of the EDTA.

[At.wt`sCa = 40 , C = 12 , O = 16]

c –Calculate the pCl in a solution obtained by reacting 50 ml each of 0.1 M NaCl and 0.1 M $AgNO_3$. [K_{SP}(AgCl)= $1x10^{-10}$]

Second Question:

a-What is the electrode potential in a solution containing 0.50 M $KBrO_3$and 0.20 M Br_2at pH 2.5 ? [E^o Br O_3^-, Br_2 = 1.52 V]

b -Given that the formation constant for the lead- EDTA chelate (PbY^{2-}) is $1.10x10^{18}$ and $\alpha\ Y^{4-}$ at pH 10 = 0.35. Calculate the conditional formation constant.

c –Explain why ?

i – Mohr method should be performed in neutral or faintly acidic solution.

ii –Volhard method should be performed in acidic solution .

Third question:

a – Describe the acid- base equilibria of EDTA.

b – Calculate the equilibrium concentrations of different species in 0.1 M Fumaric acid (H_2A) at pH 4. [pK_{a1} = 3.05 , pK_{a2} = 4.5]

c-i -Distinguish between Systematic error and Random error

ii - Calculate the pH of the solution during the titration of 100 ml CH_3COOH with 0.1 M NaOH after addition of 0, 10 , 50 , 100 , and 110 ml of NaOH . Sketch the diagram and select the indicator used.

[($K_a = 1.75x10^{-5}$, $K_w = 1x10^{-14}$]

Fourth question:

a-i-Distinguish between accuracy and precision

ii- Write briefly on Bronsted acid- base theory

b - Calculate the mean and the standard deviation of the following set of analytical results: 15.67 g, 15.69 g, 16.03 g .

c- Find the pH of a buffer solution prepared by dissolving 12.43 g of tris (M.wt = 121.135) plus 4. 67 g of tris hydrochloride (M.wt = 157.596) in 1.0 L of water, ($pK_a = 8.61$).

Fifth Question:

a – i – Definethe Standard deviation

ii- Explain the principles of the theory of neutralization indicators

. **b**-Calculate the pH of solution prepared by adding 25 ml of 0.1 M NaOH to 30 ml of 0.2 M CH_3COOH.

c - The carbohydrate content of glycoprotein (a protein with sugars attached to it) is determined to be 12.6 , 11.9 , 13.0 , 12.7 and 12.5 g of carbohydrate / 100g of protein in replicate analysis, Find the 50% and 90% confidence intervals for the carbohydrate, (t at 50 % = 0.741 , t at 90 % = 2.132).

Good Luck

SedairaProf. Dr. Hassa

Prof. Dr. Elham Y. Hashem

Assiut University
Faculty of Science
Chemistry Department

16 May 2017
Time: 3 hours

Final Examination of Environmental and Green Chemistry (214C) for Credited Hours Students

Answer the following questions: **(50 Marks)**

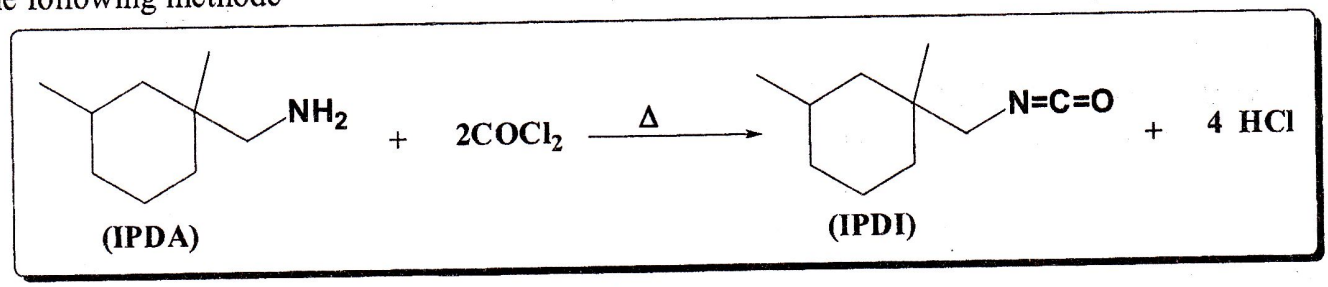
First question: **(10 Marks)**

(A) Answer **Only One** of the following **(5 Marks)**

I- Caprolactam is the precursor to Nylon 6, a widely used synthetic polymer, and can be prepared by different industrial methods.

Give the different methods of manufacturing the Caprolactam and choose the greener method giving the reason?

II- Isophorone Diisocyanate (IPDI) is used in the synthesis of coating polymers which are resistant to abrasion and degradation from ultraviolet light. These properties are particularly desirable in, for instance, the exterior paint applied to aircraft. Isophorone Diisocyanate can be prepared according to the following methode



1- What are the disadvantages of this method?

2- How can you synthesize IPDI by a greener method?

(B) How can synthesize **Only Two** of the following fungicides giving their agricultural application? **(5 Marks)**

1- Thiram 2- Benomyl 3- Dimethirimol

Second question: **(10 Marks)**

(A) Although 2-methyl-4-chlorophenoxybutyric acid (MCPB) is classified as a non-herbicide, it is used as a selective herbicide to kill the weeds without harming the leguminous crop. Also, Atrazine is used as a selective herbicide to kill weeds in maize and sugar cane even Atrazine is toxic. **(5 Marks)**

1. Show, only by equations, how can you synthesize both of MCPB and Atrazine
2. Explain the mechanism of working both MCPB and Atrazine as selective herbicides.

(B) How can you carry out a safer disposal **Only Two** of the following toxic compounds? **(5 Marks)**

1- Poly chlorinated biphenyl (PCB) 2- Glyphosate 3- Atrazine

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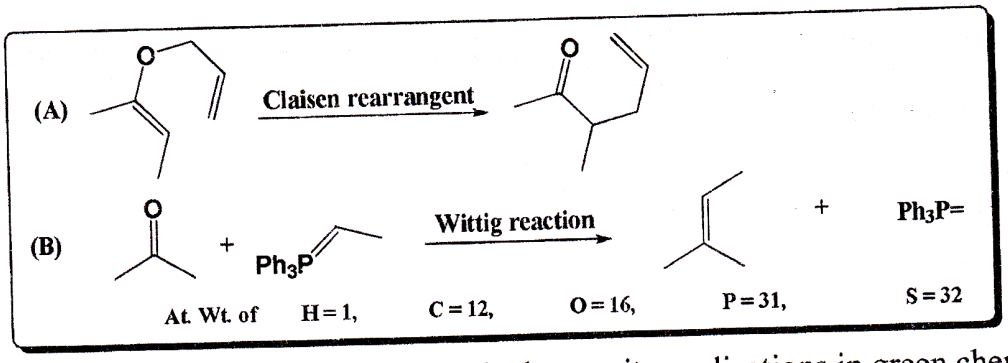
Third question: **(10 Marks)**

(A) Give the atom ecomony for the following Claisen (A) and Wittig (B) reactions showing the greener one? **(5 Marks)**



(B) What is the meaning of supercritical CO_2 and what are its applications in green chemistry? **(5 Marks)**

(10 Marks)

Fourth question: **(5 Marks)**

(A) Give the meaning **Only Five** of the following?

1- Biochemical oxygen demand **2-** Lindane insecticide **3-** Gibberellins

4- Phytotoxicity **5-** Weeds **6-** Flue gas desulfurization (FGD)

(5 Marks)

(B) Give the reason **Only Two** of the following

1- Ethephon can be used as a plant hormone?

2- Tobacco extract can be used as an insecticide?

3- Acid rain is dangerous on the environment?

(10 Marks)

Fifth question:

(A) Give by equation the tropospheric oxidation of Methane and its effect on the environment. **(5 Marks)**

(B) Give five green chemistry principals achieved in **Only Two** of the following published papers

1- *First paper*

A highly efficient and environmentally benign protocol has been developed for the construction of various potentially biologically active N-methyl-2-nitro-aryl-1*H*-benzo[*f*]chromen-3-amine derivatives using one-pot, multi-component cascade reaction of various naphthalen-2-ol, aldehydes, and (*E*)-N-methyl-1-(methylthio)-2-nitroethenamine under catalyst-free conditions in the presence of green solvent medium (ethanol-water) is described. The significant features of this protocol are short reaction times, provide excellent yields, avoidance of toxic solvents and catalysts, no column chromatographic purification, atom-economy and uses ethanol water as a green solvent which is considered to be relatively environmentally benign. This is the first example of the condensation of naphthalen-2-ol, aldehydes, and (*E*)-N-methyl-1-(methylthio)-2-nitroethenamine to provide a novel series of 1*H*-benzo[*f*] chromen-3-amine derivatives.

Tetrahedron 72 (**2016**) 6484

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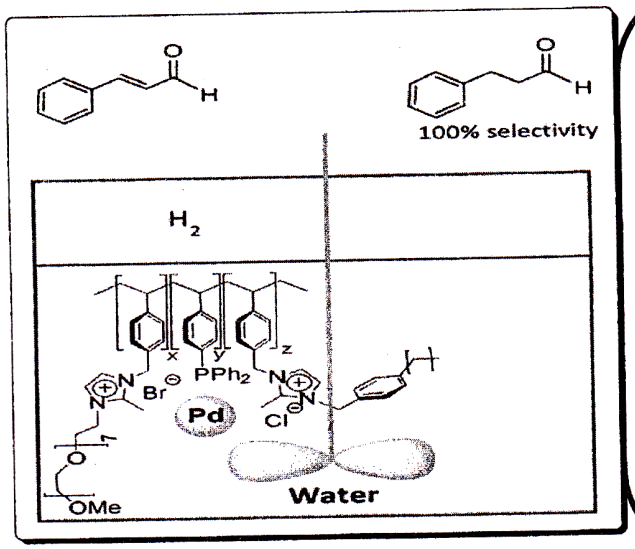
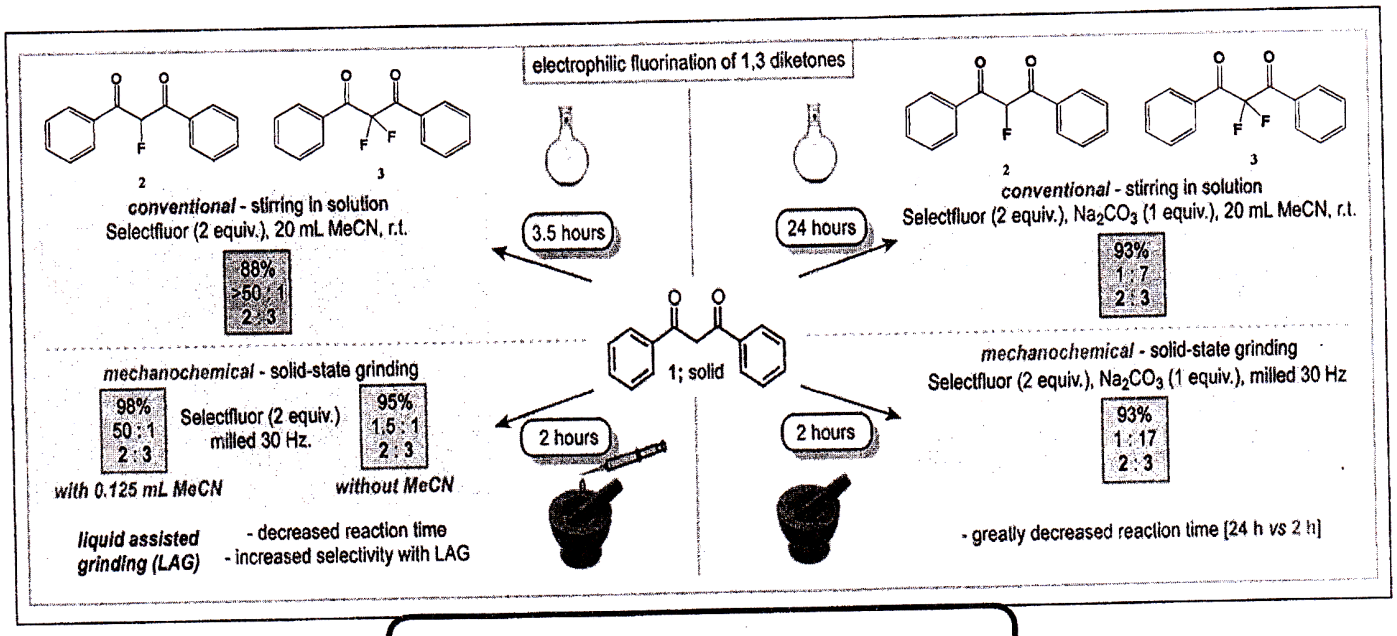
2-*Second paper*



Phosphino-decorated polymer immobilised ionic liquid-stabilised PdNPs catalyse the hydrogenation of α,β–unsaturated aldehydes, with remarkable selectivity for the C=C double bond in water under mild conditions.

Green Chem., **2017**,
DOI: 10.1039/C6GC03528K

3- *Third paper*



Green Chem., **2016**,
DOI: 10.1039/c6gc03139k

GOOD LUCK,,,,,,,,,, **Examiner : *Dr. Awad Said***

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Department of Chemistry		Date: 18/5/2017
Faculty of Science		Time: Two hours

Final Examination in Industrial Methods of Analysis (C-205)
For 2nd level Students (Industrial Chemistry Program)

Section (A) (25 Marks)

1) Answer the following questions: (9 Marks)

A. Define each of the following:

Spectrometry, Absorptivity, Auxochrome, Bathochromic shift, Isosbestic point

B. Describe the absorption phenomena taking place in the far-infrared, mid-infrared and visible-ultraviolet regions of the spectrum.

2) Answer *Four only* of the following: (16 Marks)

A. Give the theoretical bases of spectrophotometric quantification of binary mixtures. How the wavelengths should be chosen?

B. What are the most frequent electronic transitions during absorption of electromagnetic radiation?

C. Convert the wavelength 4000 A° into frequency (Hz) and into wavenumber (cm^{-1}).

D. Calculate the pKa of 2-nitro-4-chlorophenol in water at 25 °C from this data taken at 427 nm. The absorbance of the undissociated phenol, measured in 0.01 M HCl was 0.062. The absorbance of the fully ionized phenol, measured in 0.01 M NaOH was 0.855. In a buffer solution of pH 6.22, the absorbance was 0.365.

E. 0.1 mg of anthracene ($C_{14}H_{10}$, RMM = 178) dissolved in 100 cm^3 of dry cyclohexane and placed in 1-cm cell, gave an absorbance maximum at 256 nm with A = 1.01. If 1g of dry soil was extracted with a total 100 cm^3 of dry cyclohexane and gave an absorbance of 0.32 under the same conditions, what was the concentration of anthracene in the soil in mg/kg?

Section (B) (25 Marks)

Answer *only Two* questions from the following:

1) A. Define each of the following: (12.5 Marks)

1) Specific conductance 2) Resistivity 3) Strong electrolytes

B. Differentiate between metallic conduction and electrolytic conduction.

C. The F^- concentration of tap water in Moscow is maintained at 1.00 mg/mL. The response of a F^- selective electrode for this sample was measured at 0.320 volts. A sample of tap water from Pullman was measured with the same electrode at 0.360 volts. What is the concentration of F^- in Pullman water?

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2) A. Choose the correct answer: **(12.5 Marks)**

1. Ion selective electrodes measure potential difference across a membrane using the principles of
   a) Coulometry. b) Potentiometry.
   c) Amperometry. d) Conductivity.
2. The ability of an indicator (measuring) electrode to respond to a single species of ion and not any other is referred to as:
   a) Sensitivity b) Accuracy
   c) Precision d) Selectivity
3. Electrodes made of pH sensitive glass may be used in the analysis of:
   a) PCO_2 b) PO_2
   c) pH d) (a) and (c) are correct
4. Which of the following electrochemical methods requires the formation of an insoluble form of the analyte?
   a) electrogravimetry b) coulometry
   c) potentiometry d) voltammetry
5. The electrolyte solution within the glass electrode (ref.) of the pH meter is:
   a) Saturated KCl b) Concentrated HCl
   c) Dilute KC1 d) Dilute HCl
6. What is the $[OH^-]$ of a solution with a pH of 9.0?
   a) 1×10^{-5} M b) 1×10^{-9} M
   c) 1×10^{-4} M d) 1×10^{-7} M
7. Respond directly to changing activity of electrode ion
   a) Electrodes of first kind b) Inert metal electrodes
   c) Reference electrodes d) Electrodes of second kind
8. A very common interference for the glass pH electrode is _____.
   a) CO_2 b) F^-
   c) Na^+ d) EDTA

B. What are the different types of metallic indicator electrodes? Explain only one type of these electrodes.

3) A. Draw and explain the conductometric titration curve for strong acid with strong base. **(12.5 Marks)**

B. what are the sources of error in pH measurements?

C. A glass electrode was immersed into a solution of pH 4.33 gave a response of 677.1 mV. This electrode was used to measure a sample solution and gave a response of 544.7 mV. What is the pH of the sample?

Good Luck...

Examiners: Prof. Dr. Hassan Sedaira & Dr. Mohamed Kotb

Assiut University **MAY 2017**
Faculty Of Science **Time: 2 Hours**
Chemistry Department

Second Semester Final Examination Inorganic Chemistry (C-220)
Subject : Inorganic Chemistry (C- 220)

Answer the following questions : **(50 Marks)**

1) Answer the following : **(12 Marks)**

A) Compare between the following and ***explain why*** **(answer four only)**

i- Portland cement and aluminia cement.
ii- Differences in acidity between HNO_3 and HNO_2.
iii- The acidic strength of HF and HBr.
iv- Oxidation states of oxygen and group VI elements.
v- Li, Ga , F (hardness , electro negativity, solubility).

B) Mark with (x) for the wrong statement or (√) for the correct statements of the following and ***explain why*** **(answer four only)** **(12 Marks)**

i. Xenon reacts with fluorine depending on the F_2/Xe ratio.
ii. Boiling point of NaCl is higher than $AlCl_3$.
iii. Cesium salts is harder than lithium salts.
iv. Hellium is diatomic.
v. H_2O_2 act as a strong oxidizing agent.

2) Answer the following :

A) Give reasons for the following statements: **(answer four only)** **(12Marks)**

i- Boric acid behaves as strong monobasic acid in presence of glycerol.
ii- KO_2 is used in space capsules.
iii- Pb (+II) is more stable than Pb (+IV).
iv- Freon causes damage to the ozone layer.
v- HF is kept in glass containers.

B) Complete the following statements: **(12 Marks)**

i- Great reactivity of fluorine is due to 1…..2…….
ii- Factors influencing complex formation are 1…..2…..3…..
iii- The balanced equation for the reaction between MnO_4^- and N_2H_4 in alkaline solution to produce MnO_2 and N_2 is …….

C) Show by equations how can you prepare the following : **(2 Marks)** **(answer four only)**

i- Urea ii- B_2O_3 iii- CO vi- H_2O_2 v- HF

"Good Luck "

Examiners

Dr Dina M. Fouad

Assiut University Faculty of Science Chemistry Department		Date: 20/5/2017 Time: 3 hours

The Final Physical Chemistry II (C-232) Examination for Second Level Students

Answer all the following questions (I, II, III): **(16 2/3 Marks for each)**

I) Phase Rule:

A) Explain briefly *Only Two* from the following: **(10 Marks)**

i) Sodium sulphate - water system.

ii) Two component system A and B forming compound AB with congruent melting point.

iii) The ternary system $NH_4NO_3 - AgNO_3 - H_2O$ at 30 °C, where the binary compound $NH_4NO_3 - AgNO_3$ is formed.

B) What are the main differences between the phase diagram of Ag – Pb system and that of KI – water system? **(3 2/3 Marks)**

C) Complete each of the following: **(3 Marks)**

i) The phase diagram of sulphur system at metastable equilibria consists of ..... areas, ... curves and ..... triple points.

ii) For a pure substance and an aqueous solution of sugar, the degree of freedom is ..... and ..... respectively.

iii) In order to define a two component system completely, ... variable must be specified namely, ...

II) Electrochemistry: **Answer the following questions:** **(16 2/3 Marks)**

A) Write briefly with drawing on *Only One* from the following:

i) Standard cell, ii) Lead acid battery.

B) Answer *Only One* from the following:

1- In the following cell $Zn / Zn^{2+} // H^+ / H_2$. pt.

i) Write the cell reaction. ii) Calculate E°_{cell} if $E^\circ_{Zn} = -0.762$ volt and $E^\circ_{H2} = 0$.

2- From the following cell: $Zn / Zn^{2+} // Zn^{2+} / Zn$

Write the type of the cell for each of the following cases:

i) Zn^{2+} ions in both electrodes have the same concentrations.

ii) Zn^{2+} ions concentration in one of them is 10^{-3} M and the other is 1 M.

iii) Calculate E°cell for the above cell.

C) Calculate the hydrogen ion concentration in the following cell if $E_{cell} = 0.48$ V

$$Pt, H_2 / H^+ // Cl^-, Hg_2Cl_2 / Hg$$
$$(X) \qquad 0.244 \text{ V}$$

D) Prove that secondary electrode potential is anion dependent.

E) Write electrolysis product of the following solutions: H_2SO_4 and $CuCl_2$.

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III) Colloids:

A) Define ***Only Three*** from the following terms: (3 2/3 Marks)

i) Macromolecular Colloids (Give an example). ii) Zeta potential.

iii) Emulsifier (Give an example). iv) Thixotropy.

B) Complete ***Only Two*** from the following: (2 Marks)

i) Emulsifying agent which uses for stabilization of Hollandaise sause is .....

ii) The coagulation capacity of an electrolyte depends upon .....

iii) The stability of a sol is due to .....

C) Describe a method for the preparation of ***Only Three*** from the following: (3 Marks)

i) Arsenous sulphide sol. ii) A Colloidal solution of sulphur.

iii) Gold sol. iv) Sol of ferric hydroxide.

D) Explain briefly each of the following: (8 Marks)

i) The Bredig's arc method for preparation of lyophilic colloidal solutions.

ii) The origin of charge on colloidal particles. (Give an example).

iii) How oil in water emulsion can be converted to water in oil emulsion?

---------- Good Luck ----------

Prof. Dr. Maher M. A. Hamed.

Dr. M. H. Wahdan

Dr. Rasha M. Kamal

Assiut University Faculty of Science Chemistry Department		May, 2017 Time: 2 hrs Marks: 50
Final Exam. of Physical and Inorganic Chemistry (250 - CH)		

Section I (Inorganic Chemistry) (25 Marks)

1-a) Explain the reasons for **Five only** from the following:

i. The Unexpected high boiling point of H_2O.
ii. Na_2O is a basic Oxide
iii. SF6 is known but OF6 is not
iv. In pure water Be salt are acidic.
v. A mixture of (O_2+He)is used for respiration in deep sea diving in preference to air
vi. CO is a toxic gas .

b)How you can prepare three only from the following:
HF, water gas, NH_3, HI,.

c) In each pairs of acids, state which is stronger and why?
HF and HBr, HClO and HIO, HNO_3 and HNO_2.

2-a) Choose the correct answer and comment:

i) In which species does sulphur not exhibit its highest oxidation state(SF_6 ,SO_3 ,SO_4^{2-} ,S) .
ii)Which one of the following species contains an odd number of electrons:(CO,NH_4^+, NO)
iii)The species which contains paramagnetic properties is (NO, O_2, N_2)

b) How does $Ca_3(PO_4)_2$ reacts with each of sulphuric and phosphoric acids ?

c) What the types of hardness of water ? How we can remove this problem?

See the Next Page

Section II (Physical Chemistry) (Mark: 25)

Answer the following questions

I) Choose the correct answer: **(Mark: 10)**

1) If the V is keeping constant, then $\Delta E = ...$ a) $\Delta F^{\#}$ b) q_v c) q_p

2) For reversible processing: $q_{irrev} = ...$ a) $\Delta F^{\#}$ b) $\Delta G^{\#}$ c) q_{irrev} d) R

3) $\Delta H = \Delta E + ...$ a) $\Delta F^{\#}$, b) ΔR, c) $\Delta(PV)$, d) ΔC_p

4) Under isothermal expansion of ideal gas: $\Delta S^{\#}$ =.....

a) $nRT\ln\frac{V_2}{V_1}$, b) $nR\ln\frac{V_2}{V_1}$, c) $C_P \ln T$, d) $C_V \ln P$

5) If $\Delta H^{\#}$ is negative, then $\Delta S^{\#} = ...$

a) negative, b) positive, c) zero d) ΔR

6) Write the W in each operation, , W_{max}, and efficiency (η) during Carnot cycle.

7) $dG = ...-...-....$ 8) $\ln K = ...+....$

9) $\frac{d\ln K}{dT} = \frac{.....}{....}$ 10) $\frac{d(\ln P_{vap})}{d(1/T)} = -\frac{.....}{.....}$

II) i) Show, how can you calculate the $\Delta S^{\#}$ depending on:

a) *Variable..V* b) *Variable..P*, c) *Variable..T* **(Mark: 3)**

ii) For decomposition of gaseous $H_2O_{2(g)}$ according to the reaction: **(Mark: 3)**

$$H_2O_{2(g)} \xleftrightarrow{k_1/k_{-1}} H_2O_{(g)} + \frac{1}{2}O_{2(g)}$$ if: $\Delta G^{\#)} = -29.9..kcal.mol^{-1}$

Calculate K of this reaction at T: 300, 350, and 400 K

III) i) The equilibrium between: $H_2O_{(l)} \longleftrightarrow H_2O_{(g)}$

Prove that the vapor pressure ($P_{vap(}$) of Water depends on T **(Mark: 3)**

ii) If: $T_1 = 300.K$, $T_2 = 273.K$, $R = 1.987..cal/mol - \deg$

$P_1 = 223.8...mm$, $P_2 = ...mm$

$\Delta H^{\#0} = 10.510.kcal/mol.$ $R = 1.987..cal/mol - \deg$

Calculate: i) $\Delta G^{\#0}$ at T_1 ii) $P_{vap} = P_2$ iii) $\Delta S^{\#}$ **(Mark: 6)**

Good Luck

Examiners: Prof. Dr. Amna S A Zidan, Prof. Dr. Seddique M Ahmed

Assiut University
Faculty of Science
Chemistry Department

June: 2017
Time: 3 hour

Examination of Physical Chemistry(I) for second level Students (Industry group) 208 IC

Answer the following questions:

1) Answer **Two only** from the following:

a) Derive the relation between the standard free energy change with each of the following:

i) Standard cell potential ii) Equilibrium constant

b) Show how to calculate the entropy change for the following thermodynamic processes:

i) Reversible and irreversible isothermal expansions of gases

ii) Processes accompanied by temperature changes.

c) Derive an expression for the effeciency of heat engine working between two temperatures T_1 and T_2.

2) Answer **Two only** from the following:

a) Discuss the effect of temperature on the enthalpy change of chemical processes.

b) Derive the relation between pressure and volume in adiabatic processes.

c) Discuss the different methods which are frequently used for free energy change determination.

3) Answer **Two only** from the following:

a) Derive the relation between heat capacity at constant volume and that at constant pressure.

b) Discuss the effect of temperature on the entropy change for reversible and irreversible processes.

c) Check the validity for the relation between the enthalpy of reaction and its enthalpies of formation for both reactants and products.

Good Luck

Examiner: Prof.Dr.R.M.Gabr

Assiut University
Faculty of Science
Chemistry Department

May 2017
Time: 3 hours

Examination of physical chemistry (I) for second level students (230-Ch)

Answer the following questions:

1- Answer Two only from the following: (17 Marks)

a) Drive the kinetic equation to determine the specific rate constant for the following reactions:

(i) $A \xrightarrow{K_1}$ **Products**

(ii) $A + B \xrightarrow{K_2}$ **Products**

b) Discuss the effect of temperature on the reaction velocity

c) At 25 °C the specific rate constant for the hydrolysis of ethyl acetate by NaOH is 6.36 $mol^{-1}min^{-1}$. Starting with concentrations of base and ester 0.02 mol L^{-1} at 25 °C, what proportion of ester will be hydrolyzed in 10 min?

2- Answer Two only from the following: (16.5 Marks)

a) Drive the following relations:

(i) volume and temperature for adiabatic expansion of an ideal gas

(ii) the enthalpy change for a reaction and temperature

b) Find the relation between the enthalpy change of a reaction and the enthalpy of formation of both reactants and products

c) State the third law of thermodynamics and show how it can be applied to calculate the absolute entropy of a compound and the entropy change for chemical reactions

3- Answer Two only from the following: (16.5 Marks)

a) Discuss the electrical method for determining both the standard free energy and equilibrium constant for a reaction

b) Drive an expression for the efficiency of heat engine and its two working temperatures T_1 and T_2

c) Explain, how the free energy change of a reaction provides the convenient criterion for equilibrium and spontaneity of chemical systems. Also discuss the effect of sign of each ΔH and ΔS.

GOOD LUCK

Examiners: Prof. Temerk and Prof. Gaber

Assiut University
Faculty of Science
Chemistry Department

Date: Tuesday 16/05/2017
Time : 3 Hours
Course No.: 210C

Final Exam. for Second Level Chemistry Students (Reaction mechanism & Carbonyl compounds) (210C) Sec. term (2016/2017)

Answer the Following Questions (50 Marks)

Part A : Reaction mechanism (25 Marks)

Question One: (15 Marks)

(a) Mark Six Only (√) or (X) for the following sentences and then correct the wrong one: (6 Marks)

1- E2 reactions need high concentration of good nucleophile

2- Chemoselectivity is defined as which functional group will react

3- Nucleophile is a leaving group which departs with its bonding pair of electrons.

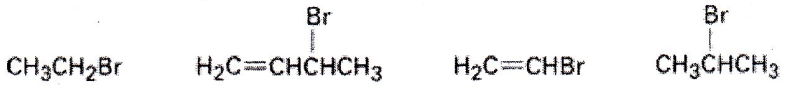
4- Hydrolysisi of vinyl bromide by NaOH form vinyl alcohol

5- DMF is a suitable solvent for S_N^2 mechanism

6- Free radical stabilized by alkyl substituents by inductive effect and hyperconjugation

7- A reaction involving a carbocation, the transition states structur look like the product

(b) a. Rank the following substances in order of their expected S_N1 reactivity (3 Marks)



CH_3CH_2Br $H_2C{=}CHCHCH_3$ (Br) $H_2C{=}CHBr$ CH_3CHCH_3 (Br)

b. Arrange the following according to its nucleophilicity order:

CH_3O^- HO^- $C_6H_5O^-$ CH_3OH H_2O

c. Arrange the following according to its increasing acidity

$ClCH_2COOH$ CH_3COOH $Cl_2CHCOOH$ Cl_3CCOOH

(c) Choose the correct answer from the following sentences: (6 Marks)

1- Methyl iodid reacts with CH_3CH_2ONa / CH_3CH_2OH via

a. S_N1 mechanisme , c. E1 mechanisme

b. S_N2 mechanisme , d. E2 mechanisme

2- Reaction mechanism is means:

a. Mechanisms are composed of elementary reactions or steps and starting materials follow on their way to become products

b. Elementary reactions or steps are the individual molecular events that make up the mechanism.

c. Elementary reactions can be unimolecular, bimolecular or termolecular.

d. All the previous.

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3- Benzene is classified as :

a. polar aprotic solvent , b. polar protic solvent , c. nonpolar solvent

4- The typical reaction of the olefinic bond is :

a. electrophilic substitution , c. nucleophilic substitution

b. electrophilic addition , d. nucleophilic addition

5- Based on Saytzeffs rule, select the most stable alkene

a. 1-methylcyclohexene , c. 3-methylcyclohexene

b. 4-methylcyclohexene , d.They are all of equall stability

6- Which of the following anions would be the best leaving group for substitution reactions

a. $TosO^-$, b. HO^- , c. H_3C^- , d. Cl^-

Question Two: (10 Marks)

a. Discuss by equations the reaction mechanism of bromination of cyclohexene.

Write the name of this reaction and type of selectivity. (3 Marks)

b. Show by equations the reaction mechanism of 1-butene with HI in the presence and absence of peroxide and light. (4 Marks)

c. Show by equations the reaction mechanism of the following reaction and then explain it by the energy diagram. (3 Marks)

cis-1-bromo-2-methylcyclopentane + EtONa/EtOH →

Section (B) Carbonyl Compounds: (25 marks)

Question Three (15 Marks)

a-Mark Five Only(√) for the right statements and (×)for the wrong one: (5 Marks)

1-Wolff-Kishner reaction is heating the ketones with N_2H_4/KOH form imines.

2-Aldol condensation is treatment of RCHO Or R_2CO with base to form α,β-unsaturate ketone

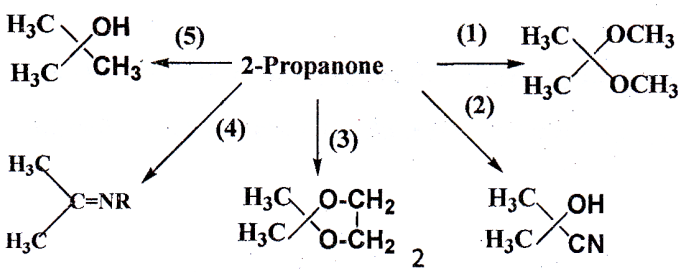
3-Benzyl Chloride react with NaCN,then hydrolysis in H_2O/H^+form benzoic acid.

4-In RMgX the carbon has unchared pair of electrons bears negative charge and consider a good nucleophile.

5-In halocarboxilic acids acidity increase with decreasing the number of halo atoms.

6-The major product from the heating of ethyl acetate in $NaOC_2H_5$ is ethyl acetoacetate

b-Show reagents & Conditions to bring about each equations: (5 Marks)



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c- Explain by equation the following reactions , the reactions name, and then discuss the mechanism of <u>One Only</u> : **(5 Marks)**

1-Cyclohexanone + $NaOC_2H_5$ → intermediate ,then react with ethyl formate .

2-Acetaldehyde + Acetophenone /OH^- → A +B + C + D

3-CH_3COCH_3 + PhMgBr then hydrolysis .

4- $2C_6H_5CHO + OH^- / H_2O \rightarrow A + B$

<u>Question Four</u> **(10 Marks)**

a-Complete <u>Five Only</u> from the following equations : **(5 Marks)**

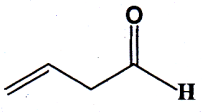
1-Cyclopentanol $\xrightarrow{PCC/CH_2Cl_2}$? **2-$CH_3COOC_2H_5$ $\xrightarrow{DIBAl\ -H}$?**

3-CH_3COOH + $\xrightarrow{LiOH}$? **4-CH_3CHO + HCN then $\xrightarrow{H^+/H_2O}$?**

5-($CH_3)_2CO + CH_2=PPh_3$ ⟶ ? $\xrightarrow{H^+/H_2O}$?

6-Ph CHO + HCHO $\xrightarrow{OH^-}$? + ?

b-Write the IUPAC name for <u>Five Only</u> of the following : **(5 Marks)**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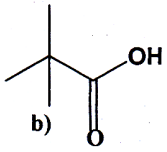

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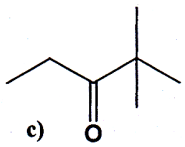
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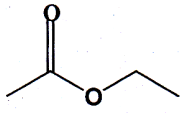
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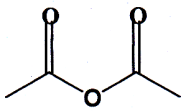
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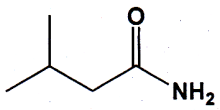

f)

Good Luck

الممتحنين : ا.د. زينب حزين د.اميمه سعد