

Mansoura university  
Faculty of science  
Chemistry Department  
Subject :Analytical Chemistry



3<sup>rd</sup> level chemistry  
Date: Jan. 2012  
Time allowed 3 hours  
Full mark 80 marks

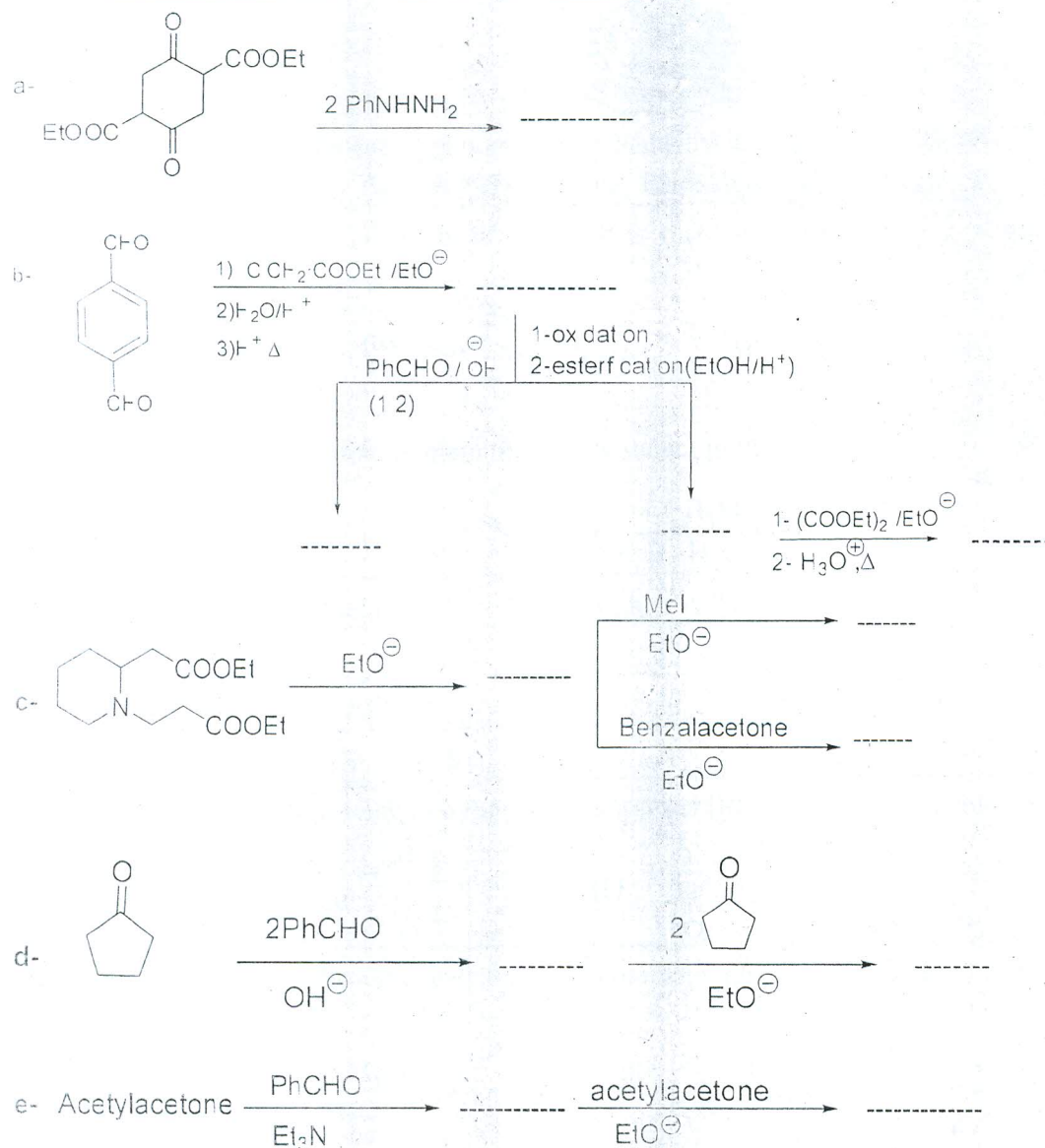
Course: (314) gravimetry

Answer all questions and express your answer by equation, diagram, formula, figures whenever possible.

- 1- Discuss the requirements should be met in order a gravimetric method be successful .  
(10 marks)
- 2- Suggest and draw flow sheet of gravimetric method for determination of :  
a- Calcium in water      b- Al and iron in iron ore      (10 marks)
- 3- Explain shortly the effect of i) temperature   ii) common ion   iii) divers ions  
On the solubility of sparingly soluble salt .      (5 marks)
- 4- Diagram TG and DTA curves in the thermal analysis . What are the  
important information from the curves ?      (5marks)
- 5- For determination of %p in commercial detergent , 0703 gm of sample was  
dissolved in HCl to convert P to  $H_3PO_4$  . The phosphate was precipitated as  
 $MgNH_4PO_4 \cdot xH_2O$  by addition of  $Mg^{2+}$  and  $NH_4OH$  . After filtration and  
washing , the precipitate was converted to  $Mg_2P_2O_7$  by ignition and weighed  
0.432gm . ( P=31 , Fw of  $Mg_2P_2O_7$  = 222.6 ) .  
a – Calculate %P in the sample . b- Draw flow sheet for the experiment .  
c- Why it is necessary ignition step .      (8marks)
- 6- Calculate the necessary volume of  $10^{-4}M$   $H_2SO_4$  to precipitate completely  
100ml ,  $10^{-3}M$   $PbCl_2$  (  $K_{sp} PbSO_4 = 10^{-8}$  ) .      (8marks)
- 7-Suggest an gravimetric method for separation of iron and magnesium from  
 $0.1M$   $Mg^{2+}$  and  $0.05 M$   $Fe^{3+}$  ( $K_{sp} Mg(OH)_2 = 10^{-12}$  and  $K_{sp} Fe(OH)_3 = 10^{-38}$ )
- 8- What the difference (mgs) between the amount of silver contained in 400ml of  
a saturated solution of AgBr ( $K_{sp} = 10^{-13}$ ) and amount of silver in 400ml of  
saturated solution of AgCl ( $K_{sp} AgCl = 10^{-10}$ )      (8marks)
- 9-Mixture of  $CaCO_3$  and CaO was analysed by TGA.The weight of the sample  
decreased from 125.3 mg to 95.4 mg at 500-900C due to loss of  $CO_2$ .  
Find % $CaCO_3$  in the sample .      (8marks)
- 10-Calculate the ionic strength of a mixed  $0.05M$   $Na_2SO_4$  and  $0.02M$   $NaCl$   
Solution .      ( 5marks)
- 11-According to the international standards , Pb in Food must not exceeds than  
0.5 ppm (g / Kg) , if sample from fish weighed 113.0 gm and it was contained  
0.11 gm Pb . a- Find %Pb in the samp      (5marks)  
b- Decide ,does the sample in the permissible limit or not ?

With Best Wishes  
Dr .Mohamed El-Defrawy

**Q. 3: Complete the following equations: (20 Marks)**



**Q. 4: (20 Marks)**

- Outline the steps of the synthesis of phenylalanine from glycine using Erlenmeyer's azalactone synthesis.
- Mention **two** synthetic applications for Claisen condensation.
- Write on **three** synthetic applications for Aldol condensation.
- Write on the use of Stobbe reaction in the synthesis of fused systems.
- Write **two** synthetic applications of Dieckmann reaction.

With our best Wishes

Examiners. Dr. E. Abdel-Galil & Dr. S. M. Abdelmageed



Mansoura University  
Faculty of Science  
Chemistry Department  
Subject: Chemistry  
Course (s): Chem 321  
d-Block elements



First Term  
Year: 3<sup>rd</sup> Year Chemistry  
Date: 5/1/ 2012  
Time Allowed: 2hrs  
Total Marks: 80 marks

Answer the following questions:-

1- Put (✓) or (x) and correct the statements:- (22.5 points):-

- i-  $\text{La}(\text{OH})_3$  is less basic than  $\text{Al}(\text{OH})_3$ .
- ii-  $\text{TiO}_2$  is basic oxide.
- iii-  $\text{Cu}^{2+}$  complexes have regular octahedral structures.
- iv- It is easy to differentiate between antiferromagnetic compounds at high temperatures.
- v-  $\text{Na}_2\text{FeO}_4$  is a strong oxidizing agent than  $\text{Na}_2\text{MnO}_4$ .
- vi- Separation of Mo from W is very difficult.
- vii- Sugar in urine is easily detected using cuprous sulphate.
- viii-  $\text{Mn}(\text{II})$  compounds are more stable than  $\text{Mn}(\text{VII})$ .
- ix- Octahedral cobalt (II) complexes are used for the detection of  $\text{H}_2\text{O}$ .
- x- Nitrogen gas is purified from small amounts of  $\text{O}_2$  using  $[\text{Cr}(\text{H}_2\text{O})_6]\text{Cl}_3$ .
- xi-  $\text{Y}(\text{OH})_3$  is used for the detection of  $\text{CO}_2$ .
- xii-  $\text{MnO}_2$  is red in colour and used as oxidizing agent.
- xiii- Cr easily reacts with water while Mn does not.
- xiv-  $\text{CoF}_3$  is an unstable compound.
- xv- Cu is more reactive than K.

2- Complete and balance the following equations (15 points):-

- i-  $\text{Cu}_2\text{O} + \text{HBr} \rightarrow$
- ii-  $\text{Sc} + \text{H}_2\text{O} \rightarrow$
- iii-  $\text{MnO}_2 + \text{H}_2\text{SO}_4 \rightarrow$
- iv-  $\text{Ti} + \text{C} + \text{Cl}_2 (900^\circ\text{C}) \rightarrow$
- v-  $\text{KMnO}_4 + \text{OH}^- \rightarrow$
- vi-  $\text{CrO}_3 + \text{NaOH} \rightarrow$
- vii-  $\text{Ti}^{3+} \xrightarrow{\text{heat}} \rightarrow$
- viii-  $\text{Mn}_2\text{O}_7 + \text{H}_2\text{O} \rightarrow$
- ix-  $\text{LaCl}_3 \cdot 7\text{H}_2\text{O} \xrightarrow{\text{by heating}} \rightarrow$
- x-  $\text{Cu}^+ + \text{H}_2\text{O} \rightarrow$

3- Comments on the following (20 points):-

- i-  $\text{FeCO}_3$  is known while  $\text{Fe}_2(\text{CO}_3)_3$  is not known.
- ii-  $\text{CrO}_3$  is used as oxidizing agent.
- iii- Most of transition metals are coloured.
- iv-  $\text{Mn}(\text{II})$  complexes are octahedral and have pink in color.
- v-  $\text{TiCl}_4$  is a colourless and fuming liquid.
- vi-  $\text{Cr}^{2+}$  is less stable than  $\text{Mn}^{2+}$  and  $\text{Fe}^{2+}$ .

- vii- CO is a posinous gas.
- viii- The existence of Ti(IV) is detected by  $\text{H}_2\text{O}_2$ .
- ix-  $\text{TiCl}_4$  is a colourless compound while  $\text{TiI}_4$  is coloured.
- x- The equivalent weight of  $\text{KMnO}_4$  depends on the pH.

4- Write short notes on the following (17.5 points):-

- i- Non-stoichimetric compoundzs (2.5 points).
- ii- Uses of vanadiumand its compounds (2.5 points).
- iii- Manganese oxides (2.5 points).
- iv- Methods of preparation of V (2.5 points).
- v- Polarization power. (2.5 points).
- vi- V oxides. (2.5 points).
- vii- Differences between  $\text{Na}_2\text{CrO}_4$  and  $\text{K}_2\text{Cr}_2\text{O}_7$ . (2.5 points).

5- Arrange the following (5 points):-

6-

- i-  $\text{Ta}^{5+}$ ,  $\text{V}^{5+}$ ,  $\text{Nb}^{5+}$  (according to stability).
- ii-  $\text{Ti}^{2+}$ ,  $\text{Ti}^{4+}$ ,  $\text{Ti}^{3+}$  (according to reactivity).
- iii- Sc, La, Y (according to complex formation).
- iv-  $\text{FeO}_4^{2-}$ ,  $\text{CrO}_4^{2-}$ ,  $\text{MnO}_4^{2-}$ ,  $\text{CoO}_4^{2-}$  (according to oxidation power).
- v-  $\text{TiF}_4$ ,  $\text{TiCl}_4$ ,  $\text{TiBr}_4$ ,  $\text{TiI}_4$  (according to solubility).

Good luck

Prof. Mohsen Mostafa



المستوى الثاني - كيمياء - كيمياء غير عضوية (الكيمياء)

Mansoura University  
Faculty of Science  
Department of Chemistry

First Semester  
Date 29-12.2011  
Time: Two Hours  
Full Mark ( 60)

**Exam. of Course 331( Heterocyclic Chemistry)**  
**For 3<sup>rd</sup> Level (Chemistry Students)**

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**ANSWER THE FOLLOWING QUESTIONS**

**1-a-** Epoxides may be cleaved by aqueous acid to give glycols that are often diastereomeric (anti-hydroxylation ),give example ( **7.5 Marks**).

**b-** Aromatic heterocycles can be both nucleophiles and electrophiles. Explain and illustrate with oxazole ( **7.5 Marks**).

**2- a-** Explain the Feist-Binary synthesis and its modification for the synthesis of furans ( **7.5 Marks**)..

**b-** Indicate by equations the following: ( **7.5 Marks**).

**i-** Nitration of pyrroles   **ii-** Vilsmeier formylation of pyrroles

**iii-** Halogenation of thiophenes.

**3- a-** Explain the Fisher-Indole synthesis for the preparation of 2,3-dialkyle indole ( **7.5 Marks**).

**b-** Use the Mannich reaction for the preparation of 3-substituted indole ( **7.5 Marks**)..

**4- a-** Mention one method for the preparation of 1,3- and 1,2-azoles ( **7.5 Marks**).

**b- i-** Some reactions of aromatic heterocycles are very similar to reactions of benzene, whereas some reactions are very different. Provide examples of this concept and explain ( **3.5 Marks**)....

**ii-** Give examples for the following reactions: ( **4 Marks**)..

**1-** Hantsch pyridine synthesis.   **2-** Pomeranz –Fritsch synthesis of isoquinoline.

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**Good Luck**

**Prof.Dr. Mohamed Abbas Metwally**

Mansoura University  
Faculty of Science  
Chemistry Department  
Subject: Chemistry

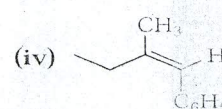
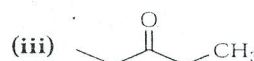
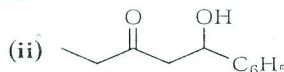
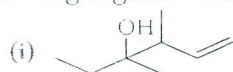


Course: Organic Synthesis and Organometallic Chemistry (Chem. 332)

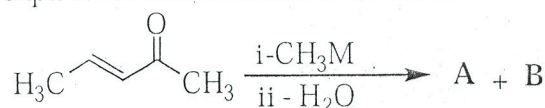
First Term  
3<sup>rd</sup> Level Chemistry students  
Date: Jan. 2012  
Time Allowed: 2 Hours  
Full Mark: 80 Marks

Answer All Questions, Each Question = 20 Marks

Question 1: A- outlines all steps in a synthesis that would transform 2-butanone into each of the following organic compounds (12 Marks)

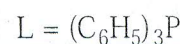
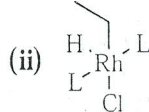
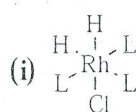


B- For the following reaction: explain the results shown in the table (5 Marks)

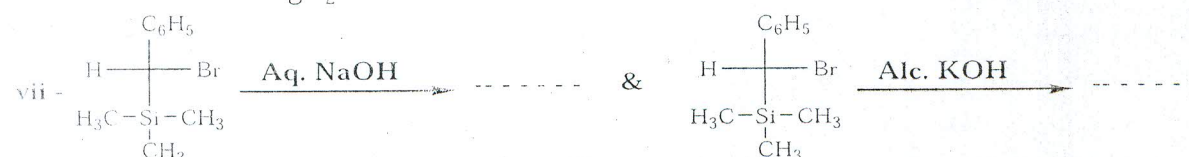
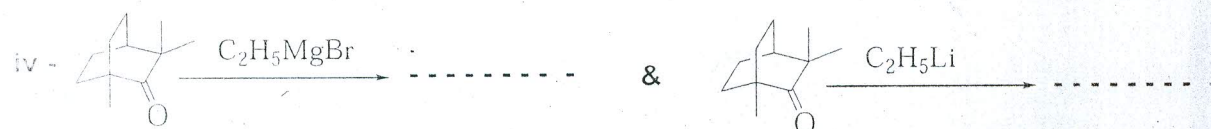
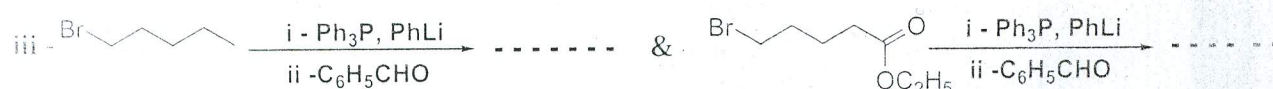
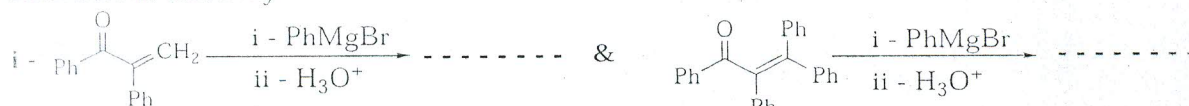


Metal type	Product A (%)	Product B (%)
Li	85	zero
MgBr	20	72
MgBr / Cu <sub>2</sub> Br <sub>2</sub>	70	20

C- Which one of the following two rhodium complexes [Rh = 45] is more stable. Why (3 Marks)



Q. 2: For each of the following reactions pair, complete, discuss the reaction mechanism and compare the difference in reactivity





المستوى الثالث : كيمياء ، كيمياء البترول (٢٣٣٥)

Mansoura University  
Faculty of Science  
Chemistry Department  
Subject: Organic Chemistry



First-Term Examination  
3<sup>rd</sup> Level Chemistry Students.  
Date : January 2012  
Time Allowed : Two hours

**Answer three only of the following questions:**

1. Discuss the following topics:-
  - a) Octane number of motor fuels, and show how it is affected by the fuel composition. (8 Marks)
  - b) The Polymerization process used for production of the highest grade octane number motor fuel (polymeric motor fuel). (8 Marks)
  - c) Diesel index of diesel fuel. (4 Marks)
2. Discuss each of the following topics:
  - a) Classification of crude petroleum. (5 Marks)
  - b) Deasphalting of lube oil stocks. (5 Marks)
  - c) Nitrogen compounds in petroleum. (5 Marks)
  - d) Specifications of the solvents used for extraction of aromatic hydrocarbons from petroleum distillates. (5 Marks)
3. Give a brief account on each of the following:
  - a) The structure and different classes of synthetic detergents. Give one example only for each class. (8 Marks)
  - b) The different methods used for refining crude oil distillates from mercaptans. (8 Marks)
  - c) Aniline point of petroleum distillates. (4 Marks)
4. Discuss the following items:
  - a) The different reactions involved in the catalytic reforming of straight-run gasoline. (8 Marks)
  - b) Flash point of petroleum distillates. (5 Marks)
  - c) The main differences between thermal and catalytic cracking. (7 Marks)

GOOD LUCK

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Prof.Dr. O.Habib

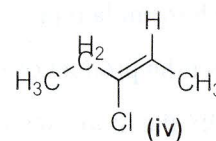
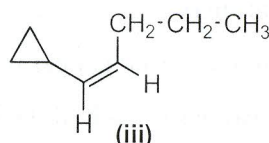
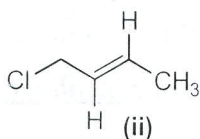
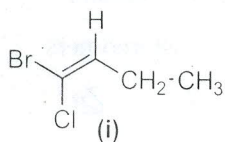
Mansoura University  
Faculty of Science  
Chemistry Department  
Subject: Chemistry  
Course: Stereochemistry (Chem. 334)



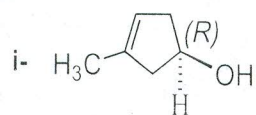
First Term  
3<sup>rd</sup> Level Chemistry students  
Date: Jan. 2012  
Time Allowed: 2 Hours  
Full Mark: 60 Marks

Answer **All** Questions, Each Question = **20** Marks

**Q. 1: A)** Tell whether the following compounds is (*Z*), (*E*), (*Cis*) or *Trans*: **(4 marks)**

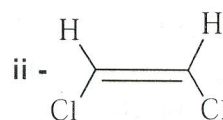


**B)** Write equations showing the stereochemistry of product(s) of the following reactions: **(10 marks)**



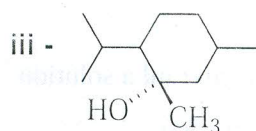
$\xrightarrow[\text{Pyridine}]{\text{SOCl}_2}$

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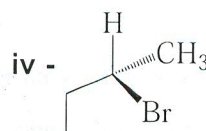
$\xrightarrow{\text{Br}_2, \text{CCl}_4}$

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$\xrightarrow{\text{HCl}, \text{H}_2\text{O}}$

-----



$\xrightarrow{\text{Alc. KOH}}$

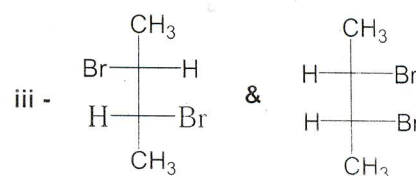
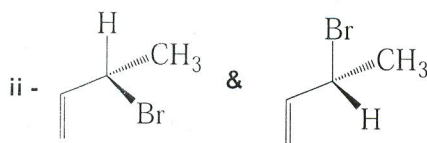
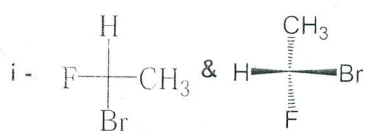
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**C)** For 1,2-dimethylcyclohexane: **(i)** Which stereoisomer exists in two equivalent chair conformations?

**(ii)** Draw the chair conformation of this stereoisomer.

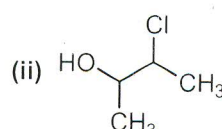
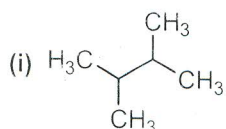
**(iii)** Draw the 1,2-dimethylcyclohexane stereoisomer that has two nonequivalent chair conformations, and specify which conformation is more stable. **(6 marks)**

**Q. 2: A)** Tell whether the two structures in each pair represent enantiomers, diastereomers or two molecules of the same compound in different orientations: **(6 marks)**



**B)** Show how you could synthesis *meso*-2,3-butandiol starting from *cis*-2-butene. Please do not forget to include the stereochemistry of the reaction. **(4 marks)**

**C)** Draw all conformational structures and sketch a potential energy diagram that occur showing in general the energy changes that arise from the free rotation of the  $\text{C}_2\text{-C}_3$  bond in each of the following compounds and indicate the most stable (preferred) conformation of: **(6 marks)**

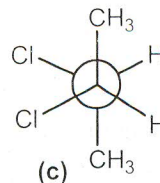
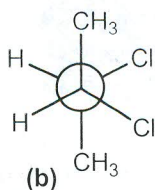
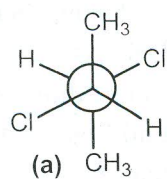


**D)** Monochlorination of (*S*)-1-chloro-2-methylbutane at  $\text{C}_2$  give a mixture of two isomeric products. Explain the reaction mechanism, with indicating the relation between these two products and their optical activity. **(4 Marks)**



Q. 3: A) Shown below are Newman projection formula of 2,3-dichlorobutane.

(12 marks)



i- Which formula is (R, R), (S, S) and (R, S).

ii- Which formula represent *meso* isomer.

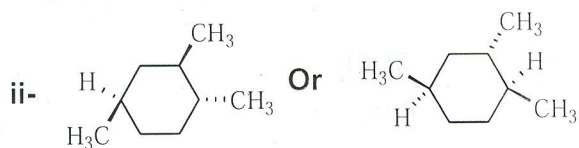
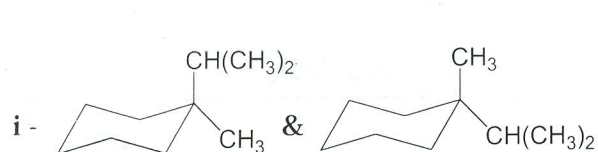
iii- Which formula represent enantiomers

iv- Which formula represent diastereomers

iv- Predict the product of reaction when each isomer was heated with alcoholic KOH & Zn.

B) Identify the more stable stereoisomer in each of the following pairs; give the reason of your choice

(4 Marks)



C) (S)-2-iodobutane has an  $[\alpha]_D$  at 24°C of +15.9. What is the observed rotation at 24°C of 1 gm / ml a solution in 10 cm sample tube of a mixture that is 25 % (R)- and 75 % (S)-2-iodobutane. (4 marks)

With my Best Wishes

Dr. Ebrahim Abdel-Galil

Mansoura University  
Faculty of Science  
Chemistry Department  
Chemistry 341  
Electrochemistry



Third Year Chem.  
January 2012  
Time Allowed: 2 hrs  
Full Mark: [60]  
Final Exam

Answer the following questions:

1-Complete the following:

[12 marks]

- Chemical cell is -----but concentration cell is-----
- Transport number is -----
- Decomposition potential is -----
- The equation used for reversible processes is the -----but the equation used for irreversible processes is the -----
- Overpotential is the difference between -----
- Concentration overpotential is due to -----

2- Write Briefly on:

- Concentration overpotential
- Electrodes used for pH determination

[9 marks]

[9 marks]

3- For the cell:  $\text{Cd}/\text{Cd}^{2+} (a = 1) \parallel \text{Cu}^{2+} (a = 1) / \text{Cu}$  at  $25^\circ\text{C}$ , knowing:  
 $\text{Cd}^{2+}/\text{Cd} = -0.403 \text{ V}$  and  $\text{Cu}^{2+}/\text{Cu} = 0.337 \text{ V}$

Write the electrode reactions, cell reaction and calculate  $E^\circ$ ,  $\Delta G^\circ$  and the equilibrium constant ( $K_{\text{eqm}}$ ) for the cell reaction at  $25^\circ\text{C}$

[10 marks]

4- Define the following:

[10 marks]

- Steps of hydrogen evolution
- Liquid junction potential
- Salt bridge
- Reversible and irreversible processes
- Exchange current

5- The following values of the emf of the cell:

[10 marks]

$\text{Ag}|\text{AgBr}_{(s)}, \text{KBr}, \text{Hg}_2\text{Br}_2|\text{Hg}$  at various temperatures is given as follows:

$t^\circ\text{C}$	25	30	35
$E, \text{V}$	0.07	0.08	0.09

write the electrode reactions, cell reaction and calculate: (i)  $\Delta G$  (ii)  $\Delta H$ , (iii)  $\Delta S$  for cell reaction at  $25^\circ\text{C}$ .

With Best Wishes  
Prof.Dr. Abd El\_Aziz S. Fouda





**ANSWER THE FOLLOWING QUESTIONS :**

1-

a ) Deduce the kinetic equation for the reaction  $A + B \longrightarrow P$  . [12 mark]

b ) Nitrogen oxide decomposes at 300K with a rate constant  $= 21 \text{ s}^{-1}$  , calculate :

I ) the time required for the concentration to drop from 0.16 to 0.10 mol l and to half-decomposed

II) the concentration after 4 minutes . [8 marks]

2-

a) Discuss the relation between the rate constant and the temperature. [10 marks]

b) The rate constant for the reaction of oxygen and benzene was  $1.44 \times 10^{-7}$  and  $3.03 \times 10^{-7} \text{ l mol}^{-1} \text{ s}^{-1}$  at 27 and 77 °C respectively what is the pre-exponential factor . [10 marks]

3-

a) Write the postulates of each: the transition state and the collision theories. [8 marks]

b ) Apply the steady state approximation to the kinetics of a chain reaction . [12 mark]

4-

Discuss two of the following :

I) effect of the ionic strength on the reaction rates . [10marks]

II) collision theory for unimolecular reactions . [10marks]

III) kinetics of the reaction  $A \longrightarrow B \longrightarrow C$  . [10marks]

BEST WISHES

Prof. Dr. H. M. Abu Elnader  
Prof. Dr. A. I. Ahmed