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# TANTA UNIVERSITY FACULTY OF SCIENCE

DEPARTMENT OF CHEMISTRY

FINAL EXAMINATION FOR ALL DOUBLE MAJOR THIRD LEVEL STUDENTS

COURSE TITLE:

(Coordination Chemistry)

COURSE CODE:

CH3246

DATE:

1,JUNE 2017

TERM: SECOND TOTAL ASSESSMENT MARKS

TIME ALLOWED: 2 HOURS

#### **Answer the following Questions:**

- 1-) For each complex define the following: (Total marks 20)
- 1-Name

2- The type of isomerism

3- The type of hybridization

4- Calculate the magnetic moment

I-)  $[Mn (H_2O)_6]Cl_2$ 

(5marks)

II-)  $K_2 \left[ Zn(CN)_4 \right]$ 

(5marks)

III-)  $K_2[Ni(NO_2)_4]$ 

(5marks)

IV-) Na<sub>3</sub>[Co Cl<sub>6</sub>]

(5marks)

- 2-)A -)Iron ion forms an inner diamagnetic complex ion containing the cyano ligand.

  Derive the formulae of the complex. (4marks)
- B-) Discuss the effect of central metal ion and its charge on  $\Delta_0$  value. (4marks)
- C-) Manganese (II) ion forms inner complex ion with cyano ligands. Calculate the magnetic moment value of the complex. (4marks)
- D-) Discuss the hydration isomerism with example. (3marks) (Total marks 15)
- 3-) A-) Wite full account on Jahn-Teller effect with examples (5marks)
- B-) What is the formula of the following complex: (2marks)
  Tetrammine copper (II) hexachloro copperate (II)
- C-) For the two complexes: 1-) Hexammine cobalt(III) chloride (8marks)
- 2-)Potassium hexacyano ferrate (II)
- a-)Draw the d- orbital splitting indicate the number of electrons in t<sub>2g</sub> and e<sub>g</sub>
- b-) Calculate the CFSE value and magnetic moment for each complex. (Total marks 15)

Note: (Atomic number for Mn 25, Fe 26, Co 27, Ni 28, Cu 29 & Zn 30)

Good Luck

Examiners: Prof. Dr: Kamal Elbaradie, Prof. Dr: Ekhlas Abd Elhay

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	TANTA UNIVERSITY FACULTY OF SCIENCE DEPARTMENT OF CHEMISTRY					
	Final Examination of for third year students (Double major)					
1965	COURSE TITLE		Organic Spectroscopy	COURSE CODE: CH3248		
DATE:	JUN. 2017	TERM: SECOND	TOTAL ASSESSMENT MARKS: 100	TIME ALLOWED: 2 HOURS		

Answer the following questions:

(100 marks) (Each question 20 marks)

1] a) Discuss the chemical shift of hydrogen attached directly to a  $\Pi$ - bonded carbon and give the relative order of downfield shift of:

Acetylenic, vinylic, aldehydic and aryl hydrogen compared to alkyl hydrogens.

- b) Is the  $\delta$  value of a given kind of hydrogen proton a constant value? Find the  $\delta$  value and the observed shift from TMS in HZ of a signal in a 100- MHZ instrument? That is 162 HZ in a 60-MHZ instrument.
- 2] a) Draw the <sup>1</sup>HNMR spectra with multiplicity, peak accounting and showing relative chemical shifts for the following structures:

i) p- CH<sub>3</sub>-C<sub>6</sub>H<sub>4</sub>-CH (CH<sub>3</sub>)<sub>2</sub>

ii) C<sub>6</sub>H<sub>5</sub>-O-CH<sub>2</sub>-CH<sub>2</sub>Cl

iii) o-CH<sub>3</sub>-O-C<sub>6</sub>H<sub>4</sub>-COOH

iv)  $CH \equiv C-CH_2-O-CH_3$ 

- b) Use <sup>1</sup>HNMR spectroscopy to distinguish between the following geometric isomers:
- i) Cis -stilbene and trans-stilbene.

ii) 
$$C = C CH_3$$
 and  $C = CCH_3$ 

- 3] a) 4-Heptanone shows two important characteristic peaks in its mass spectrum due to ions at m/e = 86 and m/e = 58. Explain the fragmentation pattern of the compound.
- b) How do you explain that m/e = 57 and m/e = 44 ions is formed in the mass spectrum of pentanal.
- c) Give the typical fragmentation pattern in n-propyl benzene.
- 4] Explain the following by using the mentioned spectroscopic methods:
- a) o-Nitroacetanilide is deep yellow but the p- nitroacetanilide is yellow (UV & IR).
- b) The ketonic and enolic forms of ethyl benzoyl acetate (UV, IR and <sup>1</sup>HNMR).

- c) Benzamide and acetamide (IR & HNMR).
- d) How will you distinguish between benzaldehyde and cinnamaldehyde (UV, IR and <sup>1</sup>HNMR).
- e) The effect of solvent on the absorption spectro of propanal and propanone (UV & IR).
- f) How could you distinguish between the following compounds; propanoic acid, propanoic unhydride and propanamide.
- 5] An organic compound with molecular formula C<sub>4</sub>H<sub>8</sub>O, having the following spectroscopic data:

UV:  $\lambda_{\text{max}}$  276(nm),  $\epsilon$  43 (n-hexane)

 $\lambda_{max}$  242(nm),  $\epsilon$  37 (ethyl alcohol)

IR: v in cm<sup>-1</sup> 1715 (s) and 2988(m) (solid phase).

<sup>1</sup>HNMR:  $\tau$  (tau) values in CDCl<sub>3</sub> and TMS as standard reference 7.52 (q), 7.88(s), 8.93(t), in the ratio 3:3:2 (J= 7.1 HZ).

Mass data:  $M^+ = 72$  (61 %); m/e = 57 (100%); m/e = 29 (41%) and a broad peak at m/e = 14.75 (2.1%).

Find out the structure of the above compound, and explain all the given spectroscopic data.

#### Good Luck

Prof. Dr. Mohamed A. El-Borai & Ass. Prof. Dr. Sahar El-khalafy

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Chemistry Department Faculty of Science Tanta University

## **Final Examination**

## For 3<sup>rd</sup> grade students (Double Major Students) May 2017, Spring semester

Course title:

**Natural Products** 

Course Code: CH3250

Exam time: 2 hours

Assessment Mark: 100 M

#### Answer ALL the following questions

#### Q1. Discuss briefly the following. (Total 28 marks, each point 7 marks)

- 1- Properties and uses of Ephedrine.
- 2- One synthetic method of Piperine.(use chemical equations ONLY to describe your answer)
- 3- Synthesis of Caffeine from Urea.(use chemical equations ONLY to describe your answer)
- 4- Synthesis of Cocaine. (use chemical equations ONLY to describe your answer)

#### Q2. Write shortly about the following.

#### (Total 28 marks, each point 7 marks)

- 1- Clinical significance, antioxidant activity, and synthesis of Vitamin E.
- 2- Synthesis of both Vitamin  $K_1$  and Vitamin  $K_3$  (use chemical equations ONLY to describe your answer).
- 3- The different chemical structures and the synthesis of Vitamin B<sub>6</sub>.
- 4- Synthesis of Vitamin C (Ascorbic acid).

### Q3. Answer the following points.

(Total 24 marks)

- a- Mark the following statements as <u>True or False</u>, <u>correcting</u> the false statement.
  - (10 marks, each point 2 marks)
- 1- Myrcene is cyclicmonoterpenoid with three conjugated double bonds, forming an adduct.
- 2- Formaldehyde, acetone, and ketodialdehyde arethe products of ozonolysis of ∞-Terpineol.
- 3- Hydration of Geraniol in the presence of sulphoric acid give Citral.
- 4- Geraniol is an optically active cyclic monoterpenoidalcohol.
- 5- The reduction of Citral in the presence of sodium ethoxide give Geraniol.
- b- Convert the following by using chemical equations. (14 marks, each point 7 marks)
  - 1- Pentane 1,3,5-tricarboxylic acid to Limonene
  - 2- P-Toluic acid to ∞-Terpineol.
- Q4. Complete the following equations by <u>chemical structures</u>, <u>naming</u> your answer. (Total <u>20 marks</u>, each point 5 marks)

1-	Cholesterol A	(i) dehydration	
		(ii) reduction	

2- Cholestanol A Oxidation / CrO<sub>3</sub>

Grignad reagent

/ methyl-magnesium iodide

3- Cholesteryl acetate A Complete Oxidation by Chromium trioxide

4-	Cholest-4-en-3-oneABPotassium permanganate	Reduction	
	/ KMnO <sub>4</sub>	Zn-Hg/HCl	
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Good Luck

Examiners: Prof. Dr. Mohamed Reda Berber, Prof. Dr. Yehia Hafez

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#### TANTA UNIVERSITY FACULTY OF SCIENCE DEPARTMENT OF CHEMISTRY **EXAMINATION FOR THIRD YEAR STUDENTS** MOLECULAR SPECTROSCOPY COURSE CODE: CH 3240 COURSE TITLE: TOTAL ASSESSMENT MARKS: 50 TIME ALLOWED: 2 HOURS TERM: SECOND TERM 25-5-2017 $(^{12}C = 19.93 \times 10^{-27} \text{ kg}; ^{16}O = 26.56 \times 10^{-27} \text{ kg}; \text{ speed of light} = 3x10^{10} \text{ cm sec}^{-1}; \text{ h} = 6.626 \text{ x}10^{-34} \text{ J sec})$ Question 1: Choose the correct answer and give the reasons for your choice (1) (2.5 Marks for each) 1. For nitrogen molecule, the degeneracy of the rotational energy level with J=3 is..... c) 6 2. Which of these molecules will show a pure rotational (microwave) spectrum: CH<sub>4</sub>, CH<sub>3</sub>Cl, CH<sub>2</sub>Cl<sub>2</sub>, CHCl<sub>3</sub>, CH<sub>2</sub>=CH<sub>2</sub>, benzene, SF<sub>6</sub>? **b)** CH<sub>4</sub>, SF<sub>6</sub>, CH<sub>3</sub>Cl & CH<sub>2</sub>=CH<sub>2</sub> a) CH<sub>3</sub>Cl, CH<sub>2</sub>Cl<sub>2</sub>, CHCl<sub>3</sub> d) All of them c) CH<sub>2</sub>Cl<sub>2</sub>, CH<sub>2</sub>=CH<sub>2</sub>, CH<sub>4</sub> & CH<sub>3</sub>Cl 3. A Raman spectrometer uses a He-Cd laser excitation source with a wavelength of 441.6 nm. Carbon tetrachloride produces a strong Raman shift at 460 cm<sup>-1</sup> due to the totally symmetric stretch, so, the wavelengths in nanometers of the Stokes and anti-Stokes lines are ..... b) 480.25 and 420.54 nm, respectively a) 450.78 and 432.81 nm, respectively c) 460.35 and 440.54 nm, respectively d) none of them 4. For transitions to be excited and observed in rotational spectroscopy, the following selection rules must be satisfied. **b)** $\Delta J = 0, \pm 1$ and $\Delta \mu = 0$ c) $\Delta J = \pm 1$ and $\Delta \mu = \pm 1$ a) $\Delta \mu \neq 0$ , $\Delta J = \pm 1$ 5. Which of the following transitions is usually observed in the absorption spectra of ketones, b) $n \rightarrow \pi^*$ c) $n \rightarrow \sigma^*$ d) $n \rightarrow \pi$ e) $\sigma \rightarrow \sigma^*$ a) $\sigma \rightarrow n$ Question 2: Answer the following; (1) 1. Sketch the potential energy function of a harmonic oscillator and indicate the energy levels. How the anharmonicity affect the vibrational spectra of diatomic molecules. 2. Calculate the number of normal modes of vibration for each: oxygen, acetylene, methane, benzene, and water. Explain your answer. 3. Differentiate between dispersive Infrared and Fourier Transform spectrometers. (Confirm your (5 Marks) answer by drawing). 4. Show by drawing how isotopic substitution affects the rotational spectra of hydrochloric acid. (3 Marks) 5. What advantages does Raman spectroscopy have compared to IR spectroscopy, for structural characterization and process monitoring? (4 Marks) Question 2: State true $(\sqrt{})$ or false $(\times)$ and give the reasons for your answer (11) (2.5 Marks for each) 1. Linear diatomic molecules are microwave active. 2. Methane absorbs IR radiations and it is Raman inactive.

3. A linear tri-atomic molecule AB2 shows only one Raman active mode of vibration.

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4.	Doppler	broadening occurs in solid state, and decreases with temperature.	( )		
5.	The abso	orption spectra of iodine in gaseous state give broad bands	( )		
6.	Sample c	cells and solvents are of less problems in Raman than IR spectrometer.	( )		
(11)	Questio	on 4: complete each of the following;			
1.	Generall	ly, the intensity of the spectral line is governed by,	,		
	however	r, the energy of transition is indicated by,			
2.	The spec	ctral band broadening is due to,			
3.	The sele	ection rules that must be satisfied in order to that an electronic transitions could be			
	observed	d in UV-Vis absorption spectra are,,	••		
4.	The vib	prational frequency of; C=N, C=C, C=O and C=S bonds decreases	following the		
	order	, and the force constant of; C-N, C=N and C=N bonds increases in the or	der		
(III)	Questio	on 5: Solve the following problem;	3 Marks)		
(111)					
	<sup>1</sup> H <sup>35</sup> Cl s	shows a strong absorption of infrared radiation at 2991 cm <sup>-1</sup> . By wi	hat factor do		
	vou ext	pect this frequency to be shifted if deuterium is substituted for hydrogeneous	rogen in this		
		le? The force constant is unaffected by this substitution.	C		
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		Good Luck			
Ex	aminers	Prof. Tarek A. Fayed			
		Dr. Marwa N. El-Nahass			