Mansoura University Faculty of Science Chemistry Department Subject: Quantum chemistry Course: Chem. 244		Second year Major Chemistry Students Time Allowed: 2 hours Full Mark: 80 Marks Date: May, 2015

Answer the following question:

Question One:

A: Define the following: **(20 marks)**

1. Stark effect
2. Quantum
3. Compton effect
4. Photon
5. Limitation of Bohr theory
6. Principle of angular momentum
7. Uses of Schrödinger equation
8. Zero point energy
9. Columbic force
10. Complex and Real functions

B: Drive Schrodinger wave eqn. And explain the conditions which must be satisfied for a wave function to be acceptable as a solution of Schrodinger eqn. ? **(10marks)**

C: Determine the Heisenberg uncertainty in momentum of an electron in a system, if the uncertainty in velocity is 10^{-5} . **(5marks)**

Question Two:

A: Calculate the first three energy value of: **(5marks)**

I. An electron move in one dimensional box of 2 A^{o} diameter.

B: Describe a function of a particle moves in a one dimensional box ? **(5marks)**

C: Explain graphically how emitted radiation from a heated body is dependent on it temperature. **(5marks)**

Question Three :

A: From Bohr calculation for hydrogen atom, the Balmer series $n_i=4$ and $n_f=3$,where $C=3x10^8\ ms^{-1}$ and $h=6.6x10^{-34}$ J.S. calculate the wave length. **(5marks)**

B: Explain briefly the following: When a photon colloid with a matter, the expected effect is highly dependent on the photon energy, explain (three cases). **(5marks)**

C: Deduce Line Spectra from Bohr Model for He atom (Z=2) **(5marks)**

Question Four:

A: Calculate the wave length and energy of a body with a mass 1 cm moving with a velocity 3 cm/ sec. **(5marks)**

B: Explain why the lowest energy level for $CH_3 = CH - CH = CH - CH= CH_2$ > $CH_2= C= CH - CH= CH- CH_3$. **(5marks)**

C: Deduce the operator form of Schrodinger equation?? **(5marks)**

With my best wishes

Dr/ Shady M. El-Dafrawy

Mansoura University Faculty of Science Chemistry Department Subject: Biochemistry	كلية العلوم جامعة المنصورة	Second Term مستوى ثانى كيمياء خاص ك ح ٢٧٩ Date : 20, May, 2015 Time Allowed: 2 hours Full Mark : 80 Marks

Answer The Following Questions

1. Show factors which affect enzymatic activities
[30 Marks]

2. Write about formol titration for amino acids, give equation and draw diagram.
[30 Marks]

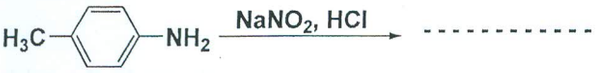
3. Give an account about fatty acids and β-oxidation. [20 Marks]

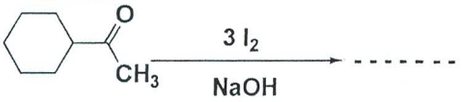
مع تحيات

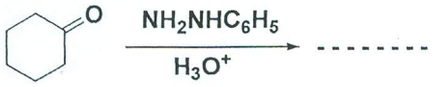
أ.د محمد عبد الحافظ الفار

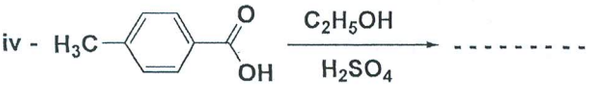
Mansoura University Faculty of Science Chemistry Department Subject: Chemistry Course(s): Chem.233 Physical Organic Chemistry II	Second Term 2nd Level Chemistry Students Date: May, 2015, 24 -5-2015 Time Allowed: 2 Hours Full Mark: **60** Marks

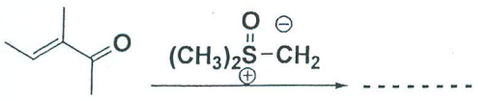
Q. 1 Give the structure of the product(s) for each of the following reactions. ***Please do not forget to*** **discuss** ***and draw out the reaction mechanism in each one.*** ***Choose 7 only*** **(21 Marks)**

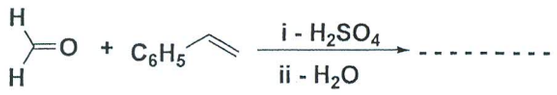
i - 

ii - 

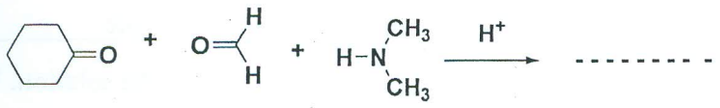
iii - 

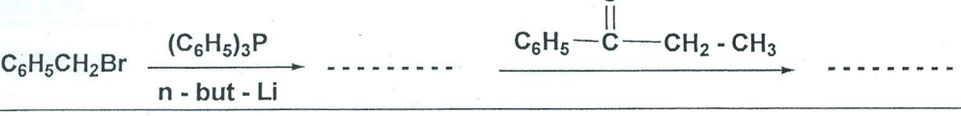
iv - 

v - 

vi - 

vii - 

viii - 

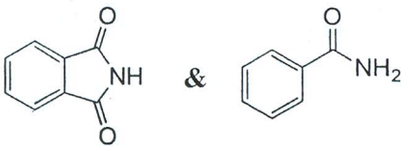
x - 

Q. 2 a) In each of the following pairs of compounds decide which member that fits the description.

Explain your answer ***Choose 4 only*** **(8 Marks)**

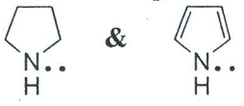
i-- More reactive toward nucleophilic addition

ii- Has lower PKb value

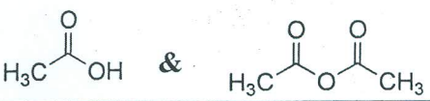


iii- More suitable for yilde synthesis with Ph_3P/Bu-Li

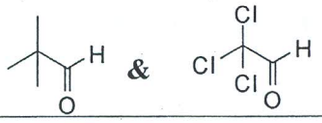
iv- Much stronger base



v- More reactive toward acyl substitution



vi- Form stable hydrate



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b) Compare the behavior of aniline and *N*-methylaniline toward benzenesulfonyl chloride (C_6H_5-SO_2-Cl) followed by treatment with KOH (aq) **(5 Marks)**

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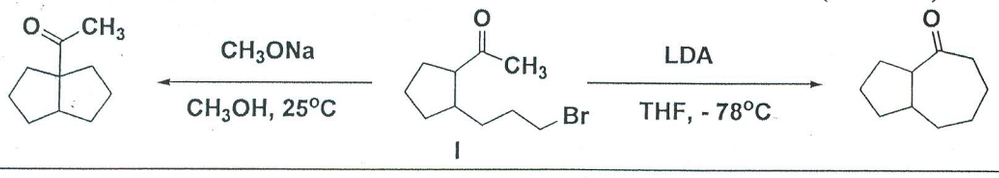
c) Explain why bromoketone **I** forms different bicyclic compounds under different basic reaction conditions **(6 Marks)**



Q. 3: Answer 4 only of the followings

a - For the Hydration reaction of aldehydes or ketones in acid medium, the results shown in the table are obtained: $R^1COR^2 + H_2O / H^+ \longrightarrow R^1C(OH)_2R^2$ **(5 Marks)**

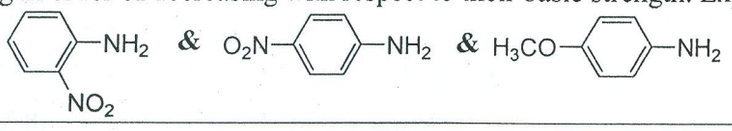
R^1	R^2	% conversion to product
H	H	99.96
CH_3	CH_3	0.14
CF_3	CF_3	80

i- Write the steps involved in the formation of the product

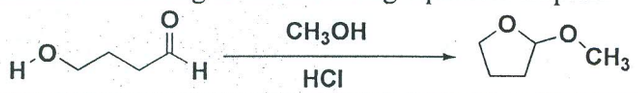
ii- Explain the difference in percent conversion of reactants to the product as shown in the table.

b) Assume that, an equimolar mixture of C_6H_5-CHO and C_6H_5-CO-CH_3 is treated with NaOH solution. Write equations for the possible combinations which may occur. **(5 Marks)**

c) Arrange the following in order of decreasing with respect to their basic strength. Explain. **(5Marks)**



d) When 4-hydroxybutanal is treated with methanol in the presence of an acid catalyst, 2-methoxytetrahydrofuran is formed according to the following equation. Explain **(5 Marks)**



e) In Cannizzaro reaction of benzaldehyde when treated with concentrated base (NaOH). When the reaction is carried out in D_2O, the alcohol that is isolated contains no deuterium bound to carbon. What does this suggest about the mechanism for the reaction? **(5 Marks)**

Examiners: Prof. Dr. Saad Elmorsy ***Dr. Eman Keshek***

Dr. Ebrahim Abdel-Galil ***Dr. Manal Elfedawy***

Mansoura University Faculty of Science Chemistry Department Subject : Chemistry Course(s):Chem (245) Physical Chemistry of liquids and solutions	كلية العلوم جامعة المنصورة	Second Term Second year Students Special Chemistry-level 2 Date : May 2015 Time Allowed : 2 hours Full Marks : 60 Marks

Answer the following questions :

1. a) Explain the partial molar volume , partial molar enthalpy and their methods of determination.

(10 marks)

b) At 303.15K calculate Δ G, Δ H and Δ S (per mole solution) for mixing

0.3 mole of pure benzene with 0.7 mole of pure toluene.(10 marks)

2. a) Write shortly on the different colligative properties of solutions and Van't Hoff factor ,derive one equation of the colligative properties and methods of determination of the molecular weight of the solute in solution.

(10 marks)

b) The boiling point of benzene is raised from its normal value 80.3 to 82.7°C by addition of 14 g of biphenyl $C_6H_5C_6H_5$ to 100 g of benzene . What are the boiling-point-elevation constant and the heat of vaporization of benzene according to these data.

(10 marks)

3. a) Explain the different applications of conductivity of electrolyte solutions.

(10 marks)

b)The specific conductance of 0.21×10^{-2} of acetic acid in 20°C is 5.3×10^{-4} Ohm^{-1} cm^2 mol^{-1}.The limiting conductance at infinite dilution of the hydrogen and acetate ions at the same temperature are 340 and 82 Ohm^{-1} cm^2 mol^{-1}, respectively .Calculate the dissociation constant of acetic acid.

(10 marks)

(R =0.0821 L atm K^{-1} , molecular weight of C =12 , H =1)

Mansoura University **Faculty of Science** **Chemistry Department** **Subject: Nuclear&** **Bonding Chemistry** **Course(s) :Chem. 222**	كلية العلوم جامعة المنصورة	**Second Term** **Second Year Chem.** **Date : May, 2015** **Time Allowed: 2 hours** **Full Mark : 60 Marks**

Answer the Following Questions (each question 15 marks)

Section (A): Nuclear chemistry

1.a) Complete the following nuclear reactions : **[3 Marks]**

i) $^{30}P \rightarrow {}^{30}_{14}Si + ...$

ii) $^{15}_{4}Be + {}^{4}_{2}He \rightarrow {}^{12}_{6}C + ...$

iii) $^{14}_{7}N + ... \rightarrow {}^{17}_{8}O + {}^{1}_{1}H$

b) Prove that 1½of radioactive elements given by 0.693/K where K the decay constant. **[4 Marks]**

c) $^{234}_{90}Th$ disintegrates to give $^{206}_{82}Pb$ as the final product. How many α and β particles are emitted during this process **[4 Marks]**

d) Explain the differences between chemical and nuclear reaction. **[4 Marks]**

2. a) Write briefly on : **[4 Marks]**

i) Isotopes (types and two methods of separating)

ii) Nuclear forces inside the nucleus

b) Calculate the energy liberated in the fusion reaction to produce 1 mole of helium from deuterium ($^{2}_{1}H = 2.014102$, $^{4}_{2}He = 4.002603$ amu) **[3 Marks]**

c) The radio activity of radioactive isotope falls to 12.5 % in 90 days. Calculate the t½ and K **[4 Marks]**

d) Explain the application of radiation isotopes in medicine and agriculture. **[4 Marks]**

Section (B):Bonding, Structures & Symmetry

QI-a) Show with drawing the difference between body centered cubic and hexagonal closest packing structures with examples. **[4 Marks]**

b) The structure of metal affects its mechanical properties such as malleability and ductility. Explain. **[4 Marks]**

c)*True and false (circulate the correct response and correct the false one)* **[7 Marks]**

i) T – F The S^{2-} ion is tetrahedrally sited.

ii) T – F Wurtzite and zinc blende are polymorphs of ZnS.

iii) T – F bcc structure is more efficient at filling the space than ccp.

Please turn over→

iv) T – F In NaCl, the radius ratio is 0.255 with bcc structure.

v) T– F Pb, Sr, Au have hexagonal close packing with coordination number 12.

vi) T – F $[Co(NH_3)_6$ adopts antiflourite structure while $K_2[PtCl_6]$ has fluorite one.

vii) T – F Intrinsic semiconductor are basically insulators.

QII: ***Choose the appreciate answer for the following:-*** **[15 Marks]**

1) Which statement is *incorrect* about a cubic close-packed lattice?

i) The packing is more efficient than in a body-centered cubic lattice.

ii) The lattice contains both tetrahedral and octahedral holes.

iii) Layers of close-packed atoms are stacked in an ABABAB... pattern.

2) The coordination number of spheres in NiAs, simple hexagonal close-packed is with .....atoms occupying the .....sites between all..... layers of ..... atoms.

i) 6:6, As,Ni. ii) 6:3, Ni,As. iii) 6:6, Ni, As. iv) 8:4, Ni, As.

3) The behavior of metals and semiconductors is usually discussed in terms of band theory. Which statement is *not true*?

i) A partially filled band is characteristic of a metal.

ii) Doping Si with As enhances its semiconducting properties.

iii) Band gaps vary among different semiconductors but are always relatively large.

4) An example of a compound that crystallizes with a layer structure is:

i) CdI_2. ii) CaF_2. iii) ZnS. iv)SnO_2

5) Na_2S crystallizes with antifluorite structure. Which statement is *true* about this structure?

i) The coordination number of each S^{2-} centre is 8.

ii) Each Na^+ ion is within a cubic arrangement of S^{2-} ions.

iii) The structure is based on an CaF_2 structure, with Na^+ ions in Na_2S occupying the same sites as Ca^{2+} ions in CaF_2.

6) Which statement is *correct* about rutile (TiO_2) structure?

i) It has the coordination number 6:3. ii) The structure is distorted bcc.

ii) Radius ratio is between 0.41&0.73. iv) all the above.

7) Diamond has essentially the same structure as.....

i) CsCl. ii) Zinc blende. iii) NaCl.

8) The attractive forces between metal ions and delocalized electrons can be made weaker only at.....

i) high T. ii) low T. iii) low P.

9) CsCl has a.....structure with r^+/r^- equals.....

i) ccp, 0.45. ii) fcc,.42. iii)hcp, 0.55 iv)bcc, 0.93.

10) Superconductors are.....

i) paramagnetic. ii)diamagnetic. iii) none of the above.

With Best Wishes

Prof.Dr.G.Abu El-Reash & Dr.O.El-Gammal

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v) T– F Pb, Sr, Au have hexagonal close packing with coordination number 12.

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With Best Wishes

Prof.Dr.G.Abu El-Reash & Dr.O.El-Gammal

Mansoura University Faculty of Science Chemistry Department Subject: Chemistry Course: Chem. 234. ***Organic Spectroscopy***		Second Term 2rd Level : Chemistry program Date: 07 June. 2015 Time Allowed: 2 hrs Full Mark: **80** Marks

Answer All Questions;

Question 1: ***Select the correct answer*** **(30 Mark)**

1. ***Which of the following isomeric dibromopropanes has only a single peak in its proton NMR spectrum?***
   A) 1,1-dibromopropane
   B) 1,3-dibromopropane
   C) 1,2-dibromopropane
   D) 2,2-dibromopropane

---

2. ***How many different types (sets) of hydrogens are there in 2,2-dimethylpentane?***
   A) 2 B) 3 C) 4 D) 5

---

3. ***Which of the following gives the furthest downfield shift from TMS in its proton ^{1}H-NMR spectrum?***
   A) $(CH_3)_4C$ B) $(CH_3)_3N$ C) $(CH_3)_2O$ D) CH_3F

---

4. ***What is the splitting type of the indicated methylene hydrogens in the ^{1}H-NMR of the following compound?*** $CH_3CH_2OCH_2\underline{CH_2}OCH_2CH_3$
   A) singlet B) doublet C) triplet D) quartet

---

5. ***The proton NMR of 1,1-dibromoethane would appear as a***
   A) downfield doublet and upfield quartet.
   B) downfield quartet and upfield doublet.
   C) downfield doublet and upfield triplet.
   D) downfield triplet and upfield doublet.

---

6. ***^{1}H-NMR spectrum of a compound, $C_3H_6Cl_2$ has a pentet at δ 2.19 and atriplet at δ 3.72 in a 1:2 ratio, respectively. Which compound below best matches the data?***
   A) 1,1- Dichloropropane
   B) 1,3- Dichloropropane
   C) 1,2- Dichloropropane
   D) 2,2- Dichloropropane

---

7. ***In infrared spectroscopy, absorption of electromagnetic radiation results in transitions between ..... energy levels.***
   A) Vibrational B) Electronic C) Rotational D) Nuclear

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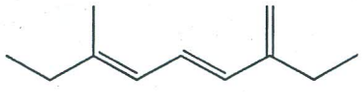
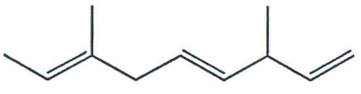
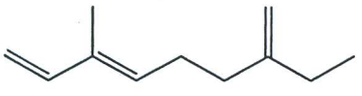
8. ***Which one of the following has a λ_{max} in its UV-visible spectrum with the longest wavelength?***

A) 

B) 

C) 

D) 

9) Which compound would be expected to show intense IR absorption at 2230 cm-1?

A) $(CH_3)_2CHCN$ B) $CH_3CH_2CH_2COOH$

C) $CH_3CH_2CH_2CONH_2$ D) $(CH_3)_2CHCH_2OH$

---

10) Which compound would be expected to show intense IR absorption at 3367, 3282 cm-1?

A) but-1-ene B) $CH3OCH_2CH3$ C) PhCOOH D) $PhCH_2NH_2$

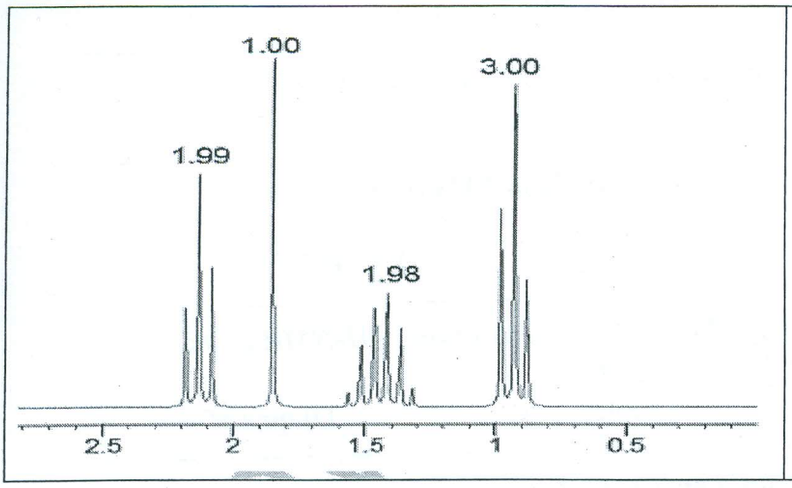
---

11)Which of the following has a C-H stretch that occurs at the highest stretching frequency?

A) hex-1-ene B) hexane C) hex-2-yne D) hex-1-yne

---

12. Which of the following C_5H_8 compounds best fits the proton NMR spectrum shown below?



A) 1-Pentyne

B) 1-Butyne

C) Cyclopentene

D) 1-Methyl cyclobutene

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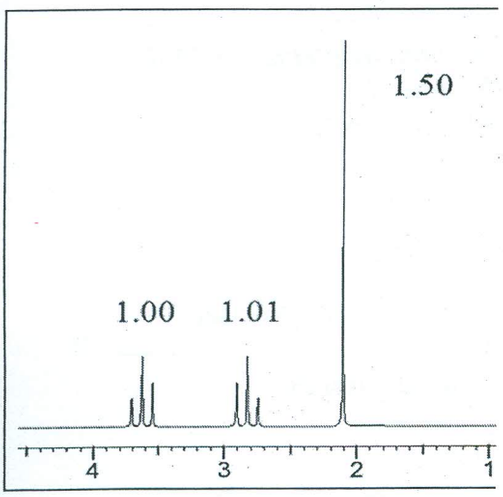
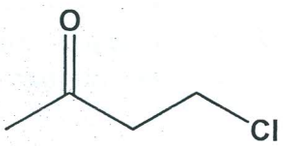
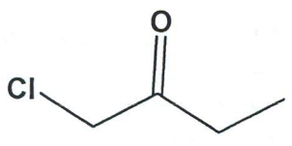
13. Which of the following C_4H_7OCl compounds best fits the proton NMR spectrum shown below?



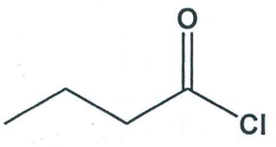
A)



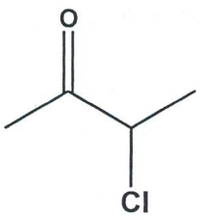
B)



C)



D)



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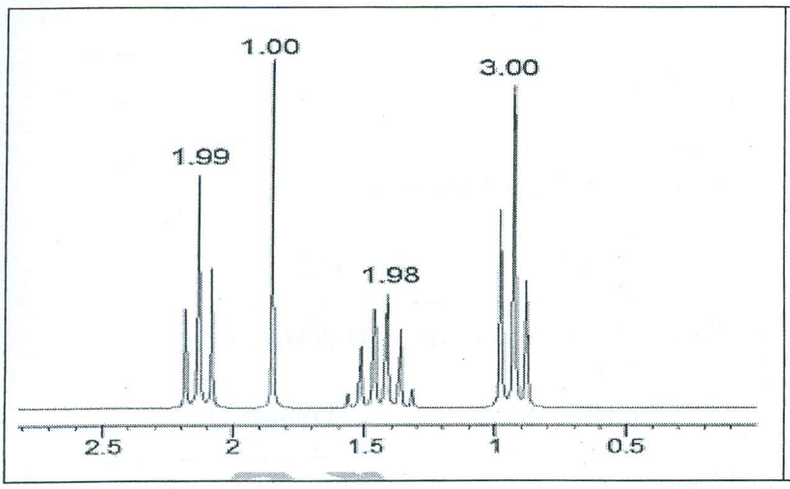
---

12. Which of the following C_5H_8 compounds best fits the proton NMR spectrum shown below?



A) 1-Pentyne

B) 1-Butyne

C) Cyclopentene

D) 1-Methyl cyclobutene

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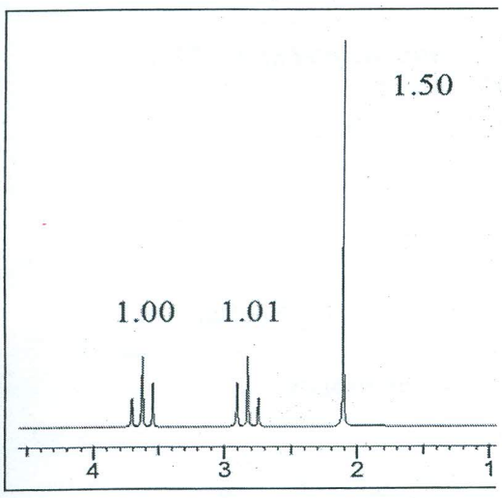
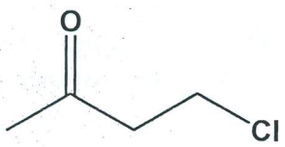
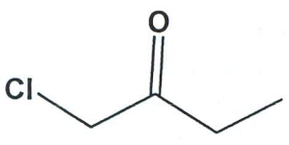
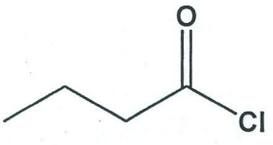
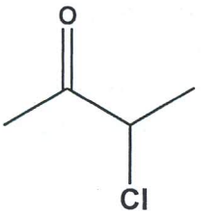
13. Which of the following C_4H_7OCl compounds best fits the proton NMR spectrum shown below?



A) 

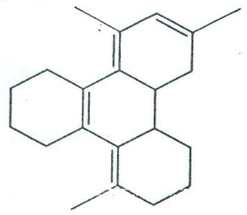
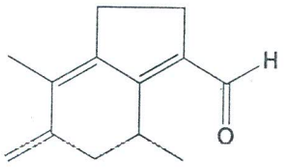
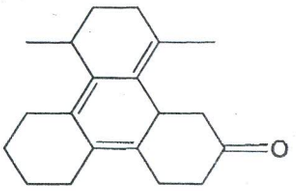
B) 

C) 

D) 

Question 2: **(15 Mark)**

Use the Woodward-Fieser rules to predict the expected λ_{max} for the following compounds:

1)	2)	3)
		

Question 3: **(15 Mark)**

Give a structure consistent with each of the following sets of spectral data:

a; $C_6H_{10}O$ " IR (Cm^{-1}) ν = 3000 , 1700, 1606 Cm^{-1} "
^{1}H-NMR δ = 1.83 (singlet, 3H) & 2.27 (singlet , 6H) & 6.15 (singlet, 1H).

b; $C_5H_9BrO_2$
^{1}H-NMR δ(ppm) : 1.20 (triplet, 3H) , 2.90 (triplet , 2H), 3.90 (triplet, 2H) and 4.2 (quartet, 2H).

c; C_5H_8O " IR (Cm^{-1}) ν = 3600 , 3300, 2215 Cm^{-1} "
^{1}H-NMR δ = 1.43 (singlet, 6H) & 2.20 (singlet , 1H) & 2.90 (singlet, broad 1H).

Question 4: **(20 Mark)**

Write what you know about :

A) Spin-Spin coupling.
B) The role of inductive effect in the value of λ_{max} and (δ) values.
C) Tetramethylsilane (TMS) is consider a good reference in 1H-NMR spectrum Why?
D) Rank with discussion the following bonds in order of increasing stretching frequency (cm^{-1}) in IR spectroscopy.

N—H , C—H , C≡N , C=N

With My Best Wishes
Prof. Dr. El-Sayed I. El-Desoky