Mansoura University		Second Term
Faculty of Science		2nd Level Chem. Students
Chemistry Department		Date: 29 / 5 / 2013
Subject: Chemistry		Time Allowed: **2** Hours
Course(s): Chem.233 Physical Organic Chemistry II		Full Mark: **60** Marks

Answer All Questions

1- Propose mechanisms for the following reactions: [20 Marks]

a)
$$\text{cyclopentanone} \xrightarrow{(CH_3)_2NH,\ H^+} \text{1-(dimethylamino)cyclopentene}$$

b) $CH_3COOH + CH_3NH_2 \xrightarrow{DCC} CH_3CONHCH_3$

c)
$$\text{PhCHO} \xrightarrow[CH_3COONa]{(CH_3CO)_2O} \text{Ph–CH=CHCOOH}$$

d)
$$\text{PhCH_2Br} \xrightarrow[2)\ (CH_3)_2CO]{1)\ Ph_3P,\ PhLi} \text{Ph–CH=C(CH_3)_2}$$

e)
$$\text{cyclopentanol} + (CH_3CO)_2O \longrightarrow \text{cyclopentyl-OCOCH_3}$$

f) $Ph\overset{O}{C}OEt \xrightarrow[2)\ H_3O^+]{1)\ 2PhMgBr} \underset{Ph}{\overset{OH}{Ph–C–Ph}}$

g)
$$\text{2,6-heptanedione} \xrightarrow{dil\ NaOH} \text{1-(2-methylcyclopent-1-enyl)ethanone}$$

h) $C_6H_5CHO \xrightarrow{\overset{\ominus}{C}H_2\overset{\oplus}{S}(CH_3)_2} C_6H_5\text{–epoxide}$
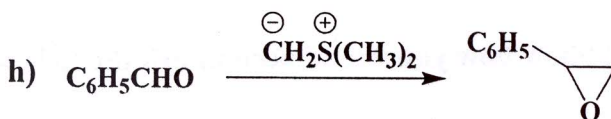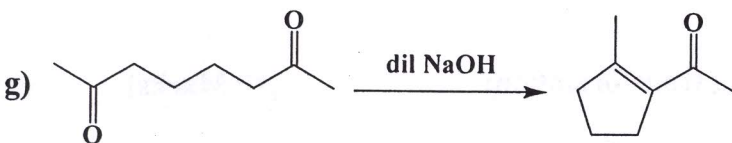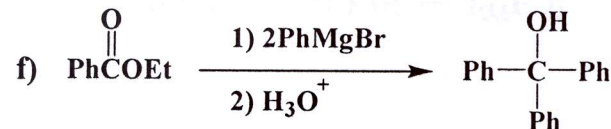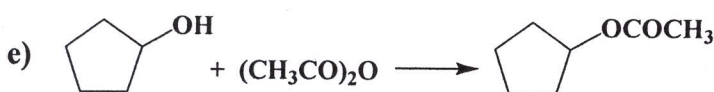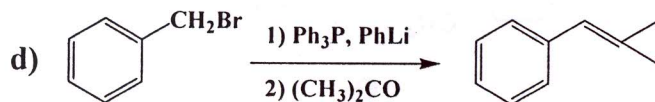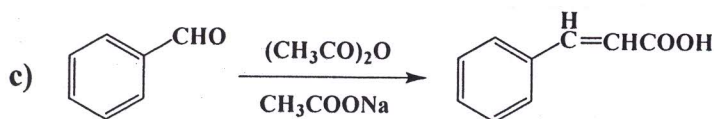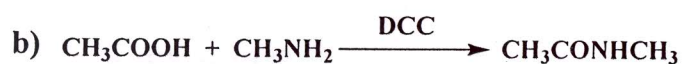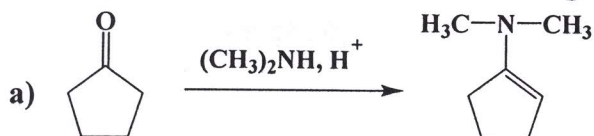
2- Complete the following equations and write the reaction mechanism to explain your answer: [20 Marks]

a)
$$\text{propiophenone} \xrightarrow[2)\ KOH]{1)\ NH_2NH_2,\ H^+} \text{..........................}$$

b)
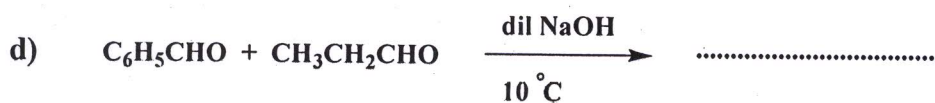$$\text{2-aminopentane} \xrightarrow[H_2O]{NaNO_2\ /\ HCl} \text{..........................}$$

c)
$$\text{2-(3-oxobutyl)benzaldehyde} \xrightarrow{alc.\ KCN} \text{..........................}$$

d) $C_6H_5CHO + CH_3CH_2CHO \xrightarrow[10\ ^\circ C]{dil\ NaOH} \text{..........................}$

e) $\text{2,4,6-trimethylbenzoic acid (H_3C–, –COOH, CH_3, CH_3)} + SOCl_2 \longrightarrow \text{..........................}$
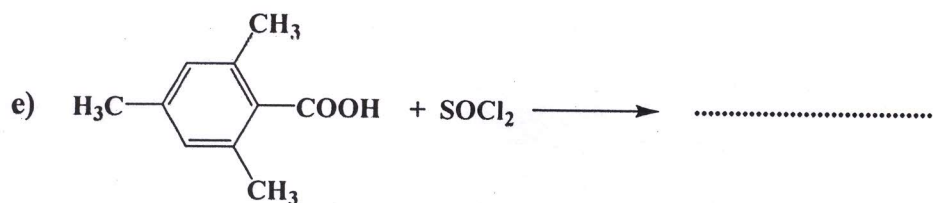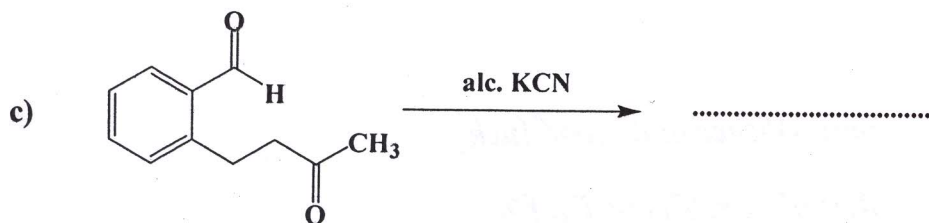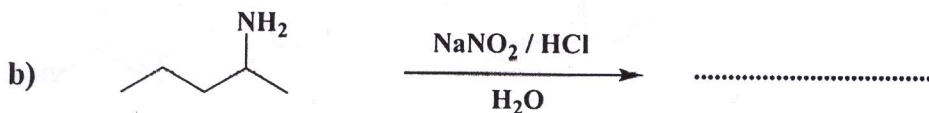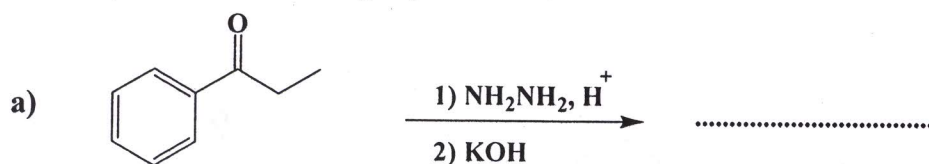
P. T. O.

3- a) Arrange the following in order of decreasing with respect to their basic strength. Explain

[4 Marks]

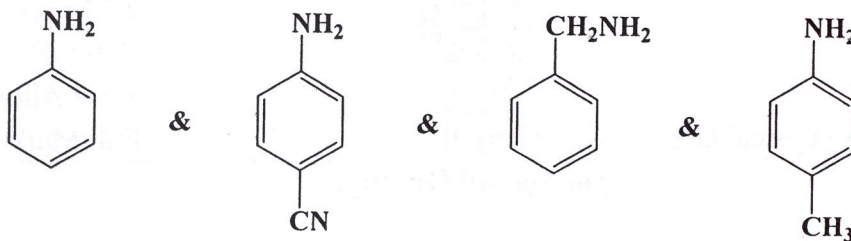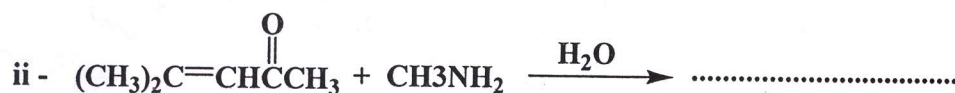NH_2 (aniline) & NH_2 / CN (4-aminobenzonitrile) & CH_2NH_2 (benzylamine) & NH_2 / CH_3 (4-methylaniline)

b) Predict the major product(s) for the following reactions: [6 Marks]

i -

1) Excess CH_3I
2) Ag_2O, H_2O
3) Heat

....

ii - $(CH_3)_2C{=}CHCCH_3$ + CH3NH$_2$ $\xrightarrow{H_2O}$ ....

(with C=O on the carbonyl carbon)
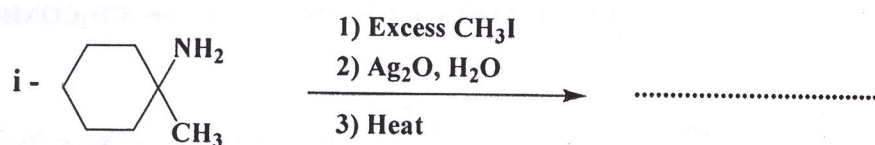
c) Show how you would accomplish the following transformation: [10 Marks]

i -

ii -

iii -
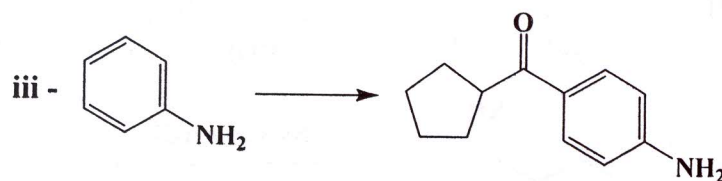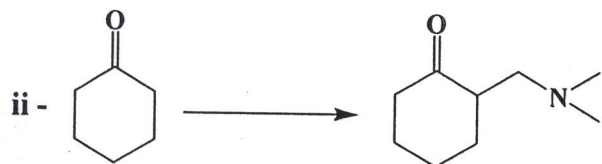
Best Wishes and Good luck

A.Prof. Dr. Eman KeshK

1. **Answer the following questions:**

   (a) Prove that $t_{1/2}$ of a radioactive element is given by 0.693/k, where k is the decay constant. **(5 Marks)**

   (b) The radioactivity of a radioactive isotope falls to 12.5% in 90 days. Calculate the $t_{1/2}$ and **k** of the radioisotope. **(5 Marks)**

   (c) Complete the following: **(5 Marks)**
   (i) $_7N^{14} + \text{———} \rightarrow {_8}O^{17} + {_1}H^1$
   (ii) $_{15}P^{30} \rightarrow {_{14}}Si^{30} + \text{———}$
   (iii) $_4Be^4 + {_2}He^4 \rightarrow {_6}C^{12} + \text{———}$

2. **Answer the following questions:**

   (a) One gram of $_{79}Au^{198}$ ($t_{1/2}$ = 65 hrs) decays by β emission to produce stable Hg.
   (i) Write the nuclear reaction for the process.
   (ii) How much Hg will be present after 260 hrs? **(4 Marks)**

   (b) What is nuclear reaction and how are they classified? **(3 Marks)**

   (c) I and I¯ have the same nuclear reactions. Why? **(4 Marks)**

   (d) The nuclear stability related to packing fraction and n/p ratio. Comment. **(4 Marks)**

3. **Answer the following questions:**

   (a) A solid is found to have an energy band gap (Eg) of 3 eV. What is the colour of this solid in transmitted sunlight?
   (Planck's constant = 6.626×10^{-34} m^{2}kg/s   Speed of light = 299 m/s
   Violet wavelength 400 - 450 nm,   Green wavelength 520 - 570 nm, Yellow wavelength 570 – 590 nm) **(4 Marks)**

   (b) Account for the conductivity of (a) Na (metallic) and (b) Mg (metallic) on the basis of appropriate energy diagrams. **(4 Marks)**

   (c) How do you expect the conductivity to vary in a metallic conductor with increasing temperature? (Explain your answer.) **(4 Marks)**

   (d) Predict three (3) properties of a chemical compound formed upon reaction of two (2) elements with each other whose difference in relative electronegativity is very low. **(3 Marks)**

4. **Answer the following questions:**

    (a) Compare between $MgAl_2O_4$ and Fe_3O_4.   (3 Marks)

    (b) Determine the packing efficiency of body centered cubic systems.   (3 Marks)

    (c) Explain the rock salt structure by two (2) different ways.   (3 Marks)

    (d) Choose the correct answer: (6 Marks)

(i) A chemical analysis indicates that a silicon crystal weighing 100 g contains 28 mg of boron. Is this crystal

    (a) n-type   (b) p-type   (c) insulator   (d) none

(ii) Electron sea exists in

    (a) Polar bonds   (b) Ionic bond   (c) Covalent bond   (d) Metallic bond

(iii) Repeatable entity of a crystal structure is known as

    (a) Crystal   (b) Lattice   (c) Unit cell   (d) Miller indices

(iv) Coordination number for a metal closest packed crystal structure

    (a) 6   (b) 12   (c) 8   (d) 4

(v) Miller indices showing the close-packing plane in cubic crystal

    (a) (100)   (b) (110)   (c) (111)   (d) None

(vi) Sheet silicate structures consists of the following group

    (a) SiO_4^{4-} (b) $Si_2O_5^{2-}$ (c) $Si_2O_7^{6-}$ (d) SiO_4^{4-}

Very Best Wishes

Prof. Dr. Gaber Abu-El-Reash   Dr. Ahmed Lutfi

Mansoura University Faculty of Science Chemistry Department Subject: Quantum chemistry Course: Chem. 244		Second Semester Second year Major Chemistry Students Time Allowed:2 hours Full Mark: 80 Marks Date: Jun, 2013

Answer the following question:

Question one: **(6 mark)**

1. Bohr theory succeeded in explain …., but not explain…….

2. Zeeman effect …………………………………………………………

3. Stark effect……………………………………………………………

Question two: Explain the relation between the kinetic energy of the emitted photoelectrons and the frequency of the incident radiation in Einstein's experiment.   **(6mark)**

Question three: Calculate the first three energy value of: **(12 mark)**

a) An electron move in one dimensional box of 2 A° diameter.

b) An 10 gm particle moving in a box of 10cm, Where m (of electron) $= 9.1 \times 10^{-31}$ kg , h= 6.625×10^{-34} J.s, Comment on the quantum character of the results obtained.

Question four: From Einstein experiment, a bulb emits light of wave length300nm. this light strikes a metal which has a work function of 2.13 ev. Calculate

1) The energy of the emitted photon.   **(6mark)**

2) The kinetic energy of the emitted photon. Where h=6.625×10^{-34} , mass= 9.1×10^{-31} kg, C =3×10^8 .   **(6mark)**

1

Question five: Explain the Heisenberg uncertainty principal from quantum mechanics postulate point of view. (5 mark)

Question six: Explain briefly the following: (20mark)

a) Two operator do commute with each other.

b) The function which describe a quantum mechanical system should be well behaved.

c) The function in mechanical quantum system is Orthogonal.

d) The $A^\wedge$ operator is Hermation.

e) The $A^\wedge$ operator is linear.

f) The two function ψ_1, ψ_2 is degenerate.

Question seven: Explain graphically how emitted radiation from a heated body is dependent on its temperature. (5 mark)

Question eight: When a photon colloid with a matter, the expected effect is highly dependent on the photon energy, explain (three cases). (5mark)

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

Question ten: Calculate the lowest energy level benzene. (4mark)

Mansoura University Faculty of Science Chemistry Department Subject : Chemistry Course(s):No.(245) Physical Chemistry of liquids and solutions		Second Term Second year Students Special Chemistry-level 2 Date : June 2013 Time Allowed : 2 hours Full Marks : 60 Marks

Answer the following questions :

1.a) Explain the partial molar quantities and their methods of estimation .
(10 marks)

b) Calculate ΔG , ΔH and ΔS (per mole solution) at $28^{o}C$ for mixing 2.3 mole of pure benzene with 3.5 mole of pure toulene.
(10 marks)

2. a) Write on the Gibbs-Duhem equation and Van't Hoff factor and their use in solution Chemistry.   (10 marks)

b) The specific conductance of 0.31×10^{-2} M of acetic acid at $19^{o}C$ is 5.2×10^{-4} Ohm^{-1} cm^{-1}.The mobilities of hydrogen and acetate ions at the same temperature are 310 and 77 Ohm^{-1} cm^{2} mol^{-1}, respectively .Calculate the dissociation constant of acetic acid.   (10 marks)

3. a) Explain the different applications of conductance measurements of electrolyte solutions in Chemistry.   (10 marks)

b) The vapour pressure of chloroform ($CHCl_3$) and carbon tetrachloride (CCl_4) at $30^{o}C$ are 201.2 and 116.7 mm Hg , respectively .Assuming ideal mixture ,what are(a) the total vapour pressure and (b) the mass percentage of $CHCl_3$ in the vapour equilibrium with a liquid mixture containing 1 mole of each liquid.
(10 marks)

(R =8.31 J K^{-1} mol^{-1}, molecular weight of H=1 ,C =12 and Cl=35.5)

With best wishes; Prof.Dr.Esam Gomaa

دور مايو ٢٠١٣		الشعب: ك+ك.حيوي +ميكروبيولوجي+ك/نبات+
الزمن: ساعتان		ك/حيوان+جيولوجيا+علوم البيئة.
التاريخ: ٢٠١٣/٠٦/١٦	كلية العلوم – قسم الرياضيات	المادة: رياضيات بحتة – ر ٢٠١

<u>أجب على الأسئلة الآتية</u> : [٢٠ درجة لكل سؤال]

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[1]أ. ابحث اتصال الدالة :
$$F(x,y)=\begin{cases} \dfrac{2xy}{x^2+y^2} & ; \ (x,y)\neq (0,0) \\ 0 & ; \ (x,y)=(0,0) \end{cases}$$
، وذلك عند النقطة (0,0) .

[١٠ درجات]

ب. إذا كانت $z = \sin^{-1}\left(\dfrac{x^4+y^4}{5x-3y}\right)$ فاثبت أن $x\dfrac{\partial z}{\partial x} + y\dfrac{\partial z}{\partial y} = 3\tan z$.

[١٠ درجات]

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[2] اذكر بدون برهان نظرية "جرين". حقق نظرية "جرين" بحساب كلا الطرفين لمعادلة "جرين" بالنسبة للتكامل :
$$\oint_{c} (x^2 - 6xy)\, dx + (y^2 + 2x^2)\, dy$$

حيث c هو المثلث المحيط بالمنطقة R المحدودة بالمستقيمات: $y=0$ ، $x+y=0$ ، $x=0$ مأخوذا في الاتجاه ضد عقارب الساعة.

[٢٠ درجة]

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[٣] أ. اوجد قيمة التكامل $\iint\limits_{R}(x^2+y^2)\, dx\, dy$ حيث R هي المنطقة الواقعة في الربع الأول للمستوى والمحصورة بين الدائرتين : $x^2+y^2=1$, $x^2+y^2=9$.

[١٠ درجات]

ب. حل مسألة الشروط الإبتدائية :

$(\cos y + 2x\sin y - 4)dx + (x^2\cos y - x\sin y)dy = 0$; $y(1)=0$

[١٠ درجات]

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[٤] اوجد الحل العام لكل من المعادلات التفاضلية الآتيــة :

(i) $(x^2+xy+3y^2)\, dx = (x^2+2xy)dy$

[١٠ درجات]

(ii) $dx - (3\cos^2 y + x\tan y)dy = 0$

[١٠ درجات]

مع التمنيات بالتوفيق ﻬ

Mansoura University		Second Term
Faculty of Science		2rd Level :
Chemistry Department		Chemistry program
Subject: Chemistry		Date: 19 June. 2013
Course: Chem. 234		Time Allowed: 2 hrs
Organic Spectroscopy		Full Mark: 80 Marks

Answer All Questions;

Question 1:   Select the correct answer.   (20 Marks)

1) Which of the following molecules would have the highest frequency carbonyl stretching:
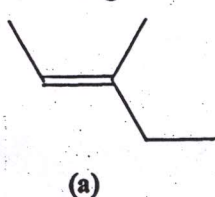a; acetamde   b; acetic acid   c; acetyl chloride   d; acetyl bromide

2) Which of the following compounds has the highest λ_{max} value:

   (a)   (b)   (c)   (d)
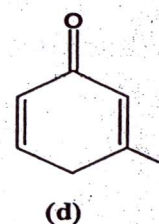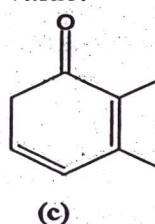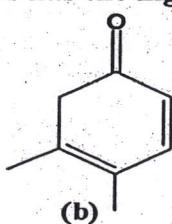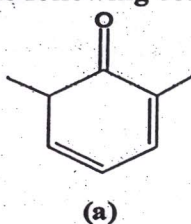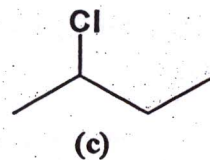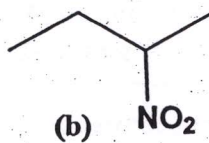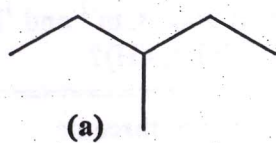
3) Which of the following hydrocarbons gives the lowest field ^{1}H NMR signal:
a; Cyclohexane   b; 1-Butyne;   c; Benzene   d; 1,4-Cyclohexadiene

4) Which of the following structures displays an infrared signal at 1622 cm-1?

      (a)   (b)   (c)   (d)
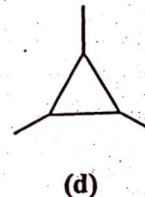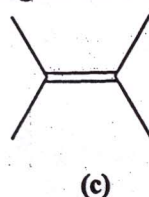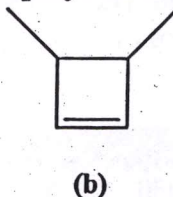
5) Which of the following gives four types of ^{1}H NMR signals:

All of them

   (a)   (b) NO$_2$ (c)   (d)

6) Which of the following compounds has the MOST deshielded protons:
   a; CH$_3$Cl   b; CH$_3$I   c; CH$_3$Br   d; CH$_4$

7) Absorption of what type of electromagnetic radiation results in the transition among allowed vibrational motions?
   a; Radio waves.   b; Microwaves.   c; Infrared.   d; Ultraviolet.

8) An unknown compound shows in its 1H NMR spectrum two singlet signals at δ 1.4 and 3.9 ppm with the ratio 6:4 Which of the following is the most likely formula of this compound?

   (a)   (b)   (c)   (d)
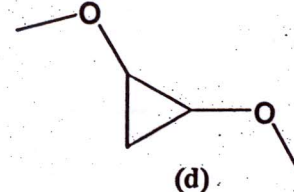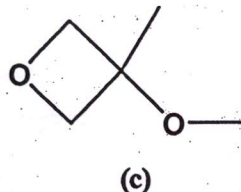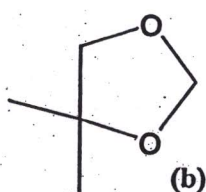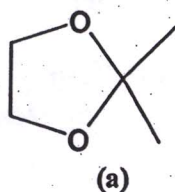
I) Use the *Woodward-Fieser* rules to predict the expected λ_{max} for the following compounds:

(1)

(2)

CHO

H_3C

CH_3

(3)
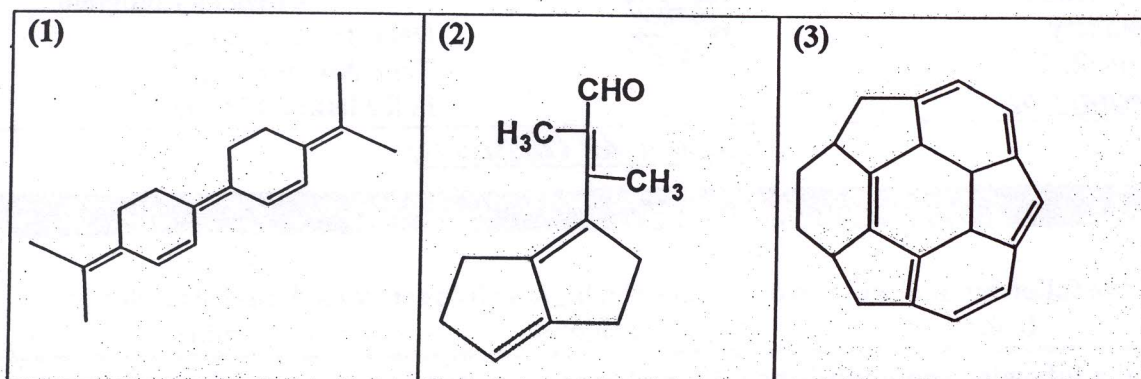
II) Explain, by using the chemical and physical techniques, how you can follow up the following sketch?

Cl

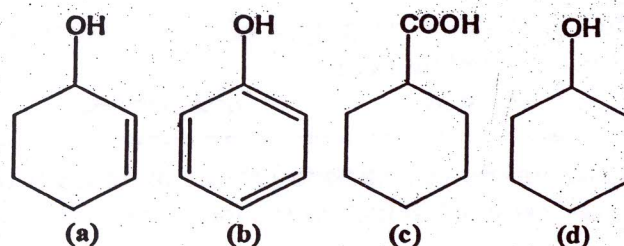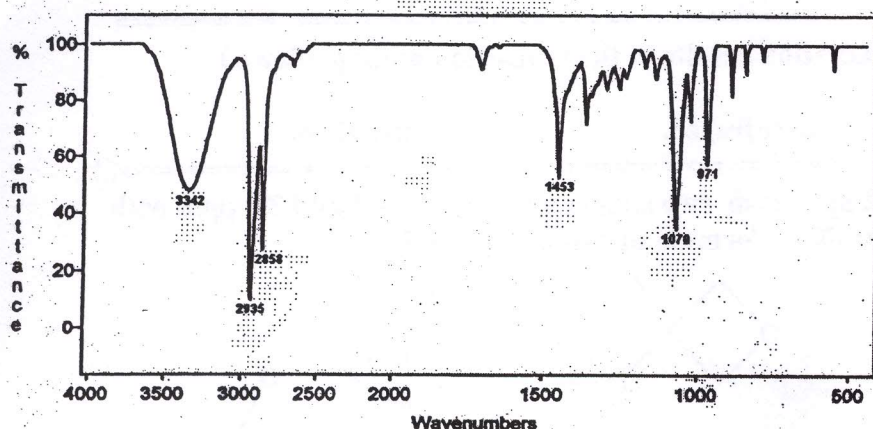$\overset{\ominus}{OH}$

OH

[O]

O

β,β−dimethyl acrylaldehyde

Base

O
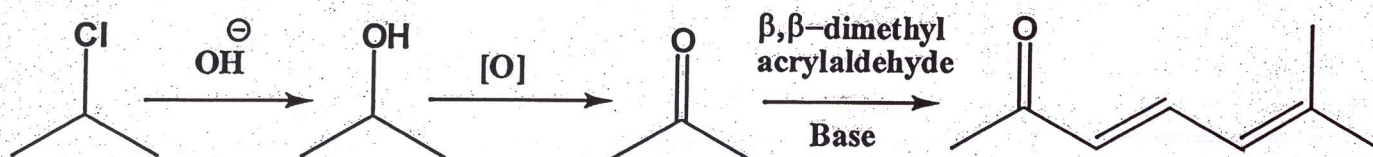
Question 3: (20 Marks)

Write shortly what you know about the following:

a; The role of conjugation effect in the change of (v') and (λ_{max}) values.

b; Disadvantages the chemical techniques in elucidation of the organic compounds.

c, Spin spin coupling.

d; Modes of vibrations.

Question 4: (20 Marks)

a; A compound C_5H_8O shows IR absorption at $3600 – 3b50$ (br), 3300, 2210 Cm^{-1}. Its 1H NMR spectrum contained singlets signals at δ 1.5, 2.2 and 2.9 (broad) ppm in a ratio 6:1:1. Name the compound.

b; What is the structure of a compound $C_{10}H_{11}O_2$ which has an IR absorption at 1688 Cm^{-1} and ^1H NMR signals at δ: 1.89 (s, 3H), 3.45 (s, 2H), 3.88 (s, 3H) and 6.82 - 7.7.23 (multiplet, 4H)?

c; An unknown compound has the molecular formula $C_{10}H_{10}$ showed in its ^1H NMR spectrum three signals at 1.60 (triplet, 3H), 2.85 (triplet, 3H) and 7.01 (multiplet, 4H). Deduce the structural formula of this compound.

d; Which of the following structures best fits with IR spectrum shown below? Discuss the reasons.

OH

OH

COOH

OH

(a)

(b)

(c)

(d)

% Transmittance

100
80
60
40
20
0

3342
2858
2135
1453
1078
971

4000 3500 3000 2500 2000 1500 1000 500

Wavenumbers

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