



Final Exam. in Spectroscopy and Stereochemistry for 3rd year students
(Chemistry group, 311C)

Section A (Spectroscopy)

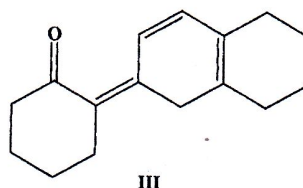
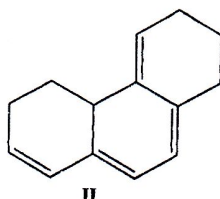
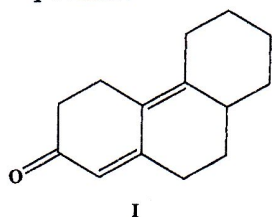
Answer the following questions:

(33 Marks)

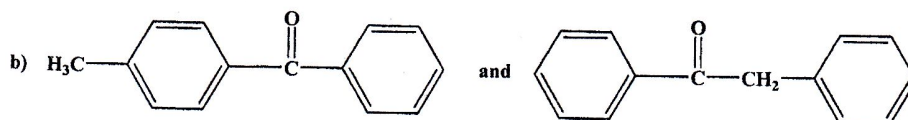
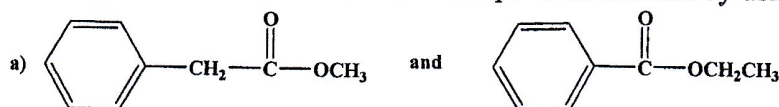
(9 Marks)

- 1) Describe briefly ONLY THREE of the followings:
 - a) β -Cleavage with McLafferty rearrangement in the mass spectra of carbonyl compounds (Give one example).
 - b) The position of R and K bands are strongly affected by increasing polarity of the solvent.
 - c) Bending vibrations in IR spectroscopy.
 - d) In UV spectral analysis, phenolic structures are measured in neutral and alkaline solutions while primary amines are measured in neutral and acidic solution.
- 2) Explain the appearance of the following peaks at m/z 122, 107, 79, 77, 51 and a meta stable ion peak at m/z 33.8 in the mass spectrum of 1-phenyl ethanol. (3 Marks)

- 3) Using the provided tables for rules of diene and enone absorption, calculate the $\lambda_{\max}$ of the following compounds: (6 Marks)



- 4) Answer ONLY ONE of the followings: (3 Marks)
 - a) Explain by drawing a diagram and short notes, why the aromatic protons of Toluene appear at δ 7-8 ppm, while the methyl protons appear at δ 2.3 ppm
 - b) Discuss briefly the even electron rule and isotope abundance in mass spectroscopy.
- 5) How can you differentiate between each pairs of isomers by using IR spectra: (6 Marks)



- 6) You are provided with UV, IR, MS, ^1H NMR and ^{13}C NMR of compound B having the molecular formula $\text{C}_9\text{H}_{10}\text{O}$ in the attached paper (6 Marks)
 - i) Write the different probable structures which can be represented by this formula.
 - ii) Assign the suitable structure which agrees with the provided spectra, interpret IR, ^1H NMR, ^{13}C NMR spectra and assign the fragmentation patterns of its MS spectrum.

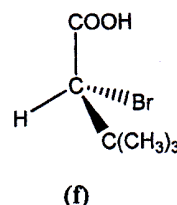
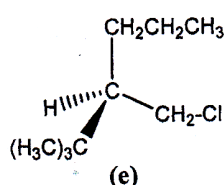
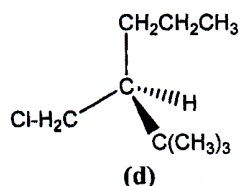
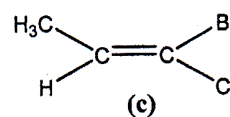
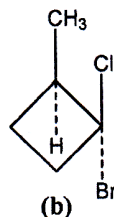
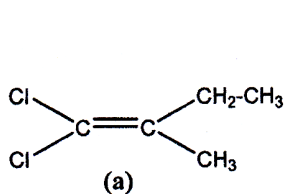
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Section B (Stereochemistry)

Answer **THREE ONLY** of the following questions:

(17 Marks)

- 1) a) Write briefly on:
Tautomerism – Specific rotation
b) Draw all structural formulas of organic compounds which corresponding to each of the following molecular formulas: C_4H_9Cl - $C_3H_6O_2$
- 2) On catalytic hydrogenation of 2-butanone by using H_2/Pt , a mixture of (R)-2-butanol and (S)-2-butanol was obtained. If you need just one enantiomer of 2-butanol, discuss using equations how can you separate it from the other enantiomer
- 3) Give a complete name of the following compounds:

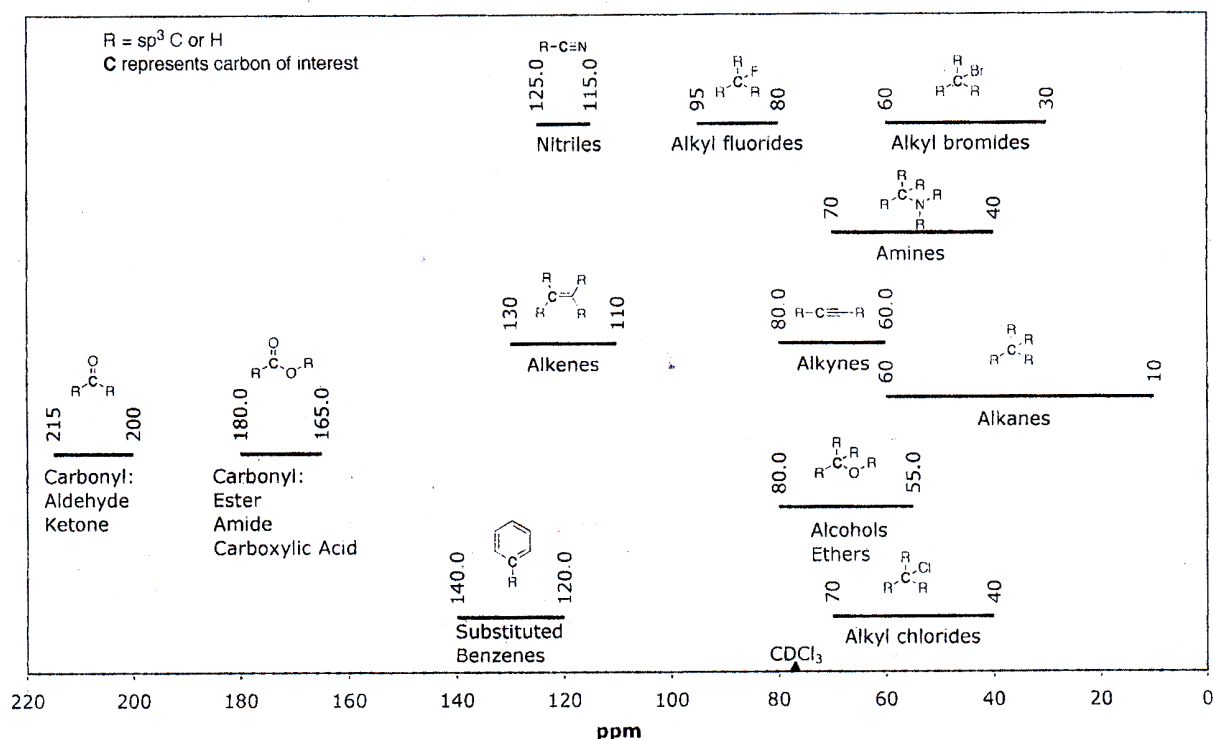


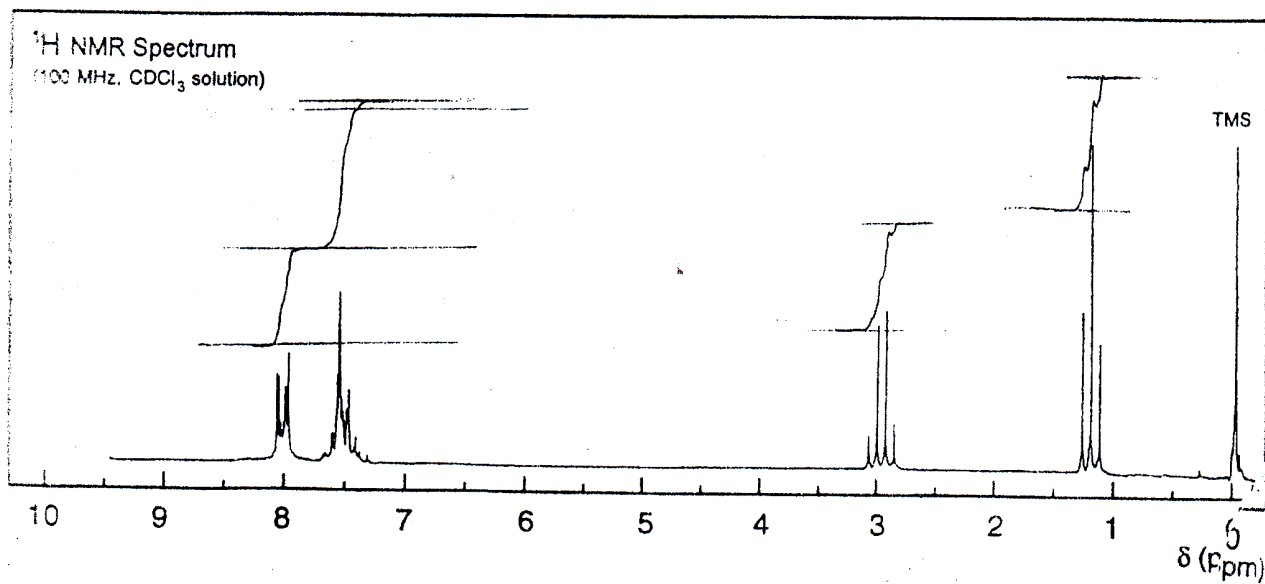
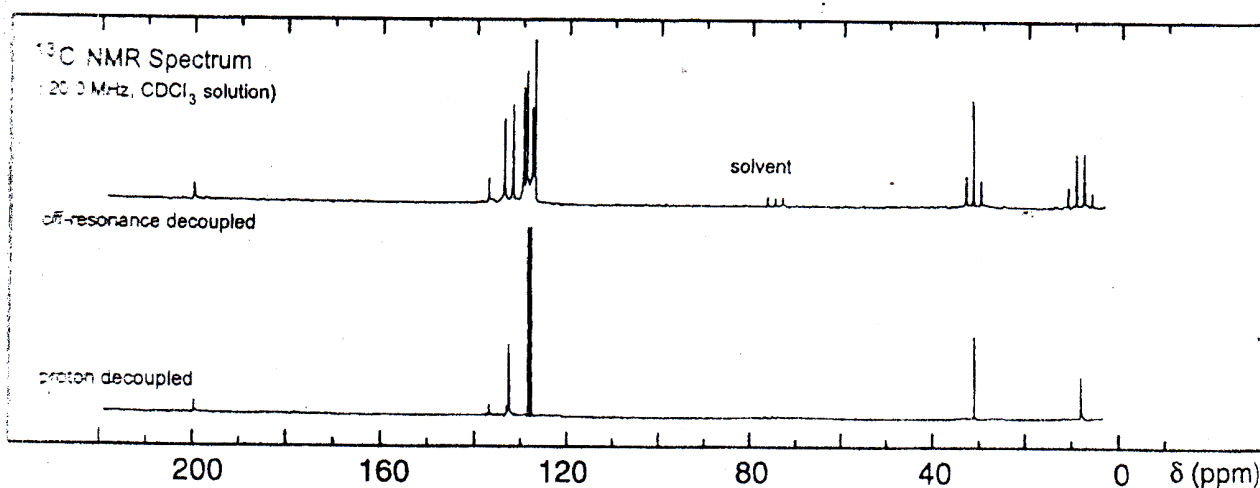
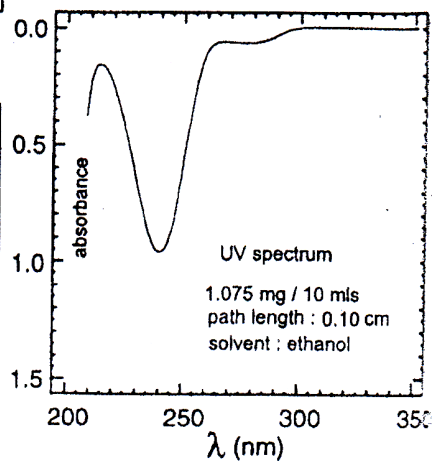
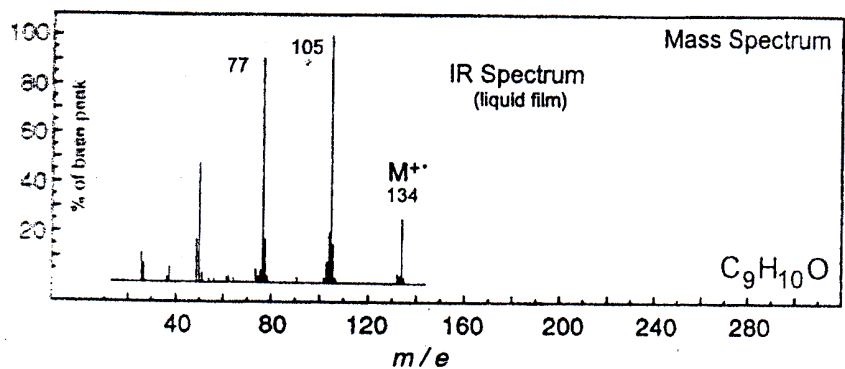
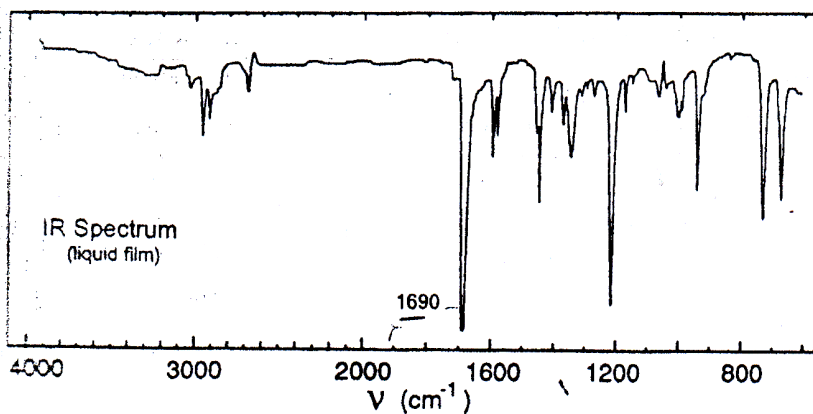
- 4) Draw the structural formulas of all possible stereoisomers which corresponding to both 2,3,4-trihydroxybutanal and 2,3-dibromobutane.

Good Luck

Examiners: Prof. Dr./ Etiafy A. Bakhite
Dr./ Remon M. Zaki

¹³C NMR Chemical Shift Table





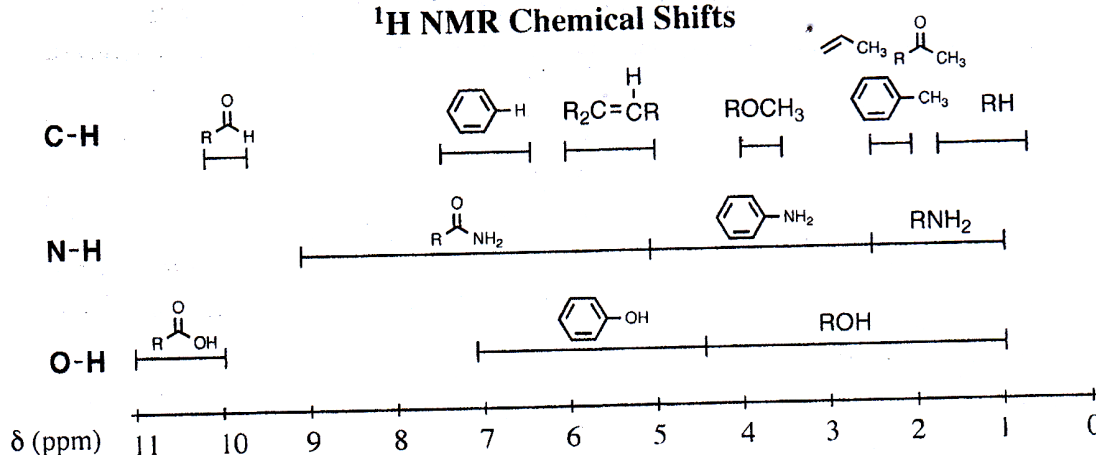
CHARACTERISTIC INFRARED ABSORPTION BANDS OF FUNCTIONAL GROUPS

Class of Compounds	Absorption, cm^{-1}	Intensity	Assignment	Class of Compounds	Absorption, cm^{-1}	Intensity	Assignment
Alkanes and Alkyls	2850-3000 1450-1470 1370-1390 1365 + 1395 (two bands) 715-725	s s m m w	C-H stretch C-H bend CH_3 C-H bend $-\text{CH}(\text{CH}_3)_2$ or $-(\text{CH}_3)_3$ bend $-(\text{CH}_2)_n$ bend	Carboxylic Acids	2500-3500 1710-1715 1680-1710	s, broad s, broad s	O-H stretch C=O stretch C=O stretch
Alkenes	3020-3140 1640-1670 910 + 990 (two bands)	w-m vw-m m + s	=C-H stretch C=C stretch* =C-H bend	Esters	aliphatic 1160-1210 acetates ~1240 aromatic 1250-1310	s-vs s s	O=C-O-C stretch C=O stretch C=O stretch
$\text{RCH}=\text{CH}_2$	885-895 665-730 960-980 790-840	s m-s, broad s s	=C-H bend =C-H bend =C-H bend =C-H bend	Acyl Chlorides	1785-1815 1770-1800	s s	C=O stretch C=O stretch
$\text{RR}'\text{C}=\text{CH}_2$				Anhydrides			
<i>cis</i> - $\text{RCH}=\text{CHR}'$				R-C(O)-O-C(O)-R	~1750 + ~1815	s,s	C=O symmetric
<i>trans</i> - $\text{RCH}=\text{CHR}'$				Ar-C(O)-O-C(O)-Ar	~1720 + ~1775 (both two bands)	s,s	& asym. stretch
$\text{RCH}=\text{CR}'\text{R}''$				Nitriles			
Alkynes				$\text{R-C}\equiv\text{N}$	2240-2260	m-s	C $\equiv$ N stretch
$\text{R-C}\equiv\text{C-H}$	3265-3335 2100-2140 610-700	s, sharp m s, broad	$\equiv\text{C-H}$ stretch C $\equiv\text{C}$ stretch $\equiv\text{C-H}$ bend	$\text{C}\equiv\text{C-C}\equiv\text{N}$ or $\text{Ar-C}\equiv\text{N}$	2220-2240	s	C $\equiv\text{N}$ stretch
$\text{R-C}\equiv\text{C-R}'$	2190-2260	vw-w	C $\equiv\text{C}$ stretch	Amines			
Alkyl halides				R-NH_2	~3400 + ~3500 (two bands) 1580-1650	w w-m	N-H symmetric & asym. stretch N-H bend
R-F	1000-1350	vs	C-F stretch	$\text{RR}'\text{N-H}$	3310-33350	w	N-H stretch
R-Cl	750-850	s	C-Cl stretch	Amides			
R-Br	500-680	s	C-Br stretch	R-C(O)-NH_2	3200-3400 and 3400-3500 (two bands)	w-m	N-H symmetric & asym. stretch
R-I	200-500	s	C-I stretch		1650-1690 1590-1655	s, broad m-s	C=O stretch N-H bend
Alcohols				R-C(O)-NH-R	3400-3500 1640-1690 1510-1560	w-m s, broad m-s	N-H stretch C=O stretch N-H bend
$\text{C}=\text{C-CH}_2\text{-OH}$	3300-3400	s, broad	O-H stretch	$\text{R-C(O)-NR}'\text{R}''$	1630-1680	m-s	C=O stretch
$\text{R-CH}_2\text{-OH (1}^\circ\text{) or C}=\text{C-CH(R)-OH}$	1035-1050 1050-1085	m-s m-s	C-O stretch C-O stretch	Nitro Compounds			
$\text{RR}'\text{CH-OH (2}^\circ\text{) or C}=\text{C-CRR}'\text{-OH}$	1085-1125	m-s	C-O stretch	R-NO_2	~1550 and ~1370	s s	N-O symmetric & asym. stretch
$\text{RR}'\text{R}''\text{C-OH (3}^\circ\text{)}$	1125-1205	m-s	C-O stretch	$\text{C}=\text{C-NO}_2$ or Ar-NO_2	~1525 and ~1335 (both two bands)	s s	N-O symmetric & asym. stretch
Ar-O-H	1180-1260	m-s	C-O stretch	Aromatic Compounds	3010-3100 1450-1600 (two to four bands)	m m-s sharp	Ar C-H stretch ring C=C stretch
Ethers				monosubstituted	730-770 and 690-710 (two bands)	s s	C-H bend C-H bend
$\text{R-O-R}'$	1085-1150	s	C-O-C stretch	<i>o</i> -disubstituted	735-770	s	C-H bend
Ar-O-R	1020-1075 and 1200-1275 (two band)	m-s	=C-O-C sym. & asym. stretch	<i>m</i> -disubstituted	750-810 and 690-710	s s	C-H bend C-H bend
Aldehydes				<i>p</i> -disubstituted	810-840	s	C-H bend
R-CH=O	2700-2725 1720-1740 1685-1710	m s s	H-C=O stretch C=O stretch C=O stretch				
$\text{C}=\text{C-CH=O}$ or Ar-CH=O							
Ketones							
$\text{RR}'\text{C=O}$	1710-1720	s	C=O stretch				
$\text{C}=\text{C-C(O)-R}$	1665-1685	s	C=O stretch				
Ar-C(O)-R	1675-1695	s	C=O stretch				
four member cyclic	1770-1780	s	C=O stretch				
five member cyclic	1740-1755	s	C=O stretch				
six member cyclic	1710-1720	s	C=O stretch				

Intensity abbreviations: vw = very weak, w = weak, m = medium, s = strong, vs = very strong

California State Polytechnic University, Pomona
Dr. Laurie S. Starkey, Organic Chemistry Lab CHM 318L

¹H NMR Chemical Shifts



Protons on Carbon

Type of C-H	δ (ppm)	Description of Proton
R-CH ₃	0.9	alkyl (methyl)
R-CH ₂ -R	1.3	alkyl (methylene)
R ₃ C-H	1.5-2	alkyl (methine)
	1.8	allylic (C is next to a pi bond)
	2-2.3	α to carbonyl (C is next to C=O)
Ar-CH ₃	2.3	benzylic (C is next to Ph)
RC≡C-H	2.5	alkynyl
R ₂ N-CH ₃	2-3	α to nitrogen (C is attached to N)
R-CH ₂ -X	2-4	α to halogen (C is attached to Cl, Br, I)
RO-CH ₃	3.8	α to oxygen (C is attached to O)
R-CH ₂ -F	4.5	α to fluorine (C is attached to F)
	5-5.3	vinylic (H is attached to alkene C)
Ar-H	7.3	aromatic (H is on phenyl ring)
	9.7	aldehyde (H is on C=O)

Note: aldehyde (-CHO) proton usually does not couple with neighboring H's so appears as a singlet

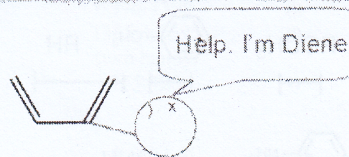
Protons on Oxygen/Nitrogen*

Type of H	δ (ppm)	Description
ROH	0.5-5	alcohol
ArOH	4-7	phenol
	10-13	carb. acid
RNH ₂	0.5-5	amine
ArNH ₂	3-5	aniline
	5-9	amide

**Protons on N or O typically have wide ranges of expected chemical shifts; the actual δ value depends on the solvent used, the concentration, temperature, etc. Because these protons are acidic and, therefore, exchangeable, they may be broad peaks and usually do not couple with neighboring protons (typically they are broad singlets). If a protic deuterated solvent is used (e.g., D₂O or CD₃OD), then the NH and OH protons will exchange with the deuterium and the peaks will shrink or disappear entirely, since D (²H) does not show up in the ¹H NMR spectrum.*

R = alkyl group
 Ar = aromatic ring,
 such as phenyl (Ph)

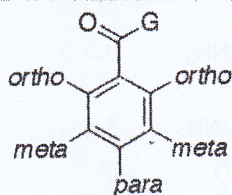
UV-VIS Calculation Tables



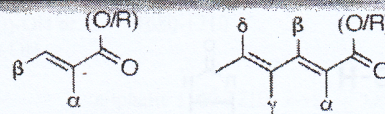
Base value for heteroannular diene	214
Base value for homoannular diene	253
Increments for	
Double bond extending conjugation	+30
Alkyl substituent or ring residue	+5
Exocyclic double bond	+5
Polar groupings: OAc	+0
OAlk	+6
SAlk	+30
Cl, Br	+5
N(Alk) ₂	+60
Solvent correction ^a	+0
$\lambda_{calc} = \text{Total}$	

^aSee L. M. Fieser and M. Fieser, *Steroids*. New York: Reinhold, 1959, pp. 15-24; R. B. Woodward, *J. Am. Chem. Soc.*, 63, 1123 (1941); 64, 72, 76 (1942); A. I. Scott, *Interpretation of the Ultraviolet Spectra of Natural Products*. New York: Pergamon (Macmillan), 1964.

^aSolvents have negligible effects upon the λ_{max} of these $\pi \rightarrow \pi^*$ transitions.



ArCOR/ArCHO/ArCO ₂ H/ArCO ₂ R	λ_{max} (nm)
Parent chromophore: Ar = C ₆ H ₅	
G = Alkyl or ring residue, (e.g., ArCOR)	246
G = H, (ArCHO)	250
G = OH, OAlk, (ArCO ₂ H and ArCO ₂ R)	230
Increment for each substituent on Ar:	
—Alkyl or ring residue	$\phi, m^- +3$
	$p^- +10$
—OH, —OCH ₃ , —OAlk	$\phi, m^- +7$
	$p^- +25$
—O ⁻ (oxyanion)	$\phi +11$
	$m^- +20$
—Cl	$p^- +78^a$
	$\phi, m^- +0$
—Br	$p^- +10$
	$\phi, m^- +2$
—NH ₂	$p^- +15$
	$\phi, m^- +13$
—NHCOCH ₃	$p^- +58$
	$\phi, m^- +20$
—NHCH ₃	$p^- +45$
	$p^- +73$
—N(CH ₃) ₂	$\phi, m^- +20$
	$p^- +85$

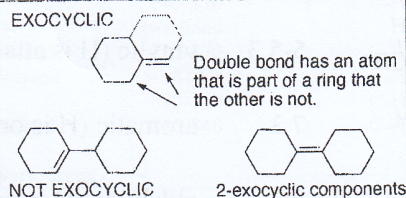
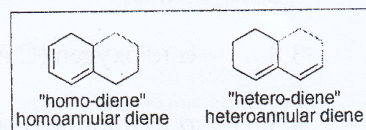


	enone	dienone	(nm)
Base values			
Acyclic α, β -unsaturated ketones			215
Six-membered cyclic α, β -unsaturated ketones			215
Five-membered cyclic α, β -unsaturated ketones			202
α, β -Unsaturated aldehydes			210
α, β -Unsaturated carboxylic acids and esters			195
Increments for			
Double bond extending conjugation			+30
Alkyl group, ring residue	α		+10
	β		+12
	γ and higher		+18
Polar groupings: —OH	α		+35
	β		+30
	δ		+50
—OAc	α, β, δ		+6
—OMe	α		+35
	β		+30
	γ		+17
	δ		+31
—SAlk	β		+85
—Cl	α		+15
	β		+12
—Br	α		+25
	β		+30
—NR ₂	β		+95
Exocyclic double bond			+5
Homodiene component ^a			+39
Solvent correction (see table below)			Variable
$\lambda_{calc} = \text{Total}^b$			

^aTwo conjugated double bonds, both in the same ring.

^bThe calculated values usually fall within ± 3 nm of the observed values. The molar absorptivities of *cisoid* enones are usually less than 10,000, whereas the molar absorptivities of *transoid* enones are greater than 10,000.

Terminology



Photochemistry and Reactive Intermediates (313C)
Final Examination

Answer on the Following Two Sections:

(50 Marks)

Section A : Photochemistry:

(25 Marks)

Answer on the Following Questions:

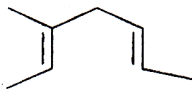
I]- Answer only **Four** of the following :

(2 X 4 = 8 Marks)

- 1- Briefly discuss the reactions of singlet oxygen with different types of Olefins.
- 2- Explain the possible methods for determination the Mechanism of a photochemical reaction .
- 3- Discuss in details the mechanism of Photochemical reduction of Ketones .
- 4- Explain the significance of photoisomerization during the vision process.
- 5- Discuss the advantages of heating by Microwave Radiations.

II] Complete only **Four** of the following reactions and discuss the reaction mechanism:

[9 Marks]

- a - 1,3-Cycloheptadiene + $^3\text{O}_2$ $\xrightarrow[\text{sensitizer}]{h\nu}$? (2 Marks)
- b- 1,3-Butadiene $\xrightarrow[h\nu (500 \text{ nm})]{\text{PhCOCH}_3}$? (3 Marks)
- c- 2,5-Hexadione + CH_3NH_2 $\xrightarrow[\text{Sulfuric Acid}]{\text{Microwave}}$? + ? (2 Marks)
- d-  $\xrightarrow{h\nu}$? (2 Marks)
- e- 2-Cyclopentenone $\xrightarrow{h\nu}$? (2 Marks)

III] – Mark right ($\checkmark$) or wrong (X) on only **four** of the following statements, and explain your answer :

(2 X 4 = 8 Marks)

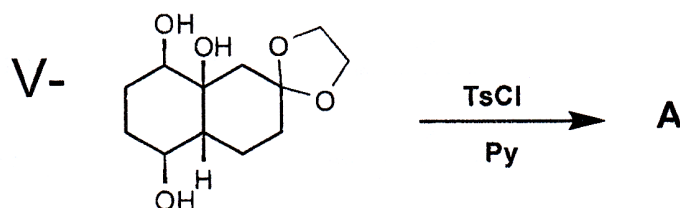
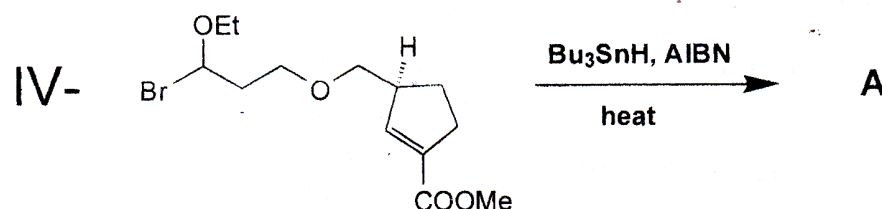
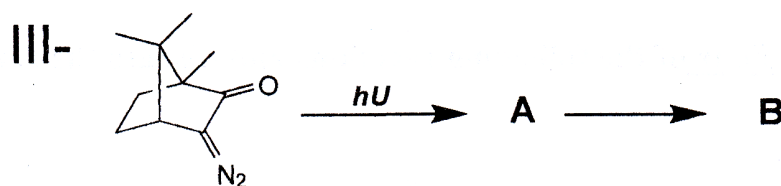
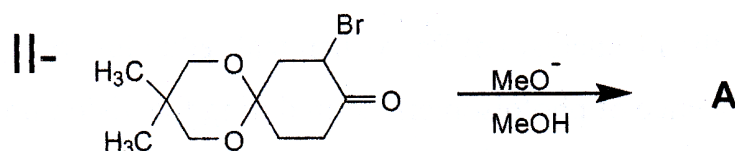
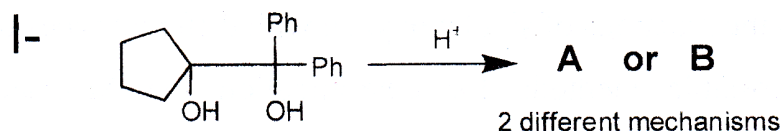
- 1- Glass pyrex absorbing $\geq 400 \text{ nm}$ radiations can be used in UV photolysis of organic compounds. ()
- 2- Concerted Mechanism includes open chain transition state. ()
- 3- Singlet $\rightarrow$ Singlet transition is a Symmetry Allowed transition. ()

4- Photopolymerization of Ethylene has a Product Quantum Number more than one. ()

5- Vision is a Photochemical process initiated by Absorption of light. ()

Section (B): Reactive Intermediates: (25 Marks)

1- Suggest the suitable product and mechanism for Only Four of the following reactions. Give the name of the suggested mechanism and indicate each step using arrows. (16 Marks)



2- Write on two only of the following (use equations) (9 Marks)

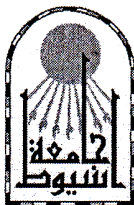
a-The solvolysis of 1-bromo-2-dimethylpropane at high temperature leads to different products.

b-Compare between the electronic configuration of singlet and triplet carbenes.

c-The ethyl and cyclohexyl radicals are π radicals while the trifluoromethyl and cyclopropyl radicals are σ radicals (explain this statement).

Good Luck

Prof. A. A. Abdel-Wahab & Dr. M.A. Abdel-Rahman



Assiut University
Faculty of Science
Chemistry Department

First semester (2018/2019)
Time: 2hrs

**Final Exam For 3rd Year Students (Industrial Chemistry Programme Students-
Oils, Soaps and detergents (C 309))**

Answer the following questions:

I. First question (10 Marks)

1. Define the following terms: (Answer five only) (5 Marks)

- a) Rancidity.
- b) Saponification number.
- c) Acid value.
- d) Allelochemicals.
- e) Fermentation.
- f) Acetyl number.

2. Draw the chemical structure of triolein and answer the following questions:

(5 Marks)

- a) What is the type of this triglyceride?
- b) Calculate the Iodine number for triolein.
- c) Calculate the Saponification value for triolein.

[Mol.Wt of triolein = 884; A.Wt. of iodine = 127; Mol.Wt. KOH = 56]

II. Second question (10 Marks)

1. Write short notes on: (Answer three only) (6 Marks)

- a) Importance of lipids.
- b) Disadvantage of soap.
- c) Hazards of rancid fats.
- d) Isomerism of oleic acid.

2. Draw the structures of the five key terpenoids and show how they can interconvert to each other? (4 Marks)

-Look at the back-

III. Third question: Put (✓) in front of the correct statement and (X) in front of the wrong one: (Answer ten only) **(10 Marks)**

- a) Polyunsaturated fatty acid can be synthesized in human body.
- b) Rancidity increases as the number of double bonds decreases.
- c) Most naturally occurring fatty acids have an even number of carbon atoms.
- d) Terpenoids are defined as materials which are made up of isoprene.
- e) Tripalmitin oil has zero iodine number.
- f) As far as perfume materials are concerned, the most important members of the terpenoid family are the oxygenated monoterpenoids.
- g) Risk assessment examines the potential of any material to cause harm and the likelihood of that potential being reached during normal use conditions.
- h) The cis-isomer of PTBCHA is stronger than the trans- and has a desirable jasmine/floral character.
- i) Shikimic acid derivatives represent an important source of perfume ingredients.
- j) Oils with high acetyl number are toxic.
- k) In practice, the fermentation yield of ethanol from sugar is 97%.
- l) The materials used as perfume ingredients are mostly Primary metabolites.

IV. Fourth question **(10 Marks)**

- 1. Explain the mechanism of the cleaning action of soap? **(3 Marks)**
- 2. Discuss with equations the anaerobic fermentation of glucose? **(3 Marks)**
- 3. Give the reason for the following: (Answer two only) **(4 Marks)**
 - a) Castor oil is inedible.
 - b) Unsaturated triglycerides have lower melting point.
 - c) Perfume materials obtained by distillation are referred to as essential oils.
 - d) Linalool is not stable under pyrolysis conditions.

V. Fifth question **(10 Marks)**

- 1. Explain the pyrolysis process of β -pinene and discuss the disadvantage of this process? **(4 Marks)**
- 2. Answer two only from the following questions: **(6 Marks)**
 - a) Show with equations the synthesis of the perfume ingredients which derived from toluene? **(3 Marks)**
 - b) Explain the medical response procedures when the chemicals splashed into the eye? **(3 Marks)**
 - c) Explain with equations the biosynthesis of eugenol? **(3 Marks)**

Good luck

Dr. Ahmed Mahmoud Sayed

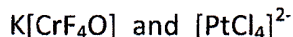
Answer the following questions.

Question number one.

(16 marks)

a) answer only one of the following:

(i) Write the IUPAC name of the following complexes.



(ii) What kind of isomerism the following complexes can possess?



b) Write the formula of the following complexes:

1. Dicyanotetrammineplatinum(IV)tetrachloroplatinate(II).
2. Hexammine- μ -hydroxo- μ -amidodicobalt(II) chloride.
3. Sulfatobis(ethylenediamine)Cobalt(III)nitrate

c) Put ($\checkmark$) or (x) in front of each of the following :

- Polarizability increases with decreasing electronegativity. ()
- Highly polarized ligands prefer to form complexes with soft metal ions. ()
- Soft metal ions have high charge and small size. ()
- Softness of Lewis bases decreases with increasing atomic number of the donor atom in the same group of periodic table ()

d) (i) Suggest the possible structures that Werner deduced in $CoCl_3 \cdot 6NH_3$

(ii) Calculate the effective atomic number of the complex $Ni(CO)_4$

(atomic numbers: Ni 28, C 12, O 16, Kr 36).

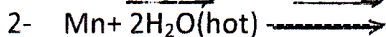
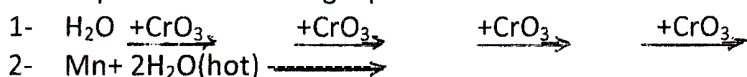
Question number two.

A) Write the different steps of extraction of vanadium from its ores.

B) Write briefly on only two of the following:

- i- Variation of atomic radii in the different series and groups of transition metals.
- ii- How can the unstable oxidation states of transition metal ions get stabilized.
- iii- Oxides and oxy-acids of Cr group.

C) i- complete the following equations:



ii- Write the chemical formula and show the oxidation state of the metal ion for the following:

- 1- Potassium ferrocyanide.
- 2- Trimanganese tetraoxide.
- 3- Lithopone.

Question number three

- A) Explain the determination of the magnetic amount of a complex by Gouy's method.
- B) Give reason(s) of only three of the following:
- i- Iron family metals act as good catalyst.
 - ii- Copper sulfate solution looks blue.
 - iii- The bivalent and trivalent ions of titanium behave as reducing agents.
 - iv- Coinage metals do not displace hydrogen from acids.
- C) i- What is the difference between interstitial compounds and alloy of a transition metal.
- ii Show by equation the action of strong and weak alkalies on Zn group elements.
- iii- Write on the different uses of platinum metal.

المتتحنون: أ.د/ سعيد إبراهيم ، أ.د/ سحر الجيار ، أ.د/ أسماء إبراهيم

Final Exam for course No.301(Nuclear and radiochemistry)

Answer the following question

(18marks)

From the nuclear data given below

I-126
13.11d
ϵ
$\beta^- 0.9, 1.3 \dots$
$\beta^+ 1.1$
$\gamma 389, 666$
$\sigma 5960$

A- Sketch the decay scheme of I-126

Write the complete decay equation of I-126

How many I-atoms are present in 1mCi of I-126

Insert spin and parity of parent and daughter nuclei

What is the specific activity of I-126

B- I) Define the following items

Exposure dose, Absorbed dose, LET, Mass stopping powder, Sievert, Auger electron, Internal conversion, specific ionization

II) What will be the disintegration rate of Au-198 ($T_{1/2}=2.7\text{d}$) in a 10mg sample of gold that has been irradiated in a nuclear reactor at a flux of $10^{12} \text{ n/cm}^2/\text{s}$ for 1 day

C- The exposure rate at a point near a cobalt -60 source was 235R min^{-1} on October 15, 2018. Calculate the exposure rate at same point on August 15, 2019 and February 15, 2020. Take 5.27 years as $T_{1/2}$ for Co-60

Answer Two question only of the following
Question no.2

(16mark)

A- Define the following items

Inelastic collision of neutron with matter, cross section of a nuclear reaction, Excitation function of a nuclear, annihilation process, photoelectric effect

B- A 0.100mg of pure pu-239 (an α -emitter) was found to undergo $1.38 \times 10^7 \text{ dpm}$. Calculate the half-life of this nuclide. Pu-239 is formed by β decay of Np-239 ($T_{1/2}=2.35\text{d}$). How many curies of Np-239 would be required to produce 0.100mg of Pu-239?

C- A sample of $1.00 \times 10^{-10} \text{ g}$ of Mo-99 ($T_{1/2}=66\text{h}$) is freshly purified at $t=0$

1- What kind of equilibrium exist between Mo-99 and its daughter Tc-99m ($T_{1/2}=6\text{h}$)

- 2- If this sample is left without further treatment, when will the amount of Tc-99m in it be a maximum
- 3- At that time of maximum growth, what will be the weight of Tc-99m present

Question no.3

A- Define the following items

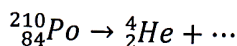
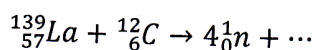
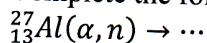
Compton scattering, Dose equivalent unit, isomeric transition, Gray, Anti-neutrino, neutron capture, Bremsstrahlung emission, linear attenuation coefficient.

B- In the reaction $^{106}\text{Pd}(n, p)^{106}\text{Rh}$, the product Rh-106 ($T_{1/2}=30\text{s}$) decays by β^- emission with maximum kinetic energy of 3.5 MeV. Calculate the Q value of the reaction

C- Calculate the mass absorption coefficient for 1MeV γ -rays for sodium iodide (a_μ for Na and I atoms are 2.32 and 12.03b/atom, respectively)

Question no.4

A- Complete the following reaction



B- Calculate the approximate height of coulomb barrier and the threshold energy for
a) Proton b) He ions colliding with Co-59

C- $^{238}_{92}\text{U}$ decays finally to stable $^{206}_{82}\text{Pb}$. Determine the number of α and β^- making up the chain of disintegrations.

Constants: $m_p=1.00727u$, $m_n=1.00866u$, $N_A=6.023 \times 10^{23} \text{mol}^{-1}$, $1b=1 \times 10^{-24} \text{cm}^2$,
 $1\text{Ci}=3.7 \times 10^{10} \text{Bq}$, $\hbar = 1.054589 \times 10^{-27} \text{erg}$

Good Luck
 Prof.Dr.R.M.Mahfouz

Answer the following question

(25marks)

A- Consider Na-22($T_{1/2}=2.602y$) nucleous

- 1- How many Na-22 atoms are present in 1mCi of Na-22 Activity
- 2- What are the partial half-lives of Na-22 for the decay by
(a) Ec (9.5%) and (b) β^+ (90.5%).write the complete decay equations for the two processes.
- 3- Determine spins and parities of Na-22 and its daughters
- 4- What is the specific activity of Na-22

B- Define the following items

Exposure dose, Absorbed dose, LET, Mass stopping power, Sievert, Auger electron, IC, G-value

C- Calculate the activity of No-254 ($T_{1/2}=55s$) produced in a 1-minute of pb-208 via the nuclear reaction $^{208}\text{Pb}(^{28}\text{Ca}, 2n)^{254}\text{No}$ using the beam current of $0.5\mu\text{A}$ of Ca-atoms. Assume the ^{208}Pb target thickness is $0.5\text{mg}/\text{cm}^2$ and σ for this reaction is $3.0\mu\text{b}$.

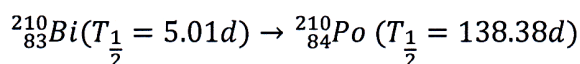
D- P-32 ($T_{1/2}=14.262d$) is a popular tracer in biochemistry. If I need to have 0.1×10^6 dps activity 60day from now. How much P-32 tracer must I purchase today.

Answer One of the following two questions

(25mark)

Question No. (2)

A- For the nuclear reaction



What kind of radioactive decay occurs in this process.

If a sample of 1.0×10^{-10} g of ^{210}Bi is freshly purified of at $t=0$ and is left without further treatment.

When will the amount of Po-210 in it be a maximum. At that time of maximum growth, what will be the weight of Po-210 present.

B- Define the following items

Annihilation process, cross section of a nuclear reaction, Compton scattering, neutron capture process, Excitation function of a nuclear reaction.

C- The Exposure dose at a point near Co-60 source was 235 min^{-1} on October 15, 2018. Calculate the Exposure dose at the same point on August 15, 2019 and February 15, 2020 ($T_{1/2}$ for Co-60=5.27y)

D- It is desired to produce 5mCi Zn-65($T_{1/2}=244.1d$) by Exposing Zn metal for 24h in a nuclear reaction at a flux of $1 \times 10^{14} \text{ n}/\text{cm}^2/\text{s}$. How much Zn has to be exposed ($\sigma_n = 1.1b$).

E- For the nuclear reaction $^{27}\text{Al}(\alpha, n)^{30}\text{P}$

Calculate the minimum kinetic energy of α - particles required for this reaction to occurs

Question No. (3)

A- Define the following items

Dose equivalent unit, isomeric transition, Gray, Anti-neutrino, Bremstrahlung emission.

B- Calculate the mass absorption coefficient for 1 MeV γ -rays for NaI

(a_u for Na and I atoms are 2.32 and 12.03 b/atom respectively).

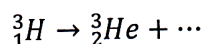
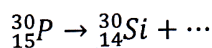
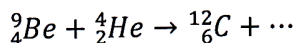
C- How long will it take for a 10-mCi sample of P-32 ($T_{1/2}=14.3$ day) and 100-mCi sample Ga-67 ($T_{1/2}=3.2$ days) to possess the same activity.

D- If one "milks" a sample of Mo-99 ($T_{1/2}=66$ h) to remove the daughter nuclei Tc-99m (6 hours). How long does it take before the Mo-99 "Caw" has an equilibrium amount of Tc-99m. At equilibrium if the activity is 75 mCi, what is the activity of ^{99m}Tc (Assume $\approx 87\%$ Mo-99 decay to Tc-99m).

E- Consider a reactor in which the production rate of U-239 via the nuclear reaction $^{238}\text{U}(n, \alpha)^{239}\text{U}$ is 10^5 atoms/s. Calculate the activity of ^{239}Pu after an irradiation of 1 day.

($^{238}\text{U}_{T_{1/2}} = 4.468 \times 10^9 \text{ y}$, $^{239}\text{U}_{T_{1/2}} = 23.5 \text{ m}$, $^{239}\text{Np}_{T_{1/2}} = 2.35 \text{ d}$ and $^{239}\text{Pu}_{T_{1/2}} = 2.4 \times 10^4 \text{ y}$)

F- Complete the following nuclear reaction



Constants: $m_p=1.00727u$, $m_n=1.00866u$, $N_A=6.023 \times 10^{23} \text{ mol}^{-1}$, $1A=6.2 \times 10^{18} \text{ C/s}$
 $1b=1 \times 10^{-24} \text{ cm}^2$, $1\text{Ci}=3.7 \times 10^{10} \text{ Bq}$, $\hbar = 1.054589 \times 10^{-27} \text{ erg}$

Good Luck
Prof.Dr.R.M.Mahfouz

Assiut University
Faculty of Science - Chemistry Department

Date: 31/12/2018
Time: 2 hours

Colloids and Surface Chemistry Examination for 3rd Level Applied Industrial Chemistry Students (Chem.303).

Answer the Following Questions:

I. Colloids: (25 Marks)

1 - Explain what is meant by Only Three from the following terms : (Give an example for each one): (6 Marks)

i) Multimolecular colloids. ii) Electrophoresis. iii) Dialysis. iv) Tyndall effect.

2 - Describe a method for the preparation of Only Three from the following: (6 Marks)

i) Colloidal platinum. ii) Paint pigment sols.
iii) Water in oleic acid emulsion. iv) Calcium acetate gel.

3- Mark (✓) for the correct sentence and (x) for the wrong one : (5 Marks)

i- Smoke is an example of gas dispersed in solid.

ii- Hydrous ferric oxide sol can be obtained by Bredig's arc method.

iii- A sol of As_2S_3 moves to the negative electrode.

iv- The process of removing ions (or molecules) from a sol by diffusion through a permeable membrane is called osmosis.

v- The dispersal of a precipitated material into colloidal solution by the action of an electrolyte in solution is called peptization.

4. a) Give the structure of the colloidal ion of hydrous ferric oxide sol. (2 Mark)

b) Mark (✓) on the correct answer: (3 Marks)

i. The presence of the double layer in colloids accounts for

a) kinetic properties b) electrical properties c) optical properties d) stability of colloids

ii. If the sol particles in a given colloid move towards the anode, the dispersion medium carries.....charge.

a) no b) positive c) negative d) sometimes positive and sometimes negative

iii) The movement of the dispersion medium under the influence of applied potential is known as a) osmosis b) diffusion c) electro-osmosis d) electrophoresis

5. Complete the following:- (3 Marks)

i) is a common thixotropic gel , and the dispersed phase in emulsions are generally charged.

ii) can be obtained by hydrolysis, whereas sol can be obtained by

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change of solvent.

iii) Mercury sols can be obtained by , whereas edible jelly can be obtained by

II. Surface Chemistry: (25 Marks)

Answer the following questions:

1- Define each of the following: (6 Marks)

(i) Adsorbent (ii) Total pore volume (iii) Monolayer adsorption (iv) Mesopores.

2- On applying the BET equation for determining the S_{BET} of a catalyst using N_2 gas as adsorbate, the slope and intercept were 72.6 and 1.2, respectively. Calculate the value of S_{BET} take into your consideration that surface area occupied by one molecule of N_2 is $16.4 \text{ \AA}^2$. (4 Marks)

3- Answer only three of the following: (15 Marks)

- i- Compare between the chemisorption and physisorption.
- ii- How the porosity of solids can be assessed from adsorption isotherm data.
- iii- What are the main factors which affect on adsorption of gases on solids.
- iv- State the postulates and the mathematical expressions of Langmuir adsorption isotherm.

Good Luck

Examiners: Prof. Maher M. Girgis and Dr. Mohamed N. Abd El-Hameed



Environmental Analytical Chemistry Examination (C-343)

Answer the following questions: (50 Marks)

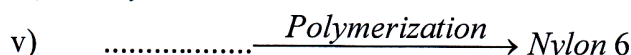
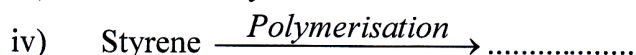
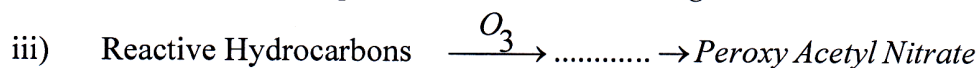
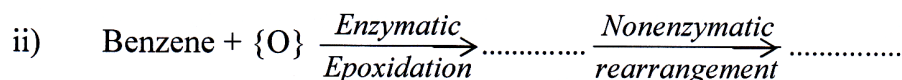
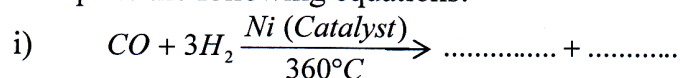
1- Answer only four of the following: (12 Marks)

a- Define each of the following terms:

Positive lapse rate – Turbulent zone – Classical Smog – Acid rain – Ozone hole.

b- Write short notes on the poisoning effects of lead, Mercury and Arsenic ions.

c- Complete the following equations:



d- Describe with diagram the main differences between Flame Atomic Absorption Spectrometry (FAAS) and Graphite Furnace Atomic Absorption Spectrometry (GFAAS) as analytical tools used in Environmental Analysis.

e- What are the major effects of fungicides on the environment.

2- Answer only two of the following: (10 Marks)

a- Draw the chemical structure for each of the following compounds:

DDT , Parathion , Carbaryl , Carboxyin , Nylon 66

b- Describe the flow sheet of petroleum refining.

c- Discuss the biogas production by anaerobic fermentation.

3- Answer only two of the following: (8 Marks)

a- Compare between wind energy and biomass energy as important good sources for energy.

b- What are the biological importances of Mg^{+2} , Ca^{+2} and Zn^{+2} ions.

c- Describe with equations the depletion of ozone layer by chlorofluorocarbons.

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4- Briefly discuss, with aid of equation if applicable, only two of the following sentences: (8 Marks)

- i. The determination of dissolved oxygen (DO) in wastewater effluents, and the relation between DO concentration and the degree of water self-purification.
- ii. The main objective of each of the treatment stages from the preliminary to the tertiary treatment stage.
- iii. Bio-amplification of mercury and its poisoning effect, mentioning the most common chemotherapeutic agents used for the treatment of such poisoning.

5- Differentiate between only two of the following: (8 Marks)

- i. Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) for the determination of the organic content in wastewater.
- ii. Temporary and permeant hardness
- iii. Oil separation via American Petroleum Institute (API) and Corrugated Plate Interceptors (CPI) oil separators

6- Put (✓) or (X) in front of only four of the following sentences, and correct the wrong statement: (4 Marks)

- i. Lake at higher level will have a lower value of dissolved oxygen than one near the sea level.
- ii. Refractory organic compounds are known to be easily removed by conventional treatment methods.
- iii. The performance of plain sedimentation process in removing total suspended matter is much higher than that was removed by chemical precipitation
- iv. Reverse osmosis membranes have the ability to remove very fine particles even dissolved salts.
- v. Carbon adsorption is selective toward the removal of certain organic contaminants such as volatile organic compounds (VOCs)

"Good luck"

Examiners: Dr. Ahmed M. Kamal & Dr. Haitham M. El-Bery

Photochemistry and Reactive Intermediates (313C)

Final Examination (Summer Semester)

Answer on the Following Two Sections:

(50 Marks)

Section A : Photochemistry:

(25 Marks)

Answer on the Following Questions:

I]- Answer **only Four** of the following :

(2 X 4 = 8 Marks)

- 1- What is meant by Photochromism ?, Give an example
- 2- Explain the significance of quantum yield in Photochemistry? give an example.
- 5- Discuss briefly the possible mechanisms of Photochemical cleavage of organic compounds with special reference to Franck –Condon principle .
- 4-Discuss the significance of photoisomerization during the processes of vision .
- 6- Indicate the disadvantages of heating by Microwave Radiations.

II] – Mark right ($\sqrt{}$) or wrong (X) on **only four** of the following statements,
and explain your answer :

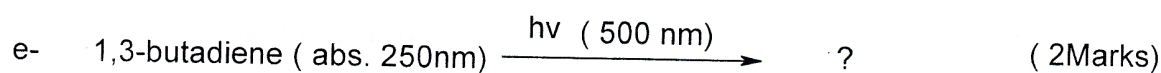
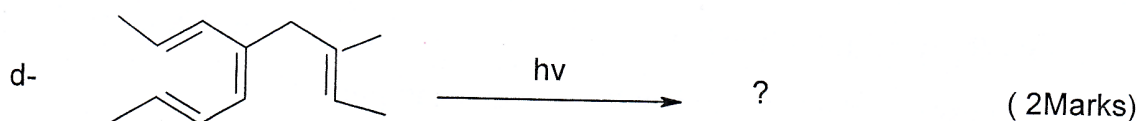
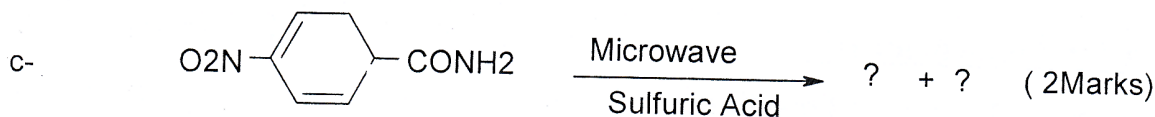
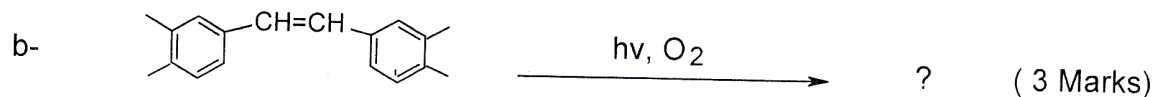
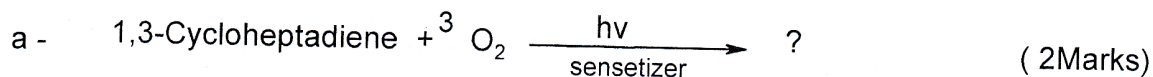
(2 X 4 = 8 Marks)

- 1- Glass window absorbing ≥ 400 nm radiations can be used in Visible light photolysis of organic compounds. ()
- 2- Concerted Mechanism includes electrocyclic transition state. ()
- 3- Singlet $\rightarrow$ Triplet transition is a Symmetry Allowed transition. ()
- 4- Photodimerization of Propylene has a Product Quantum Number more than one . ()
- 5- Vision is a Thermochemical process initiated by Emission of light. ()

ملحوظة هامة : الأسئلة ٣ صفحات

III] Complete only Four of the following reactions and discuss the reaction mechanism:

[9 Marks]

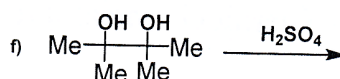
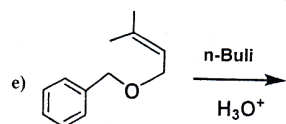
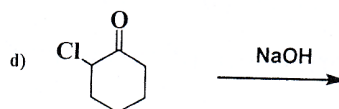
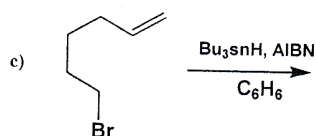
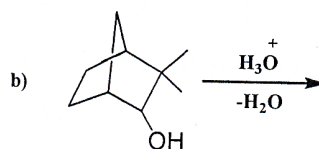
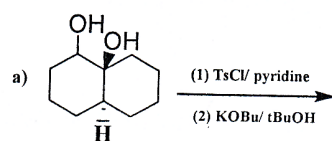


Section (B): Reactive Intermediates:

(25 Marks)

Answer the Following Questions:

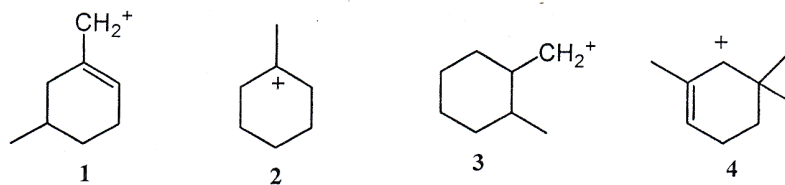
1), Provide a complete stepwise reaction mechanism for four only of the following reactions: (12 Marks)



2) Answer two only of the following:

(2x2.5=5 Marks)

i) Arrange the following carbocations according to decreasing order of their stability:

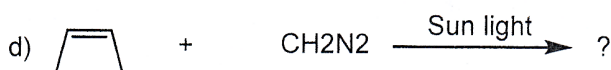
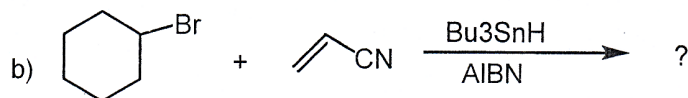
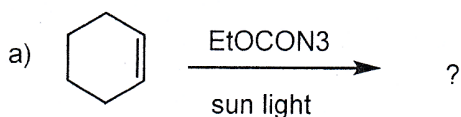


ii) Describe the properties of carbene intermediates showing the difference between singlet and triplet carbenes.

iii) Explain the methods of generation of nitrenes and free radicals.

3) Complete the following equations:

(4x2=8 Marks)



Good Luck

Prof. A.A Abdel-Wahab & Prof. Y. A. Abdel Moez

Final Exam for C-321 Students

Answer the following questions:

Section (A)

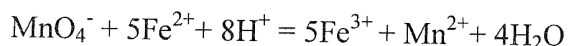
(17 marks)

1. Explain how could Werner explain bonding in the following complexes: (4 marks)
a) $\text{Co}(\text{NH}_3)_6\text{Cl}_3$ b) $\text{Co}(\text{NH}_3)_5\text{Cl}_3$ c) $\text{Co}(\text{NH}_3)_4\text{Cl}_3$ d) $\text{Co}(\text{NH}_3)_3\text{Cl}_3$
2. Write the isomers and their types for two of the following complexes: (3 marks)
a) $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]^+$ b) $[\text{Ni}(\text{en})_2\text{Cl}_2]$ c) $[\text{Co}(\text{NH}_3)_6][\text{Cr}(\text{CN})_6]$
3. Write about three methods of preparation of coordination compounds? (3 marks)
4. In the light of covalent bond theory explain in detail why $\text{Co}(\text{II})$ is easily oxidized into $\text{Co}(\text{III})$ in the presence of ammonia. (4 marks)
5. Name three only of the following complexes: (3 marks)
a) $\text{K}_3[\text{Fe}(\text{CN})_6]$ b) $\text{K}_4[\text{Fe}(\text{CN})_6]$ c) $[\text{Ni}(\text{en})_2\text{Cl}_2]$ d) $[\text{Ni}(\text{DMG})_2]$

Section (B)

(33 marks)

1. Define briefly **only five** from the following terms: (10 marks)
a) Transition elements b) Disproportionation c) Diamagnetic substance
d) Egyptian blue e) Prussian blue f) Non-stoichiometric compounds
g) Cobaltite h) Mond Process
2. What are the common oxidation states for the following elements?
a) V b) Fe c) Zn (3 marks)
3. Write the production steps of copper from chalcopyrite CuFeS_2 ? (3 marks)
4. Explain the origin of the color for the following compounds:
a) TiO^{2+} b) Ag_3PO_4 c) FeCl_3 (3 marks)
5. Write an application for **only five** of the following materials: (5 marks)
a) Palladium nanoparticles b) Silver nanoparticles c) Gold nanoparticles
d) TiCl_4 e) MnO_2 f) V_2O_5
6. Give reasons for the following statements: (6 marks)
a) Chromium in contact with concentrated HNO_3 is passive.
b) Aqueous solution of ferrous sulphate forms a dark greenish brown compound when it reacts with NO .
c) Zinc oxide (ZnO) is a good white pigment.
7. Write the two half-cell reactions of the following equation: (3 marks)



=====Good Luck=====

Dr. Zahar Khafagy, Dr. Hani Nasser Abdelhamid

Assiut University
Faculty of Science
Chemistry department

Sept. 2018
Time: 3 hours
Summer Semester

Physical Chemistry III Examination (C-332)
for Third Level Students

Answer All The following questions (I, II and III) (50 Marks)

I- Answer Only Three of the following: (17 marks)

- a) Discuss the following:
- i- Photo-electric effect.
 - ii- Black body radiation.
 - iii- Physical significance of De Broglie hypothesis and its relation to electron diffraction.
- b) Derive the complete solution of Schrödinger equation for a system of an electron confined in a box.
- c) Derive the complete solution of Schrödinger equation of an electron in a ring.
- d) i- Explain, how the value of angular momentum (Z-direction) derived from Quantum mechanics postulations is exactly to that postulated by Bohr and De Broglie.
- ii- Derive an expression for each of the following:
- 1) Hamiltonian operator.
 - 2) Angular momentum operator for component in Z direction using spherical polar coordinates.

II- Answer Only Three of the following: (17 marks)

- a) From Maxwell-Boltzmann distribution law of velocities, derive an expression for the average translational kinetic energy of a gas molecule.
- b) Discuss briefly the collision between like and unlike gas molecules, then explain the effect of temperature and pressure on terms L and Z_{11} .
- c) i- How the viscosity arises in liquids and gases?
- ii- The van der Waals constant b for n-heptane (molar mass = 100) is $0.265 \text{ dm}^3 \text{ mol}^{-1}$. Estimate the viscosity coefficient of this gas at 300 K.
- d) i- Why a linear polyatomic molecule behave like a diatomic molecule in regard to rotation?
- ii- Calculate the thermal conductivity of argon (atomic weight = 40) at 27°C , given that the molar heat capacity at constant volume is $12.5 \text{ J K}^{-1} \text{ mol}^{-1}$ and collision diameter is $5.6 \times 10^{-10} \text{ m}$.
- ($R = 0.082 \text{ L atm K}^{-1} \text{ mol}^{-1}$, $8.314 \text{ J K}^{-1} \text{ mol}^{-1}$, $1.987 \text{ cal K}^{-1} \text{ mol}^{-1}$, Avogadro's number = 6.022×10^{23}).

Turn Over

III-Answer Only Five of the following questions:

(16 marks)

- a) Which of the following molecules can show pure rotational spectra and which can show pure vibrational spectra
 CCl_4 , HI , $\text{C}_2\text{H}_5\text{OH}$, N_2 , $\text{H}_2\text{C}=\text{CH}_2$, H_2O , BF_3 , SO_2
- b) Calculate the degrees of freedom for formate ion and draw its vibrational modes.
- c) Write the rule of mutual exclusion, and show when ZnCl_2 molecule will be infrared active and when Raman active.
- d) The ESR frequency for a free electron is 9000 MHz. Calculate the magnetic field at which the ESR spectrometer is working, (Bohr magneton $\beta = 9.273 \times 10^{-24} \text{ J T}^{-1}$, g value = 2, $h = 6.626 \times 10^{-34} \text{ J s}^{-1}$).
- e) Explain, how the electron charge cloud around an atom or molecule is distorted, when light is absorbed or emitted by the atom or molecule.
- f) Find the frequency at which a proton NMR spectrometer should be operating under a magnetic field 1.8 T ($g_N = 5.449$, $\mu_N = 5.0504 \times 10^{-27} \text{ J T}^{-1}$, $h = 6.626 \times 10^{-34} \text{ J s}^{-1}$).
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With Our Best Wishes

The Examiners:- Prof. Dr. Rabei Gabr
Prof. Dr. Maher M. A. Hamed
Dr. Mostafa Farrag



Assiut University
Faculty of Science
Chemistry Department

Final Examination in Biochemistry and Natural Products (312C) for the 3th Level
Students (Summer Course)

Date: Monday , 27/08/2018

Time: 3 hours.

Answer the following Two Sections :

(50 Mark)

(Section A: Biochemistry):

Write short notes on **Six Only** from the following:

- i) Mutarotation in Maltose .
- ii) Inversion of Sucrose .
- iii) Viscose silk. iv) Sanger' s reagent. v) Estimation of amino acid.
- vi) Distinction between normal soap and synthetic detergents.
- vii) Conversion of arabinose to fructose and vice versa.
- viii) Ninhydrine reaction.

(Section B: Natural Products):

Answer the following questions :-

- 1) a) Starting with cholesterol how can you prepare 5β -cholanic acid and progesterone?
b) Differentiate between α -Farnesene and β - Farnesene ?
- 2) a) Starting from Acetone how can you prepare the Citral ?
b) Describe by chemical reactions, How can you convert Camphor to Bornane?
- 3) Discuss by chemical equations the synthesis of the following:
i)Adrenalin ii) Nicotine
- 4) a) Discuss by equation the Diel's Alder reaction of Myrcene?
b) Proof the function group in α -Terpinol ?
- 5) a) Mention the different types of alkaloids ?
b) Explain by equation the elucidation of ring system and function group in Cholesterol ?

Good Luck

Examiners:

Prof Dr Morsi M Ali & Prof. Dr. Kamal I Aly