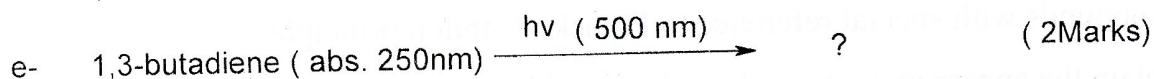
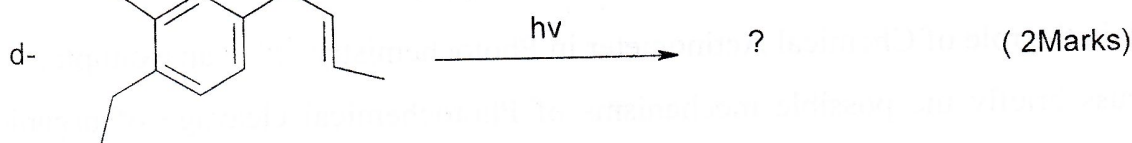
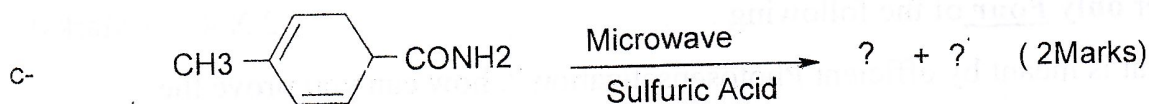
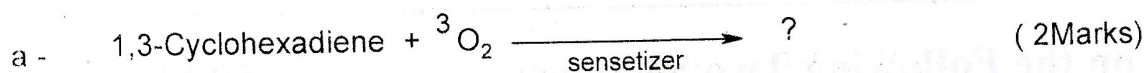


III] Complete only Four of the following reactions and discuss the reaction mechanism: [9 Marks]



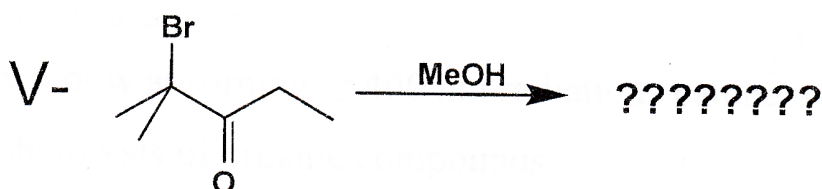
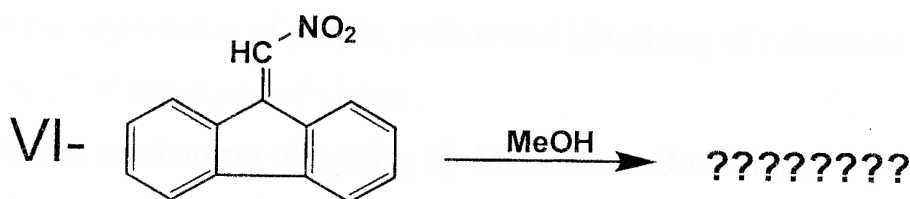
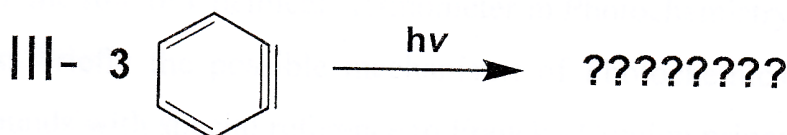
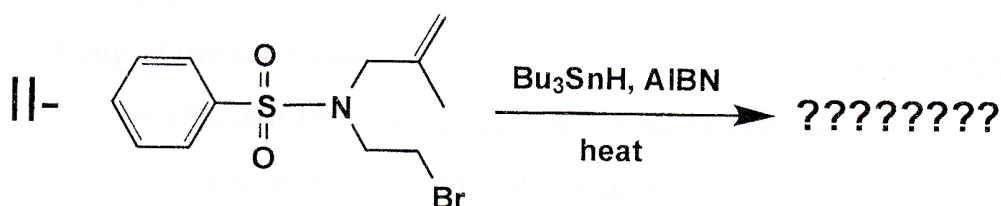
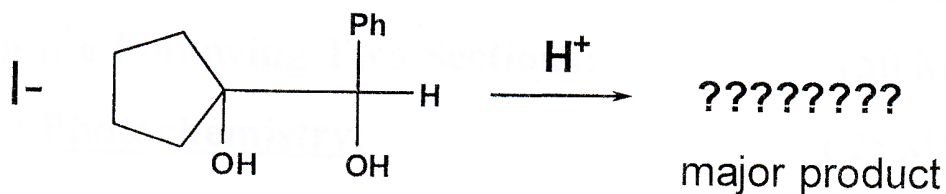
Section (B) Reactive Intermediates: (25 Marks)

Answer the Following Questions:

1 | Write on two only of the following (use equations): (9 Marks)

- The decomposition of diazomethane in benzene at high temperature.
- Comparison between the electronic configuration of singlet and triplet nitrenes.
- Methyl carbocation is less stable than *tert*-butyl carbocation. Explain this statement.

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



Good Luck

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

Photochemistry and Reactive Intermediates (313C)

Final Examination

Answer on the Following Two Sections: (50 Marks)

Section A : Photochemistry: (25 Marks)

Answer the Following Questions:

I]- Answer **only Four** of the following : (2 X 4 =8 Marks)

- 1- What is meant by efficient Photosensetization ?, how can you prove the process of photosensitization in a chemical reaction?.
- 2- Explain the role of Chemical Actinometer in Photochemistry? give an example.
- 3- Discuss briefly the possible mechanisms of Photochemical cleavage of organic compounds with special reference to Franck –Condon principle .
- 4-Explain the appearance of purple, yellow and bleaching of colours in the photochemical processes of vision .
- 5-Describe the mechanism 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- Photochromism is a nonreversible process. ()
- 3- Triplet $\rightarrow$ Triplet transition is a Symmetry allowed transition. ()
- 4- Photopolymerization of Ethylene has a Product Quantum Number more than one ()
- 5-Vision is a Thermochemical process initiated by Cis-Trans Isomerization of Rhodopsin . ()

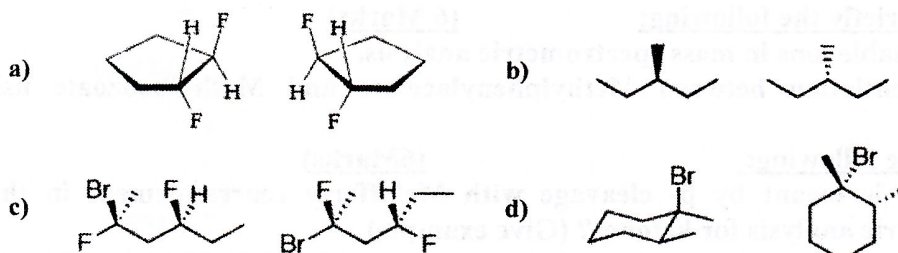


Final Exam of Organic Chemistry (311C) for the 3rd Level students

Section (A): Stereochemistry (16 Marks)

Answer four only of the following questions:

1- For each pair of the following pairs of compounds below, determine whether they are the same molecule, constitutional isomers, enantiomers, diastereomers, identical or different molecules?

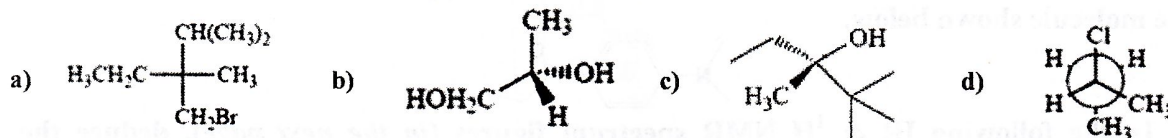


2- Predict the products of addition of bromine to trans-2-butene? Is attack by bromide ion by the two paths equally likely? Account for the fact that inactive material is actually obtained? Do the same for cis-2-pentene?

3- Discuss how the stereochemistry a designation varies with the position of methyl groups of dimethyl-substituted?

4- A solution of sucrose in water at 25°C in a tube that is 10.0 cm long gives an observed rotation of +2.0°. The specific rotation of sucrose in water at this temperature and the same wavelength of light is +66.4°. What is the concentration of sucrose in g/100 mL?

5- Determine the absolute configuration (R & S) for the following enantiomers?



Section (B): Spectroscopy (34 Marks)

Answer the following questions:

1) Choose the best answer from a, b, c or d for the following: **(6 Marks)**

i) Which type of C-H has the highest stretching frequency in the IR?

- a) butanal b) butane
c) 2-methyl-1-propene d) 1-butyne

ii) Which C=O function has the highest stretching frequency in the IR?

- a) benzaldehyde b) benzamide
c) benzyl acetate d) benzoyl chloride

iii) Which hydrocarbon gives the lowest field ¹H NMR signal?

- a) 1-butyne b) cyclohexane
c) 1,4-cyclohexadiene d) benzene

Please see the next page

iv) Assuming all the compounds listed below yield an observable molecular ion, which would have an odd number m/z value for this ion?

- a) $C_9H_{15}F$ b) $C_7H_{10}N_2O$
c) $C_8H_{10}N$ d) All the above have odd mass molecular

v) The mass spectrum of 3-pentanone has a very large ion peak at $m/z=57$. Which of the following ions is thought to be responsible for this peak?

- a) $C_2H_5-C\equiv O^+$ b) $CH_3CH_2CH^+CH_3$ c) $(CH_3)_3C^+$ d) $CH_3CH=C=OH^+$

vi) The following hydrocarbons all have 1H NMR spectra consisting of a single sharp peak which exhibits the greatest shielding?

- a) benzene b) 1, 3-butadiene
c) 2-butyne d) 1, 2, 3-butatriene

2) Describe briefly the following: (6 Marks)

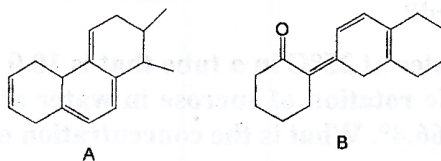
- (a) Metastable ions in mass spectrometric analysis.
(b) Differentiation between Methylphenylacetate and Methylbenzoate using IR spectra

3) Explain the following: (6 Marks)

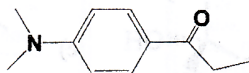
- (a) What is meant by β - cleavage with McLafferty rearrangement in the mass spectrometric analysis for ketones? (Give example)
(b) The appearance of the following peaks at m/e 122, 107, 79, 77, 51 and a metastable ion at m/e 33.8 in the mass spectrum of *p*-ethyl phenol.

4) Answer the following: (10 Marks)

(a) Using the provided tables for rules of diene and enone absorption calculate the λ_{max} of the following compounds:

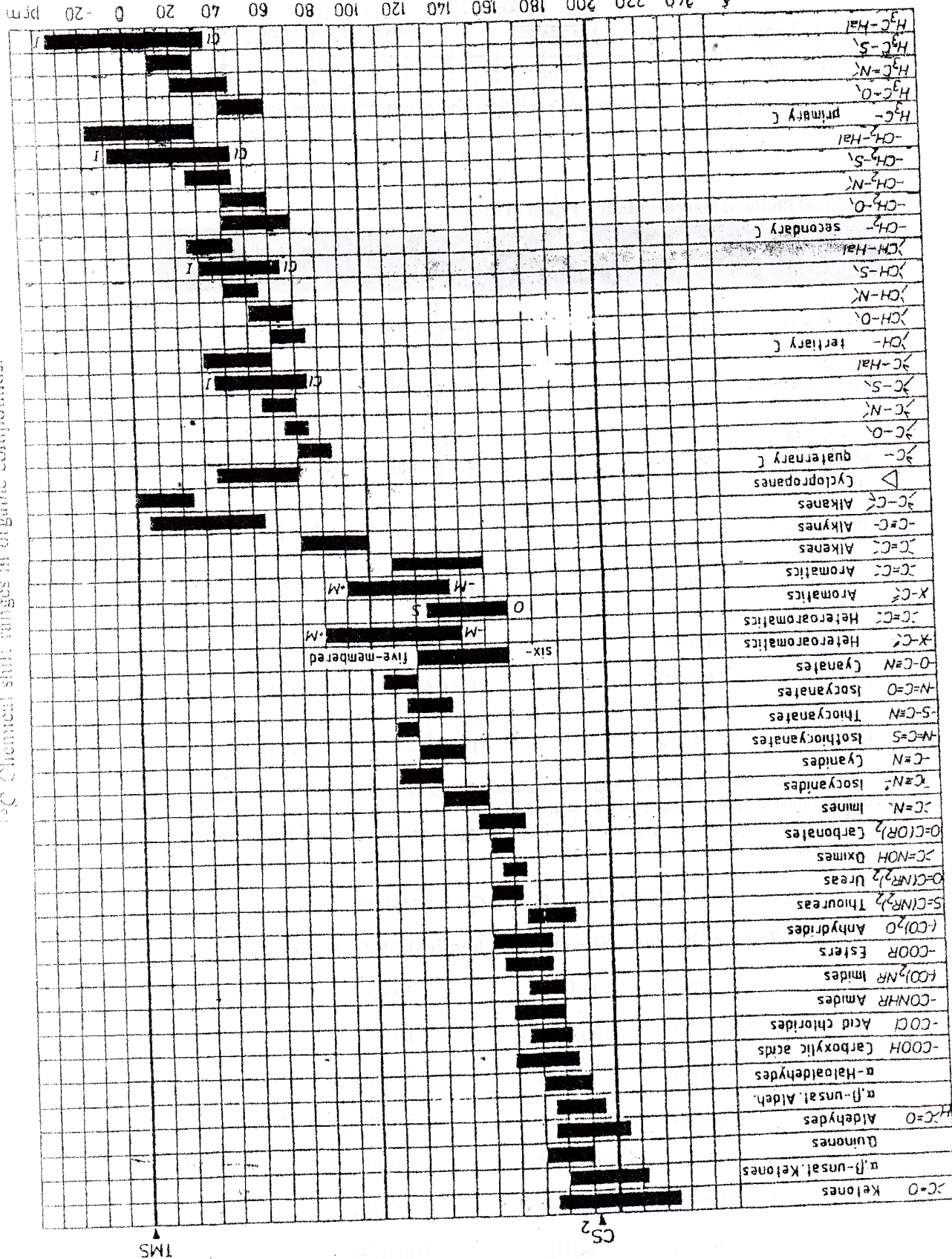


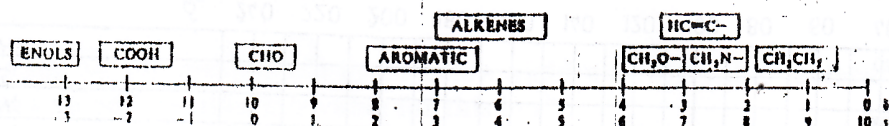
(b) Sketch 1H NMR, ^{13}C NMR, DEPT-135 and DEPT-90 spectrums that you expect for the molecule shown below.



5) In the following IR & 1H NMR spectrum figures (in the next page), deduce the structure of compound has a molecular formula $C_9H_{11}NO$ with the IR absorption at 2720, 2820 and 1690 cm^{-1} . Its ^{13}C NMR shows 6 signals at δ (ppm) = 191.1, 155.4, 130.8 (2 carbon atoms), 126.4, 114.8 (2 carbon atoms), 40.3 (2 carbon atoms); its DEPT-90 shows 3 signal at δ (ppm) = 114.8, 130.8 and 191.1; while its DEPT-135 shows 4(+) signals at δ (ppm) = 40.3, 114.8, 130.8 and 191.1. (6 Marks)

0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300 320 340 360 380 400 420 440 460 480 500 520 540 560 580 600 620 640 660 680 700 720 740 760 780 800 820 840 860 880 900 920 940 960 980 1000 1020 1040 1060 1080 1100 1120 1140 1160 1180 1200 1220 1240 1260 1280 1300 1320 1340 1360 1380 1400 1420 1440 1460 1480 1500 1520 1540 1560 1580 1600 1620 1640 1660 1680 1700 1720 1740 1760 1780 1800 1820 1840 1860 1880 1900 1920 1940 1960 1980 2000 2020 2040 2060 2080 2100 2120 2140 2160 2180 2200 2220 2240 2260 2280 2300 2320 2340 2360 2380 2400 2420 2440 2460 2480 2500 2520 2540 2560 2580 2600 2620 2640 2660 2680 2700 2720 2740 2760 2780 2800 2820 2840 2860 2880 2900 2920 2940 2960 2980 3000 3020 3040 3060 3080 3100 3120 3140 3160 3180 3200 3220 3240 3260 3280 3300 3320 3340 3360 3380 3400 3420 3440 3460 3480 3500 3520 3540 3560 3580 3600 3620 3640 3660 3680 3700 3720 3740 3760 3780 3800 3820 3840 3860 3880 3900 3920 3940 3960 3980 4000 4020 4040 4060 4080 4100 4120 4140 4160 4180 4200 4220 4240 4260 4280 4300 4320 4340 4360 4380 4400 4420 4440 4460 4480 4500 4520 4540 4560 4580 4600 4620 4640 4660 4680 4700 4720 4740 4760 4780 4800 4820 4840 4860 4880 4900 4920 4940 4960 4980 5000 5020 5040 5060 5080 5100 5120 5140 5160 5180 5200 5220 5240 5260 5280 5300 5320 5340 5360 5380 5400 5420 5440 5460 5480 5500 5520 5540 5560 5580 5600 5620 5640 5660 5680 5700 5720 5740 5760 5780 5800 5820 5840 5860 5880 5900 5920 5940 5960 5980 6000 6020 6040 6060 6080 6100 6120 6140 6160 6180 6200 6220 6240 6260 6280 6300 6320 6340 6360 6380 6400 6420 6440 6460 6480 6500 6520 6540 6560 6580 6600 6620 6640 6660 6680 6700 6720 6740 6760 6780 6800 6820 6840 6860 6880 6900 6920 6940 6960 6980 7000 7020 7040 7060 7080 7100 7120 7140 7160 7180 7200 7220 7240 7260 7280 7300 7320 7340 7360 7380 7400 7420 7440 7460 7480 7500 7520 7540 7560 7580 7600 7620 7640 7660 7680 7700 7720 7740 7760 7780 7800 7820 7840 7860 7880 7900 7920 7940 7960 7980 8000 8020 8040 8060 8080 8100 8120 8140 8160 8180 8200 8220 8240 8260 8280 8300 8320 8340 8360 8380 8400 8420 8440 8460 8480 8500 8520 8540 8560 8580 8600 8620 8640 8660 8680 8700 8720 8740 8760 8780 8800 8820 8840 8860 8880 8900 8920 8940 8960 8980 9000 9020 9040 9060 9080 9100 9120 9140 9160 9180 9200 9220 9240 9260 9280 9300 9320 9340 9360 9380 9400 9420 9440 9460 9480 9500 9520 9540 9560 9580 9600 9620 9640 9660 9680 9700 9720 9740 9760 9780 9800 9820 9840 9860 9880 9900 9920 9940 9960 9980 10000 10020 10040 10060 10080 10100 10120 10140 10160 10180 10200 10220 10240 10260 10280 10300 10320 10340 10360 10380 10400 10420 10440 10460 10480 10500 10520 10540 10560 10580 10600 10620 10640 10660 10680 10700 10720 10740 10760 10780 10800 10820 10840 10860 10880 10900 10920 10940 10960 10980 11000 11020 11040 11060 11080 11100 11120 11140 11160 11180 11200 11220 11240 11260 11280 11300 11320 11340 11360 11380 11400 11420 11440 11460 11480 11500 11520 11540 11560 11580 11600 11620 11640 11660 11680 11700 11720 11740 11760 11780 11800 11820 11840 11860 11880 11900 11920 11940 11960 11980 12000 12020 12040 12060 12080 12100 12120 12140 12160 12180 12200 12220 12240 12260 12280 12300 12320 12340 12360 12380 12400 12420 12440 12460 12480 12500 12520 12540 12560 12580 12600 12620 12640 12660 12680 12700 12720 12740 12760 12780 12800 12820 12840 12860 12880 12900 12920 12940 12960 12980 13000 13020 13040 13060 13080 13100 13120 13140 13160 13180 13200 13220 13240 13260 13280 13300 13320 13340 13360 13380 13400 13420 13440 13460 13480 13500 13520 13540 13560 13580 13600 13620 13640 13660 13680 13700 13720 13740 13760 13780 13800 13820 13840 13860 13880 13900 13920 13940 13960 13980 14000 14020 14040 14060 14080 14100 14120 14140 14160 14180 14200 14220 14240 14260 14280 14300 14320 14340 14360 14380 14400 14420 14440 14460 14480 14500 14520 14540 14560 14580 14600 14620 14640 14660 14680 14700 14720 14740 14760 14780 14800 14820 14840 14860 14880 14900 14920 14940 14960 14980 15000 15020 15040 15060 15080 15100 15120 15140 15160 15180 15200 15220 15240 15260 15280 15300 15320 15340 15360 15380 15400 15420 15440 15460 15480


$$\left(\frac{8}{8}\right)$$



Approximate chemical shift positions for protons in organic molecules.

Chemical Shifts of Representative Types of Protons

Type of proton	Chemical shift (ppm)*	Type of proton	Chemical shift (ppm)*
$\text{H}-\text{C}-\text{R}$	0.9-1.8	$\text{H}-\text{C}-\text{NH}$	2.2-2.9
$\text{H}-\text{C}-\text{C}=\text{C}$	1.6-2.6	$\text{H}-\text{C}-\text{Cl}$	3.1-4.1
$\text{H}-\text{C}-\text{C}(=\text{O})-$	2.1-2.5	$\text{H}-\text{C}-\text{Br}$	2.7-4.1
$\text{H}-\text{C}\equiv\text{C}-$	2.5	$\text{H}-\text{C}-\text{O}$	3.3-3.7
$\text{H}-\text{C}-\text{Ar}$	2.3-2.8	$\text{H}-\text{NR}$	1-3†
$\text{H}-\text{C}=\text{C}$ (alkene)	4.5-6.5	$\text{H}-\text{OR}$	0.5-5†
$\text{H}-\text{Ar}$	6.5-8.5	$\text{H}-\text{OAr}$	6-8†
$\text{H}-\text{C}(=\text{O})-$	9-10	$\text{H}-\text{OC}(=\text{O})-$	10-13†

* Approximate values relative to tetramethylsilane; other groups within the molecule can cause a proton signal to appear outside of the range cited.

† The chemical shifts of protons bonded to nitrogen and oxygen are temperature- and concentration-dependent.

USEFUL ^{13}C CHEMICAL SHIFTS

Type of Proton	Structure	Chemical Shift, δ , ppm
Primary	$\text{R}-\text{CH}_3$	0-40
Secondary	R_2-CH_2	10-50
Tertiary	R_3-CH	15-50
Alcohol	$\text{C}-\text{OH}$	50-90
Ether	$\text{C}-\text{O}-\text{C}$	50-90
Alkene	$-\text{C}=\text{C}-$	100-170
Aromatic	C_6H_6	100-170
Aldehydes	$-\text{CHO}$	182-215
Ketones	$-\text{C}(=\text{O})-$	182-215

($\frac{7}{8}$)

Typical Infrared Absorption Frequencies

Stretching Vibrations				Bending Vibrations			
Range (nm)	Intensity	Assignment	Range (nm)	Intensity	Assignment		
Alkanes	2850-3000	str	C-H alkane	1350-1470 1370-1390 720-725	med med wk	CH ₂ & CH ₃ deformation CH ₃ deformation CH ₂ rocking	
Alkenes	3020-3100 1630-1680 1900-2000	med var str	=C-H alkene C=C (symmetry reduces intensity) C=C asymmetric stretch	880-995 780-850 675-730	str med med	=C-H & =CH ₂ (out-of-plane bending) cis-RCH=CHR	
Alkynes	3300 2100-2250	str var	≡C-H alkyne (usually sharp) C≡C (symmetry reduces intensity)	600-700	str	C-H deformation	
Aromatic	3030 1400 - 1600 several bands	var med-wk	C-H aromatic C=C (benzene ring) (usually 2 or 3 bands)	690-900	str-med	C-H bending & ring puckering	
Alcohols & Phenols	3580-3650 sharp 3200-3550 broad 1030-1250	var str str	O-H (free) O-H (H-bonded) C-O	1330-1430 650-770	med var-wk	O-H bending (in-plane) O-H bend (out-of-plane)	
Amines	3400-3500 3300-3400 1000-1250	med-wk med-wk med	N-H (1°-amines), 2 bands N-H (2°-amines) one peak C-N	1550-1650 660-900	med-str var	NH ₂ scissoring (1°-amines) NH ₂ & N-H wagging (shifts on H-bonding)	
Aldehydes & Ketones	2690-2850 (2 bands) 1720-1740 1710-1720 1690	med str str str	C-H (aldehyde C-H) C=O (saturated aldehyde) C=O (saturated ketone) C=O α,β-unsaturation	1350-1360 1400-1450 1100	str str med	α-CH ₃ bending α-CH ₂ bending C-C-C bending	
Carboxylic Acids & Derivatives	2500-3400 (acids) overlap C-H 1705-1720 (acids) 1210-1320 (acids) 1785-1815 (acyl halides) 1750 & 1820 (anhydrides) 1735-1750 (esters) 1630-1695 (amides)	str str med-str str str str str	O-H (H-bonded) (very broad) C=O O-C (sometimes 2-peaks) C=O C=O (2-bands) C=O C=O (amide)	1395-1440 1590-1650 1500-1560	med med med	C-O-H bending N-H (1°-amide) II band N-H (2°-amide) II band	
Nitriles	2240-2260 sharp	med	C≡N				

Aromatic Absorption Frequencies

Stretching Vibrations			Bending Vibrations		
Range (nm)	Intensity	Assignment	Range (nm)	Intensity	Assignment
3000-3070 1400-1600	med med-var	C-H (2 or 3-bands) C=C (ring, 2 or 3-bands)	730-770 & 680-720 950-1225 (2 or 3 bands)	str & str wk & sharp	=C-H bending (out-of-plane) (in-plane & ring torsion)
3000-3070 1400-1600 1400-1600 1400-1600	med med med med	C-H (2 or 3-bands) C=C (ring, 2 or 3-bands) C=C (ring, 2 or 3-bands) C=C (ring, usually 2-bands)	735-770 685-720 & 750-810 & 810-900 800-860	str str & str & med str	C-H bending (out-of-plane)
3000-3070 1400-1600 1400-1600 1400-1600	med med med med	C-H (2 or 3-bands) C=C (ring, 2 or 3-bands) C=C (ring, 2 or 3-bands) C=C (ring, usually 2-bands)	685-720 & 750-810 800-860 & 820-900 685-720 & 820-900	med & str str & med med & str	=C-H bending (out-of-plane)
3000-3070 1400-1600 1400-1600 1400-1600	med med med med	C-H (2 or 3-bands) C=C (ring, 2 or 3-bands) C=C (ring, 2 or 3-bands) C=C (ring, usually 2-bands)	800-840 840-880 840-880	str str str	=C-H bending (out-of-plane)
3010-3040 1670	med med	=C-H C=C	840-880	str	=C-H bending (out-of-plane)

Monosubstituted

Di-substituted

ortho
meta
para

Tri-substituted

1,2,3-
1,2,4-
1,3,5-

Tet substituted

1,2,3,4-
1,2,3,5-
1,2,4,5-

Pentasubstituted

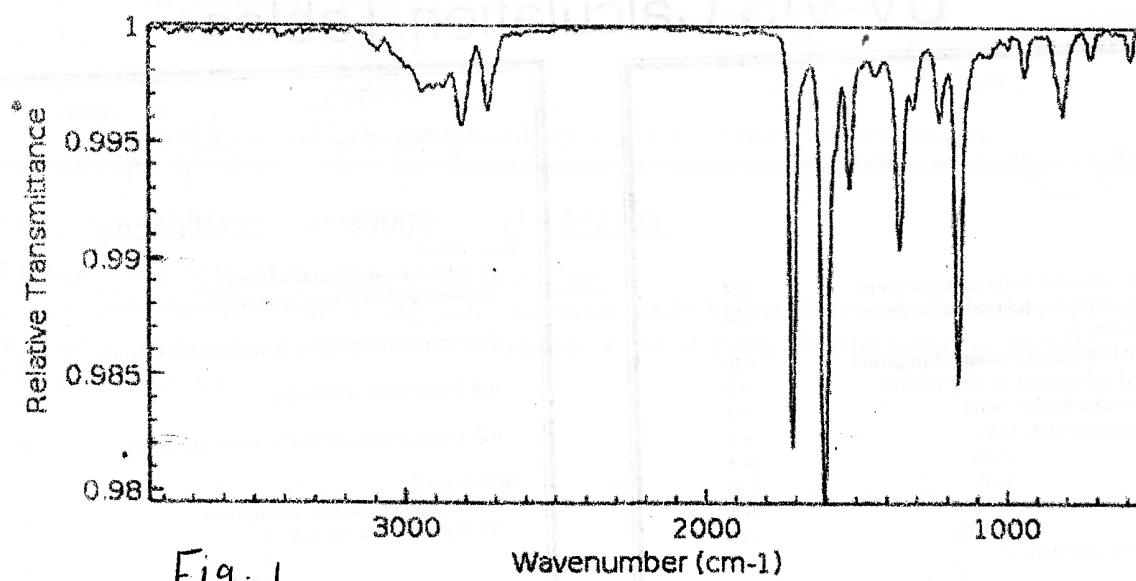


Fig. 1

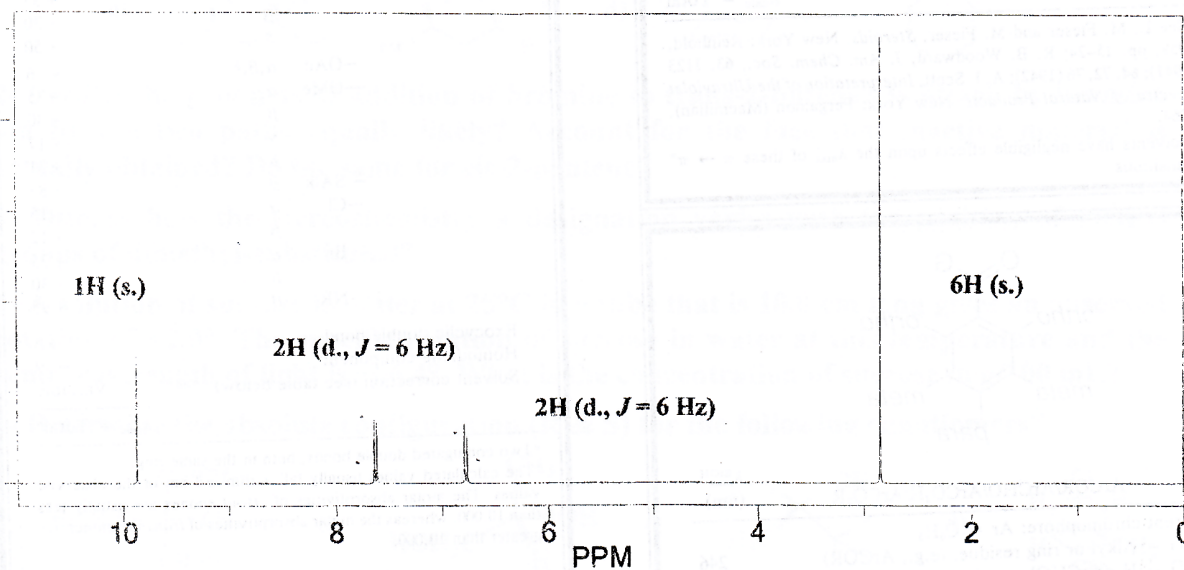


Fig- 2

$(\frac{3}{8})$

UV-VIS Calculation Tables

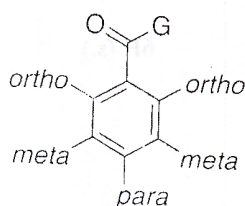


Base value for heteroannular diene	214
Base value for homoannular diene	253
Increments for	
Double bond extending conjugation	+30
Alkyl substituent or ring residue	+5
Exocyclic double bond	+5
Polar groupings: OAc	+0
OAlk	+6
SAlk	+30
Cl, Br	+5
N(Alk) ₂	+60
Solvent correction ^a	+0

$\lambda_{calc} = \text{Total}$

^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.

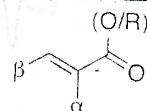
^bSolvents have negligible effects upon the λ_{max} of these $\pi \rightarrow \pi^*$ transitions.



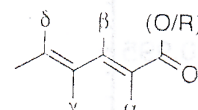
ArCOR/ArCHO/ArCO₂H/ArCO₂R

λ_{max}^{ArOH}
(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	o-, m- +3
	p- +10
—OH, —OCH ₃ , —OAlk	o-, m- +7
	p- +25
—O ⁻ (oxyanion)	o- +11
	m- +20
	p- +78 ^a
—Cl	o-, m- +0
	p- +10
—Br	o-, m- +2
	p- +15
—NH ₂	o-, m- +13
	p- +58
—NHCOCH ₃	o-, m- +20
	p- +45
—NHCH ₃	p- +73
—N(CH ₃) ₂	o-, m- +20
	p- +85



enone



dienone

Base values

Acyclic α,β -unsaturated ketones	(nm) 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

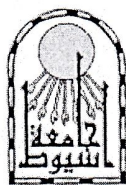
Double bond extending conjugation	+30
Alkyl group, ring residue	α +10
	β +12
	γ and higher +18
Polar groupings: —OH	α +35
	β +30
	δ +50
—OAc	α,β,δ +6
—OMe	α +35
	β -30
	γ -17
	δ -31
—SAlk	β -85
—Cl	α -15
	β -12
—Br	α -25
	β -30
—NR ₂	β -95

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.



Special program
Industrial Chemistry
Final Exam 2017-2018



Assiut University

Ceramics Industry
Time: 2 Hours

Faculty of Science

Answer the following questions

The second paper includes all data needed for calculations

Question NO. 1 (4+3+5=12 points).

- a- What are the major raw materials for both traditional and advanced ceramics?
- b- Show that the minimum cation-to-anion radius ratio for the coordination number 3 is 0.155.
- c- Compute the percent ionic character of the interatomic bonds for the following compounds: GaP, CsF, and FeO. Which one is closer to be a ceramic material?

Question NO. 2 (3+5+5=13 points).

- a- What is the vitrification process? In what type of ceramic materials does vitrification take place?
- b- What are the three main components of a whiteware ceramic such as porcelain? What role does each component play in the forming and firing procedures?
- c- Why is it so important to control the rate of drying of a ceramic body that has been hydroplastically formed or slip cast? Cite three factors that influence the rate of drying, and explain how each affects the rate.

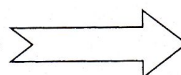
Question NO. 3 (6+3+3=12 points).

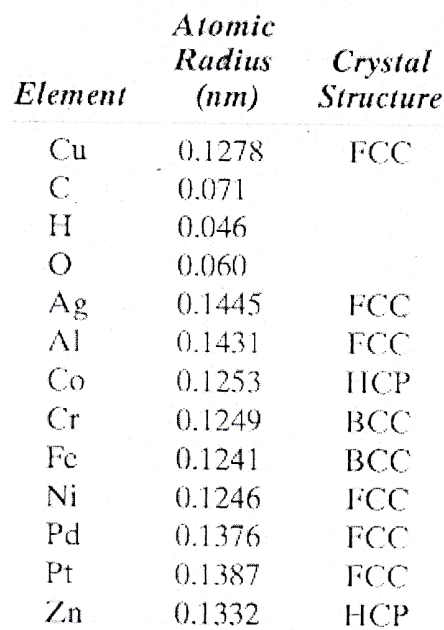
- a- Steel is coated with a thin layer of ceramic to help protect against corrosion. What do you expect to happen to the coating when the temperature of the steel is increased significantly? Explain.
- b- On the basis of ionic radii, what crystal structure do you predict for FeO?
- c- If you are given 2 materials A and B (as shown in Figure in next page), compare between them in terms of melting point, modulus of elasticity, and coefficient of thermal expansion.

Question NO. 4 (6+7=13 points).

- a- Calculate atomic packing factor for Body Centered Cubic (BCC) crystal structure.
- b- Explain with sketches the powder pressing process for ceramic materials.

Figures in next page





The diagram shows the periodic table with atomic sizes represented by the height of the element blocks. The elements are arranged in rows and columns, with their symbols and relative size values (e.g., H 2.1, Li 1.0, Na 0.9, K 0.8, Rb 0.8, Cs 0.7) displayed on the blocks. The size increases from top-left to bottom-right.

r/R	CN	Structural arrangement	Arrange of anions around the cation	Example
0.15 – 0.225	3	Trigonal	Corners of equilateral triangle	Boron oxide
0.225 – 0.414	4	Tetrahedral	Corners of a tetrahedron	ZnS
0.414 – 0.73	6	octahedral	Corners of an octahedron	NaCl
0.732 – 1.000	8	Cubic	corners of a cube	CsCl

| Page 2

Final Inorganic Chemistry Exam(C-321) For Third Level Students

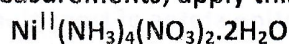
Question Number One:

(16marks)

A) Answer the following:

(8marks)

- a- In some cases the structure of the complex can be deduced using the magnetic moment measurements; apply this fact on the following compound:



- b- State the effective atomic number rule and calculate the effective atomic number of:



Which of them obey the rule and which is not?

B) Answer only four of the following:

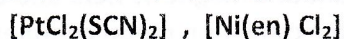
(8 marks)

a) Write the formula of the following complexes.

(i) μ -amido- μ -hydroxo octa-amminedicobalt(III)ion.

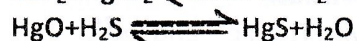
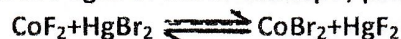
(ii) ammonium tetrathocyanatodiamminechromate(III).

b) Write the IUPAC name of the following complexes.



c) For a three- step complex formation in solution prove that $\beta_3 = K_1 \cdot K_2 \cdot K_3$

d) In the light of HSAB concept , predict which direction the following reactions will go.



e) Write an example for (i) ionization isomerism and (ii) coordination position isomerism

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Question Number Two:

(17 marks)

A) Write on the extraction of pure vanadium from carnotite ore.

B) Give reason(s) for Only four of the following:

- i- Most of transition metals and their compounds are colored.
- ii- Ni^{2+} compounds are thermodynamically more stable than Pt^{2+} while Pt^{4+} compounds are relatively more stable than Ni^{4+} .
- iii- The bivalent and trivalent titanium compounds behave as reducing agents.
- iv- $\text{La}(\text{OH})_3$ is stronger base than $\text{Sc}(\text{OH})_3$ and $\text{Y}(\text{OH})_3$.
- v- KMnO_4 is used as strong oxidizing agent in acidic medium only.

C) Answer Only two of the following:

- i- How can the lower and higher oxidation states of transition metals be stabilised.
- ii- Write on the different uses of platinum metal.
- iii- What is meant by rusting of iron.

Question number Three:

(17 marks)

A) Write briefly on only three of the following:

- i- Different oxidation states of V and Fe.
- ii- Action of NH_3 on zinc group salts.
- iii- Acidic /basic character of the compounds of a given transition metal in various oxidation states.
- iv- Preparation of Mn_3O_4 and its structure.

B) Write the different behaviors of a material under a magnetic field and the different uses of magnetic moment values for transition metal complexes.

c) Answer Only three of the following:

- i- Many metals should not be heated in platinum crucibles.
- ii- Coinage metals do not displace hydrogen from acids.
- iii- Calculate the magnetic moment values for : Mn , Ti^{3+} , Fe^{2+} and Zn^{2+} .
- iv- Calculate the energy associated with absorbed light with a wavelength equals $5000\text{\AA}$.

(Atomic numbers): $\text{Ti}=22$, $\text{Fe}=26$, $\text{Zn}=30$, $\text{V}=23$, $\text{Mn}=25$

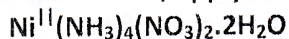
المتتحنون: أ.د/ سعيد إبراهيم ، أ.د/ سحر الجيار ، أ.د/ أسماء إبراهيم

Final Inorganic Chemistry Exam(C-321) For Third Level Students

Question Number One: (16marks)

A) Answer the following: (8 marks)

- a- In some cases the structure of the complex can be deduced using the magnetic moment measurements; apply this fact on the following compound:



- b- State the effective atomic number rule and calculate the effective atomic number of:



Which of them obey the rule and which is not?

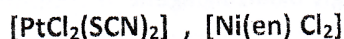
B) Answer only four of the following: (8 marks)

a) Write the formula of the following complexes.

(i) μ -amido- μ -hydroxo octa-amminedicobalt(III)ion.

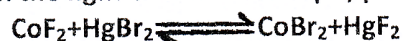
(ii) ammonium tetrathocyanatodiamminechromate(III).

b) Write the IUPAC name of the following complexes.



c) For a three- step complex formation in solution prove that $\beta_3 = K_1 \cdot K_2 \cdot K_3$

d) In the light of HSAB concept , predict which direction the following reactions will go.



e) Write an example for (i) ionization isomerism and (ii) coordination position isomerism

Question No. two: (17 Marks)

a) Put (✓) in front and expect those wrong ones and put (x) in front for only eight of the following : (8 Marks)

i- Most Mn(II) complexes are octahedral and have five unpaired electrons ()

ii- $[\text{CoCl}_4]^{-2}$ tetrahedral complex while $[\text{Co}(\text{en})_2]^{+2}$ square planar complexes ()

iii- Cu_2O is basic oxide and reacts with HCl giving CuCl ()

iv- The KMnO_4 solution should be stored in dark bottle ()

v- Pt(IV) compounds are more stable than Ni (IV) compounds ()

vi- Highest oxidation state of Mn equal $[\text{Ar}]3d^04s^0$ ()

Vii- Cr^{+2} ions are more stable in aqueous solution than Cr^{+3} ions ()

viii- FeO is basic but Fe_2O_3 is amphoteric oxide ()

viii- The number of unpaired electron increase in the first half of the series ()

انظر خلفه

b) Write a brief account on: (9 Marks)

- i- Of the ions Co^{+2} ; Sc^{+3} ; Cr^{+3} ; Ni^{+2} and V^{+3} which one will give colored solution and respond magnetic field
- ii- For each the complex ions $[\text{Ni}(\text{H}_2\text{O})_6]^{+2}$ and $[\text{Ni}(\text{CN})_4]^{-2}$ define the number of unpaired electrons; spin; shape; color magnetic properties and draw energy diagrams
- iii- Ziegler -Natta catalyst for polymerizing ethylene

Question No.3

(17 marks)

a) Describe a method for preparing only six of the following: (9 marks)

- i- Potassium hexacyanoferrate (II) from ferrous sulfate
- ii- Potassium manganate from manganese oxide
- iii- chromium (III) oxide from ammonium dichromate
- iv- V_2O_5 from ammonium metavanadate
- v- chlorotitanic acid from titanium tetrachloride
- vi- Sodium nickelate from nickel metal
- vii- Disodium pentacyanonitrosyl ferrate(II) from sodium hexacyanoferrate(II)

b) Explain why for only eight of the following : (8Marks)

- i- Many transition metal compounds are colored and paramagnetic
- ii- The lower oxidation state of the transition metals the more metallic its behavior
- iii- The electronegativity increase as you go down a group of the transition metals
- iv- Transition metals and their compounds functions as catalysts
- v- $\text{Cr}(\text{II})$ is reducing agent while $\text{Cr}(\text{IV})$ is a strongly oxidizing agent
- vi- FeI_3 does not exist
- vii- TiO_2 is amphoteric oxide
- viii- V_2O_5 acts as catalyst
- ix- Transition metals are well known to form complex compounds

(Atomic number: Sc=21; Ti=22; V=23; Cr=24; Mn=25; Fe=26; Co=27; Ni=28; Cu=29)

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Answer the following question (15 marks)

From the nuclear data given below

Cs 137
30.08 a
 β^- 0.5, 1.2, ...
 γ (284)
m, g
 σ 0.20 + 0.07

A) Sketch the decay scheme of Cs-137.

Write the complete decay equation of Cs-137.

How many Cs atoms are present in 1mCi of Cs-137 activity?

Insert spin and parity of parent and daughter nuclei.

What is the specific activity of Cs-137?

B) Calculate the number of Co-60 atoms produced in 10-mg sample of cobalt metal exposed for 2 min to a thermal-neutron flux of $2 \times 10^{13} \text{ cm}^{-2} \text{ s}^{-1}$ in a reactor. What is the decay rate of the cobalt sample 2 hours after irradiation?

Answer **One question only** of the following

Question no. 1 (10 marks)

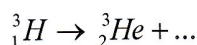
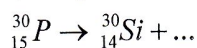
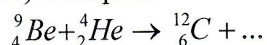
A sample of $1.00 \times 10^{-10} \text{ g}$ of Mo-99 ($T_{1/2} = 66 \text{ h}$) is freshly purified at $t = 0$

- What kind of equilibrium exist between Mo-99 and its daughter Tc-99m ($T_{1/2} = 6 \text{ h}$)?
- If this sample is left without further treatment, when will the amount of Tc-99m in it be a maximum?
- At that time of maximum growth, what will be the weight of Tc-99m present?

Question no.2 (10 marks)

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

B) Complete the following nuclear reactions



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

Good Luck

Prof. Dr. R. M. Mahfouz

Section II: Radiation Chemistry (25 Marks)**(Time: 1 hr)****Answer (only- two) of the following questions:****First Question (12.5 Marks)**

a- It well known that the detection or identification of un-visible radiation such as nuclear radiation by direct ways is very difficult. How to identify this radiation in terms of interaction of radiation with matter.

b- Prove that the decay constant of a certain radioactive nuclide (λ) of a sample which decays to give two isotopes (D_1 and D_2) in a cascade reaction is related by the following equation:

$$\lambda = \frac{1}{t} \ln \left[1 + \frac{1}{p} (D_1 + D_2) \right]$$

where P is the parent and D_1 and D_2 are the respective daughters.

c- Write short notes on the application of alpha-particles.

Second Question (12.5 Marks)

a- Write short notes on type of counters (detectors) used for detection of radiation.

b- Determine the age of earth using the following data for U-235 & U-238 radioactive nuclides:

	U-235	U-238
Half-life($t_{1/2}$), y	7.18×10^8	4.50×10^9
Abundance, %	99.27	0.72

c- Define the following items:

Rad- Curie- Exposure doze- Mean (average) time

Third Question (12.5 Marks)

a- A fissionable uranium-235 is bombarded by a deuteron ($D-2$) of frequency equals 10^{23} cycle/sec.

i- Does this deuteron capable to cause a fission of U-235 nuclide and why! Explain your answer by two proves.

ii- Uranium-235 is known as unstable radioactive nuclide and, hence, it tends to decay by emission of α , β and γ radiation until reaches the more stable Pb-207 element. Calculate the number of both α and β particles in a cascade decay.

iii- Calculate the amount of energy generated from fission of 15 g of U-235 (in Mwd) knowing that each fission produces 200 Mev of energy. Also, calculate the number of curies equivalent to such fission.

$m_{D-2} = 2.0147 \text{ amu}$; $Z_{Pb} = 82$; $Z_U = 92$; $(t_{1/2})$ of U-235 = $7.18 \times 10^8 \text{ y}$,
 $R_0 = 1.3 \times 10^{-13} \text{ cm}$; $\text{Mev} = 1.6 \times 10^{-13} \text{ w.s.}$

Good Luck**Prof. Dr. Refat El-Moushy**

Periodic Table of Elements

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18

Atomic #	Symbol	Name	Atomic Weight
1	H	Hydrogen	1.00794
3	Li	Lithium	6.941
11	Na	Sodium	22.98976928
12	Mg	Magnesium	24.3050
19	K	Potassium	39.0983
20	Ca	Calcium	40.078
37	Rb	Rubidium	85.4678
38	Sr	Strontium	87.62
55	Ba	Barium	137.327
88	Ra	Radium	(226)

C	Solid
Hg	Liquid
H	Gas
Rf	Unknown

Metals	Nonmetals
Alkali metals	
Alkaline earth metals	
Lanthanoids	
Actinoids	
Transition metals	
Poor metals	
Other nonmetals	
Noble gases	

2	He	Helium	4.002602
10	Ne	Neon	20.1797
18	Ar	Argon	39.948
36	Kr	Krypton	83.796
54	Xe	Xenon	131.293
86	Rn	Radon	(222.0175)
118	Uuo	Ununoctium	(294)
9	F	Fluorine	18.9984032
17	Cl	Chlorine	35.453
35	Br	Bromine	79.904
53	I	Iodine	126.90547
85	At	Astatine	(210)
117	Uus	Ununseptium	(289)
6	C	Carbon	12.011
14	Si	Silicon	28.0855
32	Ge	Germanium	72.64
50	Sn	Tin	118.710
82	Pb	Lead	207.2
114	Fl	Flerovium	(289)
7	N	Nitrogen	14.00643
15	P	Phosphorus	30.973762
33	As	Arsenic	74.9216
51	Sb	Antimony	121.757
83	Bi	Bismuth	208.9804
115	Uup	Ununpentium	(288)
8	O	Oxygen	15.999
16	S	Sulfur	32.06
34	Se	Selenium	78.96
52	Te	Tellurium	127.6
84	Po	Polonium	(209)
116	Lv	Livermorium	(293)
5	B	Boron	10.811
13	Al	Aluminum	26.9815386
31	Ga	Gallium	69.723
49	In	Indium	114.818
81	Tl	Thallium	204.3833
113	Uut	Ununtrium	(284)
4	Be	Beryllium	9.012182
12	Mg	Magnesium	24.3050
20	Ca	Calcium	40.078
38	Sr	Strontium	87.62
56	Ba	Barium	137.327
88	Ra	Radium	(226)
21	Sc	Scandium	44.955912
39	Y	Yttrium	88.905848
57	La	Lanthanum	138.90547
89	Ac	Actinium	(227)
22	Ti	Titanium	47.88
40	Zr	Zirconium	91.224
58	Ce	Cerium	140.116
90	Th	Thorium	232.0377
23	V	Vanadium	50.9415
41	Nb	Niobium	92.90638
59	Pr	Praseodymium	140.90768
91	Pa	Protactinium	231.03688
24	Cr	Chromium	51.99616
42	Mo	Molybdenum	95.94
60	Nd	Neodymium	144.242
92	U	Uranium	238.02891
25	Mn	Manganese	54.938045
43	Tc	Technetium	(98)
61	Pm	Promethium	(145)
93	Np	Neptunium	(237)
26	Fe	Iron	55.845
44	Ru	Ruthenium	101.07
62	Sm	Samarium	150.36
94	Pu	Plutonium	(244)
27	Co	Cobalt	58.933195
45	Rh	Rhodium	102.90550
63	Eu	Europium	151.964
95	Am	Americium	(243)
28	Ni	Nickel	58.6934
46	Pd	Palladium	106.9051
64	Gd	Gadolinium	157.25
96	Cm	Curium	(247)
29	Cu	Copper	63.546
47	Ag	Silver	107.8682
65	Tb	Terbium	158.92535
97	Bk	Berkelium	(247)
30	Zn	Zinc	65.38
48	Cd	Cadmium	112.411
66	Dy	Dysprosium	162.500
98	Cf	Californium	(251)
31	Ga	Gallium	69.723
49	In	Indium	114.818
67	Ho	Holmium	164.93032
99	Es	Einsteinium	(252)
32	Ge	Germanium	72.64
50	Sn	Tin	118.710
68	Er	Erbium	167.259
100	Fm	Fermium	(257)
33	As	Arsenic	74.9216
51	Sb	Antimony	121.757
69	Tm	Thulium	168.93421
101	Md	Mendelevium	(258)
34	Se	Selenium	78.96
52	Te	Tellurium	127.6
70	Yb	Ytterbium	173.054
102	No	Nobelium	(259)
35	Br	Bromine	79.904
53	I	Iodine	126.90547
71	Lu	Lutetium	174.967
103	Lr	Lawrencium	(262)

For elements with no stable isotopes, the mass number of the isotope with the longest half-life is in parentheses.

Periodic Table Design and Interface Copyright © 1997 Michael Dayan. <http://www.ptable.com/> Last updated: May 9, 2013.

57	La	Lanthanum	138.90547
58	Ce	Cerium	140.116
59	Pr	Praseodymium	140.90768
60	Nd	Neodymium	144.242
61	Pm	Promethium	(145)
62	Sm	Samarium	150.36
63	Eu	Europium	151.964
64	Gd	Gadolinium	157.25
65	Tb	Terbium	158.92535
66	Dy	Dysprosium	162.500
67	Ho	Holmium	164.93032
68	Er	Erbium	167.259
69	Tm	Thulium	168.93421
70	Yb	Ytterbium	173.054
71	Lu	Lutetium	174.967
89	Ac	Actinium	(227)
90	Th	Thorium	232.0377
91	Pa	Protactinium	231.03688
92	U	Uranium	238.02891
93	Np	Neptunium	(237)
94	Pu	Plutonium	(244)
95	Am	Americium	(243)
96	Cm	Curium	(247)
97	Bk	Berkelium	(247)
98	Cf	Californium	(251)
99	Es	Einsteinium	(252)
100	Fm	Fermium	(257)
101	Md	Mendelevium	(258)
102	No	Nobelium	(259)
103	Lr	Lawrencium	(262)

[illegible]



Answer the Following Questions:

I. Surface Chemistry

1- Choose the correct answer: (5 Marks)

- a) Which of the following statement is not true?
- (i) The value of adsorption enthalpy of physical adsorption is less than chemical adsorption.
 - (ii) The physical adsorption occurs due to the van der Waals forces.
 - (iii) Chemical adsorption decreases at high temperature
 - (iv) Physical adsorption is reversible
- b) How magnitude of adsorption gas is expressed?
- a) $\frac{m}{x}$ b) $m \cdot \Delta x$ c) $\frac{x}{m}$ d) $x + m$
- (c) If the value of $\frac{1}{n}$ becomes zero in Freundlich adsorption isotherm the adsorption is independent to:
- (a) Pressure (b) Temperature (c) quantity (d) a and b
- (d) What will be the intercept in a graph of Freundlich isotherm?
- (a) k (b) $\log k$ (c) $\frac{1}{a}$ (d) $\frac{1}{n}$
- (e) Whose value is less than zero during adsorption
- (a) ΔG (b) ΔH (c) ΔS (d) All the given

2- Define the following terms : (5 Marks)

- (i) Adsorption (ii) chemisorptions (iii) monolayer adsorption (iv) surface excess concentration
(v) micropores

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

- a) Give an account of Langmuir adsorption isotherm.
- b) Apply the BET equation for determining of the S_{BET} of solid catalyst from the adsorption isotherm.
- c) How is the porosity of a solid catalyst be assessed from the adsorption isotherm.
- d) Explain three factors that effect the adsorption of gases on solids.

II. Colloids

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

- i) Associated Colloids. ii) Electro-osmosis. iii) Salting out of an emulsified substance.

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

- i) Hydrous ferric oxide sol. ii) Oleic acid in water emulsion.
iii) Gold sol by the reduction method. iv) Calcium acetate gel.

3-a) Give the structure of the colloidal ion of SiO_2 sol in water. (2 Marks)

b) Write a short note on Only Two from the followings: (6 Marks)

- i) The physical properties of sols.
- ii) Purification of sols by electro-dialysis methods.
- iii) The behavior of platinum sol under an applied electric potential difference.

4- Give reasons for Only One from the following:- (2 Marks)

- i) The amount of electrolyte required to precipitate a given sol depends on the nature of the electrolyte added. Give an example.
- ii) The breaking of oil in water emulsion stabilized by sodium soap through addition of sulphuric acid.

5- Complete the following:- (3 Marks)

- i) _____ is a common thixotropic gel, and the dispersed phase in emulsions are generally _____ charged.
- ii) _____ sol can be obtained by change of solvent, whereas silicic acid gels can be obtained by _____.
- iii) Edible jelly can be obtained by _____, whereas _____ can be obtained by Bredig's arc method.

----- Good Luck -----

Prof. Dr. Abdel-Aziz A. Said ,

Prof. Dr. Maher M. Girgis.



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

- i) Hydrous ferric oxide sol. ii) Oleic acid in water emulsion.
iii) Gold sol by the reduction method. iv) Calcium acetate gel.

3-a) Give the structure of the colloidal ion of SiO_2 sol in water. (2 Marks)

b) Write a short note on Only Two from the followings: (6 Marks)

- i) The physical properties of sols.
- ii) Purification of sols by electro-dialysis methods.
- iii) The behavior of platinum sol under an applied electric potential difference.

4- Give reasons for Only One from the following:- (2 Marks)

- i) The amount of electrolyte required to precipitate a given sol depends on the nature of the electrolyte added. Give an example.
- ii) The breaking of oil in water emulsion stabilized by sodium soap through addition of sulphuric acid.

5- Complete the following:- (3 Marks)

- i) _____ is a common thixotropic gel, and the dispersed phase in emulsions are generally _____ charged.
- ii) _____ sol can be obtained by change of solvent, whereas silicic acid gels can be obtained by _____.
- iii) Edible jelly can be obtained by _____, whereas _____ can be obtained by Bredig's arc method.

----- Good Luck -----

Prof. Dr. Abdel-Aziz A. Said ,

Prof. Dr. Maher M. Girgis.

Assiut University
Faculty of Science
Chemistry Department

Date:21/12/2017

Time:2 hrs

**Final Organic Chemistry Examination(chem 309)For Third Year
Industrial Chemistry Students**

Answer the following questions: (50 Marks)

1) What is the effect of Five of the following reagents on glucose.

Phenyl hydrazine , Ac_2O , $\text{HNO}_3(\text{conc.})$, $\text{NaOH}(\text{dil})$, Na/Hg ,
dimethylsulphate (5x5=25 marks)

2) Discuss the preparation of alanine by two different methods , and what are the products of its reaction with the following :

- | | |
|----------------------|------------------------|
| a- Nitric acid. | b- Ninhydrin reaction. |
| c- Benzoyl chloride. | d- Dry heat. |
| e- Methanol / Hcl. | (15 Marks) |

3) Discuss the following:

- a- Distinction between sun flower oil and paraffin oil.
- b- Distinction between normal soap and synthetic anionic detergent.
- c- Conversion of triolein to tristearin.
- d- Determination of the sequence of amino acids in a polypeptide.
- e- Rancidity of vegetable oils ; causes and prevention.

(5x2=10 marks)

Good Luck

Examiner: Prof.Dr.Morsy.M.Ali

Assiut University
Faculty of Science
Chemistry Department



Date: December 2017

Time: 3 hours

Marks: 50

Environmental Analytical Chemistry Examination (C-343)

Answer the following questions: (50 Marks)

1- Discuss only three of the following: (9 Marks)

- The effect of oil pollution on aquatic life and the methods used to control its impact.
- The impact of phosphate based detergents on water bodies, and the best way to protect the environment from their pollution.
- Mercury (Hg) is one of the most toxic heavy metals; however, its toxicity depends on its chemical state.
- Physical and chemical processing units used for treatment of industrial wastewater.

2- Differentiate between only two of the following: (6 Marks)

- Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) for the determination of the organic content in wastewater.
- Aerobic and anaerobic treatment of wastewater.
- Preliminary and primary treatment of domestic sewage wastewater.

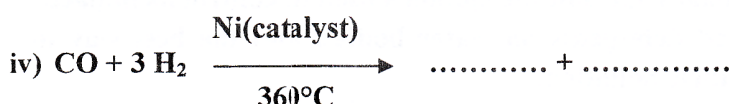
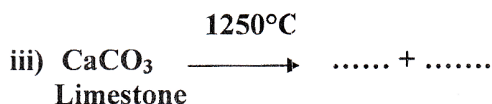
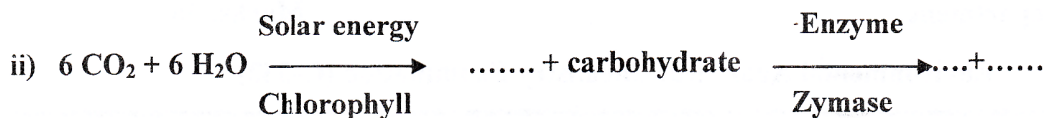
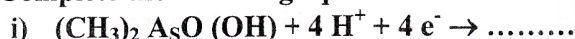
3- Put (✓) or (X) for the following sentences, and correct the wrong statement: (5 Marks)

- Detergents that possess a linear chains are less biodegradable than those having branched carbon chain.
- Dissolved oxygen value in lakes located higher than sea level is lower than dissolved oxygen value in one near the sea level.
- The BOD value of industrial wastewater discharged from paper industry is usually higher than that of the food industry.
- Plain sedimentation is more effective for the removal of total suspended matter than chemical precipitation.
- Ultrafiltration has the ability to remove very fine particles even dissolved salts.

أنظر خلفه باقى الأسئلة

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

a) Complete the following equations:



b) Show the difference between each of the following terms:

- i) Classical smog and photochemical smog.
- ii) Tetra Butyl Tin and Dimethyl Tin Chloride.
- iii) Poisoning effects of CO and CO₂ gases.
- iv) Flame and graphite furnace atomic absorption spectrometry.

c) Write briefly on the poisoning effects of mercury and arsenic ions for human due to environmental contamination.

d) What are the major industrial uses of organotin compounds.

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

a) Show by equations some functions of nitrogen oxides in the atmosphere.

b) Define each of the following:

The acid rain – The phosphine – Aflatoxin B₁.

c) How can toluene may be converted to Hippuric acid.

d) Describe briefly the advantages of differential pulse anodic stripping voltammetry as an analytical tool for measuring some trace elements in environmental samples.

e) An amine reacts with picric acid to form amine picrate which absorb strongly at 359 nm ($\epsilon = 1.25 \times 10^4$). unknown amine (0.1155g) is dissolved in water and diluted to 100 ml. If the solution exhibits an absorbance of 0.454 at 359 nm using 1 cm cell.
What is the molecular weight of the amine?

"Good Luck"

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

Assiut University

Faculty of Science

Chemistry Department

First Term 2017 – 2018

Industrial Chemistry 307

3 rd Year

Dyes

Date: 27/12/2017

Time: 2 hrs

Answer the following questions:

- 1) Colour and Constitution of Organic Molecules are related: Discuss.
- 2) Explain the reaction mechanism in Azo Dyes production.
- 3) Write using equations the synthesis of the vat dye named Indigo.

Examiner: Prof.Dr.Saoud Metwally