Faculty of Science
Chemistry Department

January 5, 2015
Time : 3 Hours

Photochemistry and Reactive Intermediates (313C)

Final Examination For Third Level Students

Ansewr 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 the theory of Photochemistry ?.

2- Discuss the application Franck–Condon Principle in photocatalytic Cleavage.

3-Explain the role of Chemical Actinometers in Photochemistry?, give an example.

4- Discuss the possible Norrish **type II** cleavage of 2-pentanone.

5- Describe the chemical changes of Rhodopsin during the process of vision.

II] – Mark right (√) or wrong (X) on **Only Four** of the following statements, and **explain** your answer : (2 X 4 = 8 Marks)

1- Light filters absorbing ≥ 220 nm radiations can be used for UV photolysis of organic compounds. ( )

2- Microwaves heating is due to molecular vibrations. ( )

3- Gerade → Gerade transition is a spin allowed transition. ( )

4- ***Z/E***-Thermal and photoisomerization are similar. ( )

5 - Photosensitization is very effective when the triplet energy of the photosensitizer is much higher than that of the acceptor. ( )

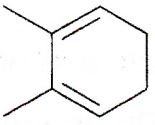
ملحوظة هامة : الأسئلة ٣ صفحـــات

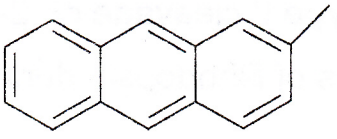
(2)

III] - Complete **Only Three** of the following reactions and **discuss** the reaction mechanism: (3 X 3 = 9 Marks)

a - 1,2- Diphenylbenzene $\xrightarrow[O_2]{hv}$?

b- 2 $CH_2 = CH - CH = CH\ OCH_3$ $\xrightarrow[\text{Benzophenone}]{hv,\ 450\ nm}$?

c-  $\xrightarrow{^1O_2}$?

d- 

$\xrightarrow{hv\ ,\text{isopropanol}}$?

Section (B) Reactive Intermediates : (25 Marks)

Answer the Following Questions:

1) Write on the following (use equations): (3x3 = 9 Marks)

a. Difference between singlet and triplet carbenes.

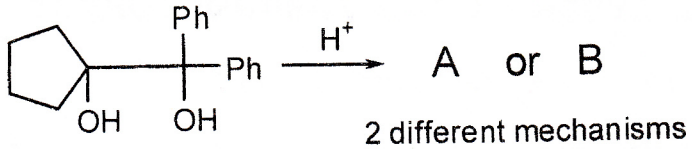
b. Generation of nitrene compound from phthalic acid.

c. Benzyl carbocation is more stable than methyl carbocation, (explain this statement).

2) Complete *Only Four* of the following reactions. Suggest the suitable mechanism , and give the name of this mechanism:

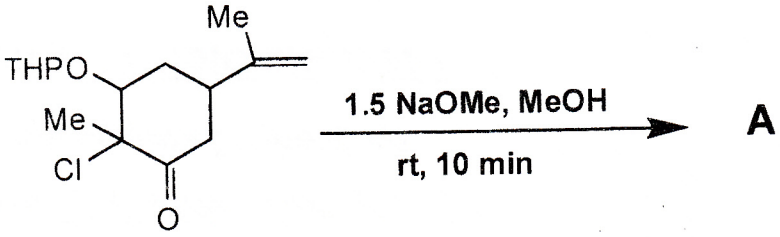
(4x4=16 Marks)

I-

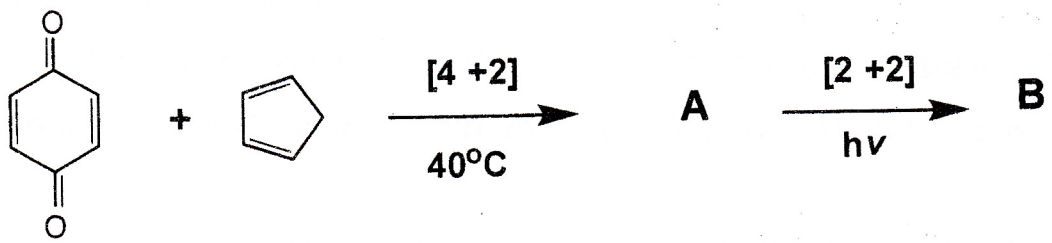


2 different mechanisms

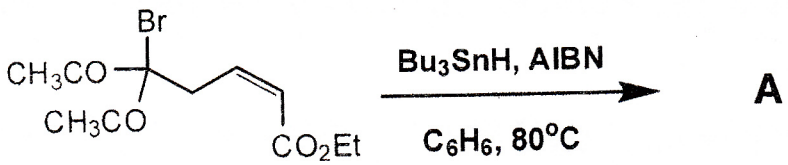
II-



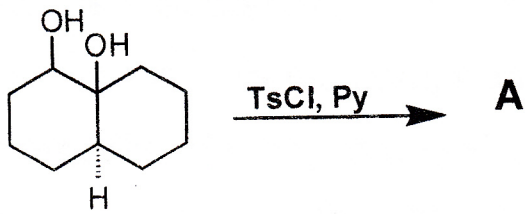
III-



VI-



V-



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

3-

Assiut University
Faculty of Science
Chemistry Department

(1)

Date: Jan. 2015
Time allowed: 3 hrs.

Organic Chemistry Examination for 3rd Chemistry Students
311C (Spectroscopy and Stereo Chemistry)

Section A: Spectroscopy **(34 Marks)**

Answer the following questions:

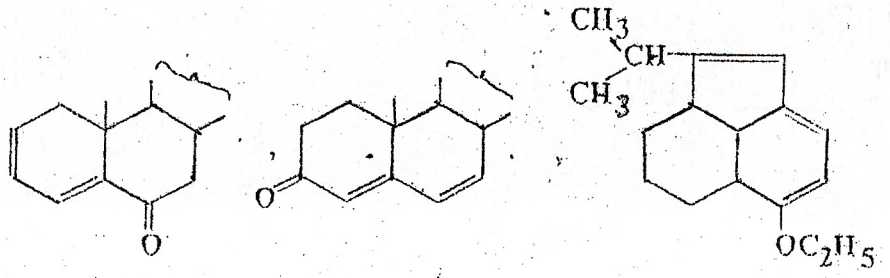
1) Write what is meant by:

Chromophore , Auxochrome , Bathochromic shift , Hypochromic effect

(3.5 Marks)

2) Using the provided tables show if the following compounds are coloured or not:

(3.5 Marks)



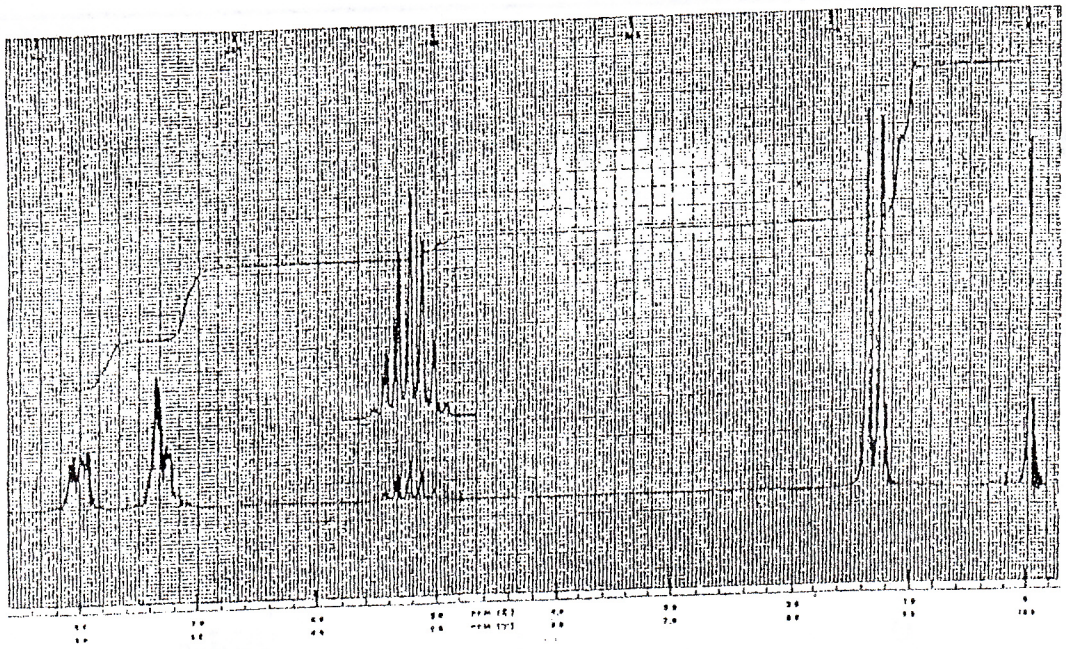
3) Substitution of alkyl group on benzene ring produces a bathochromic shift of B-band, and the addition of a second alkyl group is most effective in red shift if it is in para position (not ortho), explain this statement. **(3.5 Marks)**

4) Interpret the following table and show what can you deduce from these readings:

(3.5 Marks)

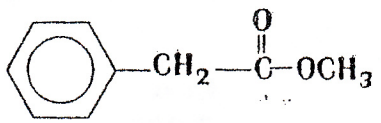
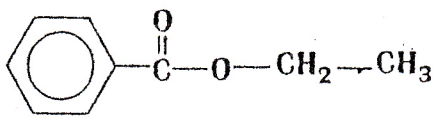
	λ_{max}	ε_{max}
Benzene	**204**	**7.000**
Phenol	**210.5**	**6.200**
Phenolate anion	**235**	**9.400**
Aniline	**230**	**8.600**
Anilinium cation	**203**	**7.500**
N,N-Dimethylaniline	**251**	**15.500**
2-Methly-N,N-dimethylaniline	**248**	**6.300**

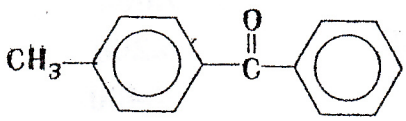
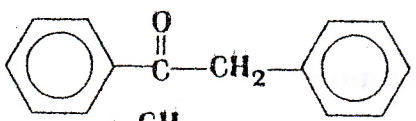
u are provided with the NMR spectrum of a compound having the molecular ormula $C_{10}H_{12}O_2$ and which may have one of the following structures: C_6H_5-$COOCH_2CH_2CH_3$; C_6H_5-$COOCH(CH_3)_2$; C_6H_5-$CH_2COOCH_2CH_3$ Assign the suitable structures which agrees with the provided spectrum, give reasons for your assignment and show the NMR peaks which confirm your answer. **(3.5 Marks)**

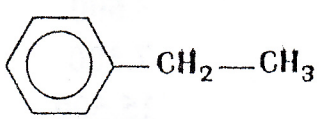
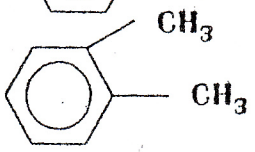


6) Explain how can you differentiate between the following pairs of isomers by the Use of I.R. spectra. **(3.5 Marks)**

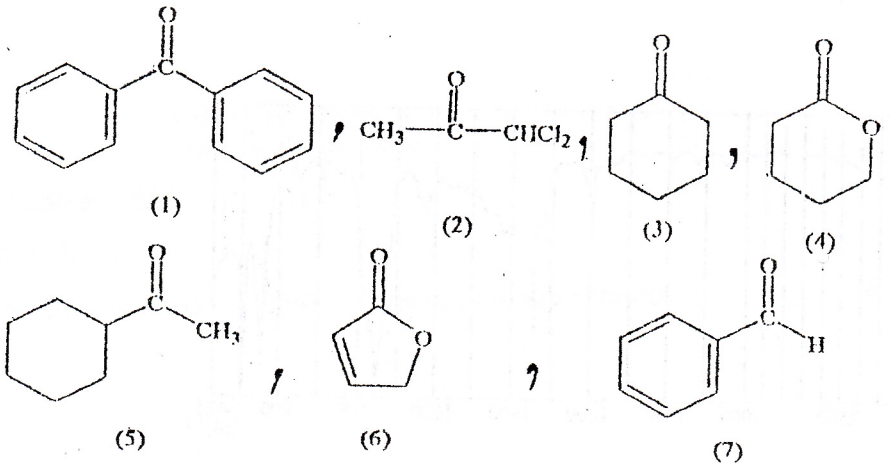
(i) $H_3C-C\equiv C-CH_3$ and $H_3C-CH_2-C\equiv CH$

(ii)  and 

(iii)  and 

(iv)  and 

7) Assign the most appropriate carbonyl frequencies in cm-1 for the following compounds, try to explain the reason. (3.5 Mark



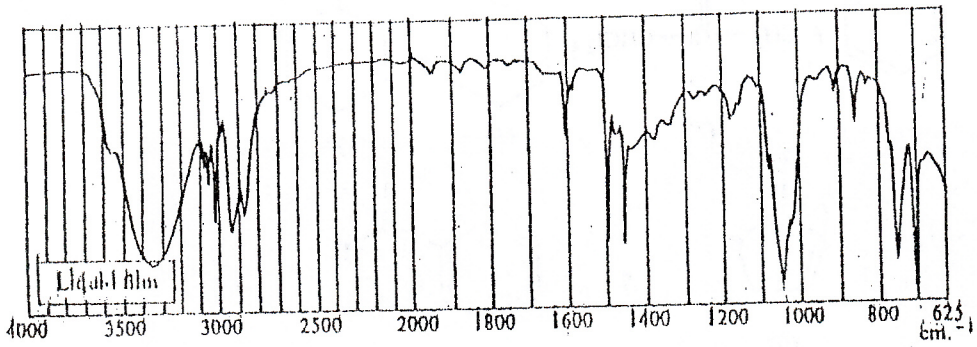
8) Explain what is meant by " Ortho effect " in mass spectrometry ? illustrate your answer by an example. (2.5 Marks)

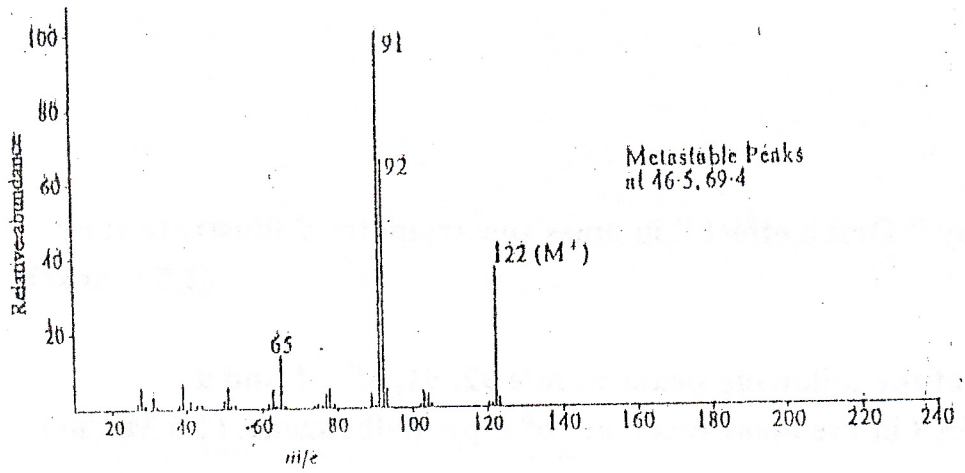
9)Explain the appearance of the following peaks at m/e 92, 91, 65, 51 and a metastable ion peak at 33.8 in the mass spectrum of n-propylbenzene. (2.5 Marks)

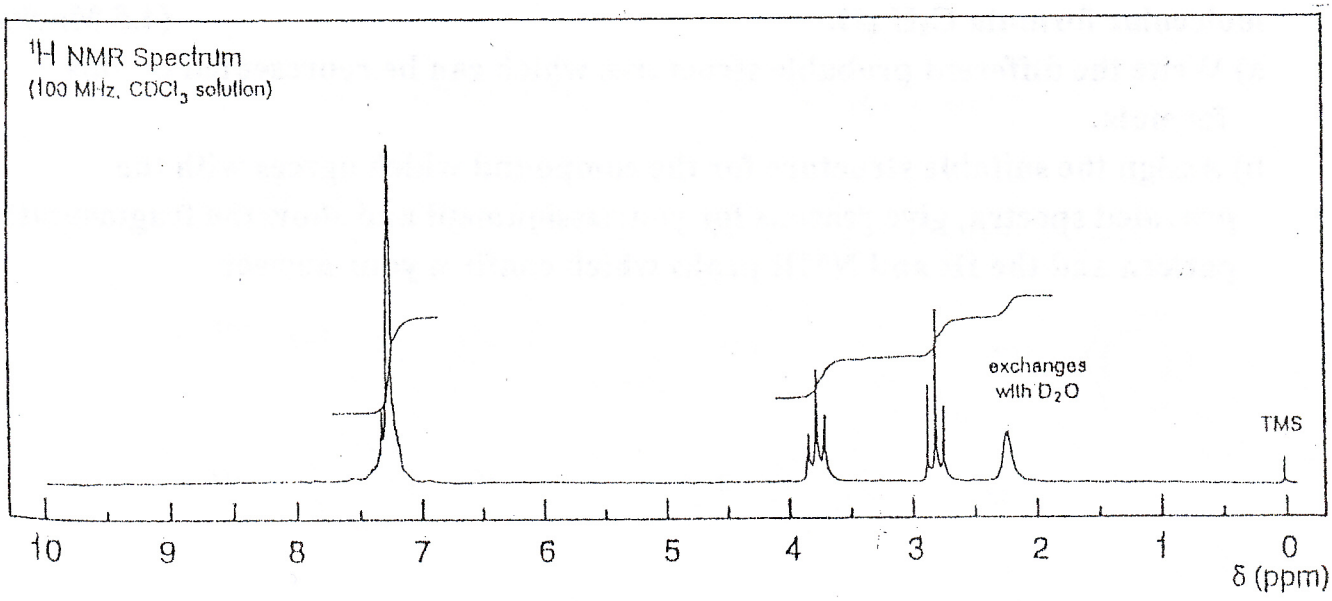
10) You are provided with the IR, MS and NMR spectra of a compound having the molecular formula $C_8H_{10}O$. (4.5 Marks)

a) Write the different probable structures which can be represented by this formula.

b) Assign the suitable structure for the compound which agrees with the provided spectra, give reasons for your assignment and show the fragmentation pattern and the IR and NMR peaks which confirm your answer.


Liquid film
4000
3500
3000
2500
2000
1800
1600
1400
1200
1000
800
625
cm.⁻¹


Relative abundance
100
80
60
40
20
91
92
122 (M⁺)
65
Metastable peaks
at 46·5, 69·4
20
40
60
80
100
120
140
160
180
200
220
240
m/e


¹H NMR Spectrum
(100 MHz, CDCl₃ solution)
exchanges
with D₂O
TMS
10
9
8
7
6
5
4
3
2
1
0
δ (ppm)

(15)

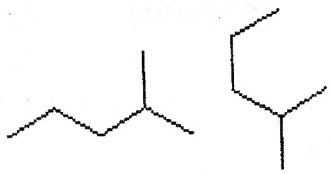
(Stereochemistry)

Answer the following questions:

Section .: Stereochemistry:

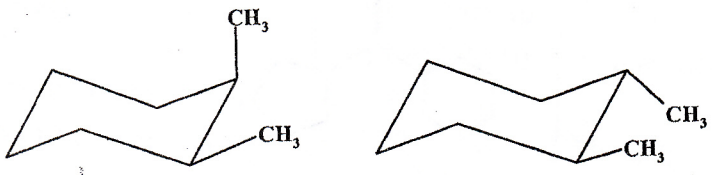
Question 1: State how the following structures in each pair are related: **(6 Marks)**

a.

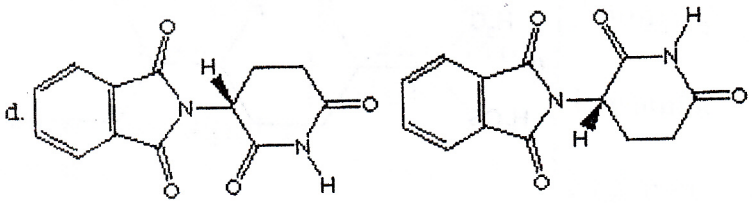


b.

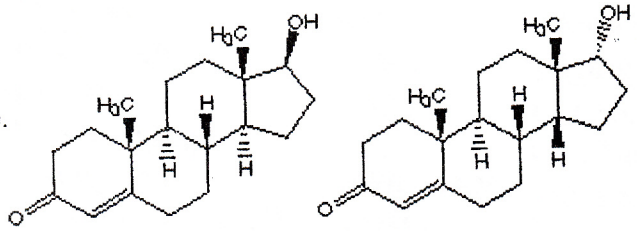
c.



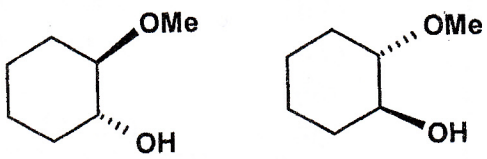
d.



e.



f.



See the next page

(6)

Question 2: **(4 Marks)**

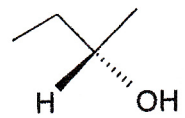
a) Given that (R)-2-bromobutane has a specific rotation of -23.1°, what is the specific rotation of (S)-2-bromobutane?

b) Using the data from the previous point, what is the optical purity and % composition of a mixture of (R)- and (S)-2-bromobutane whose specific rotation was found to be +18.4° ?

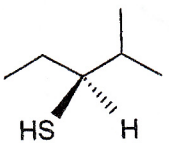
c) What about a mixture whose specific rotation was found to be - 9.2° ?

Question 3: Designate the RS configurations for **ONLY SIX** of each chiral center in the structures shown below: **(6 Marks)**

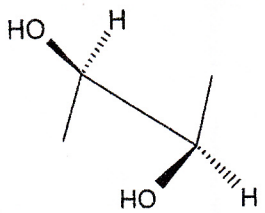
a)



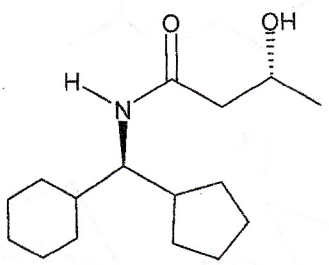
b)



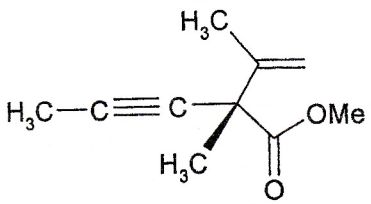
c)



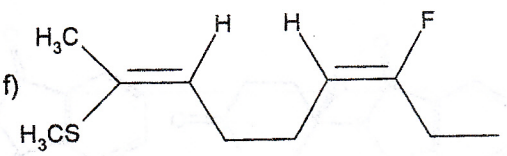
d)



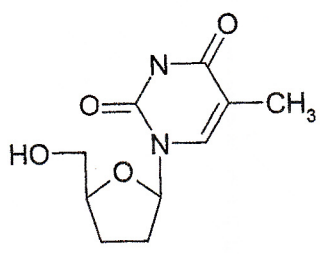
e)



f)



g)

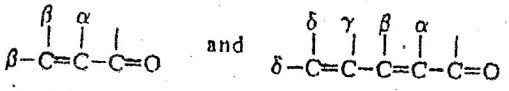


Characteristic Infrared absorption of functional groups

C - H Stretching	
Alkane	2962 - 2853
Alkene monosubst. (vinyl)	3040 - 3070
Alkene disubstit. (cis, trans)	3040 - 3010
Alkene disubstit. (gem)	3095 - 3070
Alkyne	~ 3333
Aromatic	3030 - 3100
Aldehyde	2720, 2820
C - H Bending	
Alkane	~ 1340
Alkane - CH_2 -	1485 - 1445
Alkane - CH_3	1470 - 1430 1380 - 1370
Alkane gem. Dimethyl	1385 - 1380 1370 - 1365
Alkane tert-butyl	1395 - 1385 ~ 1365
Alkene, monosubst. (vinyl)	995 - 985 915 - 905 1420 - 1410
Alkene, disubst. cis	~ 690
Alkene, disubst. trans	970 - 960 1310 - 1295
Alkene, disubst. gem	895 - 885 1420 - 1410 ~ 636
Aromatic Substitution	
Monosubst.	~ 750 ~ 700
Disubstit. ortho	~ 750
Disuubstit. meta	~ 780
Disulstit. Para	~ 820
C = C Stretching	
Non conjugated	1680 - 1620
Monosubstituted (vinyl)	~ 1645
Disubstit., cis	~ 1658
Disubstit., trans	~ 1675
Disubstit., gem	~ 1653
Trisubstit.,	~ 1669
Tetrasubst. (weak)	~ 1669

C ≡ C Stretching	2100 - 2260
Aromatic skeleton	1600 1580 1500 1450
Carbonyl Stretching	
Saturated ketone acyclic 6 - memb. saturated ketone	1720
Amides I	~ 1696
Amides II	~ 1656
Alcohols	
O - H str. Free	6350 - 3590
O - H str. associated	3400 - 3200
Carboxylic Acids	
O - H str associated	2700 - 2500
Coupled - OH bending and C - O str.	
1 ry alcohol	~ 1050 1350 - 1260
2 nd alcohol	~ 1100 1350 - 1260
3 ry alcohol	~ 1150 1410 - 1300
Phenols	~ 1200 1410 - 1316
Amines N - H str	
1 ry amine	~ 3506 ~ 3400
2 nd amine	~ 3500 - 3310
Amine salt	3136 - 3036
Amines N - H bending	
1 ry amine	1656 - 1590
2 nd amine	1650 - 1550
amine salt	1600 - 1575 ~ 1500
C ≡ N stretching	2260 - 2240

Rules of Enone and Dienone Absorption (α,β-Unsaturated Carbonyls of Ketones)



Enone and Dienone

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
			λ_{calc} = Total[b]

Solvent Corrections*

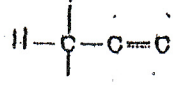
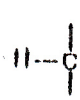
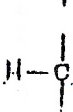
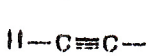
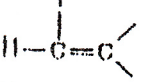
Solvent	Correction (*nm*)
Ethanol	0
Methanol	0
Dioxane	+5
Chloroform	+1
Ether	+7
Water	−8
Hexane	+11
Cyclohexane	+11

Rules of Diene Absorption

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*		+0
		λ_{calc} = Total

Approximate chemical shift positions for protons in organic molecules.

Chemical Shifts of Representative Types of Protons

Type of proton	Chemical shift (δ), ppm*	Type of proton	Chemical shift (δ), ppm*
	0.9–1.8		2.2–2.9
	1.8–2.6		3.1–4.1
	2.1–2.5		2.7–4.1
	2.5		3.3–3.7
	2.3–2.5		1–3†
	4.5–6.5		0.5–5†
	6.5–8.5		0–8†
	9–10		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.

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Assiut University

Faculty of science

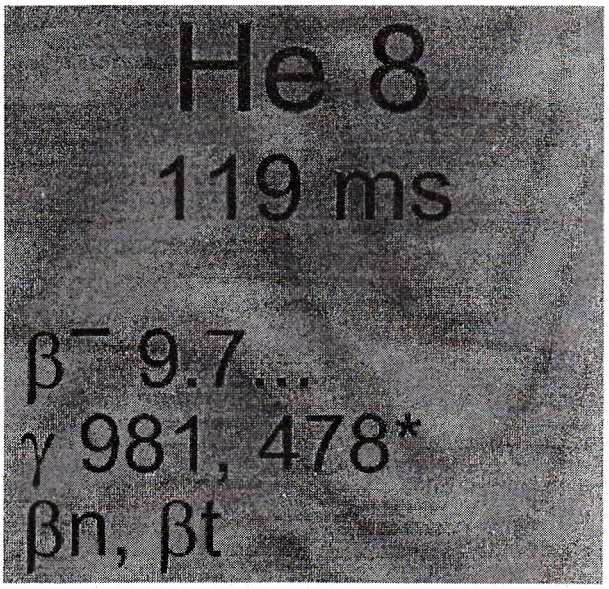
Chemistry department

Final Exam. For course no.333 (nuclear and radiochemistry) , academic year 2014/2015

Time allowed (3 hours)

Answer the following question (*18 marks*)

Given the following nuclear data for He-8.



1) Sketch the decay scheme of He-8

2) Write the complete decay equations (β^- , βn , βt).

3) Insert spin and parity of both parent and daughter nuclei

4) The reaction $^{33}S(n,p)\ ^{33}p$ is exoergic by 0.533 MeV. The mass of ^{33}S is 32.971458 u

What is the mass of ^{33}P.

5) What is the time intervals during which Ga-67 ($T_{1/2}$ = 3.2 d) decay to 40% of the original activity

6) Complete the following nuclear equations

$^{14}_{7}N + ^{4}_{2}He \rightarrow ^{16}_{8}O + \ldots$

(2)

$^{256}_{100}Fm \rightarrow ^{140}_{54}Xe + ... + 4n$

$^{9}_{4}Be + ^{4}_{2}He \rightarrow ^{12}_{6}C + ...$

$^{64}_{29}Cu \rightarrow ^{64}_{30}Zn + ...$

$^{11}_{3}Li + .. \rightarrow ^{9}_{3}Li + ...$

7) Consider the odd-odd nuclei ^{38}Cl , ^{26}Al and ^{56}Co. predict the ground and excited states spins **only** for the nuclei.

8) write short notes on the interaction of neutrons with matter

9) for the fusion reaction

P + p ⟶ d + β^+ + v

Balance the nuclear equation of the reaction

Calculate the Q-value of the reaction

Is this reaction exothermic or endothermic

Answer *two*
only of the following questions ***(32 marks)***

1) Given the SEMF below

EB = 16 A-20 $A^{2/3}$ – 0.75 $Z^2/A^{1/3}$ – 21 (N-Z)^2/A + 11.2 /$A^{1/2}$

A) Calculate the binding energy per nucleon for Fe = 52

B) Consider the nuclei ^{15}C, ^{15}N, and ^{15}O. Which of these nuclei is stable? What Types of radioactive decay would the other two undergo? Calculate the

binding energy difference between ^{15}N and ^{15}O. Assuming this difference comes from the Coulomb term in the semi-empirical binding energy equation, calculate the nuclear radius.

C) Define the following items

Mass stopping power of a charged particle in matter , equivalent dose ,exposure dose
Auger electron

D) What is the specific activity of Rd -226

E) Calculate the the mass absorption coefficient of 1- MeV ϒ- ray for NaI (μ_aNa=2.32b atom^{-1} ,μ_a I =12.03 b atom^{-1}),

---

2) Given 2.00 kg of $^{238}_{92}U$ ($T_{1/2} = 4.5 \times 10^9$) the stable decay product in this series is $^{206}_{82}Pb$

A) To which naturally occurring series U-92 belong to

B) What weight of U-92 is left after 3×10^9 y.

C) What weight of Pb-82 is produced in this time

D) For the following nuclear equations

^{106}Pd ***(n,p)*** ^{106}Rh

^{106} Rh $\longrightarrow$ β^- +...

Complete the decay equation of Rh-106

From the two equations calculate the mass of Rh-106 (the mass of Pd-106 =105.9035 u)

E) Define the following items

Photo electric effect , Compton scattering , Gray ,absorbed dose

F)How long 60-mg of co -59 has to be placed in a flux of 5x1013 n/cm2/sec to make 10 mCi of Co-60. What type of nuclear reaction we used in this experiment

---

3) For the following nuclear decay

(4)

$$^{99}_{42}Mo\,(T_{1/2} \equiv 67\,h) \rightarrow {}^{99\,m}_{43}Tc\,(T_{1/2} \equiv 6h) \rightarrow {}^{99}_{43}Tc\,(T_{1/2} \equiv 2.1\times10^{5}y) \rightarrow {}^{99}Ru$$

A) What are the modes of decay of Mo-99 , ^{99m}Tc and Tc-99

B)Calculate the total number of atoms and the total mass in 15 mCi (555 MBq) of Mo-99 activity

C) Calculate the activity of ^{99m}Tc after 6 hours and 60 hours decay of Mo-99 if the initial activity is 15mCi

D) Calculate the time for the maximum activity of ^{99m}Tc

E) A radionuclide has initial activity of 2.0 x10^6 dis./min. and after 4.0 days its activity is 9x10^5 dis. /min.. Calculate the activity in the sample after 40 days

F) U-235 ($T_{1/2}$ =7.04 x10^8 y) emits α particle to form Th-231 ($T_{1/2}$ =25.5h).

Determine the following

The atomic ratio of Th-231 to the initial U-235

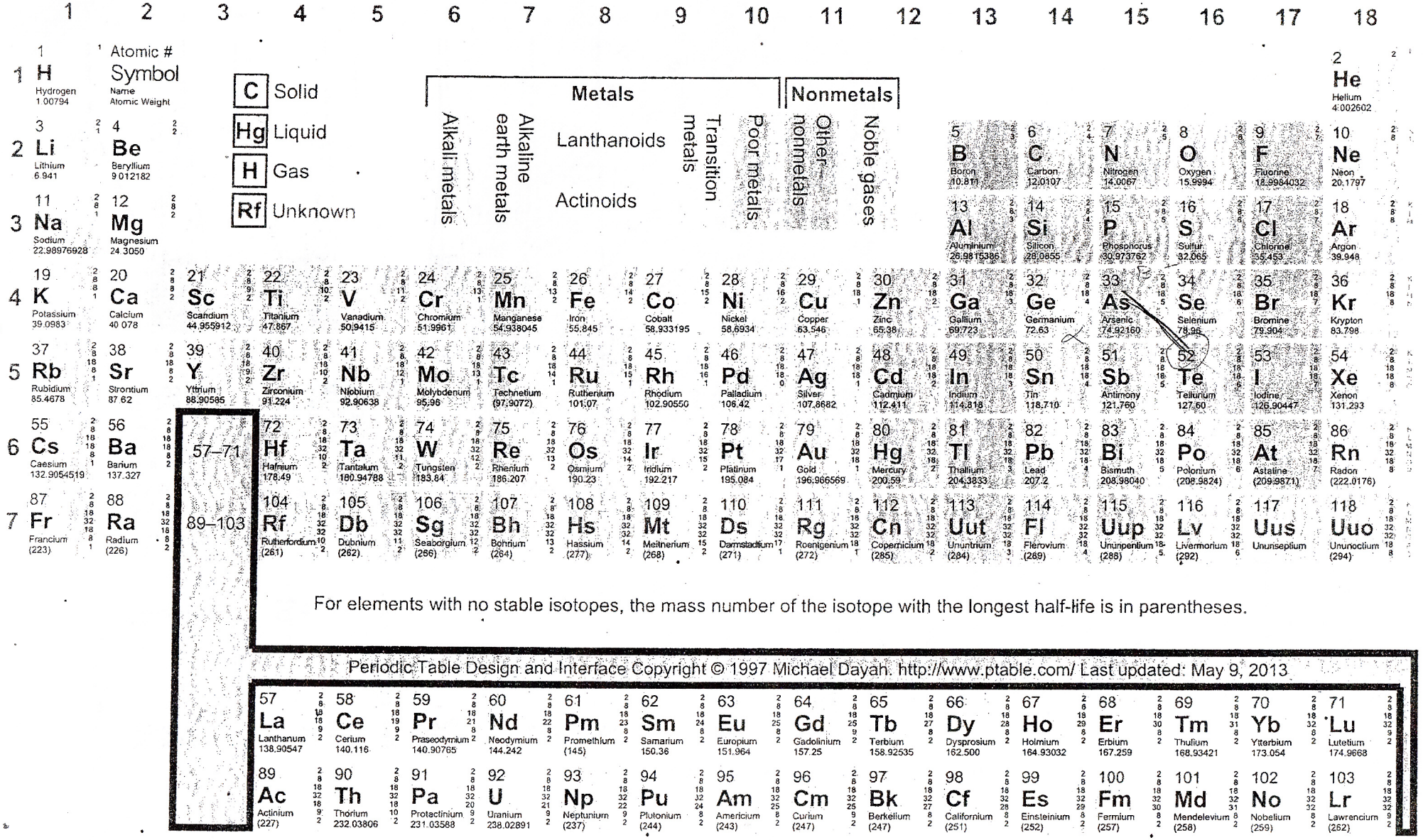
The ratio of the total activity (rate of particle emission to the initial value) after 50 h

G) Define the following items

Bremstruhlung emission , pair production , G-value , specific ionization , photonuclear reaction

Constants ; $m_{H\text{-}2}$ =2.0141018 u m_p= 1.00727 u , m_n= 1.00866 u ,Na= 6.023x10^{23} mole^{-1}

Periodic Table of Elements



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

Michael Dayah

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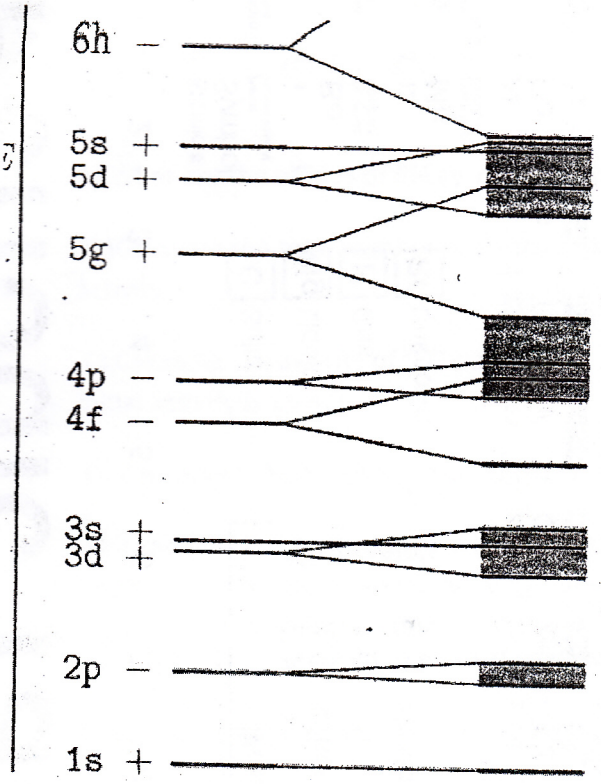

−	$6h_{11/2} = 1h_{11/2}$	12		82
+	$5d_{3/2} = 2d_{3/2}$	4		70
+	$5s_{1/2} = 3s_{1/2}$	2		66
+	$5g_{7/2} = 1g_{7/2}$	8		64
+	$5d_{5/2} = 2d_{5/2}$	6		56
+	$5g_{9/2} = 1g_{9/2}$	10		50
−	$4p_{1/2} = 2p_{1/2}$	2		40
−	$4f_{5/2} = 1f_{5/2}$	6		38
−	$4p_{3/2} = 2p_{3/2}$	4		32
−	$4f_{7/2} = 1f_{7/2}$	8		28
+	$3d_{3/2} = 1d_{3/2}$	4		20
+	$3s_{1/2} = 2s_{1/2}$	2		16
+	$3d_{5/2} = 1d_{5/2}$	6		14
−	$2p_{1/2} = 1p_{1/2}$	2		8
−	$2p_{3/2} = 1p_{3/2}$	4		6
+	$1s_{1/2} = 1s_{1/2}$	2		2

Assiut University
Faculty of Science
Chemistry Department

(1)

Jan. 2015
Time: 3 hrs.

Final Exam of (321-C)

Question No. One: (17 Marks)

From your study of coordination compounds expect the write facts and put (✓) in front and expect those wrong ones and put (x) in front:

a) The double salts lose their identity in solution but the coordination compounds retain their identity in solution. ( )

b) Primary valency is the ionizable valency and secondary valency is the non ionizable valency ( )

c) In an octahedral complex $CoCl_3$ $4NH_3$ the three chlorines act as primary valency. ( )

d) Depression in freezing point measurements depend on the number of charges present and on the concentration of solute. ( )

e) The electrical conductivity of a solution depends on the number of particles present. ( )

f) The tendency to attain an inert gas configuration (e.a.n.rule) is a significant factor but not a necessary condition for complex formation. ( )

g) In an octahedral complex the e_g orbitals (d_{x2-y2} and d_{z2}) point in between the axes x,y and z and the t_{2g} orbitals (d_{x-y}, d_{x-z} and d_{y-z}) are directed a long the axes. ( )

h) The difference in energy between the two d levels e_g and t_{2g} is given by the symbol Δ_o or 10Dq. ( )

i) As the charge on the central metal ion of complex increase the magnitude of Δ_o decrease ( )

j) The crystal field stabilization energy is zero in case of electronic configuration 1,2 and 3 in an octahedral complex ( )

k) In an octahedral complex distortion from uneven filling of the e_g orbitals is too small and not important ( )

l) Chelated complexes are less stable than similar complexes with unidentate ligands ( )

m) Tetrahedral complexes are favoured where the ligands small and strong ( )

n) In a complex the negative ion is named first followed by positive ion ( )

o) If the complex contain two or more metal atoms, it termed mononuclear ( )

p) The exchange of groups between the complex ion and ions out side it gives rise to coordination isomerism ( )

q) Optical isomerism is common in octahedral complexes involving bidentate groups ( )

Question No. Two: (16Marks)

For the 1st transition series elements discuss only Three of the following:

a) Formation of complexes and their stability (use hard – soft theory)

b) Colour and spectral properties.

c) Chemical reactivity of mercury.

e) Titanium – tin relationship.

Question No. Three:

a) Give reasons for **Five** only of the following: (5 Marks)

i)Compounds of Zn(ii) are colourless while many compounds of Hg(ii) are highly coloured.

ii) $[MnF_6]^{4-}$ is pale while $[Mn(CN)_6]^{4-}$ is highly coloured.

iii) $KMnO_4$ solution should be maintained in brown bottles.

iv) Freshly precipitated $Mn(OH)_2$ turns brown on standing.

v) In contrast to $[Fe(CN)_6]^{4-}$, the hexacyanoferrate (iii)is labile and quite poisonous.

vi) Formation of blue compounds when acidified dichromate solutions are treated with H_2O_2 in presence of diethyl ether.

b) Complete the following sentences with the correct choice (between brackets) (4 Marks)

i) ..... Crystallizes in an essentially molecular lattice.

(HgF_2 – $HgCl_2$ – $ZnCl_2$ – $CuCl_2$)

ii) Co^{2+} ions are easily oxidized in .....

(alkaline medium – acidic medium – neutral solutions)

iii) The ..... ions are unstable and can be stabilized by precipitation as acetate.

(V^{2+} - V^{3+} - Cr^{2+} - Cr^{3+})

iv) Disproportionation of ..... is favoured in presence of S^{2-}, OH^- or CN^- ions.

[Cu_2O – K_2MnO_4 – $Hg(NO_3)_2$ – $Hg_2(NO_3)_2$]

c) What is the effect of dilute HCl on only **Four** of the following: (4 Marks)

i) K_2MnO_4 ii) Na_3VO_4

iii) $Co(OH)_3$ iv) $[Au(Cn)_2]^-$

v) $K_2Cr_2O_7$ in presence of conc. H_2SO_4

d) Describe a method for preparing only **Four** of the following: (4 Marks)

i) Sodium nitroprusside.

ii) Isolation of pure Cu from copper pyrite.

iii) K_2MnO_4 and its conversion to $KMnO_4$.

iv) Cr_2O_3 from chrom iron stone.

v) Titanium from rutile.

Assiut University
Faculty of Science
Chemistry Department

(1)

Date: Jan. 2015
Time allowed: 3 hrs.

Environmental Anal. Chem. Examination (343-C)

Answer the following questions: (50Marks)

I- a) Write briefly on: (4.5 Marks)

Reference electrodes ; Normal hydrogen electrode ; Alkaline error
Location of the end point in a pH-metric titration.

b) Answer Four Only: (12 Marks)

1) Write the equivalent galvanic cells for the following reactions (assume all concentrations are 1M)

i) $6Fe^{2+} + Cr_2O_7^{2-} + 14H^+ = 6Fe^{3+} + 2Cr^{3+} + 7H_2O$

ii) $Zn + Cu^{2+} = Zn^{2+} + Cu$

2) From the standard potentials of the following half-reactions, determine the reaction that will occur, and calculate the corresponding cell voltage.

$VO_2^+ + 2H^+ + e^- = VO^{2+} + H_2O$ $\quad E° = 1.00V$

$UO_2^{2+} + 4H^+ + 2e^- = U^{4+} + 2H_2O$ $\quad E° = 0.33V$

3) A solution is 10^{-3} M in $Cr_2O_7^{2-}$ and 10^{-2} M in Cr^{3+}. If the pH is 2.0, what is the potential of the half-reaction. ($E°Cr_2O_7^{2-}$, Cr^{3+} = 1.33V)

4) Given that the standard potential of the calomel electrode is 0.268 V and that of Hg / Hg_2^{2+} electrode is 0.789 V, calculate the K_{sp} for calomel(Hg_2Cl_2).

5) A glass electrode – SCE pair is calibrated at 25°C with a pH 4.01 standard buffer, the measured voltage being 0.814V. Calculate the pH of an unknown solution for which the measured voltage is 0.467V.

II- a) Write briefly on: (4.5 Marks)

i) Aeration ii) Coagulation iii) UV radiation as a disinfecting agent.

b) Answer Four Only: (12 Marks)

1) Describe Winkler's method, for quantification of dissolved oxygen in water.

2) A 50.00 ml sample of oxygenated water at 0°C is treated with Winkler method. The liberated I_2 is titrated against 0.01136 mol L^{-1} $Na_2S_2O_3$, of which 8.11 ml are required to reduce all the I_2. Calculate the solubility of O_2 in water at 0°C.

3) A water supply contains 40 ppm of calcium in the form of $Ca(HCO_3)_2$. What mass of lime should be used to soften 2.2×10^4L of this water?
(At. wts. Ca = 40 , C = 12 , O = 16 , H = 1).

4) Explain why:

i) The pH is not a good guide to alkalinity.

ii) Ground water tends to be less contaminated than surface water.

iii) Soft water has a low alkalinity.

iv) All disinfecting agents, must be followed with a low dose of Cl_2.

أنظر خلفه باقي الاسئلة،،،

5) What are the pH and the total carbonate concentration of a sample of water in equilibrium with air?
K_H (for CO_2 in water) = 3.4×10^{-2} mol L^{-1} atm^{-1}.
$P(CO_2)g = 3.0 \times 10^{-4}$ atm. ; K_{a1} (H_2CO_3) = 4.2×10^{-7}.

III- a) Define or characterize: (3 Marks)
i) Spot test and sampling. ii) Absorptivity iii) Molar absorptivity.
b) Describe the main objectives of pollution monitoring in environmental analysis. (2 Marks)
c) Answer Four Only: (12 Marks)
1) Why is nitrogen gas inert? What is meant by the terms nitrification and denitrification? What are the main sources of nitrogen oxides in the atmosphere?
2) Carbon is the key element in biological system, carbon dioxide is the beginning and the end product of biological processes. Discuss this statement.
3) Describe the photometric titration of a mixture of Bi^{3+} and Cu^{2+} with standard EDTA solution, sketch the graph.
4) Discuss the application of uv/ vis spectrophotometric techniques for determination of the stoichiometry of metal chelate by Job's method.
5) The molar absorptivity for the complex formed between Bi^{3+} and thiourea is 9.32×10^3 L $mol^{-1}cm^{-1}$ at 470nm. Calculate the range of permissible concentrations for the complex if the absorbance is to be no less than 0.15 nor greater than 0.80 when the measurements are made in 1.0 cm cell.

Good Luck,,,

Examiners: Prof. Dr. Hassan Sedira.
Prof. Dr. Elham Y. Hashem.