Final Examination of The Summer Semester for the 3rd Year Students
Inorganic Chemistry (C-321)

Section # 1

Answer Three only of the Following Questions: (15 Marks)

1- Name each of the following coordination compounds: (5 Marks)

 i) $NH_4[Cr(NH_3)_2(NCS)_4]$, ii) $[Al(OH)(H_2O)_5]^{2+}$, iii) $K_2[Pt(CN)_4]$, iv) $[Co(en)_2Cl(ONO)]Cl$ and
 v) $[(NH_3)_5Cr(OH)Cr(NH_3)_5]Cl_5$.

2- The complex $[Ni(CN)_4]^{2-}$ is square planar, and the complex $[NiCl_4]^{2-}$ is tetrahedral. Draw valence bond diagrams for these complexes and predict the number of unpaired electrons in each. (5 Marks)

3- How can a complex be prepared by two different methods (give examples)? (5 Marks)

4- For the following coordination compounds show whether EAN rule is applied or not?

 i) $[Pt(NH_3)_4]^{2+}$, ii) $[PdCl_4]^{2+}$, iii) $[Cr(en)I_4]^-$ and iv) $[Co(NH_3)_4Br_2]^+$ (5 Marks)

Section # 2

Answer the Following Questions: (35 Marks)

1- Give the reason that explains <u>five only</u> of the following phenomena: (10 Marks)

 i. TiO_2 is white while $TiCl_3$ is violet.

 ii. The Atomic radius of Ti is smaller than that of Zr whereas Zr and Hf have almost the same atomic radius.

 iii. AgCl is white whereas AgBr is pale yellow and AgI is yellow.

 iv. HCl cannot be used as acidic medium in the redox reaction involving $KMnO_4$.

 v. Fe^{2+} is easily oxidized to Fe^{3+} while Mn^{2+} is difficult to be oxidized to Mn^{3+}.

 vi. CrO_4^{2-} is strong oxidizing agent, while MoO_4^{2-} or WO_4^{2-} are stable.

2- What is the difference between comproportionation and disproportionation reaction? (give an example for each). (5 Marks)

3- What is meant by rusting of iron? And what are the factors inducing such process? (5 Marks)

4- How can the chromous (Cr^{++}) ion be stabilized? (5 Marks)

5- From rutile (TiO_2) show how can the pure Ti be prepared? (5 Marks)

6- Complete <u>four only</u> of the following equations (balance if necessary). (5 Marks)

 i. $Cr_2O_7^{2-} + I^- + H^+ = \ldots\ldots + \ldots\ldots + \ldots\ldots$

 ii. $MnO_4^- + C_2O_4^{2-} + H^+ = \ldots\ldots + \ldots\ldots + \ldots\ldots$

 iii. $VO_3^- + Fe^{2+} + H^+ = \ldots\ldots + \ldots\ldots + \ldots\ldots$

 iv. $TiO_2 + H_2 = \ldots\ldots + \ldots\ldots$ (at 1000 °C)

 v. $2VF_4 = \ldots\ldots + \ldots\ldots$

(Atomic number of Ti = 22, Cr = 24, Mn =25, Fe = 26, Co = 27, Ni =28, Kr = 36, Zr = 40, Pd = 46, Ag = 47, Xe = 54, Hf = 7, Pt = 78 and Rn = 86).

Best Wishes
Examiner: Dr. Mohamed Abdel megeed

Assiut University
Faculty of Science
Chemistry Department
Final Examination in Biochemistry and Natural Products (312C) for the 3th Level Students (Summer Course)

Date: Tuesday , 27/08/2019	Time: 3 hours.

Answer the following Two Sections : (50 Mark)
(Section A: Biochemistry):

Answer the following questions :-

1) Discuss briefly the types of monosaccharide ?

2) What is the importance of asymmetric carbon atom in carbohydrate?

3) Explain the optical activity phenomena in carbohydrate?

4) Discuss the oxidation properties in glucose?

5) Discuss by equation transformation of glucose to sorbitol or mannitol ?

(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
Examiner: Prof. Dr. Kamal I Aly

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 questions: (17 marks)

a) From barometric formula derive the Maxwell-Boltzmann distribution law for molecular speeds in space.

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- Why a linear polyatomic molecule behave like diatomic molecule in regard to rotation?

   ii- Making use of equipartition principle, calculate the value of c_v for the following gases:

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acetylene, HCN , NH_3

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d) i- Explain briefly, how the viscosity arises in gases?

   ii- Calculation the fraction of hydrogen molecules at 760 mmHg and 300K where kinetic energies are in the range of $E - 0.005\ E$ and $E + 0.005\ E$.

    ($R = 8.314\ JK^{-1}mol^{-1}$, $1.987\ calK^{-1}mol^{-1}$, $N_A = 6.022 \times 10^{23}$, atomic weight of hydrogen = 1.008)

II- Answer *Only Five* of the following questions: (17 marks)

a) Assuming that the force constants for C≡C, C=C and C−C are in the ratio 3:2:1 and that the normal range of C=C stretch absorption is $1630-1690\ cm^{-1}$, what range would you expect for C−C and C≡C stretch vibration?

b) Which of the following molecules can show pure rotational spectra and which can show pure vibrational spectra   **NH_4Cl, N_2, HF, $H_2C = CH_2$, CH_3Cl, C_6H_5OH, NO, CO, SO_2**

c) When a beam of light strikes a piece of matter, many changes may take place in both the light and matter, discuss?

d) The ESR frequency for a free electron is 9000 MHz. Calculate the magnetic field at which the ESR spectrometer is working   (Bohr magneton $\beta = 9.273 \times 10^{-24}\ JT^{-1}$ and g value = 2).

e) Write the rule of mutual exclusion, and show when **CS_2** molecule will be infrared active and when Raman active.

f) Explain, how the electron charge cloud around an atom or molecule is distorted when UV-Vis light is absorbed or emitted by the atom or molecule.

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Turn Over

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III- Answer *Only Four* of the following questions: (16 marks)

a) Explain briefly the postulates of quantum mechanics.

b) Explain the photoelectric effect and show how classical mechanics fails to describe this phenomenon.

c) Electrons are used to determine the structure of crystal surfaces. To have diffraction, the wavelength of the electrons should be on the order of the lattice constant, which is typically 0.30 nm. Calculate the energy of such electrons.
($h = 6.626 \times 10^{-34}$ Js, $m_e = 9.109 \times 10^{-31}$ kg)

d) Derive the solution for the Schrödinger equation for an electron moving in one-dimensional box.

e) For an electron moving on the surface of a sphere:

   i- Derive the solution for the Schrödinger equation.

   ii- Write down the expression for the energy and show that it is quantized. What is the source of quantization?

   iii- What is the degeneracy of energy levels?

$$\nabla^2 = \frac{1}{r^2}\frac{\partial}{\partial r}\left(r^2\frac{\partial}{\partial r}\right)+\frac{1}{r^2\sin\theta}\frac{\partial}{\partial\theta}\left(\sin\theta\frac{\partial}{\partial\theta}\right)+\frac{1}{r^2\sin^2\theta}\frac{\partial^2}{\partial\phi^2}$$

With Our Best Wishes

<u>Examiners:-</u> **Prof. Dr. Maher M. A. Hamed**

            Dr. Mostafa Farrag

            Dr. Ahmed A. K. Mohammed

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** <u>Four</u> of the following :   (2 X 4 = 8 Marks)

    1- Describe the origin of Solar energy and how can we make use of it ?.

    2-Explain the main method used for determination the reaction mechanism 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-Discuss the photoisomerization process during the processes of vision .

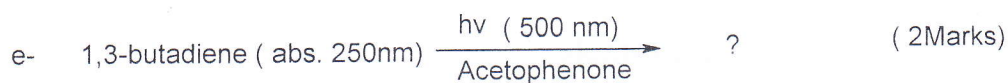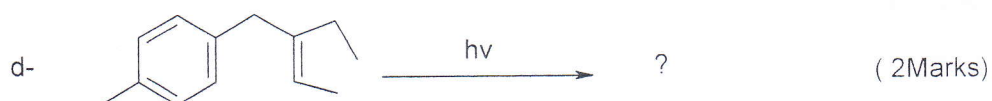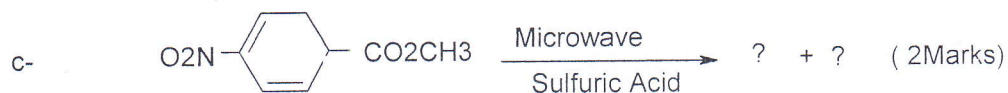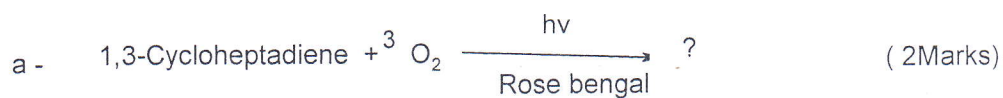   5- Indicate the advantages of heating by Microwave Radiations.

II] – Mark right (√) or wrong (X) on **only** <u>Four</u> of the following statements,

    and **Explain** your answer :   (2 X 4 = 8 Marks)

    1- Glass windows transmitting $\geq$ 400 nm radiations can be used in Visible light

      photolysis of organic compounds.   (   )

    2- Concerted Mechanism includes acyclic transition state.   (   )

    3- Gerade $\rightarrow$ Gerade transition is a Symmetry allowed transition.   (   )

    4- Photodimerization of Propylene has a Product Quantum Number

      more than one .   (   )

    5- Microwave radiations have lower energy than visible light.   (   )

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

a -   1,3-Cycloheptadiene + $^3O_2$ $\xrightarrow[\text{Rose bengal}]{hv}$?   (2Marks)

b- $\xrightarrow{hv}$?   (3 Marks)

c-   O2N —⬡— CO2CH3 $\xrightarrow[\text{Sulfuric Acid}]{\text{Microwave}}$? + ?   (2Marks)

d- $\xrightarrow{hv}$?   (2Marks)

e-   1,3-butadiene (abs. 250nm) $\xrightarrow[\text{Acetophenone}]{hv \ (500 \ nm)}$?   (2Marks)

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

Section (B) (Reactive Intermediate) (25 Marks)

Answer the following questions:

1- 1,2-Phenyl migration is one of carbanion intermediates rearrangement.

Give an example for this type of rearrangement.   (3 Marks)

2- Oxidation of phenols did not give peroxides. Show by chemical equations the

oxidation products of phenols.   (4 Marks)

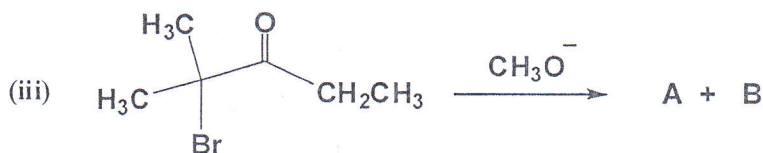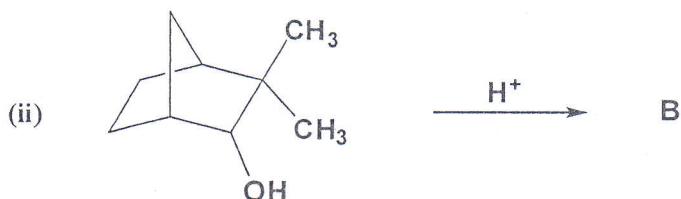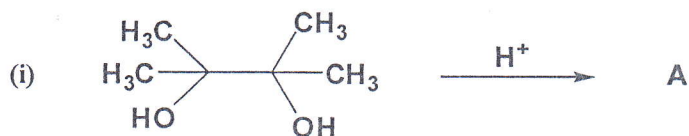3- Write on Three of the following (using chemical equations):   (6 Marks)

a) The nomenculture and the factors affecting the stability of carbocations.

b) Three types of the general methods of the synthesis of carbenes.

c) The types of radical reactions giving one example for each type.

d) Three methods for the generation of nitrenes.

4- Suggest the suitable products and mechanism for the following
reactions. Write the name of the suggested mechanism showing each
step using arrows: (12 Marks)

(i)

H_3C
H_3C—$\overset{}{\underset{HO}{C}}$—$\overset{CH_3}{\underset{OH}{C}}$—$CH_3$ $\xrightarrow{H^+}$ A

(ii)

$\xrightarrow{H^+}$ B

(iii)

H_3C
H_3C—$\overset{}{\underset{Br}{C}}$—$\overset{O}{C}$—$CH_2CH_3$ $\xrightarrow{CH_3O^-}$ A + B

Good Luck

Prof. A. A. Abdel-Wahab

Dr. Ahmed Abdou O. Abeed

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