كيمياء / إصلاح 1

Ministry of Higher Education & Scientific Research Al-Muthanna University College of Science Department of Chemistry

Subject: Advance Analytical Chemistry
Stage: MSc Students
Date: / /2018
Time: Three hours

15. 10. 2018

((Assessment of the final exam for the Second attempt/ first semester))
Academic year 2017 – 2018

45

Q1//A// Calculate the concentration of potassium ion in grams per litter after mixing 100 mL of 0.250 M KCl and 200 mL of 0.1 M K_2SO_4. (5 marks)

Q1//B/ What are the applications of oxidation reductions titrations. (5 marks)

Q2//A/ Calculate the pH of a solution prepared by mixing 2.0 mL of a strong acid solution (keep track of millimoles) of pH 3.0 and 3.0 mL of a strong base of pH 10.0 ? (10 marks)

Q2//B// What is the principle of neutralization titrations. (5 marks)

Q3//A// Define and give an example for its:-
1- Buffer solution
2- Auto protolysis
3- Common - ion
4- Standard solutions
5- An amphiprotic solvent (10 marks)

Q3//B// How many grams ammonium chloride (pk_b= 4.76) and how many millilitres 3.0M sodium hydroxide should be added to 200mL water and diluted to 500mL to prepare a buffer of pH 9.50 with salt concentrated of 0.10M ? (5 marks)

Q4//A// Briefly write the types of calculations for a weak acid and weak base titration curve. (10 marks)

Q4//B/ Cadmium sulphide is less soluble than thallium (I) sulphide. Find the conditions under which Cd^{+2} and Tl^+ can , in theory , be separated quantitative with H_2S from solutions that is 0.1M in each cation.Ksp for CdS $1X10^{-27}$, Ksp for Tl_2S $6X10^{-22}$ (5 marks)

Q5// A// Use activities to calculate the molar solubility of $Zn(OH)_2$ (Ksp $3X10^{-16}$) in
(1) 0.0200 M KCl. (5 marks)
(2) The solution that results when you mix 20.0ml of 0.1M KOH with 80.0ml of 0.0250M $ZnCl_2$. (= 0.5951 and = 0.867)

Q5//B// Calculate the pH at 0, 10, 90, 100, 110% titration of 50.0mL of 0.10M HCl with 0.10M NaOH? (10 marks)

Hint : Atomic Weights K= 39, O=16, Cl=35.5 and S= 32

Ministry of Higher Education
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Al-Muthanna University
College of Science
Department of Chemistry

Subject: Advance. Phy. Chem.
Stage: MSc students
Date: / /2018
Time: Three hours

((Assessment of the final exam for the First semester))
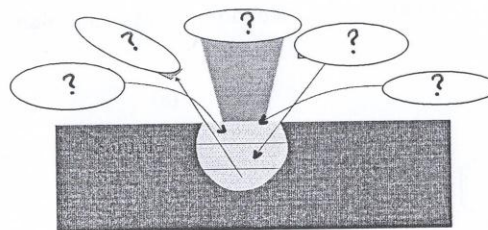
Academic year 2017 -2018 .

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(5 Marks for each pint)

1. What are the advantages and disadvantages of AES?

2. In the surface analysis why electron used as probe?

3. Fill the missing in the table below:

Technique	Probe	Spectroscopy	Imaging	Mapping
XPS	?	?	?	?
SEM	?	?	?	?
FT-IR	?	?	?	?
WDS	?	?	?	?

4. Fill the missing in the figure below:

5. SEM can use for......

6. The secondary electrons are........

7. Backscattered electrons are........

8. What is the working concept of Transmission Electron Microscope?

9. How to prepare powder sample for SEM and XPS analysis?

10. What is the difference between information provided by a TEM-EDS and a SEM-EDX of the same sample?

11. Give an overview about XPS.

12. Give a comparison of WDA and EDS.

Lecturer

Head of Department
Assist. Prof. Dr. Riyadh J. Nahi

**Ministry of Higher Education
& Scientific Research
Al-Muthanna University
College of Science**

Chemistry Department
Subject: Advance Organic Ch...
Stage: MSc students
Date: / /2018
Time: 4 Hrs.

17. 10. 2018

45

((Assessment of the final exam for the First semester))
**Academic year 2017-2018**

(12 Marks)

Q1: Explain with an example why;

1- The [1,3]-sigmatropic reactions are, however, photo-chemically allowed.
2- In thermal [2+2] cycloaddition a supra-supra process is symmetry forbidden, on the other hand, a supra-antra process is symmetry allowed.
3- [2+2]-cycloadditions are thermally forbidden.

Q2: For the following opening cyclic reaction, determine the number of electron pairs and the type of rotation, and whether the reaction is allowed or forbidden. **(6 Marks)**
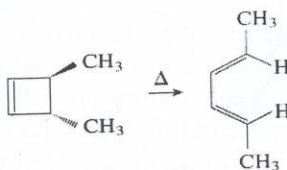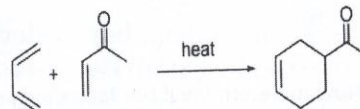

Q3: Use the frontier molecular orbitals in each molecule to explain the following reactions: **(8 Marks)**

(i)

(ii)
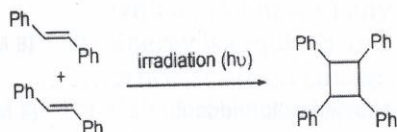
(12 Marks)

Q4: Define the following terms: Give an example for each one.

1- Cheletropic pericyclic reaction
2- Group transfer pericyclic reaction
3- Electrocyclic pericyclic reaction
4- Cycloaddition reaction

Q5: Why in thermal reaction cis 3,4-dimethylcyclobutane gives cis, trans-2,4-hexadiene [(E,Z)-hexa-2,4-diene] while the trans isomer gives only tans-trans 2,4-hexadiene [(2E, 4E) hexadien]. **(6 Marks)**

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ry of Higher Education
& Scientific Research
Al-Muthanna University
College of Science

Chemistry Department
Subject: Advance Organic Chem.
Stage: MSc students
Date: / /2018
Time: 4 Hrs.

17. 10. 2018

((Assessment of the final exam for the First semester))
Academic year 2017-2018

45

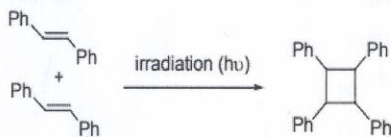**Q6:** Suggest a synthetic route to synthesis the following compounds starting from monofunctional organic compounds.

    A) Dimethyl ether   **B) Methyl acetate**   **C) *N*-Methylacetamid**

                                                                         (6 Marks)
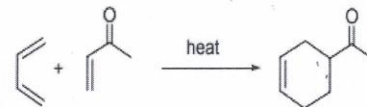
Q7: Use the frontier orbitals in each molecule to explain the reaction: **(8 Marks)**
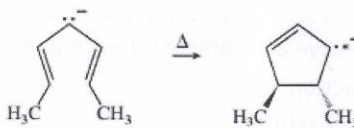

Q8: Draw the molecular orbitals and depict the HOMO and LUMO of ground state for the following molecules:

    A) Allyl anion   **B) 1,3-cyclobutadiene**   **C) 2-Butene**   **D) 1,3,5-Hexatriene**

                                                                             (8 Marks)

Q9: How to determine if the following pericyclic reaction is allowed or forbidden: **(4 Marks)**

GOOD LUCK

((Assessment of second round of the final exam for the First semester))
Academic year 2017 – 2018

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Q1)   Explain the following in details: (15 Marks)
1. How to prove experimentally that DNA is the currier of genetic information in comparison with proteins and RNA?
2. How to pretend that DNA specifies the sequence of amino acids in a protein?
3. How to extract and purify a protein from its source? Follow all the steps to obtain a pure protein. Then clarify the relation between specific activity and protein purity.

Q2)   Answer the following: (12 Marks)
a) Based on Chargaff's rules, how to determine the organism identity?
b) Classify proteins based on their secondary structure and determine their functions with an example of each.
c) How could the scientists found experimentally that DNA must be the carrier of genetic information?
d) What are the universal similarities occurring in all cells?

Q3)   Answer the following: (12 Marks)
a) What are Homo and Heteropolysaccharides and their functions with an example of any of them?
b) Energy is required and released in anabolism and catabolism processes respectively. Draw the diagram shows these points.
c) Calculate the stereoisomers of D-Psicose, D-Talose, and dihydroxyacetone?
d) Write equations of formation of hemiacetals and hemiketals from aldehyde and ketone monosaccharides.

Q4) Mention reasons of the following?   (9 Marks)
a) Why are hepatocytes don't store glucose in its monomeric form? Clarify that.
b) Why do some proteins become an enzyme, another a hormone and else an antibody?
c) Why is RNA hydrolyzed rapidly under alkaline conditions in the test tube, but DNA is not? Write the equation of hydrolysis of RNA under alkaline conditions.

Q5) Give a brief answer of the following. (10 Marks)

    a) What are the reasons that cause protein denaturation? Explain each of them.

    b) Explain the initiation of RNA synthesis by transcription bubble, which is forming DNA-RNA hybrid helix.

Q6) Answer the following.   (12 Marks)

    a) Show hydrogen-bonding patterns in the base pairs defined by Watson and Crick, which predominate in the double-stranded DNA and RNA.

    b) Write the structure of sphingomyelin and plasmalogen, and determine the net charge of either of them.

    c) Write the reaction that produces di-sulfide bond between two peptide chains.

    d) Write structure of Phenylalanine and plot the titration curve for it at the physiological conditions with determining buffering regions.

.... Best wishes ....

Instructor

Dr. Jawad K. Muraih

Chair

Dr. Riyadh J. Nahi

Assessment of second round of the final exam for the first semester

Q1) **(10 Marks)** Follow the degradation of glucose in the red blood cells with all enzymes in response to its enzymatic reactions and determine the energy yield in the processes.

Q2) **(10 Marks)**
a. Plot structures of biological membranes, micelles, liposomes and emulsions.
b. Write the chemical structure of glutathione, sphingomyelin and lysolecithin.

Q3) **(10 Marks)**
a. How to purify proteins to determine its primary structure?
b. Adding an enzyme as catalyst can lower the activation energy of biological reactions. Explain that.

Q4) **(10 Marks)**
c. Clarify (by diagram) the role of ATP/ADP cycle in transfer of high-energy phosphate.
d. What are the major sources of ~P taking part in energy conservation or energy capture?

Q5) **(10 Marks)**
a. Classify the enzymes and explain how enzymes facilitate diagnosis of genetic diseases?
b. What is the fate of pyruvate in the generation of metabolic energy in the cells?

Q6) **(10 Marks)**
c. Why do polysaccharides serve as fuel and structural functions in the plant and human cells?
d. Which lipids are the main constituents of biological membranes?

Q7) **(10 Marks)**
e. Draw the scheme of outline of the pathways for catabolism of dietary macromolecules in cells.
f. Determine the pathways and end products of amino acid metabolism (from diet protein).

.... Good Luck ....

Committee
Assist Prof. Dr. Jawad K. Muraih

Head of Department
Assist Prof. Dr. Laith A. Alobaidi

Assessment of the final exam for the First semester
Academic year 2017 - 2018

Q.1/ (A) Explain the following terms :   (6 Marks)
1. Spherical harmonics
2. Heat of atomization .
3. the trance effect .

(B) Write resonance structure formula for SO_4^{-2} (Atomiv number S = 16 , 0 = 8)
(8 Marks)

Q.2/ A hypothetical AX type of cermic material is known to have a density of $2.65 g/cm^3$ and a unit cell of cabic symmetry with a cell edge length of 0.34 nm . The atomic weight of the A and X are 86.6 and 40.3 g / mol , respectively . What is the number of formula units within the unit cell with digram for crystal structure .
(14 Marks)

Q.3/ (A) Give reason for the following :   (6 Marks)
1. The resonance
2. The bond for F_2 longer from H_2
3. Polarization for caf_2 more than CaI_2 .

(B) What is type of hybridization , geometry shap , magnetic properts , and magnetic moment for   1) HNO3   2) $[PtCl_4]^{2-}$ (8 Marks)
   Atomic number for   N = 7 , O = 8 , Pt = 78

Q.4/ (A) If you know pairing energy is 20425 cm^{-1} and spillting energy 14.000 cm^{-1} for complex $[Cr(H_2O)_6]^{+2}$. what is staplity stat favourite .   (7 Marks)
        Atomic number for Cr = 24

(B) Draw energy digram for complex $[FeCl_4]^-$ According MOT (Fe= 26) (7 Marks)

Q.5/ Explain the following :   (14 Marks)
1. What is Term symbols for V^{+2} if you know Atomic number for v = 23 .
2. Calculate the ionization energy of the He^+ when n = 1   to n_2 = infinity
3. What is substitution reaction in octahedral complexes .

Best of luck

Lecturer
Assist. Prof. Dr. Hassan Sabih

Head of Department
Asst. Prof. Dr. Riyadh JaleelNahi

Ministry of Higher Education
& Scientific Research
Al-Muthanna University
College of Science
Department of Chemistry

Subject: Advance Of
 Separation Methods
Stage: postgraduate MSc
Date: / /2018
Time: 3 hours

22. 10. 2018

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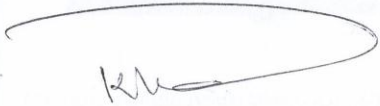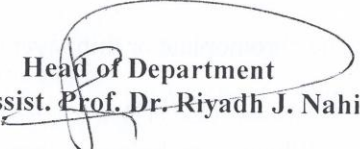((Assessment of the final exam for the second semester))
Academic year 2018 - 2017

4. What must be done to the solid samples for it to be introduced into the column without using solid injection syringes in gas chromatography:

a) Introduced in hot-zone of the column   b) Dissolved in volatile liquids
c) Introduced using rotary sample valve   d) Introduced using sampling loops

5. What does the electrophoresis apparatus consist of:

a) Gel, buffer chamber and fire pack   b) Buffer chamber and electrophoresis unit
c) Electrophoresis unit and gel separator d) Power pack and electrophoresis unit

6. Slow injection of large samples leads to band broadening and loss of resolution:
a) True   b) False

7. The size of thin layer of adsorbent is about:

a) 0.1 mm   b) 0.2 mm   c) 0.3 mm   d) 0.4 mm

(30Marks)

Good Luck

Lecturer
Dr. Khawla Kani Jassim

Head of Department
Assist. Prof. Dr. Riyadh J. Nahi

Ministry of Higher Education
& Scientific Research
Al-Muthanna University
College of Science
Department of Chemistry

Subject: Advance Of Separation Methods
Stage: postgraduate MSc
Date: / /2018
Time: 3 hours 22. 10. 2018

((Assessment of the final exam for the second semester))
Academic year 2018 - 2017

45

Q1// What is the basic for (Electrophoresis) process? What is it used for? What fields? How is the gel prepared/made? (10Marks)

Q2// Describe a method for identifying a compound using GC analysis? (10Marks)

Q3// How can you tell if the sample is Retained On the HPLC Column? Or what does it mean when no chromatography took place? (10Marks)
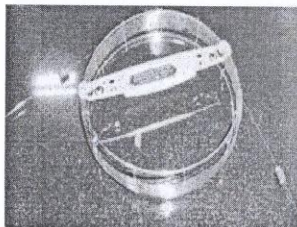
Q4//1.The mobile phase used in HPLC analysis is ………………………………?
   2. Light – Sensitive Samples are store in ……………………...................?
   3. Isocratic mode of operation implies…………………………………?
   4. HPLC columns are generally made of………………………………?
   5. Which technique is not recommended for degassing of mobile phase………………?
                                               (10Marks)

Q5// Choose the correct answer :- (only six)
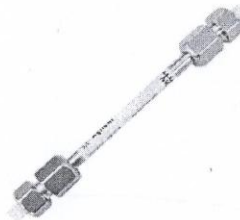   1. Identify the column used in HPLC analysis:
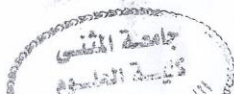

a.   b.   c.
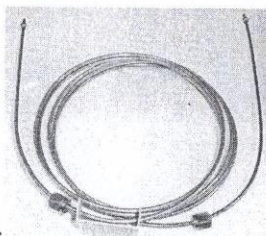
2. The chromoplate or thin layer chromatography plate is made up of:

a) Glass   b) Wood   c) Fiber   d) Metal

3. Which technique separates charged particles using electric field:
a) Hydrolysis   b) Electrophoresis   c) Protein synthesis   d) Protein denaturing

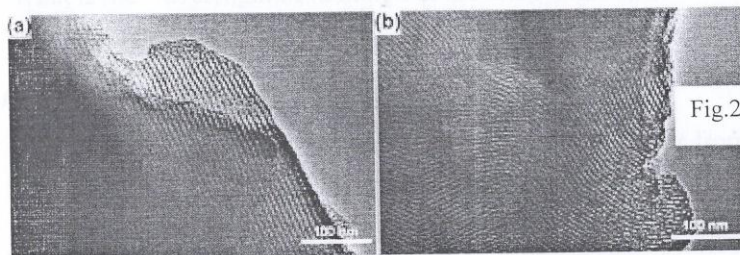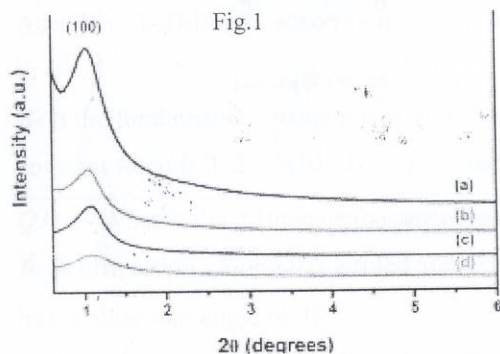**((Assessment of the final exam for the Second semester))**
Academic year 2017 -2018 .

(10 Marks for each question)

Q1.How can reach the optimum parameters of any catalyst?

Q2. The Figures below (1 and 2) are the XRD and TEM of catalyst. Could you explain the Figures in details? What can you conclude from those figures?

Fig.1

Fig.2

Q3.How can the researcher used nano techniques in catalyst field?

Q4. What are the differences between heterogeneous catalyst and Ionic Liquid?

Q5. What types of catalyst can you choice if you have chemical dye and you want to crack this dye? Could you explain the reaction steps?

Lecturer

Head of Department

Ministry of Higher Education
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Al Muthanna University
College of Science
Chemistry Department

Subject: Advance Catalysis
Stage: MSc
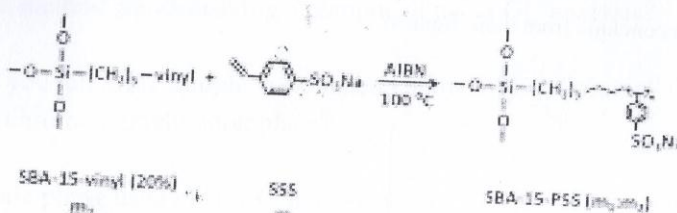Date: /   /2018
Time: Three hours

((Assessment of the final exam for the Second semester))
Academic year 2017   -2018

23, 10, 2018
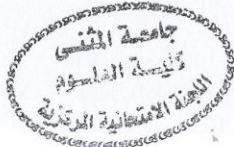
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Q6. The reaction below was published elsewhere. Pleas suggest and explain in details three different methods to proof the final catalyst structure.

Q7. What is the leaching test? Explain what is the importance of this test?

Best of luck

Lecturer
Prof. Kasim Mohammed Hello

Ministry of higher Education
& Scientific search
Al-Muthanna University
College of science
Department of Chemistry

Sub: Advanced spectroscopy
Post Graduate
Date: / /2017
Time: 3 Hours

24. 10. 2018

((Assessment of the final exam for the second semester))
Academic year 2017-2018

45

Q1/ A- Explain the following terms: *(6marks)*

1- Life time broadening   2- Base peak   3- Permanent magnet   4- Coupled stretching

B- Calculate the Boltzman distribution for proton the ratio of nuclei in lower energy to higher energy state at 27C° in the field strength is 2.35 tasla. *(8 marks)*

Q2/ A- Give reason: *(6 marks)*

1- The mass spectro depends on molecular ion A^+ only.   2- Decrease the chemical shifts for Acetelen.   3- Different absorption spectra depending on materials .   4- there is no coupling in C^{13}.

B- It the fundamental frequency of vibration for HI molecular is 2309 cm^{-1} and value constant force is 312.32×10^3 dyne.m^{-1}. Find the atomic mass of iodine. *(8 marsk)*

**Q3/ A-** What is the difference between (pulse FT-NMR) and (continuous wave) ? *(6 marks)*

B- A diffraction grating has a ruled area is 10.40cm wide, has 600 grooves per millimeter and has is blazed an angle of 45°.

1- What is the wavelength of radiation at the blaze angle in the first, fourth and ninth order?

2- What is resolving power in these order ? *(8marks)*
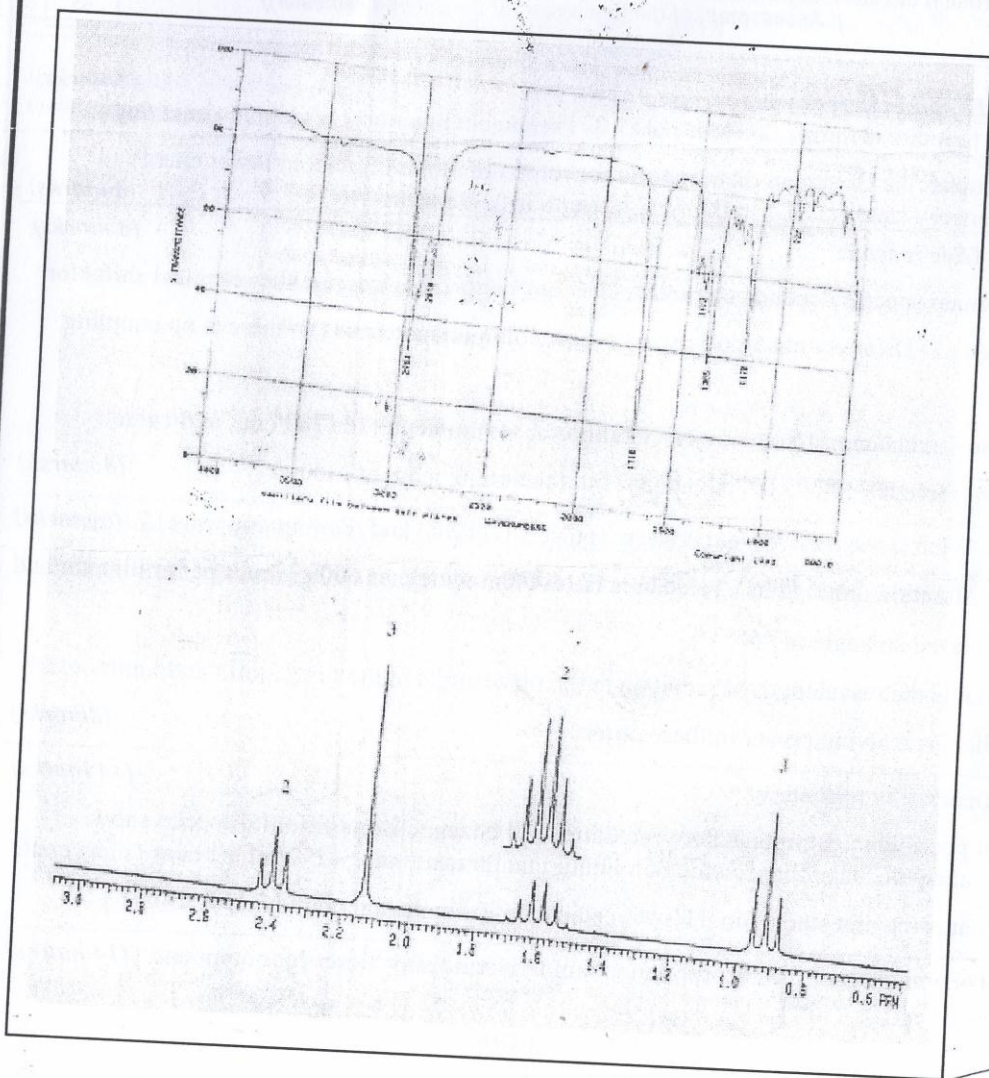
Q4/ Answer the following: *(14 marks)*

1- Is it possible to extinguish between dimethyl benzene isomer from IR spectra show.
2- calculate the absorbance value of a liquid that transmittance 12% of the beams falling on it.

3- What is the met stable ion. How to calculate it from a compound $[C_6H_5-CO-CH_3]^+$

Q5/ A- Estimation of the absorption maximum wood ward- fieser for compound *(14 marks)*
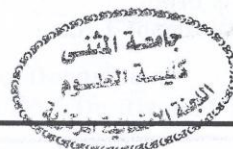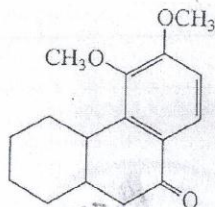
B- Explain the functional group and structure formula $C_5H_{10}O_2$ for FT-IR and H-NMR spectrum.

Head of Dept
Assist prof Dr Reyadh J. Nahi

Lecture
Assist prof. Dr. Hassan Sabih

2 5. 10. 2018

Date : 7 9 7 2018

Time : 3Hour

45

Academic year 2017 / 2018
Assessment of the final exam for the second semester

Q1) **Answer the following.** **(15 Marks)**

a) What are the three successive steps of the PDH reaction? Note: write the name of each of the three different subunits?

b) Write the overall reaction of the TCA cycle (at equilibrium equation only).

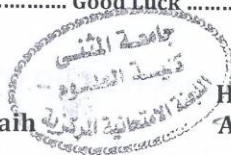c) Match the items in first column with their functions in the digestive system in the second column.

(1) Stomach	a) fluid and ion reuptake
(2) Small intestine	b) production of bile; metabolic homeostasis
(3) Large intestine	c) killing of microbes contained in the food, protein denaturation
(4) Pancreas	d) breakdown of macromolecules to small molecules
(5) Liver	e) production of digestive enzymes and of hormones

Q2) **Answer the following.** **(12 Marks)**

a) How does ethanol degradation inhibits gluconeogenesis? Show your answer in diagram?

b) How does ethanol fermentation in yeast Saccharomyces cerevisiae helps to make the bread dough rise up? Clarify your answer by the chemical reactions.

c) How to brief the complete degradation of glucose for ATP production in one diagram and how many ATP molecules can be obtained?

Q3) **Answer the following.** **(15 Marks)**

a) Follow the steps of gluconeogenesis process with the enzymes in response to each irreversible reaction and estimate the number of ATP molecules are required.

b) Follow all the reactions of glucose degradation in the red blood cells for ATP production with all enzymes in response.

c) What is the fate of pyruvate in the glycolysis process in the presence & absence of O_2?

Q4) **Answer the following.** **(12 Marks)**

a) Explain the significance of metabolism in medicine.

b) If glucose is available more than immediate needs and glycogen is already stocked up to capacity. Should glycolysis be stopped? Why?

c) Describe (by diagram) Regulation of PDH by allosteric effectors and by phosphorylation.

Q5) **Describe the following:** **(16 Marks)**

a) In respiratory chain, the switch from the two-electron carrier NADH to the one-electron carrying Fe–S clusters within complex I is mediated by FMN. Express about this by equations only.

b) What are the similarities and differences between bile acids and pancreatic juice based on their functions in the digestive system?

c) Define homotropic and heterotropic allosteric enzymes. Plot subunit interactions in an allosteric enzyme.

d) Show (by scheme) the correlation between citric acid cycle and amino acid transamination process in the liver to synthesize urea.

.... Good Luck ....

Jawad Muraih
Instructor
Assist Prof. Dr. Jawad K. Muraih

Head of Department
Assist Prof. Dr. Riyadh J. Nahi

Ministry of Higher Education
& Scientific Research
Al Muthanna University
College of Science
Department: Chemistry

Subject: Advanced Organic Synthesis
Stage: MSc
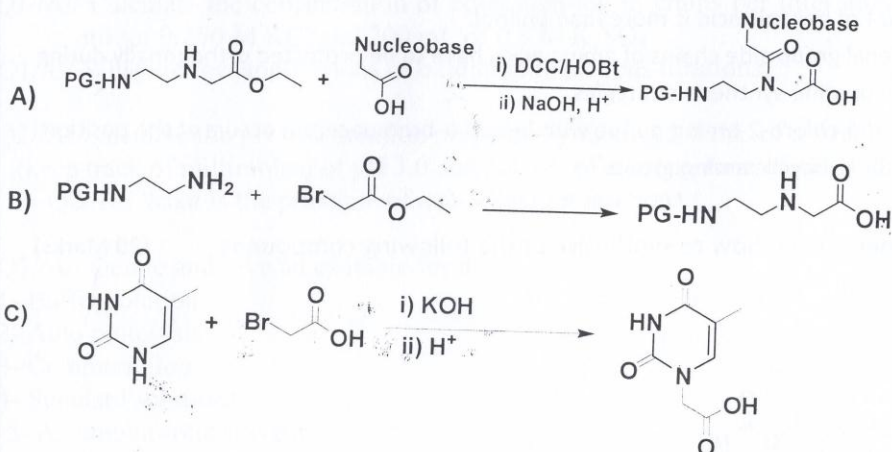Date: / /2018
Time: 3.5 Hours

01. 11. 2018

((Assessment of the final exam for the second semester))
Academic year 2017-2018

45

Q1: Give the mechanism of the following reactions: (15 Marks)

A) $PG-HN$ ... $+$ Nucleobase ... $\xrightarrow[\text{ii) NaOH, H}^+]{\text{i) DCC/HOBt}}$ ... Nucleobase ... PG-HN

B) $PGHN$ ... NH_2 $+$ Br ... O ... $\longrightarrow$ PG-HN ... OH

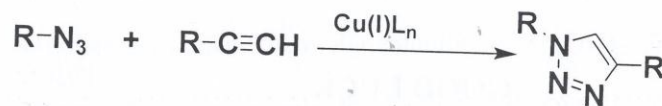C) ... $+$ Br ... OH $\xrightarrow[\text{ii) H}^+]{\text{i) KOH}}$ ... OH ... O

Q2: Draw a general scheme of solid phase peptide synthesis (SPPS) cycle. If you have Fmoc-protected resin and Fmoc-protected glycine, show the mechanism of the de-protection of this resin and coupling this amino acid to the unprotected resin using the HATU as a coupling agent.

(15 Marks)

Q3: Give a general mechanism of the following reaction: (11 Marks)

$$R-N_3 \quad + \quad R-C{\equiv}CH \quad \xrightarrow{Cu(I)L_n} \quad \begin{array}{c} R \\ N{-}N \\ N \end{array} R$$

L: a ligand

GO TO THE NEXT PAGE

Ministry of Higher Education
& Scientific Research
Al Muthanna University
College of Science
Department: Chemistry

Subject: Advanced Organic Synthesis
Stage: MSc
Date: /   /2018
Time: 3.5 Hours

01. 11. 2018

((Assessment of the final exam for the second semester))
### Academic year 2017-2018

45

Q4: Explain the following scientific statements:

(9 Marks)

1- Boiling point of benzoic acid is more than phenol.

2- The functional group side chains of amino acids have to be protected orthogonally during solid phase peptide synthesis strategies.

3- Alkylation of 6-chloro-2-amino purine with benzyl α-bromoacetate occurs at the position N9 not at the exocyclic amino group.

Q5: Show by a mechanism how to synthesise of the following compounds:

(20 Marks)

1)

2)

3)

4)
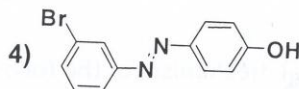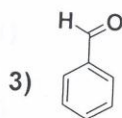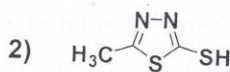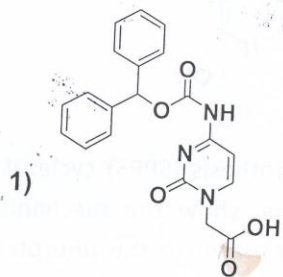
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The Examiner
Assist. Prof. Dr. Riyadh Jaleel Nahi

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