	TANTA UNIVERSITY FACULTY OF SCIENCE CHEMISTRY DEPARTMENT		
	FINAL EXAM FOR LEVEL TWO STUDENTS (CHEMISTRY)		
	COURSE TITLE:	ORGANIC CHEMISTRY (4) (CH2216)	
DATE: JUNE, 10,2015	TERM: SECOND	TOTAL ASSESSMENT MARKS: 150	TIME ALLOWED: 2 HOURS

Answer the following

1- Answer by mechanism the following:

A. Using carbon isotope, show the reaction mechanism of sodium salt with cyanogen bromide.
B. Show the reaction of benzene with propene in presence of a catalyst.
C. Addition of HBr to propene in the presence of peroxide. Show the mechanism.

2- Explain in details the following:

A. Nucleophilic substitution reaction in aliphatic and aromatic compounds.
B. Factors affecting addition to carbonium ion. Explain in details.
C. Show by mechanism Saytzef and Hoffmann rule.

3- Show the mechanism of the following:

A. Favorskii – rearrangement.
B. Benzidine – rearrangement.
C. Benzil-Benzilic acid rearrangement.

4- Answer by equation the following:

A. Show the mechanism of elimination –addition reaction.
B. Crossed-Cannizaro reaction.
C. Addition of halogen acid to 3,3-dimethyl-1 butene. Show the mechanism.

Examiner: Prof. Mahmoud Fahmy

Good luck,,

	TANTA UNIVERSITY FACULTY OF SCIENCE DEPARTMENT OF CHEMISTRY			
1969	EXAMINATION FOR SOPHOMORES (SECOND LEVEL) STUDENTS OF SPECIAL CHEMISTRY SECTION			
	COURSE TITLE:	STEREOCHEMISTRY		COURSE CODE:CH 2212
DATE: 27	MAY , 2015	TERM: SECOND	TOTAL ASSESSMENT MARKS: 100	TIME ALLOWED:2 HOURS

Answer The Following Questions :

1) **Compare between each of the following:** **(15 Marks)**

i- Stereoselective addition of cis- and trans-2-pentene.

ii- Diastereomers and Enantiomers.

iii- Racemization via cation and anion formation

2)a-Describe the separation of (±)-2-pentanol using (R)-(-)- mandelic acid. **(18 Marks)**

b-Describe the separation of (±)-phenylglycine using chiral stationary phase (**C.S.P**).

3) **Mark (√) or (X) and correct the false statments :** **(16 Marks)**

i- Mutarotation is the conversion of glucose to fructose . ( )

ii-The streching vibration of C=C for trans-stillbene is slightly lower than that of cis-isomer, while the stretching vibration of C—H for trans-isomer is very higher than that of cis-isomer with IR-Spectra . ( )

iii-Trans-isomer of 2-hexene has slightly lower λ_{max} and very lower ε than that of cis– isomer with UV- spectra . ( )

iv- Fumaric acid readily forms with heating a cyclic anhydride while maleic acid does not give an anhydride under the same conditions. ( )

4)a-Explain the synthesis of (±)-3-ethyl-2-hexanol using ethylacetate . **(16 Marks)**

b-Using Camphor asymmetric reagent describe the synthesis of (2S)-2-methyl-1-pentanol.

5)a-Using Mayer's asymmetric reagent describe the synthesis of (3R)-3-phenylbutanoic acid . **(9 Marks)**

b-The chemical shift of ethylenic proton δ_H was found experimentally to be 7.65 ppm for **α-** methyl cinnamic acid . What is the geometrical isomerism of the above acid ? (substituent constants for chemical shift are : $-Ph_{gem} = 1.35$, $-COOH_{cis} = 1.35$, $COOH_{trans} = 0.47$, $-CH_{3\ cis} = -0.26$, $-CH_{3\ trans} = -0.29$ ppm) . **(9 Marks)**

6)a-Draw and name the isomers of the following compounds (with comment):**(12Marks)**

i- Aldotetrose . ii-2,3-Dibromobutane . iii-Dimethylcyclohexane .

b- Draw the following compounds : **(5 Marks)**

i- (R)-3-Hexanol . ii- (2S,3S)-2,3-Dichloropentane .

Examinars: **Prof.Dr. Adel Selim** **Dr. Mohamed Azam**

	TANTA UNIVERSITY FACULTY OF SCIENCE DEPARTMENT OF BOTANY			
	EXAMINATION FOR SOPHOMORES (CHEMISTRY BIOCHEMISTRY AND SPECIAL BIOCHEMISTRY)			
	COURSE TITLE:	General microbiology		COURSE CODE:MB 2240
DATE:25-5-2015	JUNE 2015	TERM: SECOND	TOTAL ASSESSMENT MARKS: 150	TIME ALLOWED: 2 HOURS

Answer the following questions

First Part: Mycology By:Prof.Dr.Sussan El-Soah Marks: 75 ; Time: 60 min.

1-Complete the following sentences (write the whole sentence): (15 Marks)

a- Class teliomycetes divided into two orders; order.....like....fungi, order.....like...fungi.

b- Class discomycetes divided into two orders; order .....their asci are ..., order ..... their asci are.....

c-Fungus *Puccinia graminis* have two stages on barberry plant ;.....stage which carrying.....spores , ... stage which carrying.....spores.

2-Explain briefly and drawing life cycle of *Rhizopus stolonifer* (25 Marks)

3- a- With label diagram discus species of family peronosporales (20 Marks)

b- Explain and drawing asexual reproduction only of fungus *Saprolegnia* (15 Marks)

Second Part: Bacteriology By: Dr.Nanis Allam Marks: 75 ; Time: 60 min.

1-Complete the following: (10 marks)

b- Single specific origin of DNA replication in bacteria called.....

c- b- The Proteobacteria are Gram ....and subdivided into 5 clades: ....,....,....,....,...

d- c-Sulfur bacteria belong to .....and called .....

e- d- Clostridium tetani causes.....

2-Compare between the following: (20 marks)

a-Batch and continuous cultures

b- pilli and flagella

3- Detect the differences in cell wall structure between Gram +ve and Gram –ve (10 marks)

4-Detect the role of pilli in conjugation (20 marks)

5-Identify the following: chemotaxis, transformation (15 marks)

Best wishes

Examiner: Prof.Dr.Sussan El-Soah, Dr. Nanis G. Allam

Tanta University
Faculty of Science
Department of Chemistry

Exam for Level Two, chemistry section CH 2204

Chemistry of Transition Elements Term: Second

June 2015 Total Assessment Marks: 100 Time Allowed: 2 h

Answer the following questions:-

1) **Complete the following** (25marks)

a) Transition elements have ability to form complexes because

1....., 2....., 3.....

b) Compounds of transition elements are usually colored because

1....., 2....., 3.....

c) The assumptions of the crystal field theory are: 1- ....., 2- ....., 3-.....

d) Zn^{+2} and Ti^{+4} compounds are white because .....

e) The d-block elements are so-called transitions because .....

2) **Discuss the following** (25marks)

a- The different types of Fe(II) and Fe(III) complexes
b- Compare and contrast the chemistry of Mn an Re
c- Explain why TiO_2 is white but $TiCl_3$ is violet

3) Write on: (25marks)

a) Compare and contrast the chemistry of Fe, Ru and Os

b) The electronic structure and oxidation state of Mn group.

4) **Explain briefly** (25marks)

a- The general properties of the transition elements comparing with the main elements.

b-The size of Hf and Zr are identical.

c- The splitting of d^2 , d^4 , d^8 and the type of hybridization in weak and strong ligands.

(Good luck)

Examiners: Prof. Dr. Gad El-Hefnawy

	TANTA UNIVERSITY FACULTY OF SCIENCE DEPATTMMENT OF CHEMISTRY		
	Final Examination For Second Level Students (Special Chemistry)		
	COURSE TITLE: The Phase Rule	COURSE CODE: CH2208	
	DATE: 30/5/2015	TOTAL ASSESSMENT MARKS: 100	TIME ALLOWED: 2 HOURS

Answer the following questions(label each area line and point in your diagram):
Each question (25 marks)

1- a)What is the phase rule ? What are the types of systems on which it is applied? What is thephase equilibrium diagram?

b)Compare between phase diagram of H_2O and phase diagram of CO_2 ?

2- A pure substance (A) has liquid vapor pressure of 320 mm Hg at 125°C, 800 mm Hg at 150°C and 60 mm Hg at the triple point 85°C. The melting point of (A) decreases slightly as pressure increases.

a) Sketch a phase diagram for (A).

b) Calculate the molar heat of vaporization and the normal boiling point of substance (A).

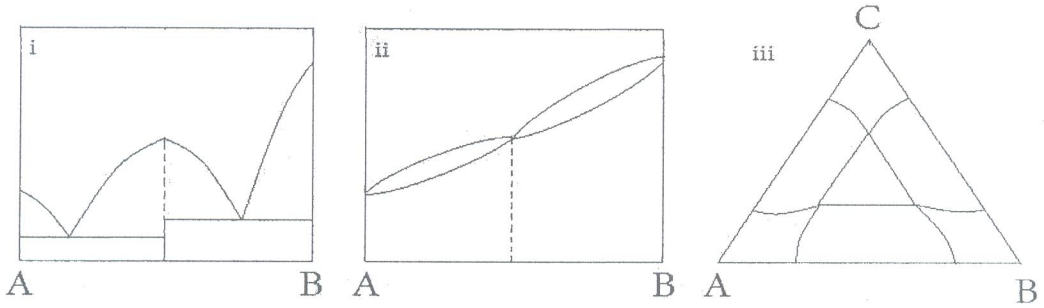
c) What phases changes occur when:

i. At constant pressure of 300 mm Hg, the temperature drops from 150°C to 50°C.
ii. At constant pressure of 50 mm Hg the temperature increases from 70°C to 90°C.
iii. At constant temperature of 100°C the pressure increases from 50 mm Hg to 3 atm.

3- a)Draw sketches for a binary condensed systems with simple eutectic, peritectic and eutectoid temperature.

b)Draw a sketch for the temperature composition phase diagram at constant pressure for partially miscible liquid with upper and lower consolute temperature. Shaw the effect of increasing pressure and existence of impurities.

4-Define the following phase diagrams, apply the phase rule at each region, line and point in your phase diagrams.



(Good luck)

1969	TANTA UNIVERSITY FACULTY OF SCIENCE DEPARTMENT OF CHEMISTRY			
	EXAMINATION FOR SECOND STAGE STUDENTS OF SPECIAL CHEMISTRY.			
	COURSE TITLE:	INSTRUMENTAL ANALYSIS (1)		COURSE CODE: CH2206
DATE:	JUNE , 2015	TERM: FIRST	TOTAL ASSESSMENT MARKS: 150	TIME ALLOWED: 2 HOURS

Answer the following questions:

The first question: (50 marks)

1. Explain: (30 marks)
   - a- The clinical application of reflectance spectroscopy (the quantitative analysis of multilayer film reactions for determination of blood glucose)
   - b- Types of magnets in NMR spectrometer. How the homogeneity of magnetic field around the sample position be increased?
   - c- The kinds of interference in atomic absorption measurements.

2. Draw the photometric titration graph for the following cases (20 marks)
   - a. X and T are coloured and P is colourless.
   - b. X and P are colourless and T is coloured.
   - c. T and X are colourless and P is coloured.
   - d. P and T are colourless and X is coloured

   The symbols: X, T and P are the unknown substance, the titrant, and the reaction product respectively. The terms: coloured and colourless mean absorb and do not absorb at the measuring wavelength respectively.

The second question: (50 marks)

1. The accuracy of a spectrophotometer can be evaluated by preparing a standard solution of 60.06-ppm $K_2Cr_2O_7$ in 0.005 M H_2SO_4 and measuring its absorbance at a wavelength of 350 nm using a cell of a path length of 1.00 cm. The expected absorbance should be 0.640. Calculate the molar concentration, the percentage transmittance (T%) and the molar absorptivity at 350 nm for the standard solution. The standard is analyzed by spectrophotometer (A) and three results of absorbance have an average value of 0.60, is the spectrophotometer (A) accurate or moderately accurate or inaccurate? Why?. (20 marks)

2. Mention all kinds the detectors that used in the following spectrometers: UV- VIS, IR, fluorescence, atomic absorption, NMR, and reflectance. (10 marks)

3. Drive a straight line equation between (20 marks)
   - a. (A) and (log T%).
   - b. log T% and concentration (c).
   - c. The total absorbance (A_{total}) and volume of the standards add (C_x) in standard addition method.
   - d. What are the values of the slope and intercept in a, b and c?

The third question: (50 marks)

1. Put (√) at the correct sentence and (X) at the wrong one. (don't write the sentence) (10 marks)

   a- $(CH_3)Si$ is used as an internal standard for measuring ^1H- NMR spectra.

Please turn the paper on

(٤)

b- In Nd -YAG laser the active medium is neodymium and the active substance is yttrium aluminum garnet.
c- The cells used for measuring UV absorption spectra are made of quartz.
d- $CDCl_3$ suitable for measuring ^1H- NMR spectra.
e- The cells used for measuring IR absorption spectrum of aqueous sample are made of silver chloride.

2. Choose the correct answer: (write your choice only) (20 marks,)
   a. $n \rightarrow \pi^*$ transition is less in energy than ($\sigma \rightarrow \sigma^*$ - $n \rightarrow \sigma^*$ - $\pi \rightarrow \pi^*$) (2 marks)
   b. In UV-VIS photodiode array spectrometer the spectra is measured (simultaneously – sequentially – point by point – all of those.) (2 marks)
   c. The principle of operation of photodiode array detector depends on (external photoelectric effect – thermal voltage (EMF) – pyroelectric effect – internal photoelectric effect.). (2 marks)
   d. The unit of absorbance is: (liter.mole^{-1}.cm^{-1} – 1000 cm^2.mole^{-1} – M^{-1}cm^{-1} – liter^{-1}.mole.cm^{-1} – a dimensionless quantity). (2 marks)
   e. The non radiative $T_1 \rightarrow S_0$ process is: (internal conversion – absorption- intersystem crossing – phosphorescence – fluorescence). (2 marks)
   f. The non radiative $S_1 \rightarrow T_1$ process is: (internal conversion – absorption – intersystem crossing – phosphorescence – fluorescence). (2 marks)
   g. The term (I_o/I_t) is called (absorbance – opacity – extinction coefficient – transmittance) (2 marks)
   h. What is the main light source used in atomic absorption spectrometer? (continuum source – deuterium lamp – hallow cathode tube – tungsten lamp) (2 marks)
   i. The atomization processes in ICP atomic emission spectrometer occurs in (ICP photomultiplier tube – ICP torch – ultrasonic nebulizer – pneumatic nebulizer) (2 marks)
   j. In UV-VIS absorption spectroscopy, the UV absorption causes (Change of nuclear spin – Change of configuration – Change of electron distribution in valance shell – Change of electron distribution in inner shells). (2 marks)

3. In the fig. (1): (20 marks)
   a. What does the figure represent? (2 marks)
   b. What do the numbers from 1 to 8 refer to? (16 marks)
   c. In what spectrometer this equipment is used? (2 marks)

Hint:
H=1, K= 39.1, Cr= 52, O= 16

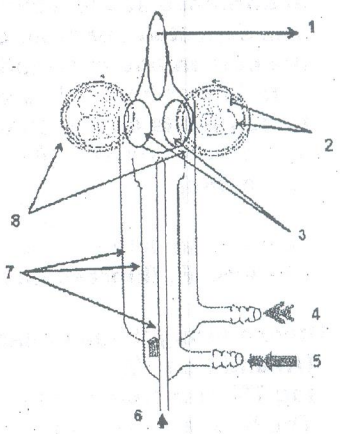


Fig.(1)

مع أطيب الامانى بالنجاح

EXAMINER	Prof. Dr. samy salem assar.

Tanta University, Faculty of Science, Department of Chemistry
Final Examination of (Organic Chemistry 3) for Level two students (special chemistry)
Date: 23/5/ 2015 Total Assessment:150 Course Code: CH2214 Time Allowed: 2hrs

Section (A) Bifunctional : (75 points)

1] Put (√)or (x) and correct the wrong answer (Explain by equations):(25 points)

a- Aldol condensation between acetone and formaldehyde followed by reduction with $LiAlH_4$ gave n-butanol. ( )

b- Addition of HBr to 1,3-butadiene gave one product only. ( )

c- Addition of C_2H_5MgCl to hex-3-en-2-one followed by hydrolysis gave 25 % of 4-ethyl-2-hexanone. ( )

d- Crossed Aldol condensation between benzaldehyde and acetophenone gave benzalacetophenone. ( )

e- Addition of HCl to Crotonic acid gave 2-chloro-butanoic acid. ( )

2] Write the mechanism of the following reactions: (15 points)

a- Pyrrolidine to 1,3-butadiene.

b- Perkin reaction

c- 1,4-Addition of hydrazine to Acraldehyde.

3] Carry out of the following conversions: (20 points)

a- Glycerol to Acrylic acid.

b- 3-Methylfurane to 4-methylphthalic acid.

c- 2-Methyl-propanal to 5-methyl-3-hexenoic acid.

d- Ethylacetate to 4-methyl-2-pentanone

4] Complete the following equations and name the final products: (15 points)

1] Methyl vinyl ketone $\xrightarrow{HCN}$ -----

2] Benzaldehyde + Acetone $\xrightarrow[-H_2O]{NaOH/\ H^+}$ --- $\xrightarrow[AgNO_3]{(O)}$ -----

3] 6,6-dimethyl-4-heptenoic acid $\xrightarrow[Fusion]{KOH}$ ----- $\xrightarrow{H_3O^+}$ ------

$\longrightarrow$

Section (B) Alicyclic compound : (75 points)

1] Draw the structure of the following compounds: (8 points)

a- 8,8-Dichloro-7-ethyl bicycle[3,2,1] 2-octanol.

b- 5-Bromo-3,3-Dimethyl-1-[3'chlorocyclopentyl]-6-[2''cyclohexanone]-2-hexanone.

2] Carry out the following conversions : (25 points)

a- 1,3-Dibromo propane to cyclobutane.

b- Acetaldehyde to Aldimedone unhydride

c-Acetylene to 2,3-diphenyl cyclopropenone

d- Diethyladipate to 1-methyl cyclopentene

e- 3-Hydroxy-3[1'hydroxy cyclobutyl] butane to 2-ethyl-2-methyl cyclopentanone.

3] Write the mechanism of the following reactions: (14 points)

a- Diethyl oxalate + 3-butanone (NaOEt) →methyl-cyclopentane

b- Diethyl succinate (NaOEt) →1-ethyl-4-methyl cyclohexane.

4] Write on By equations the action of heat on: (8 points)

a) Cyclobutyl trimethyl ammonium hydroxide b) Calcium salt of adipic acid

5] Complete the following equations and name the final products. (20 points)

1] 2-butene + diazomethane $\longrightarrow$ -- $\xrightarrow[\text{heat}]{\text{cu}}$ ---

2] cyclopentadienyl anion + acetone $\longrightarrow$ ----

3] 2-methylcyclohexanone $\xrightarrow{hv}$ -----

4] Benzoylcyclopropane + HBr $\longrightarrow$ -----

Good Luck

Examiner: *Prof. Dr.* **Sahar El-khalafy**

	TANTA UNIVERSITY FACULTY OF SCIENCE DEPARTMENT OF CHEMISTRY			
	EXAMINATION FOR LEVEL TWO OF STUDENTS OF CHEMISTRY/BIOCHEMISTRY; BIOCHEMISTRY			
	COURSE TITLE:	PRINCIPLE OF BIOCHEMISTRY II		COURSE CODE: BC2204
DATE:	3-6-2015	TERM: SECOND	TOTAL ASSESSMENT MARKS: 150	TIME ALLOWED: 2 HOUR

Answer all the following questions

Section (A)

I- Illustrate diagram and/ or biochemical equation to be clarify each of the following: (20 marks)

1- The exchange of CO_2 with O_2 in tissue to red blood cells. (8 marks)

2- Four principle reaction involved in renal regulation of acid base balance and the formation of ammonia in the kidney (12 marks)

II- What happened from each of the following and explain your answer (20 marks)

1- Patient suffers from dehydration and drink pure water

2- Albumin in plasma is lower than normal

3- Person has got hot bath with lack of oxygen

4- Patient suffer with diabetes mellitus with ketosis

III- 1- Compare between interstial and trans-cellular fluid; mention the 3 types of serous fluid. (5 marks)

2-What is the condition of substance injected into the body to be measure total and extracellular fluids? How can you measure the volume of intracellular fluid? (5 marks)

IV- 1- Find the molarity and osmolarity of 0.9 g % of NaCl; if you know the atomic mass of Na= 23 and Cl=35.5 (7 marks)

2-Find the total volume of extracellar fluid and its percentage to body weight for person weight 70 Kg injected *i.v.* with 100 mg inulin that dissolved in 10 ml. After 5 hours, the 400 ml of urine was collected and urine inulin level in urine was 10 mg % and plasma inulin level was 0.375 mg % (8 marks)

3-The specific volume of ammonium sulfate is 0.565 ml/g. The solubility of ammonium sulfate at 0^0C is 706 g/1000g water.(10 marks)

a) Calculate the concentration (g%) and molarity of ammonium sulfate in saturated solution at 0^0C.

b) The amount of solid ammonium sulfate that must be added to 100 ml of 40% saturated to bring 80% saturated.

See the next page

Q

Section (B)

I- 1- Describe by chemical equations all steps in the synthesis of: (20 marks)

a- Proline b- Tryptophan (starting from Chorismate)

c- Arginine d- Cysteine

2. Clarify by chemical equation Edman degradation reaction and it's used? (5 marks)

II- 1- An unknown tetrapeptide is found to contain one equivalent each of Arg, Cys, Gly, and Leu. Edman degradation releases Gly. Trypsin gives no apparent reaction. Partial hydrolysis in acid gives several dipeptides, including CysArg and LeuCys. Identify the structure of the tetrapeptide. (Use the standard abbreviations). (7 marks)

2- If you treat the following peptide with chymotrypsin, which peptide would you expect to generate?

Lys-Gly-Phe-Thr-Tyr-Pro-Asn-Trp-Ser-Tyr-Phe (6 marks)

3- You are given a mixture that contains glutamic acid (pI = 3.2), arginine (pI = 10.8), and valine (pI = 6.0), and you subject the mixture to electrophoresis at pH 7.1. Arrange amino acids migrate to anode or cathode (6 marks)

4. Clarify the advantage of the two-dimensional electrophoresis? (6 marks)

III- 1- Mention and illustrate diagrammatically the secondary and tertiary structure of protein with examples (13 marks)

2- Mention the name and chemical structure of each of the following amino acids containing: (7 marks)

a- Guanido group b- Immidazol ring

c- Indole group d- reactive aliphatic hydroxyl

e- Aromatic ring

3- Write the structure of lysine and glutamate as it would be expected at its isoelectric point. (5 marks)

Best wishes

Prof. Ehab M. M. Ali

Dr. Thoria Abdel Aziz

2. **Identify the missing particle in the following nuclear reaction:**

$$_{43}Tc^{99} \rightarrow \ldots\ldots\ldots + {}_{0}e^{-1}$$

(a) $_{43}Es^{99}$ (b) $_{42}Mo^{99}$ (c) $_{43}Tc^{99}$ (d) $_{44}Ru^{99}$

3. **Which of the following statements is true?**

(a) No naturally occurring isotopes are radioactive

(b) Some naturally occurring isotopes are radioactive

(c) All naturally occurring isotopes are radioactive

(d) No artificial occurring isotopes are radioactive

4. **For the most common types of radioactive decay, the order of least penetrating to human tissue, to most penetrating to human tissue is:**

(a) alpha, beta, gamma (b) beta, gamma, alpha

(c) gamma, beta, alpha (d) gamma, alpha, beta

5. **Identify the missing particle in the following nuclear reaction:**

$$_{94}Pu^{239} \rightarrow {}_{2}He^{4} + \ldots\ldots\ldots$$

(a) $_{92}U^{243}$ (b) $_{96}Cm^{235}$ (C) $_{92}U^{235}$ (d) $_{96}Cm^{243}$

6. **Atoms above the Band of Stability have too many ..... .**

(a) electrons (b) protons (c) neutrons (d) positrons

7. **Identify the missing particle in the following nuclear reaction:**

$$_{13}Al^{27} + {}_{2}He^{4} \rightarrow {}_{15}P^{30} + \ldots\ldots\ldots$$

(a) $_{0}n^{1}$ (b) $_{30}Zn^{61}$ (c) $_{1}H^{1}$ (d) $_{4}Be^{7}$

8. **What does the neutron-to-proton ratio represent?**

(a) nuclear decay (b) atomic number (c) atomic stability (d) mass number

9. **If the half-life of a hypothetical isotope is 5 hr, how much remains if 20.0g decays after 15 hr?**

(a) 2.50 g (b) 5.00 g (c) 6.67 g (d) 10.0 g

10. **Given that aluminum-27 is a stable nuclide, what type of particle would you expect to be emitted when aluminum-25?**

(a) positron (b) electron capture (c) beta particle (d) both a & b

Good Luck

Examiners	**Prof. Dr. Safaa El-din H. Etaiw** **Dr. Mohamed Mansour El-bendary**

TANTA UNIVERSITY FACULTY OF SCIENC CHEMISTRY DEPARTMENT			
FINAL EXAM FOR 2nd LEVEL STUDENTS (CHEMISTRY SECTION)			
COURSE TITLE	NUCLEAR CHEMISTRY		TIME ALLOWED: 2 HROURS
CODE	CH2210		
DATE: 13/6/2015	TERM: SECOND	TOTAL ASSESSMENT MARKS	50

Answer the following questions

Question 1: (10 Marks)

Compare between the pair of the following

(a) Nuclear chemistry and traditional chemistry

(c) Atomic bomb and hydrogen bomb

Question 2: (10 Marks)

(a) Discuss the nuclear fission, the chain reaction and the critical mass

(b) Draw and discuss briefly the nuclear power plant design and its components

Question 3: (10 Marks)

(a) Define the nuclear fusion and its reactions, the plasma state and discuss the plasma confinement bottles in the nuclear fusion

(b) Discuss the types of uranium Isotopes and its uses

Question 4: (10 Marks)

(a) Define the nucleons, binding energy, nuclides, and discuss the classification of nuclides

(b) How you can make a radiocarbon dating of an object from an archeological site?

Question 5: **Choose the correct answer from the following** (10 Marks)

1. In nuclear reactions:

(a) mass and energy are destroyed

(b) small amount of mass are converted to large amounts of mass

(c) large amount of energy are converted to small amount of mass

(d) small amounts of mass are converted to large amount of energy