



Final Exam in Spectroscopy and Stereochemistry for 3rd Level Students (C-311)

Section A (Spectroscopy)

Answer on the following questions:

Q1. Choose (T) for the true sentence or (F) for the false sentence:

(10 Marks)

- 1- The relative area of each peak in a quartet spin-spin splitting pattern is 1:2:2:1. ()
- 2- The ^{13}C -NMR spectrum of $\text{CCl}_3\text{COCCl}_3$ showed one singlet signal. ()
- 3- The splitting term in ^1H -NMR means the number of different types of protons. ()
- 4- The ^{13}C -NMR spectrum of ethylene glycol shows one signal. ()
- 5- The ^1H -NMR spectrum of succinic acid shows two signals. ()
- 6- The ^{13}C -NMR spectrum of ethyl formate shows four signals. ()
- 7- The IR spectra cannot differentiate between Ethanol and Ethanone ()
- 8- The OH group causes the absorption maximum to be shifted to a longer wavelength. ()
- 9- Acetophenone has three values of maximum wave number in the UV technique. ()
- 10- Each of the Chlorine and Bromine atoms shows two peaks in mass spectra. ()

Q2. (a) Discuss the McLafferty rearrangement in:

(6 Marks)

- (i) 4-Methyl-2-pentanone. (ii) Butanal.

(b) Predict the splitting patterns of the following molecules:

(2 Marks)

- (i) 1,1,3,3-Tetrabromopropane. (ii) Diethyl malonate.

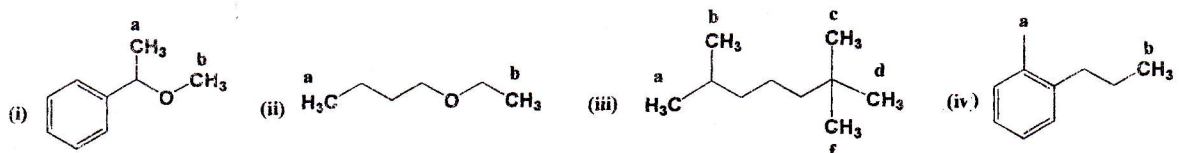
(c) Identify the different equivalent protons in the following molecule:

(2 Marks)

- (i) *p*-Chlorobenzaldehyde. (ii) 1,3,5-trimethylbenzene.

Q3. (a) Which methyl group would you expect to be more downfield NMR in the following molecules below:

(4 Marks)



(b) Using ^1H -NMR spectra, show the difference between *o*-xylene and *p*-xylene. **(2 Marks)**

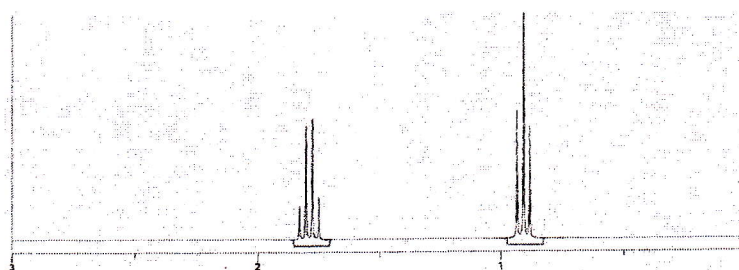
Q4. (a) What solvents are used in NMR, and explain the characteristics of suitable solvents.

(2 Marks)

(b) Deduce the possible structure of the compound with molecular formula $\text{C}_4\text{H}_{10}\text{O}$ and

^1H NMR data given below: a signal at δ 1.2 ppm and a signal at δ 2.4 ppm. **(3 Marks)**

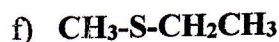
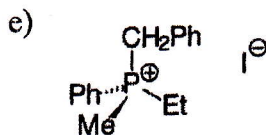
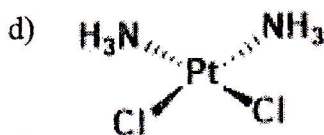
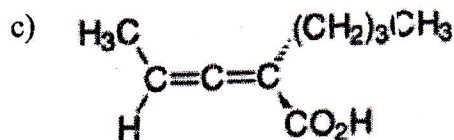
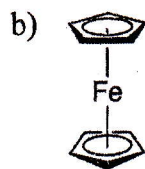
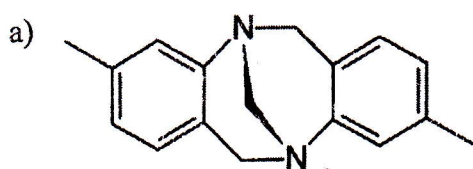
Q5. The ^1H NMR of compound X ($\text{C}_5\text{H}_{10}\text{Cl}_2$) is shown below. Propose a structure for X. (3 Marks)



Section B (Stereochemistry)

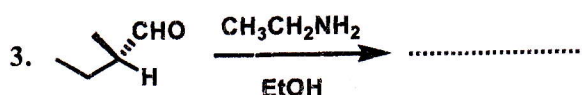
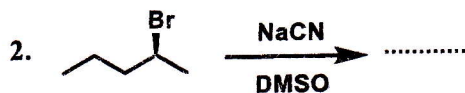
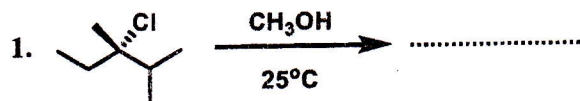
Q6: By equations, show the product(s) of hydrogenation for 2-butanone. If you have more than one stereo-isomer, how you can separate them? (4 Marks)

Q7: Which of the following is an optically active or optically inactive compound: (3 Marks)

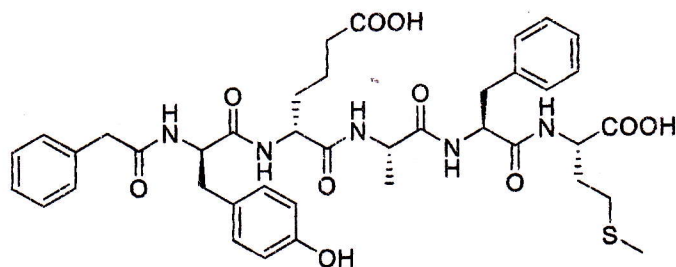


Q8: Write the products and mechanism for the halogen addition for *Cis*-2-butene. (3 Marks)

Q9: Complete the following equations and explain the type of each reaction and the absolute configuration for the products: (3 Marks)



Q10: Determine the absolute configuration for the following peptide: (3 Marks)



Good Luck

Dr. Ahmed Abdou O. Abeed & Dr. Abdelreheem A. Saddik.

17	Graph between the amount adsorbed (x/m) and pressure of adsorbate gas at a constant temperature is known as adsorption isotherm.
18	Mesopores exhibited pore diameter < 2 nm.
19	Total pore volume is the volume of gas adsorbed at value of P/Po equal to unity.
20	An increase in pressure of adsorbate causes an increase in the magnitude of adsorption process.
21	The extent of adsorption increases with the decrease of surface area of the adsorbent.
22	Type I adsorption isotherm depicts only the monolayer formation and thus it is called Langmuir adsorption isotherm.
23	Physisorption isobar show a continuous increase with temperature.
24	Chemisorption is highly specific while physisorption is not.
25	In BET-theory, it was postulated that a dynamic equilibrium is exist between the successive layers.
26	Physisorption involved the formation of multilayers while chemisorption involved only a monolayer.
27	BET theory postulated that, the molecules undergo a multilayer adsorption and the principle of Langmuir can be applied to each layer.
28	High temperature is favorable for the chemical adsorption while is not favorable for the physisorption.
29	Langmuir postulates that the surface of the adsorbent is non-uniform, that is, all the adsorption sites are not equivalent.
30	In physisorption, the forces between the adsorbate molecules and adsorbent are weak Vander Waal's forces.
31	Relation between the amount adsorbed(x/m) and temperature at a constant equilibrium pressure or concentration of adsorbate molecules is known as adsorption isobar.
32	The specific surface area can be calculated from volume-thickness method by dividing the slope of the linear presentation by 15.47.
33	Adsorption from gas mixture depends on the partial pressures of the gases contained.
34	Langmuir isotherm could be mathematically expressed as $\frac{x}{m} = K(C)^{\frac{1}{n}}$.
35	Desorption is the process of removal of an adsorbed substance from the surface on which it is adsorbed.
36	Because of adsorption, the surface energy increases.
37	Enthalpy of adsorption (ΔH adsorption) is low and positive.

 Assiut University	Industrial Chemistry Program 1 st Semester – Final Exam 2023/2024	Course Title: Ceramics industry Time: 120 minutes Marks: 50	 Faculty of Science
Important remarks	• No. of pages: 1 • Chem: 311 No. of questions: 4 Instructor: Gomaa Elsayed Abdalla.		

Answer the following question, support your answers with sketches.

- Bioceramics and bioglasses are ceramic important materials that are biocompatible. Based on your study answer the following:
 - Explain briefly bioceramic fabrication process?
 - Mention the required properties in bioceramic?
 - Mention the application of the bioceramic?
- Discuss the difference between the main types of refractories materials, type and applications?
- Discuss the fabrication and processing of clay products taking into the consideration the following, support your answers by sketches:
 - A mixture of components used i.e. typical porcelain
 - Hydroplasticity and slip mechanism.
 - Shaping by the extrusion process.
 - Tape casting to produce thin sheets.
- Firing and glazing are very important steps in ceramic tiles. Explain the following:
 - Discuss Nature, advantages, composition and manufacture of the frits?
 - Explain the firing stage?

Best wishes

Prof. Gomaa Abdalla

Q 2: Shade the correct answer; A, B, C or D:

(1 Mark each)

No.	Phrase
38	<u>Many elastic and non-elastic gels shrink in volume on standing, with an accompanying exudation of solvent. This process is called</u> A) thixotropy B) metathesis C) cataphoresis D) syneresis
39	<u>Some gels liquify readily when shaken to form a sol which on standing turns back into a gel. The sol-gel transformation is referred to as</u> A) metathesis B) syneresis C) thixotropy D) cataphoresis
40	<u>The precipitating power of Al^{3+}, Na^+, Ba^{2+} ions is in the order.....</u> A) $Na^+ > Ba^{2+} > Al^{3+}$ B) $Ba^{2+} > Na^+ > Al^{3+}$ C) $Al^{3+} > Na^+ > Ba^{2+}$ D) $Al^{3+} > Ba^{2+} > Na^+$
41	<u>The surface tension of lyophilic sols is frequently that of the pure medium.</u> A) higher than B) lower than C) sometimes higher and sometimes lower than D) not different from
42	<u>The charge on As_2S_3 sol is due to</u> A) absorption of H^+ ions B) adsorption of H^+ ions C) adsorption of S^{2-} ions D) absorption of S^{2-} ions
43	<u>The dispersed phase in emulsions are generally charged.</u> A) negatively B) positively C) neutrally D) sometimes positively and sometimes negatively
44	<u>Proteins below their isoelectric points</u> A) move to the anode B) move to the cathode C) do not move either to the anode or to the cathode D) sometimes move to the anode and sometimes to the cathode
45	<u>The continuous rapid zigzag movement executed by a colloidal particle in the dispersion medium is called</u> A) Tyndall effect B) electrophoresis C) Brownian movement D) peptization
46	<u>The movement of the dispersion medium under the influence of applied potential is known as.....</u> A) osmosis B) diffusion C) electroosmosis D) electrophoresis
47	<u>If the sol particles in a given colloid move towards the anode, the dispersion medium carries charge.</u> A) no B) positive C) negative D) sometimes positive and sometimes negative
48	<u>Which of the following ions is the most active in precipitation of As_2S_3 sol ?</u> A) SO_4^{2-} B) Al^{3+} C) PO_4^{3-} D) Ca^{2+}
49	<u>A gel is a colloidal system in which a is dispersed in a medium.</u> A) solid, liquid B) liquid, liquid C) liquid, gas D) liquid, solid



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Faculty of Science
Chemistry Department



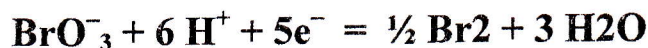
Jan., 2024
Time: 2 hours

Final Examination of Introductory Quantitative Analysis for 2nd Level Students (C-240)

Answer Four Questions Only:

(50 Mark)

1. a) Write a brief account on: Liebig method.
- b) Calculate the pAg and pCl in a solution prepared by mixing 10 ml each of 0.1 M AgNO₃ and 0.1 M NaCl. ($K_{sp}(\text{AgCl}) = 1.2 \times 10^{-10}$)
- c) What is the electrode potential (vs. NHE) in a solution containing 0.5 M KBrO₃ and 0.2 M Br₂ at pH 2.5? ($E^\circ \text{BrO}_3^- , \text{Br}_2 = 1.52 \text{ v}$)



2. a) Write briefly on: The limitations of Volhard method.
- b) How many milligrams are in 0.25 m mol Fe₂O₃?
(At.wts: O = 16 , Fe = 55.84)
- c) 5.0 mL of 0.1 M Ce⁴⁺ solution is added to 5.0 mL of 0.3 M Fe²⁺ solution. Calculate the potential of a pt electrode dipping in solution (relative to NHE). ($E^\circ \text{Ce}^{4+}, \text{Ce}^{3+} = 1.61 \text{ v}$ & $E^\circ \text{Fe}^{3+}, \text{Fe}^{2+} = 0.77 \text{ v}$)

3. a) **Define:** i) Chelating agent ii) Adsorption indicators.
- b) Calculate the fraction of fumaric acid (H₂A) that exists as A²⁻ at pH 5
($K_{a1} = 8.91 \times 10^{-4}$, $K_{a2} = 3.16 \times 10^{-5}$).
- c) Contrast random error with systematic error.
- d) The carbohydrate content of a glycoprotein is determined to be 12.6, 11.9, 13.0, 12.7 and 12.5 g of carbohydrate / 100 g of protein in replicate analysis. Find the 50% and 90% confidence intervals for the carbohydrate.
(t at 50% = 0.741 , t at 90% = 2.132)

4. a) Write briefly on: Bronsted acid-base theory.
- b) What is the pH of a solution prepared by dissolving 1.23 g of 2-nitrophenol in 250 mL? (M.wt = 139.11 , $K_a = 6.2 \times 10^{-8}$)
- c) What is the pH of a solution that is 0.2 M in phthalic acid (H₂P) and 0.1 M in potassium acid phthalate (KHP)?

$$(K_{a1} = 1.2 \times 10^{-3} , K_{a2} = 3.9 \times 10^{-6})$$

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50 Gold number is.....

- A) the number of gold atoms present in one gram of gold
- B) the number of gold atoms present in one gram of gold alloy
- C) the number of milligrams of protective colloid which just prevents the coagulation of 10 c.c of a given gold sol. when 1 c.c of a 10% solution of NaCl is added to it
- D) the number of milligrams of protective colloid which just prevents the coagulation of 10 c.c of a given gold sol. when 5 c.c of a 50% solution of Iodine is added to it

Good Luck

Prof. Dr. Maher M. Girgis and Dr. Mohamed N. Abd El-Hamed.

5. a) Write briefly on: Lewis acid–base theory.
- b) Calculate the pH of a solution obtained by reacting 50 mL each of 0.1 M NH_4OH and 0.1 M HCl .
($K_b = 1.8 \times 10^{-5}$, $K_w = 1.0 \times 10^{-14}$).
- c) An acetic acid–sodium acetate buffer of pH 5.0 is 0.1 M in NaAc . Calculate the pH after the addition of 10 mL of 0.1 M NaOH to 100 mL of the buffer. (p $K_a = 4.76$)

Good Luck

Examiners: **Prof. Dr. Hassan Sedaira**
 Prof. Dr. Elham Y. Hashem

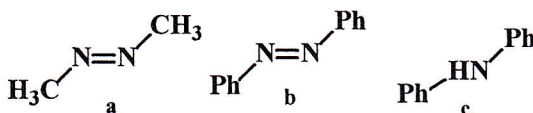


Final exam in 307 Course (dyes) for 3rd level Industrial chemistry students

Answer the following questions:

Chose the correct answer of the following(25 marks)

- The wrong about dyes is: a. chemical compounds able to absorb light and reflect in different selective wave lengths b. A colored substance that chemically bonds to the substrate. c. a substance able to absorb light completely.
- The visible light is one of the components of the electromagnetic spectrum of wavelength ranges between: a. 400 – 800 b. 200 -900 c. 380 - 700 nanometres.
- Which is not true about red color: a. has lowest frequency b. has longest wavelength c. The energy of the photon violet light is smaller than the energy of the photon of red light
- The color absorbed at wavelength between 605-700 is: a. Violet b. blue c. Red
- The shorter wave length ray in the visible light is: a. Red b. Blue c. Ultraviolet
- The color observed at wavelength between 435-480 is: a. violet b. Blue c. Red
- The white light consists of a mixture of seven colors according to their wave length are: a. Violet – Indigo – Blue – Green – Yellow – Orange – Red
b. Red – Orange – Yellow – Green – Blue – Indigo – Violet.
c. Violet–Yellow - Orange – Indigo - Green – Blue – Red
- Although that benzene containing conjugated double bonds system but when light pass through it not colored because it absorb light at: a. more than 760 b. between 435-480 c. at less than 285
- Light transmission is:
a. The amount of light that can successfully pass through glass and other types of materials
b. The reflection of light from a surface such that an incident ray is reflected at many angles, rather than at just one angle
c. reflects all light which arrives from a given direction at the same angle,
- Transparency material: a. materials permit to part of light pass through it.
b. permit to light pass through it c. reflect the light to at the same angle from surface of this material.
- 2,6-di-tert-butyl-4-methylphenol (Hindered phenol) used in dyes as: a. trapping the radicals or to decomposing the peroxides, b. as a coupler in azo dyes c. it self used as a dye.
- The commonly used UV absorbers are: a. benzene b. acetic acid c. benzophenone.
- Oxochrome group: a. the group is essential part in molecule to give color. b. group helping to appearing color or increasing the color hue. c. the group responsible about color in dyes.
- Fluorescence is: a. substance that has absorbed light and the emitted light with a longer wavelength. b. It is an optical property that makes an object appear bluish under reflected light c. This phenomenon of color perception variation as a result of changing lighting conditions such as changing the light source.
- Juglone dye was considered: a. Azoic dye b. Anthraquinone dye c. Naphthoquinone dye
- methyl orange shows red colors at pH: a. under 4.4 b. over 6.2 c. between 4.4 and 6.2
- Ingrain dye is related to: a. Azoic dyes b. Indigo dyes c. Phthalocyanines
- Which colored compound in the following:



- Alizarin was considered as: a. Alpha naphthoquinone dyes b. anthraquinone dye c. Methine dyes
- Halochromism : a. the group which when attached to chromophore the colour appear b. changing the color as the pH changes
- The part of a molecule responsible for its color called: a. chromogen b. Chromophore c. Oxochrome

Photochemistry and Reactive intermediates (313 C)
Final Exam for The 3rd level Students

Note: Support your answer with Chemical equations whenever possible.

Answer on the Following Two Sections: (50 Marks)

Section (A): Photochemistry: (25 Marks)

Answer on the Following Questions:

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

- 1- Discuss Jablonski Diagram with special reference to slow Fluorescence .
- 2- Explain the different methods for the determination of photochemical reaction mechanism with special reference to the product quantum yield method.
- 3- Discuss the different types of electron excitation in photochemical reactions with special reference to the reduction of 2-acetylnaphthalene.
- 4- Explain the photochemical reactions in the vision process .
- 5- Give examples on the advantages of Microwave spectra in organic synthesis .

II] – Mark right ($\checkmark$) or wrong (X) on Only Four of the following statements, and Explain your answer : (4 X 2 = 8 Marks)

- 1- Quartz Glass transmitting radiations ≥ 500 nm can be used in U.V. light photolysis of organic compounds. ()
- 2- Solar light is a result of fission of Hydrogen Gas. ()
- 3- Concerted Mechanism includes acyclic transition state. ()
- 4- Photochromism is a Thermal-reversible process. ()
- 5- The UV-A radiations have a lower energy than visible light. ()

ملحوظة هامة : الأسئلة 3 صفحات

- 22.colourless chemical compound that can be converted by chemical reaction into coloured compound called: a. chromogen b. Chromophore c. Oxochrome
- 23.(NH₂) group has: a. bathochromic effect b. Hypsochromic effect c. neither a nor b.
24. Indigo and the anthraquinone derivatives are examples of: a. mordant dyes b.vat dyes c. direct dyes
- 25.Kermesic acid is related to: Anthraquinone dyes b. Indigo dyes c. Phthalocyanines

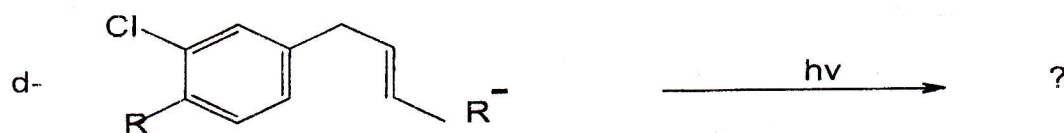
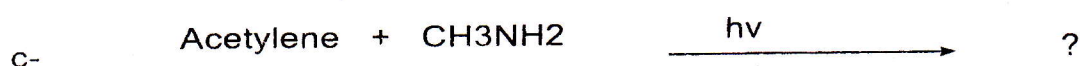
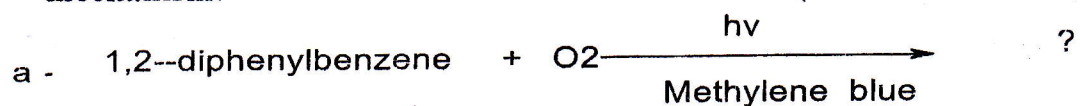
II. Put (✓) mark in the front of correct statement and (X) in the front of wrong one(25 Marks):

1. From the factors that affect the light fastness: a. Moisture content
2. Disperse dyed polyester fiber shows better resistance than disperse dyed polyamide fibers.
3. Reactive dye form covalent bond with the cellulose of the fiber. The dye particles which are properly fixed to the fiber show good resistance to UV
4. Brighter shades of dye show good resistance to light.
5. The below shows the dyes with increasing order of light fastness:
Natural Dyes > Reactive Dyes > Vat Dyes > Indigo Dyes
6. The Natural dyes are least resistant to light.
7. The hue of the spice saffron is primarily due to the carotenoid chemical crocin
8. Exhaustion: transferring dye molecules from the solution to the fiber as well as in swelling the fiber to render it more receptive
9. The orange colure was produced from mixing the blue and yellow colures.
10. A chromophore is a colored part in the molecule.
11. An auxochrome is a functional group of atoms attached to the chromophore which modifies the ability of the chromophore to absorb light
12. The object to appear colored it must have at least one chromophore.
13. 1,2-dimethyldiazene $\text{CH}_3\text{N}=\text{NCH}_3$ was appeared orange because it has azo group.
14. Although that benzene containing conjugated double bonds system appeared colorless because absorb part of light's waves with wave length less than 285 .
15. nitroaniline was colored than nitrobenzene. That is anino group is donating electron group
16. Azo dyes show different colors as pH changes. Therefore, they are used as indicators.
17. Exhaustion: In any dyeing process, whatever the chemical class of dye being used, heat must be supplied to the dye bath.
18. Mechanism of fading colure by light proceeds through free radical formation.
19. Acid dyes are usually applied on wool, silk and nylon
20. Dyes which having chelating sites to form stable coordination complex with metal ions from metal salts called Vat dyes.
21. water-insoluble dyes, such as indigo and the anthraquinone derivatives called Mordant dyes
22. Indigosol. Dyes are readily applied to cellulosic fibers and are subsequently converted to parent vat dye by oxidation treatment.
23. Reactive dye is the dye that can react with a fiber to form a covalent bonds.
24. Disperse dye is a category of synthetic dye intended for cotton and related hydrophilic fibers.
25. 5,5,7,4 tetrahydroxy antocyanidol was produced from Onion skin by boiling to extract it.

Good Luck

Prof. Dr. Adel Mohamed kamal El-Dean

III] Complete the following equations and Discuss the reaction mechanism: (5 X 2= 10 Marks)

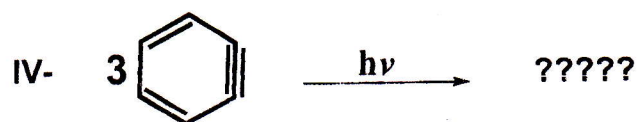
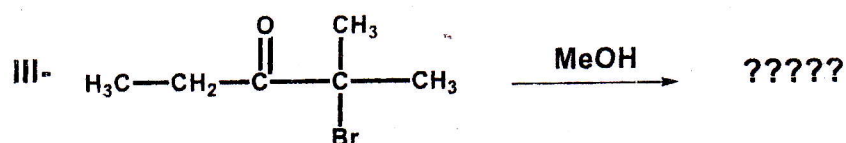
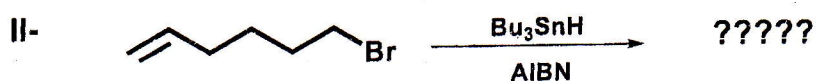
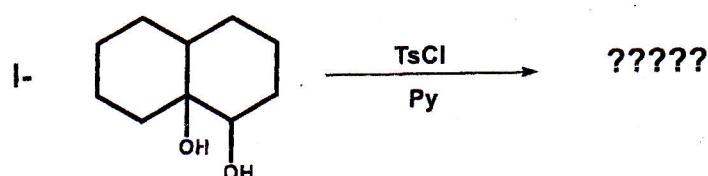


Section (B): Reactive Intermediates:

(25 Marks)

Answer on the Following Questions:

- 1) Suggest the suitable mechanism and products for Only Three of the following reactions. Write the name of the suggested mechanism indicating each step using arrows. (3 x 5 =15 Marks)





Date: Thursday, 18/01/2024

Time: 2 hours.

Answer Eight Only the following Questions:

(50 points)

- 1) Why would a hole appear when a dilute alkali is spilt on a fabric made of Polyesters, or Kevlar
discuss by mechanism equations ?
- 2) Discuss the steps of Plastic Production, showing the types of Molding?
- 3) Explain the two stages for the formation of Urea-Formaldehyde Resins ?
- 4) What are the three main types of degradable plastics? Why are they degradable?
- 5) What are the main two types of polyethylene? What is the structural difference between them?
- 6) Discuss briefly the polymerization process of PVC, and its Additives and Compounding ?
- 7) How does urea-methanal differ from nylon, Kevlar and Dacron, even though all of them are
condensation polymers?
- 8) Explain the term "vulcanization of rubber". What are the differences between natural rubber
and vulcanized rubber?
- 9) Why is the structure of DNA called a double helix? Name and draw its component structure?

Good Luck

Examiner:

Prof. Dr. Kamal Ibrahim Aly

2) Write on two only of the following (use equations): (2 x 5 = 10 Marks)

- a. Decomposition of diazomethane in benzene leads to two different products.
- b. It is possible to say that singlet carbenes add to olefins stereospecifically.
- c. Discuss the transformation of 2-methyl-1-propanol to *tert*-butanol in acidic medium.

Prof. Dr. Aboel-Magd A. Abdel- Wahab & Prof. Dr. Mona A. Abdel -Rahman

Good Luck

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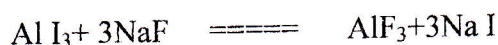
Prof. Dr. Aboel-Magd A. Abdel- Wahab & Prof. Dr. Mona A. Abdel -Rahman

Good Luck

Section I:

(17 marks)

- a-Write the effective atomic number rule.
- b- Calculate the effective atomic number for the following complexes and clarify it is obey the rule or not. (i) $[\text{Ni}(\text{CO})_4]$ (ii) $\text{K}_3[\text{Fe}(\text{CN})_6]$
- c) Write the formula of the following complexes.
(i) Tetramminedicyanoplatinum(IV)tetrachloroplatinate(II).
(ii) Hexammine- μ -hydroxo- μ -amidodicobalt(II) chloride.
- d)Write the IUPAC name of the following complexes.
(i) $[\text{PdI}_2(\text{ONO})_2]$ (ii) $[\text{Co}(\text{en})_2\text{NH}_3\text{Br}]\text{Cl}$ (iii) $\text{K}[\text{Pt}(\text{NH}_3)\text{Cl}_5]$
- e) What kinds of isomerism that compound (i) above can possess?
- f) Put ($\checkmark$) or (x) in front of the following:
(i) The compound $[\text{Co}(\text{NH}_3)_5\text{Cl}]\text{Cl}_2$ contains 4 charges and 3 ionizable Cl
(ii) The oxidation number of nickel in the complex $\text{K}_4[\text{Ni}(\text{CN})_4]$ is zero.
(iii) The number of charges in a solution of the complex $[\text{Pt}(\text{NH}_3)_2\text{Cl}_2]$ is zero.
(iv) A solution of the complex $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$ contains 6 charges and 4 particles.
(v) Chiral complexes possess superimposable mirror image isomers.
- g) In the light of HSAB concept, predict which direction the following reaction will go.?



Section I I :

(17 Marks)

A)For **only five** compare between

- 1-Reaction of Zn(II) and Cd(II) ions with excess sodium hydroxide and ammonia solutions
- 2-Reaction of Cu with non-oxidizing and oxidizing acids
- 3-Octahedral and square planar of Ni(II)complexes
- 4-Effect of NaOH solutions on CrO_3 and MnO_2
- 5-TriethylenediamineNi(II)ion complex and tetracyanoNi(II)ion complex
- 6- Behavior reaction of the KMnO_4 in acidic and basic medium

B) For **only six** complete of the following :

- 1- Cu_2O reacts with the halogen acids gives.....
- 2- Hg_2SO_4 is in H_2O
- 3-When dissolved CrO_3 in strong HCl gives
- 4-...Forming when reducing Cu tartrate by sugar
- 5- The number of unpaired electrons of iron ions in $[\text{Fe}(\text{phen})_3]\text{Cl}_2$ equal.....
- 6-When nickel metal reaction with fused NaOH from
- 7-Oxidizing SO_3^- ions in basic medium by KMnO_4 gives

C) For only five explain why:

- 1- HNO_3 used in equilibrium between dichromate and chromate ions
- 2- White solid color appeared when heating ferrous sulphate hydrate
- 3- Shape of $[\text{Co}(\text{H}_2\text{O})_6]^{+2}$ complex change to tetrahedral when reaction with Cl^- ions
- 4- $(\text{NH}_4)_2[\text{CuCl}_4]$ complex is square planar but $\text{CS}_2[\text{CuBr}_4]$ complex has tetrahedral
- 5- $\text{Fe}(\text{II})$ oxide more basic than $\text{Fe}(\text{III})$ oxide
- 6- $[\text{Cr}(\text{H}_2\text{O})_3(\text{OH})_3]$ is amphoteric complex

Section III:

(17 Marks)

1- Give reason(s) of the following:

- a- Transition metals form complexes easily.
- b- $\text{Ni}(\text{II})$ compounds are thermodynamically more stable than $\text{Pt}(\text{II})$ compounds.
- c- Halides of transition metals become more covalent with increasing oxidation state.
- d- $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$ complex ion has a purple colour.

2- Choose the correct answer:

- a- TaC is used for cutting edges of high-speed machine tools due to its:
i) Hardness ii) Ductility iii) High melting point iv) Shock resistance
- b- Upon application of magnetic field on a substance the domains are oriented in the same direction forbehavior.
i) Paramagnetic ii) Diamagnetic iii) Ferromagnetic iv) Antiferromagnetic
- c- For transition metals the delocalization of d-electrons increases:
i) Hardness ii) Electrical conductance iii) Melting point iv) All of these
- d- $\text{Cu}(\text{I})$ ion has been stabilized by forming a complex with:
i) CN^- ii) F^- iii) NO_2 iv) O^{2-}

3- Answer only four of the following:

- a- Discuss in brief the catalytic activity shown by transition metals.
- b- Show how pure titanium metal has been extracted from ilmenite ore.
- c- The measured value of volume magnetic susceptibility of a sample using Gouy balance at 239K is 1.6×10^{-4} , if the molecular weight of the sample is 240g/mole and its density equals 2.21 g/cm^3 , calculate the magnetic moment of the sample.
- d- Give the electronic configuration of the following metals:



e- Define and show the differences between interstitial compounds and alloys of transition metals.

(Sc=21 ; Ti=22 ; V=23 ; Cr=24 ; Mn=25 ; Fe=26 ; Co=27 ; Ni=28 ; Cu=29 ; Kr = 36, Ag = 47)

الاستاذ الدكتور / اسماء ابراهيم

الاستاذ الدكتور / محمد عبدالحكيم

الاستاذ الدكتور / سعيد ابراهيم



Assiut University
Faculty of Science
Chemistry Department



Date: 16th Jan. 2024
Time: 2 hrs

**Final Examination of Oils, Soaps and Detergents (C-309) for 3rd Year
Students- Industrial Chemistry Program**

Answer the following questions: (50 Marks)

I. First Question (15 Marks)

1. Write the Scientific Term for the following statements: (10 Marks)

- The number of milligrams of KOH required to neutralize the free fatty acids present in one gram of fat
- Alkaline hydrolysis of fats and oils that produces glycerol and salts of fatty acids
- Chemicals that carry messages between members of different species and are classified into kairomones, allomones and synomones.
- The number of milligrams of KOH needed to neutralize the acetic acid liberated from hydrolysis of 1 gram of acetylated fat or oil
- A physico-chemical change in the natural properties of the fat and oils leading to the development of unpleasant odor or taste or abnormal color.

2. Draw the chemical structures of the five terpenoids showing how they could be interconverted to each other. (5 Marks)

II. Second Question (10 Marks)

1. Draw the chemical structure of Triolein, then answer the following: (6 Marks)

- What is the type of triglyceride?
- Calculate the Iodine number for triolein
- Calculate the Saponification value for triolein

[Mol.Wt of triolein = 885.43; A.Wt. of iodine =127; Mol.Wt. KOH =56]

2. How can you differentiate between a Glycerophospholipid and a sphingophospholipid. Giving an example and the chemical structure for each. (4 Marks)

Please, turn over the page.

III. Third Question

(12 Marks)

1. Write briefly on THREE ONLY of the following expressions: (6 Marks)

- a) Importance of essential fatty acids
- b) Cleaning action of soap
- c) Types of detergents
- d) Hazards of rancid fats and oils

2. Draw the chemical structure for THREE ONLY of the following: (6 Marks)

- a) 2-Oleo-1,3-distearin
- b) Vitamin D2 (Ergocalciferol)
- c) Spermaceti wax (Cetyl palmitate)
- d) Ricinoleic (C₁₈:1 Δ^9 , hydroxy at C₁₂)

IV. Fourth Question

(13 Marks)

1. Give the reason for THREE ONLY of the following (6 Marks)

- a) Castor oil is inedible.
- b) Linalool isn't stable under pyrolysis conditions.
- c) Triglyceride derived from saturated fatty acids have higher melting points than the unsaturated ones.
- d) The low-density lipoprotein cholesterol (LDL) is more dangerous on health than the high density (HDL).

2. Put (✓) in front of the correct statement and (X) in front of the wrong one,

correct the wrong sentence:

(7 Marks)

- a) Rancidity increases as the number of double bonds decreases ()
- b) Tristearin has zero Iodine number. ()
- c) Saponification number increases with increasing the molecular weight of fat or oil. ()
- d) C₁₈: Δ^9 is a fatty acid contains 18 carbons and one double bond located at carbon 9 and is called palmitoleic acid ()
- e) Hydrolytic rancidity produces peroxide which on decomposition affords aldehydes, ketones and dicarboxylic acids ()
- f) The most important members of the terpenoid family are the oxygenated monoterpenoids ()
- g) Glycolipids are type of compound lipids that contain fatty acids, phosphoric acid and glycerol ()

GOOD LUCK

Prof. Dr./ Remon Melad Zaki

9) The following isotopes of $^{16}_8\text{O}$, $^{17}_8\text{O}$, and $^{18}_8\text{O}$

- A) Only $^{16}_8\text{O}$ is stable B) $^{17}_8\text{O}$ is radioactive
C) The three are stable D) $^{18}_8\text{O}$ is radioactive

10) The activity of Na-22 which give a dose rate of $64 \mu\text{Sv/h}$ at 1 m (Na-22 emits one γ - ray photon of energy 1.28 MeV) is

- A) 200 MBq B) 100 C) 50 D) 300

11) Thermal neutrons lose energy through

- A) elastic scatter B) inelastic scatter C) neutron capture D) nuclear reactions

12) ^{92}Sr ($T_{1/2} = 2.7 \text{ h}$) decay into ^{92}Y ($T_{1/2} = 3.6 \text{ h}$) the time when the daughter and parent activities equal each other's

- A) 2.24 h B) 4.48 C) 3.25 D) 4.12

13) $^{68}_{31}\text{Ga}$ undergoes β^+ and EC modes of decay. The products of these alternative paths are

- A) $^{68}_{30}\text{Zn}$, and $^{68}_{29}\text{Cu}$ B) $^{68}_{30}\text{Zn}$ and $^{68}_{28}\text{Ni}$ C) $^{68}_{30}\text{Zn}$ D) $^{68}_{30}\text{Zn}$ and $^{68}_{31}\text{Ga}$

14) The thickness of lead that would be reduce the exposure dose from ^{18}F -FDG sample by 70 % ($HTV = 0.5 \text{ cm}$) is

- A) 0.87 cm B) 2.7 C) 3.5 D) 0.38

15) If $N = 0.798 N_0$ for a nuclide at the end of 4.2 days .The $T_{1/2}$ of this nuclide is

- A) 6.4 d B) 12.8 C) 3.2 D) 1.6

16) The isotope $^{210}_{84}\text{Po}$ is an α emitter its half-life is 138.4 days .If you start with 2.87×10^{14} atoms of $^{210}_{84}\text{Po}$ the number of atoms left after 365 days is

- A) 3.76×10^{10} atoms B) 4.62×10^{13} C) 1.25×10^{12} D) 2.81×10^{13}

17) $^{45}_{20}\text{Ca}$ is

- A) stable B) α emitter C) β^- emitter D) β^+ emitter

18) A/A_0 where A and A_0 are activities, the m/m_0 where m and m_0 are masses of the same nuclide, which of the following relations is correct

- A) $A/A_0 > m/m_0$ B) $A/A_0 = m/m_0$
C) $A/A_0 < m/m_0$ D) nothing of these relations is correct

19) $^{172}_{68}\text{Er}$ decay by β^- emission ($T_{1/2}=49.5$ h) .The product nuclide is

- A) ${}^{172}_{69}\text{Tm}$ B) ${}^{172}_{70}\text{Yb}$ C) ${}^{172}_{67}\text{Ho}$ D) ${}^{172}_{66}\text{Dy}$

20) ${}^{165}_{67}\text{Ho}$ nuclide is

- A) stable B) β^+ C) α D) β^- emitter

21) The missing nuclide in the following nuclear reaction ${}^{24}_{12}\text{Mg} (d, \alpha)$ is

- A) ${}_{13}^{13}\text{Al}$ B) ${}_{15}^{28}\text{P}$ C) ${}_{11}^{22}\text{Na}$ D) ${}_{14}^{25}\text{Si}$

22) The rate of α decay/sec (dps) would be emitted from 4×10^{-12} g of ^{210}Po ($T_{1/2}=138$ d) is

- A) -602.23 dps B) -555.21 C) -666.94 D) -421.51

23) ^{13}N decays by β^+ emission. The maximum kinetic energy of the β^+ is 1.19 MeV. The nuclide mass of ^{13}N is

- A) 12.00573u B) 12.00217 C) 13.00573 D) 13.2195

24) If one curie of pure $^{32}_{15}\text{P}$ ($T_{1/2} = 14.3 \text{ d}$) is stored for 24 h, the weight of ^{32}S - would result at the end of that period is

- A) 16.6 μg B) 0.166 C) 3.2 D) 1.6

25) The time required for the decay of 8/9 of a sample of Ge-68 ($T_{1/2} = 280\text{ d}$) is

- A) 333 d B) 721 c) 525 D) 888

26) The mass of $^{226}_{88}\text{Ra}$ ($T_{1/2}=1622\text{y}$) which has an initial activity of 1.0 Ci is

- A) 2.0 g B) 0.5 C) 3.0 D) 1.0

27) The mass of ^{12}C nucleus is exactly 12 amu. The packing fraction is

- A) 3.89Mev B) 7.68 C) 9.22 D) 4.61

28) The emitted particle in the decay of $^{106}_{47}\text{Ag}$ to give $^{106}_{48}\text{Cd}$ is

- A) β^- B) β^+ C) p D) α

29) For the nuclear reaction $^{50}_{24}\text{Cr} (\alpha, n)$ the product nucleus is

- A) $^{52}_{25}\text{Mn}$ B) $^{53}_{27}\text{Co}$ C) $^{53}_{26}\text{Fe}$ D) $^{51}_{24}\text{Cr}$

30) Of the three isobars $^{114}_{48}\text{Cd}$, $^{114}_{49}\text{In}$, $^{114}_{50}\text{Sn}$. The isobar likely to be radioactive is

- A) $^{114}_{48}\text{Cd}$ B) $^{114}_{49}\text{In}$ C) $^{114}_{50}\text{Sn}$ D) none of these

31) $^{210}_{83}\text{Bi}$ decay to $^{210}_{84}\text{Po}$. The mode of $^{210}_{83}\text{Bi}$ decay is

- A) β^+ emission B) α C) β^- D) γ

32) The cross section for the reaction $^{23}_{11}\text{Na} (n, \gamma) ^{24}_{11}\text{Na}$ is 0.56 b. The activity of $^{24}_{11}\text{Na}$ ($T_{1/2} = 15 \text{ h}$) would result when 2.5 mg of sodium chloride are bombarded for 12 h by thermal neutron of flux of $1 \times 10^{13} \text{ n/cm}^2 \cdot \text{Sec}$. is

- A) $7.98 \times 10^7 \text{ dps/g NaCl}$ B) 6.13×10^7 C) 5.23×10^7 D) 7.98×10^5

33) If $^{127}_{53}\text{I}$ is irradiated with protons in a cyclotron and three neutrons are emitted from the nucleus. The product of the nuclear reaction is

- A) $^{128}_{53}\text{I}$ B) $^{125}_{54}\text{Xe}$ C) $^{127}_{52}\text{Te}$ D) $^{125}_{53}\text{I}$

34) The specific activity of carrier free $^{131}_{53}\text{I}$ ($T_{1/2} = 8 \text{ d}$) is

- A) $5.27 \times 10^6 \text{ mCi/mg}$ B) 4.63×10^3 C) 2.85×10^5 D) 1.25×10^5

35) By natural radioactivity, $^{238}_{92}\text{U}$ emits an α . The heavy residual nucleus is called UX_1 . UX_1 in turn emits β^- particles. The heavy residual nucleus from this process is called UX_2 . The UX_2 nuclide is

- A) $^{239}_{92}\text{U}$ B) $^{234}_{91}\text{Pa}$ C) $^{234}_{90}\text{Th}$ D) $^{235}_{90}\text{Th}$

36) The particle needed to complete the nuclear reaction

$^{63}_{29}\text{Cu} (p, \dots) ^{62}_{29}\text{Cu}$ is

- A) ^4_2He B) ^3_1H C) ^2_1H D) ^3_2He

37) In the reaction $^{32}\text{S} (n, \gamma) ^{33}\text{S}$ with slow neutrons, the γ is produced with an energy of 8.65 MeV. The nuclide mass of ^{33}S is

- A) 33.0112 u B) 32.97144 C) 31.8529 D) 32.15432

(The mass of $^{32}\text{S} = 31.97207 \text{ u}$, mass of $^1_0\text{n} = 1.00866 \text{ u}$)

38 The terminal member of the naturally occurring radioactive series which begins with $^{232}_{90}\text{Th}$ is

- A) $^{206}_{82}\text{Pb}$ B) $^{209}_{83}\text{Bi}$ C) $^{208}_{82}\text{Pb}$ D) $^{210}_{83}\text{Bi}$

39) From the following nuclides. The isotones are

$^{40}_{18}\text{Ar}$, $^{41}_{19}\text{K}$, $^{40}_{21}\text{Sc}$, $^{41}_{21}\text{Sc}$ and $^{90}_{40}\text{Zr}$

- A) $^{40}_{21}\text{Sc}$, $^{90}_{40}\text{Zr}$ B) $^{40}_{18}\text{Ar}$, $^{41}_{19}\text{K}$ C) $^{41}_{19}\text{K}$, $^{40}_{21}\text{Sc}$ D) $^{90}_{40}\text{Zr}$, $^{40}_{18}\text{Ar}$

40) The dose rate at 2m from a particular gamma source is 400 $\mu\text{Sv/h}$. The distance which give a dose rate of 25 $\mu\text{Sv/h}$ is

- A) 4m B) 10 C) 12 D) 8

41) The approximate dose rate at a distance of 2m from a 240 MBq cobalt -60 source (Co-60 emits two γ -rays/disintegration of 1.17 and 1.33 MeV) is

- A) 20 $\mu\text{Sv/h}$ B) 25 C) 10 D) 5

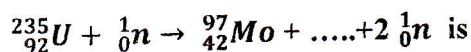
42) The half-lives of Mo- 99 and Tc- 99 m are 67 h and 6 h respectively and both are in transient equilibrium in a sample. If the activity of Mo- 99 is 1000 MBq, the activity of Tc - 99m (assume 87 % Mo - 99 decays to Tc - 99 m) is

- A) 323 MBq B) 422 C) 957 D) 531

43) When the pure nuclide $^{50}_{24}\text{Cr}$ is bombarded with α -particles, two reactions occur and two nuclides $^{53}_{26}\text{Fe}$ and $^{52}_{25}\text{Mn}$ are produced. The nuclear reaction showing the formation of the two nuclides $^{53}_{26}\text{Fe}$ and $^{52}_{25}\text{Mn}$ respectively are:

- A) (α, γ) , (α, p) B) (α, n) , (α, d) C) (α, n) , (α, p) D) (α, p) , (α, n)

44) The missing nuclide in a typical neutron - initiated fission



- A) $^{138}_{51}\text{Sb}$ B) $^{137}_{50}\text{Sn}$ C) $^{130}_{50}\text{Sn}$ D) $^{137}_{51}\text{Sb}$

45) The missing particle in the following nuclear reaction ${}^9_4\text{Be} (p, \alpha)$ is

- A) ${}^6_3\text{Li}$ B) ${}^4_2\text{He}$ C) ${}^{14}_7\text{N}$ D) ${}^3_2\text{He}$

46) From the following nuclides ${}^{208}_{82}\text{Pb}$, ${}^8_5\text{B}$, ${}^{150}_{67}\text{Ho}$, ${}^{30}_{13}\text{Al}$, ${}^{120}_{50}\text{Sn}$ and ${}^{94}_{36}\text{Kr}$. The probably β^- emitter are

- A) ${}^{150}_{67}\text{Ho}$ B) ${}^{30}_{13}\text{Al}$, ${}^{94}_{36}\text{Kr}$ C) ${}^{30}_{13}\text{Al}$, ${}^{208}_{82}\text{Pb}$ D) ${}^{120}_{50}\text{Sn}$

47) A radioactive nuclide decay by β^- (1.174 MeV) directly to stable nuclide (5.4 %) and by β^- (0.5120 MeV) to metastable state (94.6 %). The energy of γ -ray photon energy emitted to reach stable state is

- A) 0.512 MeV B) 0.1740 C) 0.4120 D) 0.6620

48) The activity of 30 μg of Cm-247 is 2.8 nCi. The half-life of Cm -247 is

- A) 2.5×10^5 y B) 2.0×10^7 C) 3.5×10^5 D) 1.5×10^7

49) ${}^{137}_{55}\text{Cs}$ decays with emission of β^- particle. The resulting nuclide is unstable and emits γ -ray photon. The final nuclide is

- A) ${}^{136}_{55}\text{Cs}$ B) ${}^{137}_{56}\text{Ba}$ C) ${}^{137m}_{56}\text{Ba}$ D) ${}^{137}_{54}\text{Xe}$

50) ${}^{22}_{11}\text{Na}$ ($T_{1/2} = 2.6$ y) decays by 89% of its decay by β^+ emission and the rest by EC. The half life for the EC mode of decay is

- A) 2.92 y B) 2.65 C) 0.029 D) 23.65

$$1\text{Ci} = 3.7 \times 10^{10} \text{ Bq}, 1\text{b} = 1 \times 10^{-24} \text{ cm}^2, N_A = 6.003 \times 10^{23} \text{ mole}^{-1}, m_p = 1.00727\text{u}, \\ m_n = 1.00866 \text{ u}, \text{ mass of } {}^3\text{He} = 3.0160293, \text{ mass of } {}^4\text{He} = 4.0026032, \text{ mass of } {}^{13}\text{C} = \\ 13.00445 \text{ u}, 1\mu\text{g} = 1 \times 10^{-6} \text{ g}.$$

Good luck

R.M.Mahfouz

45) The missing particle in the following nuclear reaction ${}^9_4\text{Be} (p, \alpha)$ is

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- A) ${}^{150}_{67}\text{Ho}$ B) ${}^{30}_{13}\text{Al}$, ${}^{94}_{36}\text{Kr}$ C) ${}^{30}_{13}\text{Al}$, ${}^{208}_{82}\text{Pb}$ D) ${}^{120}_{50}\text{Sn}$

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$1\text{Ci} = 3.7 \times 10^{10} \text{ Bq}$, $1\text{b} = 1 \times 10^{-24} \text{ cm}^2$, $N_A = 6.003 \times 10^{23} \text{ mole}^{-1}$, $m_p = 1.00727\text{u}$,
 $m_n = 1.00866 \text{ u}$, mass of ${}^3\text{He} = 3.0160293$, mass of ${}^4\text{He} = 4.0026032$, mass of ${}^{13}\text{C} = 13.00445 \text{ u}$, $1\mu\text{g} = 1 \times 10^{-6} \text{ g}$.

Good luck

R.M.Mahfouz

Final Exam. For Course No (301 Nuclear and Radiochemistry) (Industrial Chemistry)

Answer the following two questions

Question No. 1

From the following nuclear data given below

Co-57
271.80 d
ξ
$Y=122,136, 14\ldots$
e^-

A-Sketch the decay scheme of Co-57

Write the complete decay equation of Co-57

How many atoms are present in 1 mCi of Co-57 activity?

Insert spin and parity of the parent and of the daughter nuclei

What is the specific activity of carrier free Co-57

B- Define the following items

Sievert, exposure dose, specific ionization, mass stopping power of the material, internal conversion, Equivalent dose

D- The half-lives of Mo-99 and Tc-99m are 67 hr. and 6 hr., respectively and both are in Transient equilibrium in a system. If the Mo activity is 75 mCi (2.8 GBq), what is the activity of Tc-99m ? (assume 87% Mo decay to Tc-99m)

Question No.2

Define the following items

Photoelectric effect, Neutron capture, Annihilation process , and Isomeric transition

What is the time interval during which Ga-67 ($T_{1/2} = 3.2$ d) decay to 37% of the original activity?

What kind of decay you expect for I-125, and I-132?

How much time would it take for the decay of 8/9 of a sample of Ge-68 whose half-life is 280 days?

Constants: $m_p = 1.00727u$, $m_n = 1.00866u$, $N_A = 6.023 \times 10^{23} \text{ mole}^{-1}$, $1b = 1 \times 10^{-24} \text{ cm}^2$, $1Ci = 3.7 \times 10^{10} \text{ Bq}$. **Good Luck** **Prof.R.M.Mahfouz**



Final-term exam, 1st semester, 2023/2024

Histochemistry (Z 316)

Time limit: 2 hours, Date: Jan. 05th, 2024

Total score: 50 marks, the test consists of 5 pages



I- Choose the correct answer from “A, B, C, or D”, then put your answer inside the empty box, under the black arrow: (35 marks, one mark for each)



1	Which histochemical technique is used for the detection of free amino groups in proteins? A) Ninhydrin-Schiff method B) Sagaguchi method C) Mercury orange method D) Millon's reaction	
2	Which nucleic acid preferentially stains with pyronin, producing a red color? A) DNA B) RNA C) Both DNA and RNA D) Neither DNA nor RNA	
3	The histochemical method used to detect cholesterol and its ester is: A) Copper rubeanic acid method B) Schultz method C) Calcium lipase method D) Acid hematin method	
4	What is the classification of “Eicosanoids” within the lipid categories? - A) Simple lipids B) Compound lipids C) Derived lipids D) Miscellaneous Lipids	
5	Acid hematin is a histochemical method used for the demonstration of: A) Cholesterol esters B) Phospholipids C) Triglycerides D) Plasmalogens	
6	Which microscopy technique is used after staining with osmium tetroxide? A) Confocal microscopy B) Light microscopy C) Fluorescence microscopy D) Electron microscopy	
7	Which of the following methods is used to demonstrate antigens, antibodies, and antigen-antibody complexes in tissues and cells? A) Autoradiography B) Histological methods C) Immunohistochemical methods D) Enzyme labeling	
8	The structural unit of nucleic acids is: A) Monosaccharides B) Nucleotides C) Fatty acids D) Amino acids	
9	The general chemical formula for carbohydrates is: A) $C_n(H_2O)_n$ B) $C_n(H_2O)_{2n}$ C) $C_n(H_2O)_{n+1}$ D) $C_n(H_2O)_{2n+1}$	

10	Which method involves the simultaneous production and capture of primary reaction product (PRP) and final reaction product (FRP) in one incubating medium? A) Self-colored substrate B) Post-incubation coupling C) Metal precipitation technique D) Simultaneous coupling	
11	What is the recommended type of sections to use in histochemical methods for lipids? A) Fixed sections B) Paraffin-embedded sections C) Celloidin-embedded sections D) Fresh frozen sections	
12	Which type of enzymes catalyze the rearrangement of chemical bonds within a molecule? A) Ligases B) Transferases C) Isomerases D) Hydrolases	
13	What enzyme is commonly used to illustrate lysosomes? A) Alkaline phosphatase B) Acid phosphatase C) Dehydrogenase D) Esterase	
14	Which of the following staining reactions for proteins depends on their physical configuration rather than their chemical composition? A) Sagaguchi method B) Ninhydrin-Schiff method C) Mercury orange method D) Masson's Trichrome stains	
15	What are the monosaccharide units that compose sucrose? A) Glucose and fructose B) Glucose and galactose C) Glucose and mannose D) Glucose and ribose	
16	Which histochemical method is used to demonstrate free fatty acids? A) Copper rubeanic acid method B) Acid hematin method C) Schultz method D) Calcium lipase method	
17	What type of lipid plays a crucial role as a structural component in cell membranes? A) Triglycerides B) Phospholipids C) Steroids D) Sphingolipids	
18	Which microscopy technique is used to identify crystalline cholesterol and cholesterol esters? A) Polarizing microscopy B) Fluorescent microscopy C) Transmission electron microscopy D) Scanning electron microscopy	
19	What type of bond links monosaccharide subunits in a polysaccharide? A) Peptide bond B) Hydrogen bond C) Ionic bond D) Glycosidic bond	
20	Two pentoses that play crucial roles in nucleic acids and energy molecules are: A) Glucose and ribose B) Deoxyribose and fructose C) Ribose and deoxyribose D) Fructose and glucose	

21	The esters of fatty acids with alcohol groups are commonly known as: A) Triglycerides B) Phospholipids C) Steroids D) Carotenoids	
22	What is the substrate used to visualize peroxidase activity in immunoenzyme staining? A) Hematoxylin B) Alcian Blue C) Eosin D) Diaminobenzidine (DAB)	
23	Which fixation method provides better preservation of enzymatic activity and localization? A) Formalin fixation B) Cryostat fresh freezing C) Paraffin embedding D) Freeze-drying	
24	What cellular structures can be visualized using dehydrogenase and ATPase enzymes? A) Nuclei B) Golgi apparatus C) Mitochondria D) Lysosomes	
25	Which staining method is specific for glycogen? A) Alcian Blue stain B) PAS stain C) DPAS stain D) None of the above	
26	Which method involves the precipitation of colored PRP at the site of enzyme activity? A) Self-colored substrate B) Post-incubation coupling C) Metal precipitation technique D) Simultaneous coupling	
27	Which of the following is a pyrimidine base? A) Adenine B) Cytosine C) Guanine D) Inosine	
28	The primary purpose of using fluorescence microscopy for lipid staining is to examine: A) Phospholipids B) Triglycerides C) Waxes D) Fluorescent lipids	
29	Which method is used to demonstrate triglycerides in histochemical methods for lipids? A) Copper rubeanic acid method B) Acid hematin method C) Schultz method D) Calcium lipase method	
30	What color does the PAS stain produce in areas where carbohydrates are present? A) Blue B) Magenta C) Yellow D) Green	
31	Which of the following is NOT an example of a simple protein? A) Albumin B) Fibrin C) Glycoproteins D) Reticulin	
32	Which radioactive nucleotide is used to detect DNA specifically at autoradiography? A) Tritiated guanine B) Tritiated cytosine C) Tritiated thymidine D) Tritiated uracil	
33	When osmium tetroxide is reduced by unsaturated fatty acids and their esters, it turns into a: A) White oxide B) Yellow oxide C) Black oxide D) Red oxide	

34	Which histochemical method is specifically used to demonstrate DNA? A) Feulgen method C) Acridine red method	B) Basophilia D) Methyl Green Pyronin method	
35	Which of the following is a function of carbohydrates? A) Energy storage C) Cell-cell recognition	B) DNA and RNA synthesis D) All of the above	

II- Write the letter (T) if the statement is true, and write the letter (F) if the statement is false, then put your answer inside the empty box, under the black arrow: (15 marks, one mark for each)



36	Verbascose is an example of an oligosaccharide that contains 3 monosaccharide units.	
37	The staining reactions for proteins or protein-containing substances depend on their amino acid composition.	
38	Formaldehyde is the best routine fixative for lipid histochemical methods.	
39	The Sagaguchi method is a histochemical technique used for the detection of tyrosine in proteins.	
40	Glycogen is a homopolysaccharide composed of only one type of monosaccharide subunit.	
41	In Immunohistochemical methods, most of disadvantages of fluorochrome have been overcome by using of enzyme-labeling of the antibodies especially with the horseradish peroxidase.	
42	Histochemical demonstration of proteins is possible only in fresh tissue due to their high sensitivity.	
43	Cerebrosides are a type of glycolipids that consist of a fatty acid linked to sphingosine and a single carbohydrate residue.	
44	Proteins are involved in the synthesis of hormones, such as testosterone and estrogen.	
45	Alcian Blue stain is a histochemical method used to detect acidic polysaccharides in tissue samples.	
46	Sudan Black B is an appropriate histochemical method for the demonstration of phospholipids.	

47	In the Malachite green and Acridine red histochemical method, DNA is stained red, and RNA is stained green.	
48	A nucleotide is an organic molecule formed of a nitrogenous base, a six carbon-sugar, and a phosphate group.	
49	Metachromasia is the phenomenon where certain dyes or stains exhibit a color change or shift when they bind to specific tissue components.	
50	Peptide bonds are the type of bond that links monosaccharide subunits in a disaccharide.	

End of Questions, With My Best Wishes!

Dr. Ahmad U. M. Mahmoud



Final Exam for Third Level Students, Faculty of Science

Environmental Chemistry (C-343), 1st Semester

الامتحان يتكون من ثلاث صفحات، الجزء الاول (A) يجيب عنه الطالب في البابل شيت و الجزء الثاني (B) يجيب عنه

الطالب في كراسة اجابة

Part (A)

Question 1: Answer (T) for True sentence or (F) for False one (33 Marks)

1. Autotrophs, like animals, utilize the reduced carbon present in organic matter and undergo a process known as carbon fixation to convert it into energy.
2. Lakes at higher elevations generally have lower levels of dissolved oxygen compared to those near sea level.
3. The turbidity test measures the concentration of suspended solids in a water sample.
4. The BOD of a water sample is determined by incubating it for 5 days after it has been saturated with CO₂.
5. The level of self-purification in water is directly proportional to the amount of dissolved oxygen (DO).
6. Water exhibits a high surface tension, which allows it to moderate the temperature of the biosphere.
7. Cold water is denser than warm water, and salty water is denser than fresh water.
8. Detergents with a linear carbon chain are less biodegradable compared to those with a branched carbon chain.
9. Industrial wastewater discharged from the paper industry typically has a higher BOD value than that from the food industry.
10. Plain sedimentation is more effective in removing total suspended matter compared to chemical precipitation.
11. Silica adsorption selectively removes specific organic contaminants, such as volatile organic compounds (VOCs).
12. RO membranes effectively remove all types of particles, including suspended solids and dissolved salts.

13. Conventional treatment methods are not typically effective in removing refractory organic compounds.
14. The discharge of hot water from industrial effluents into streams increases the solubility of oxygen.
15. Secondary treatment primarily focuses on physically removing organic contaminants.
16. Preliminary treatment processes aim to remove large, heavy inorganic solids to protect the overall operation.
17. Flotation and skimming units are part of primary treatment processes, while coagulation and flocculation units are part of preliminary treatment.
18. Trickling biofilters utilize anaerobic microorganisms to metabolize organic contaminants.
19. COD provides a more representative measure of the organic matter content in wastewater compared to BOD.
20. The presence of dissolved oxygen is crucial for effectively removing organic matter in the activated sludge process.
21. Bio-methylation is a process performed by methanogenic bacteria under aerobic conditions within a pH range of 8-9.
22. The vapor form of mercury is the most toxic as it can enter the brain through the bloodstream, causing damage to the central nervous system.
23. Algae growth (eutrophication) is primarily caused by phosphate-based detergents.
24. Skimming as a method of controlling oil pollution in seas can be applied long after oil spills occur.
25. Natural water has a slightly basic pH due to the presence of sodium carbonate from dissolved CO_2 .
26. Organomercurials are considered non-toxic forms of mercury, unlike mercurous ions.
27. CPI separators can handle high flow rates and shock loads better than API separators.
28. Anaerobic biological treatment produces methane as a useful byproduct, unlike aerobic treatment.
29. The COD test utilizes a chemical oxidizing agent (KMnO_4) to degrade/oxidize organic matter.
30. Alkalinity is determined by titrating a water sample against mineral acids using methyl orange as an indicator.
31. Earth's biosphere is considered a closed system in terms of water, minerals and nutrients.
32. The anaerobic treatment, in comparison to aerobic treatment, has the drawback of requiring a comparatively extended retention time in the digester.
33. Disinfection and ion exchange are tertiary treatment processes implemented when certain wastewater constituents, which cannot be eliminated through primary treatment, need to be addressed.

Part (B)

Answer All the Following Questions:

(17 Marks)

First Question: Define each of the following

(3 Marks)

1. Environmental toxicology
2. Green chemistry
3. X-ray fluorescence

Second Question:

(6 Marks)

1. Explain the principle of Inductively Coupled Plasma-Atomic Emission Spectroscopy (ICP-AES).
2. Explain the principles of green chemistry.

Third Question: Choose the correct answer

(8 Marks)

1. Atomization is a process in which the sample is converted into
 - a) Vapor-phase atoms
 - b) Liquid-phase molecules
 - c) Elementary ions
 - d) None of the above
2. Which of the following can be used as a green solvent alternative to pentane?
 - a) Triethylamine
 - b) Heptane
 - c) Toluene
 - d) *tert*-butyl methyl ether
3. The cold vapor atomic absorption spectroscopy is used for detection of
 - a) Cd
 - b) Ag
 - c) Hg
 - d) Pb
4. Which of the following options explains the process of 'sputtering' that occurs in hollow cathode lamp?
 - a) Positive ions collide with cathode surface and metal atoms from cathode are ejected
 - b) Negative ions collide with cathode surface and metal atoms from anode are ejected
 - c) Positive ions collide with negative ions and metal atoms from anode are ejected
 - d) Positive ions collide with negative ions and photons are ejected
5. Ionization interferences can be eliminated by the addition of
 - a) KCl
 - b) Al
 - c) Sulfate or phosphate
 - d) EDTA
6. What are the factors determining the dose of toxins that cause harm?
 - a) The length of time of exposure
 - b) Exposure pathway
 - c) Chemical properties of toxin
 - d) All of the above
7. In Atomic Absorption Spectroscopy, with what material is the cathode in hollow cathode lamp constructed?
 - a) Tungsten
 - b) Quartz
 - c) Element to be investigated
 - d) Aluminium
8. Atomic emission occurs when a valence electron moves from:
 - a) Lower energy orbitals to higher energy orbitals
 - b) Higher energy orbitals to lower energy orbitals
 - c) Electron does not move
 - d) None of the above

WITH OUR BEST WISHES

DR. HAITHAM M. EL-BERY & DR. THARWAT H. MANSOURE



Term Exam of Petroleum, Petrochemicals and Chromatography (411C) for the 4th Level Chemistry Students

Answer all of the following questions? (50 Marks)

1- Choose the correct answer for all of the following? (40 Marks)

(Final answers must be depicted in the answer BUBBLE sheet not here)

Section (A): Petroleum Chemistry

- 1- If the smoke point of a sample of kerosene is found to be 15 mm. On removal of ---- from it, the smoke point rises to 23 mm.
- n-paraffins
 - olefins
 - aromatics
 - none of these
- 2- Acid catalyzed Friedel-Crafts alkylations between isobutylene & isobutane produce ---- - which is a good gasoline blend stock.
- 2,2,4-trimethylpentane
 - 2,2,4-trimethylhexane
 - 1,1,4-trimethylcyclopentane
 - 2,2,3-trimethylhexane
- 3- Which of the following is not among the purpose of solvent extraction process?
- Prevention of corrosion.
 - Protect catalyst in subsequent processes
 - Improve finished products
 - Remove about 90% of nitrogen, sulfur, oxygen and metals contaminants
- 4- Cetane number of diesel fuels can be improved by adding ----- additives
- 2-ethyl-hexyl nitrate
 - 2,2,4-trimethylpentane
 - Short + branched molecules
 - None of the above
- 5- Which is the most widely solvent used as wax precipitating agent in solvent dewaxing process?
- Toluene
 - Methyl ethylketone
 - Ethylene dichloride
 - Methylene chloride
- 6- Which of the following acids is not used as catalyst in the alkylation process?
- H₂SO₄
 - HF
 - Mixed acids H₂SO₄ & HNO₃
 - both (a) and (b)
- 7- In general, ----- have low Kw values while ----- have high values.
- naphthens & aromatics
 - aromatics & paraffins
 - paraffins & aromatics
 - iso-paraffins & benzenoid
- 8- Cetane number of diesel fuel used in trucks should be in the range of -----.
- 45 - 50
 - 14 - 20
 - 25 - 35
 - 30 - 38
- 9- Cloud points are measured for oils ----- contents while fraction as ----- has no cloud point data.
- waxy & naphtha
 - aromatics & paraffins
 - olefinic & polycyclic aromatics
 - solar & lubricating oil
- 10- Which type of column internals have perforations in its design covered by caps with a flow area directs the vapors horizontally into the liquid?
- Rectification
 - Stripping
 - Valve trays
 - Downcomers

11-The area designed to allow the passage of vapors on each tray is called -----.

- a) downcomers
- b) bubble caps
- c) continuous-contact areas
- d) active tray area

13-During the desalting of crude oil, which of the following statement is not true?

- a) Desalting operative pressure is maintained above vaporization pressure of crude oil.
- b) The crude oil feedstock is heated to 65-180°C.
- c) The temperature is limited by the vapor pressure of the crude-oil feedstock.
- d) Low voltage is preferable for better desalting.

12-Which of the following will have higher API gravity?

- a) Gas oil
- b) Gasoline
- c) Solar
- d) Kerosene

14-All of the following statement are characteristics of Packings EXCEPT -----.

- a) Used to increase the interfacial area for vapour-liquid contact
- b) No more energy is required to drive the vapor up the distillation column
- c) Causes excessive pressure-drop across a packed section
- d) called continuous-contact columns or staged-contact columns

Section (B): Petrochemicals

15-Which of the following is the best condition for carbon disulfide synthesis?

- a) Activated alumina/675°C/2 atm
- b) Iron/400°C/20 atm
- c) Cobalt oxides/400°C/50atm
- d) Molybdenum/230°C/30 atm

17-Degussa process used for the production of HCN and H₂ from the reaction of ammonia and methane in absence of air using ----- as a catalyst at 1200°C.

- a) platinum, aluminum-ruthenium alloy
- b) Ni-chromium oxides
- c) Zinc-copper nitrate alloy
- d) iron-molybdenum oxide catalyst

19-The oxidation process of propene to acrolein is performed by ----- using Bi₂O₃/MoO₃ as catalyst at 300-360°C/1-2 atms.

- a) Celanese process
- b) Rashig process
- c) The DuPont process
- d) Sohio process

21-What is the reaction product from reaction of methanol with isoamylene in the presence of solid acid catalyst at temperature higher 50°C?

- a) 2-Methoxy-2-methylpropane
- b) 2-Methoxy-2-methylbutane
- c) Ethylene oxide
- d) Propylene oxide

16-Choose the best catalyst used at 240°C/50 atm, in a low-pressure process for methanol production?

- a) cobalt catalyst
- b) zinc-chromium oxide catalyst
- c) nickel nitrate catalyst
- d) active copper-based catalyst

18-Which process involved the reaction of CO with steam to give CO₂ and hydrogen using iron catalyst at a temperature range of 425-500°C.

- a) Puck process
- b) Methanation process
- c) Shift conversion process
- d) obsolete process

20-Catalytic oxidation of long-chain paraffins (C₁₈-C₃₀) over manganese salts at 105-120°C/15-60 atm produces a mixture of -----.

- a) esters
- b) fatty alcohols
- c) fatty acids
- d) ethoxylates

22-Select the process name for the reaction of ethylene with HCl using thallium (III) chloride catalyst producing ethylene chlorohydrin?

- a) Celanese process
- b) Wacker process
- c) Rashig process
- d) Teijin process

23-Ammoxidation oxidation process of propylene occurs readily at 322°C over Bi-Mo catalysts gave -----.

- a) acrylonitrile
- b) adiponitrile
- c) epichlorohydrin
- d) acrolein

25-The hydroformylation followed by hydrogenation reactions of ethylene oxide will give -----.

- a) methacrylic acid
- b) 1,3-propanediol
- c) acrylic acid
- d) 2-ethylhexanol

27-Oxidation process of ethylene to acetaldehyde using $\text{PdCl}_2/\text{CuCl}_2$ -catalyst system is called -----.

- a) Shell process
- b) Wacker process
- c) Puck process
- d) Andrussaw process

24-The Celanese process is the nonselective oxidation of n-butane at a temperature range of ----- and a pressure of -----.

- a) 300–340 °C & 20 atms
- b) 200–220 °C & 70 atms
- c) 180–300 °C & 25 atms
- d) 150–225 °C & 55 atms

26- The production of glycerol from ----- was carried out by ----- using H_2O_2 to produce ----- which is further hydrolyzed to glycerol?

- a) allyl acetate-oxyacylation-propylene oxide
- b) epichlorohydrin- oxidation- propylene
- c) glycidol - insertion - allyl alcohol
- d) allyl alcohol - epoxidation- glycidol

28-Which is the reaction product from air oxidation of ethylene using silver catalyst at 200–300°C?

- a) Ethylene oxide
- b) Ethylene glycol
- c) Ethylene carbonate
- d) Ethylene chlorohydrin

Section (C): Chromatography

29-Define the eluate?

- a) It is the mobile phase leaving the column.
- b) It is the mobile phase covalently bonded the support particles in the column.
- c) It is the process of passing the mobile phase through the column.
- d) It is the addition of mobile phase that cause separation.

31-Pick out the wrong statement for the retardation forces dependence?

- a) Solubility in mobile phase
- b) Adsorption abilities f components
- c) Separation mechanism
- d) Ionic forces

33-All of the following features of *Biospecific elution* process used in affinity chromatography, *EXCEPT* -----.

- a) It useful in purification of active biological molecules
- b) It produces slow elution & broad solute peaks
- c) It gives narrow peaks & faster run times
- d) both (a) and (c)

30-Which of the following compounds would be expected to elute last from a reverse-phase liquid chromatography column?

- a) Methanol
- b) Ethanol
- c) n-propanol
- d) n-butanol

32-Select the process that leads to peak broadening due to the presence of multiple flow paths through a packed column?

- a) Eddy diffusion
- b) Mobile phase mass transfer
- c) Stationary phase mass transfer
- d) Longitudinal diffusion

34-Pick out the chromatographic mechanism, where the active centers are occupied by the more strongly adsorbed components and the least strongly adsorbed components accumulate in the traveling front?

- a) Elution Development
- b) Frontal Analysis
- c) Adsorption chromatography
- d) Displacement Development

35-Which of the following is not among HPLC advantages?

- a) Fast analysis time & narrow peaks
- b) Ease of automation
- c) Good limits of detection
- d) Greater expense & lower sample capacities

37-Select the LC Detector type that measures the overall ability of the mobile phase and its solutes to bend the light array?

- a) Conductivity detector
- b) Electrochemical detector
- c) Refractive index detector
- d) Fluorescence detector

39-Which of the following compounds could be detected by reduction reactions in Electrochemical detectors?

- a) Phenols & mercaptans (RSH)
- b) Aromatic amines & dihydroxy compounds
- c) Aldehydes & ketones
- d) None of these

36-Choose the universal visualization reagent used in planar chromatography?

- a) Formaldehyde/H₂SO₄
- b) FeCl₃/HCl
- c) KMnO₄ / H₂SO₄
- d) Sodium nitroprusside

38-Hexane is a weak mobile phase on a ----- stationary phase, but a strong mobile phase on a ----- stationary phase.

- a) Polar & non-polar
- b) non-polar & Polar
- c) Both (a) and (b)
- d) Neither (a) nor (b)

40-What is the type of chromatography where the analyte ions in the mobile phase are attracted to the counter ions in the stationary phase?

- a) Affinity Chromatography
- b) Ion exclusion chromatography
- c) Ion-exchange chromatography
- d) Adsorption chromatography

2- Answer ALL of the following with either (T) or (F)? (10 Marks)

(Final answers must be depicted in the answer BUBBLE sheet not here)

- 41. Liquid petroleum fraction rises to the middle fractionating tower with boiling points between 40°C and 370°C.
- 42. The production of allyl chloride could be effected by direct chlorination of propylene at low temperatures.
- 43. The structure of sponge-like silica particles has a porosity of 50% with surface area 150 m²/g.
- 44. The lower the cetane number the more easily the diesel fuel burns.
- 45. Chlorination of propane at 480–640°C yields a mixture of perchloroethylene and carbon tetrachloride.
- 46. Acrylic esters were produced by the acid-catalyzed ring opening of propiolactams in the presence of an alcohol.
- 47. The lower the pour point the higher the paraffin content.
- 48. Native silica should be used either above pH 8 or below pH 3.
- 49. Size exclusion chromatography based on the use of immobilized biological molecules as the stationary phase.
- 50. Multiple development-TLC is the repeatedly developed chromatogram in the same direction and to complete resolution of two or more substances.

Good Luck

Prof. Dr. Hassan Abdou Kotb

Faculty of Science

Chemistry Department

Final Exam of Chemistry of Biomolecules (413 C) for double major Students

(Chemistry of carbohydrates, Amino acids & Proteins, Lipids and nucleic acids)

Date: January 2024

Time: 2 Hours

Note: Support your answer with Chemical equations whenever possible.

Answer on the Following Questions:

(50 Marks)

(6 X 5 = 30 Marks)

I]- Answer on Only Six of the following :

Q1- Draw the chemical structure of triolein

1) What is the type of this triglyceride?

2) Calculate the Iodine number for triolein.

3) Calculate the Saponification value for triolein.

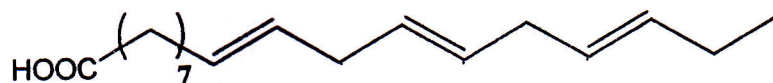
[Mol.Wt of triolein = 885.43; A.Wt. of iodine =127; Mol.Wt. KOH =56]

ملحوظة هامة : الأسئلة 6 صفحات

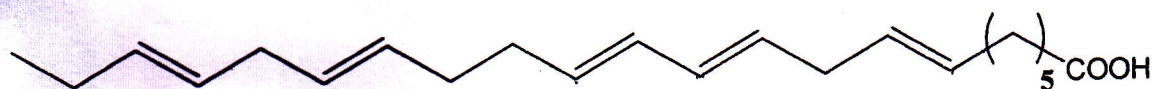
Q2- Explain this statement:

Oils are liquids at room temperature, while fats are solid at room temperature.

Q3- Write the abbreviated chemical formula for the following acids:



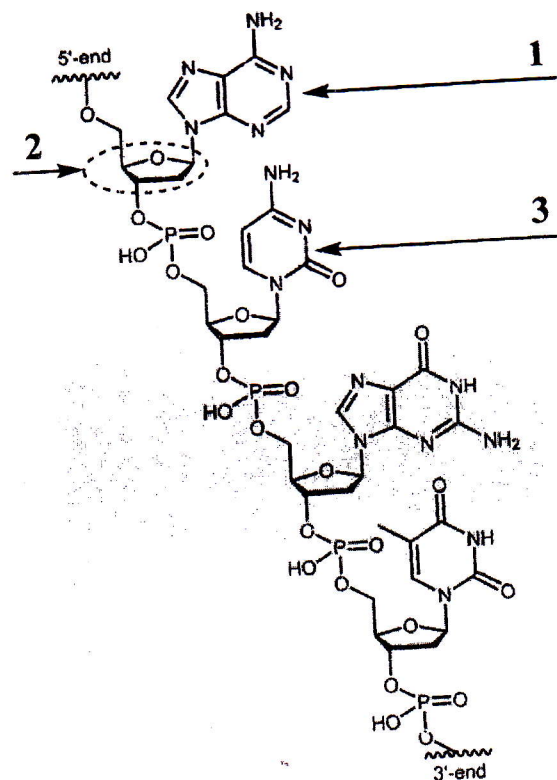
α -Linolenic acid



Clupandonic acid

Q4- Draw the structure of a tripeptide where glycine is first, serine is second, and alanine is third.

Q5- According to this figure answer the following question:



a- This figure is corresponding to part of DNA or RNA molecule, why ?

.....

.....

.....

b- Complete the following data:

- 1, is the structure of
- 2, is the structure of
- 3, is the structure of

Q6- Explain this statement:
Fructose and mannose give the same osazone, Why?

Q7- Show by equation the preparation of aspartic acid from N-potassium phthalimide.-

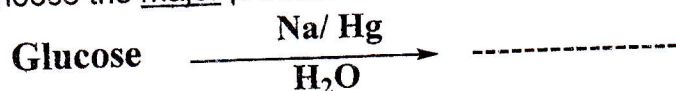
III- Choose the correct answer:

(1.5 X 14 = 20 Marks)

- 1- The complementary base sequence for matching strand in the following DNA section:
-G-T-C-C-A-A-T-G-C- is:

a) -G-T-C-C-A-A-T-G-C-	b) -C-A-G-G-T-T-A-C-G-
c) -G-A-C-C-T-T-A-C-G-	d) -C-A-G-G-T-T-A-G-C-

- 2- Choose the major product of the following reaction....



a) Lactone	b) sorbitol	c) gluconic acid	d) ribose
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- 3- Separation of amino acid mixture by Electrophoresis depends on the:

a) boiling point	b) melting point	c) isoelectric point	d) end point
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- 4- Mannose and Glucose are

a) C2 epimers	b) C3 epimers	c) C4 epimers	d) C5 epimers
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- 5- Fructose molecule calcified as sugar.

a) D-ketohexose	b) D-aldohehexose	c) D-ketopentose	d) D-aldoheptose
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- 6- Arabinose and xylose are

a) anomer	b) epimers	c) enantiomer	d) diastereoisomer
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- 7- Rancidity of oil increase as:

a) The molecular weight decrease	b) The number of double bonds decrease
c) The molecular weight increase	d) The number of double bonds increase

- 8- The sucrose molecule is unique among the common disaccharides in having an
(head-to-head) .

a) α -1, β -2-glycosidic linkage	b) α -1, β -4-glycosidic linkage
c) α -1, β -5-glycosidic linkage	d) α -1, β -6-glycosidic linkage

- 9- Mild hydrolysis to DNA gives:

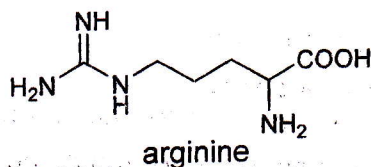
a) Nucleoside units	b) Nucleotide units
c) Hexose sugar	d) Ribose sugar

- 10- The Optical Activity can be measured using

a) Polarimeter	b) Gel permeation chromatography
c) Viscometer	d) Electrophoresis

- 11- In nucleic acids, the nucleotide monomers linked together via a:

a) Peptide linkage	b) Phosphodiester linkage
c) Glycosidic linkage	d) Ether linkage



12- Arginine classified as

a) monoamino monocarboxylic acid	b) diamino monocarboxylic acid
c) triamino monocarboxylic acid	d) tetraamino monocarboxylic acid

13- Glyceraldehyde and dihydroxyacetone are two

a) diastereoisomers	b) stereo isomers
c) enantiomers	d) constitutional isomers

14- Which of the following fatty acids has the highest melting point?

a) $\text{CH}_3(\text{CH}_2)_7\text{CH}=\text{CH}(\text{CH}_2)_7\text{COOH}$
b) $\text{CH}_3(\text{CH}_2)_4\text{CH}=\text{CHCH}_2\text{CH}=\text{CH}(\text{CH}_2)_7\text{COOH}$
c) $\text{CH}_3\text{CH}_2\text{CH}=\text{CHCH}_2\text{CH}=\text{CHCH}_2\text{CH}=\text{CH}(\text{CH}_2)_7\text{COOH}$
d) a & b

1	2	3	4	5	6	7	8	9	10	11	12	13	14



**Final Exam. of Petroleum & Petrochemicals course for (451C)
Students**

Answer the following questions:

1- Sign () and/ or (X) for the following statements and write the correct ones: (14 Marks)

- a) Oil is thermally cracked at 150°F to natural gas ().
- b) Surfactant was used to reduce corrosion in desalting process ().
- c) Steam was used in towers at atmospheric distillation to lower the vapor pressure ().
- d) The quenching in visbreaking process with cool gas oil to control the heating ().
- e) Cooking process produced straight-run cooker gasoline ().

2- I- Discuss two only of the following points: (12 Marks)

- a) Alkenes hydrocarbons as chemical composition of petroleum Crude.
- b) Effect of hydrotreating on kerosene and lub oil.
- c) Cetane number and its additives and uses.

II- Draw and discuss Phillips as alkylation process and the difference between H_2SO_4 and HF acids as catalysts for this process.

3- I- Explain two only of the following: (12 Marks)

- a) Significance of Isomerization process.
- b) The difference between thermal and catalytic cracking.
- c) Hybrid-Base crude oils

II- write by equations, hydrotreatment for Indole and quinoline.

4- I- Give an account two only on the following: (12 Marks)

- a) NaOH as solvent extraction method for desulfurization process and the difference between NaOH and KOH as alkali for this method.
- b) Effect of sulfur on gasoline.
- c) Carbide theory of petroleum in nature and its disadvantages.

II- Draw and discuss of delayed cooking process and Decoking mechanically and hydraulic methods.

مع تحياتي بالنجاح والتوفيق
أ.د. عبدالعال جابر

Examination of Industrial Catalysis for 4th Level Student (Chem.401)



Assiut University

Time :2 h

Date: 22/ 1 / 2020



Faculty of Science
Chemistry Department

Answer the Following Questions:

1- Put (✓) or (×) for following sentences

(15 Marks)

- 1- The turnover number is the number of molecules that react per site per unit time ()
- 2- The maximum rate of reaction is obtained when the bond between the adsorbed complex and the catalyst surface is too weak ()
- 3- The basic concept of a catalyst is that of a substance that in large amount causes a large change ()
- 4- A catalyst support is unstable under reaction and generation conditions ()
- 5- A promoter is a substance which added in relatively large amounts in the preparation of a catalyst ()
- 6- Structure promoter changes the chemical composition of the catalyst ()
- 7- A number of solids are acidic and can catalyze a wide variety of reactions similar to those catalyzed by strong mineral acids ()
- 8- In Wacker process ethylene is oxidized to acetaldehyde ()
- 9- In impregnation method for synthesis of a catalyst requires more equipment ()
- 10- Acrylonitrile was manufactured according to the following equation
$$\text{NH}_3 + \text{C}_3\text{H}_6 \rightarrow \text{CH}_2 = \text{CHCN} \quad ()$$
- 11- Bismuth molybdate and other molybdate catalysts are commercially used for manufacture of acrylonitrile ()
- 12- Acrolein was manufactured by the equation
$$\text{CH}_3\text{CH} = \text{CH}_2 + \text{O}_2 \rightarrow \text{CH}_2 = \text{CHCHO} + \text{H}_2\text{O} \quad ()$$
- 13- Ethylene can be oxidized to ethylene oxide with low selectivity over supported silver catalyst ()
- 14- Iron molybdate catalyst $\text{Fe}_2(\text{MoO}_4)_3$ used for production of methanol CH_3OH to formaldehyde at a reaction temperature of 200°C ()
- 15- Excess MoO_3 added in preparation of iron molybdate catalyst helps prevent formation of the molybdenum-deficient species ()

2-) Choose the correct answer

(10 Marks)

1. The industrial catalyst should be characterized by
(i) High surface area (ii) Mechanical properties (iii) Stability (iv) All of them
2. Selective catalyst should
(i) Increase the reaction rate (ii) Change the reaction products
(iii) Increase the number of molecules adsorbed on the catalyst surface
(iv) Proceed the reaction to desired product

3. What is true for catalytic reaction

- (i) Catalyst increases equally both the rate of forward and reverse reactions
- (ii) Catalyst does not effect to equilibrium constant
- (iii) Catalyst decreases activation energy (iv) Catalyst increases activation energy

4. What is the features of catalytic processes for manufactures of organic compound

- (i) They are highly exothermic (ii) Certain compound may be explosive
- (iii) The desired product must be stable (iv) All of them

5. Effective catalysts for oxidation reactions are

- (i) Transition metal oxides (ii) Metal halides (iii) Metal with physisorbed oxygen (iv) None

6. Preparation of Cu/ZnO/Al₂O₃ as an active catalyst for synthesis of methanol proceeds as.

- (i) The original catalyst was obtained by Co-Precipitation
- (ii) Calcination to decomposition of the primary phases
- (iii) Reduction of the calcined precursor (iv) All of them

7. A basic concept of catalyzed reactions explained by

- (i) The geometrical theories (ii) Electronic theories (iii) Chemical approach (iv) All of them

9. What is not true for a good catalyst.

- (i) Selective (ii) Active (iii) Stable (iv) Expensive

10. A Catalyst may lose its activity or its selectivity by

- (i) Poisoning (ii) Block of some pores (iii) creation of active site (iv) All of them

3-Answer the following questions

(15 Marks)

- (i) Explain the commercial production of formaldehyde from partial oxidation of methanol using methanol lean system in presence of iron molybdate catalyst.
- (ii) "Support is an important component in heterogeneous industrial catalysis" Explain this statement and what are the important characteristic features of supports.
- (iii) Explain the precipitation method used for synthesis of industrial catalysts taking in your consideration all factors affecting their properties.

4- Write short notes on two only of the following:

(10 Marks)

- (i) The factors responsible for deactivation of the catalyst.
- (ii) Synthesis of acetaldehyde from ethylene industrially using Wacker method.
- (iii) Synthesis of ethylene oxide industrially.

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

Prof. Dr. Abd El-Aziz A. Said

Final Exam for Fourth Level Students, Applied Industrial Chemistry Program
Fuel Cell Technology (Chem415), 1st Semester

($F = 96485 \text{ C mol}^{-1}$; $R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1}$)

Answer All the Following Questions:

(50 Marks)

First Question: Define each of the following:

(9 Marks)

- | | | |
|--------------------|-----------------------|---|
| 1. Supercapacitors | 2. Memory effect | 3. Aqueous $\text{Li} - \text{O}_2$ battery |
| 4. Green hydrogen | 5. Methanol crossover | 6. Partial oxidation of hydrocarbons |

Second Question:

(16 Marks)

1. Explain the working principle, advantages, and disadvantages of molten carbonate fuel cells.
2. What are the equations for PEM electrolysis cells?
3. What are the advantages of supercapacitors?
4. Explain the transport of Li-ions in Li-ion battery during the discharge.
5. Discuss in details the components and the anodic and cathodic reactions of aprotic $\text{Li} - \text{O}_2$ battery.
6. What are the fuel cell components? and what are the main functions of gas diffusion layer?

Third Question: Choose the Correct Answer for the following

(25 Marks)

1. A primary battery is called so because
a) The electrolyte used is completely dry b) Dry electrodes are used
c) The electrolyte used is a moist paste d) None of the previous
2. In mixed $\text{Li}-\text{O}_2$ batteries, the cathode in contact with
a) The aqueous electrolyte b) The Li-conducting membrane
c) The aprotic electrolyte d) The Li-metal
3. The maximum potential at which all the reaction steps are downhill in free energy is
a) Thermodynamic limiting potential b) Overpotential
c) Kinetic potential d) Cell Potential
4. Which of the following fuel cells sensitive to CO_2 ?
a) Alkaline fuel cells b) Molten carbonate fuel cells
c) Solid oxide fuel cells d) Phosphoric acid fuel cells
5. The electrolyte used in aqueous $\text{Li}-\text{O}_2$ batteries is
a) *n*-Propanol b) *tert*-Butyl alcohol
c) LiPF_6 in ethers d) LiCl in H_2O
6. In dry reforming of natural gas, the H_2/CO ratio equal to
a) 1 b) 2 c) ≥ 3 d) None of the previous
7. The capacitance value of a capacitor not depends on:
a) The area of the conductor plate b) Dielectric constant of the conductor material
c) The distance between the plate d) The electrode material density
8. The capacitance value of a capacitor storing 35 C of charge at 7 V equals:
a) 35 F b) 0.4 F c) 5 F d) 0.2 F
9. Which of the following fuel cells can operate using coal-derived fuel gas?
a) Phosphoric acid fuel cell b) Direct methanol fuel cell
c) Molten carbonate fuel cell d) Alkaline fuel cell
10. The final discharge product of mixed $\text{Li} - \text{O}_2$ batteries is
a) Li_2O b) Li_2O_2 c) LiCl d) LiOH
11. Which electrode materials store charges electrochemically?
a) polypyrrole b) Carbon aerogel c) Graphene d) None of the previous
12. In aqueous $\text{Li}-\text{O}_2$ batteries, a solid electrolyte interface is used to

- a) Enhance charge transfer at the anode
 - b) Combine the Li metal with the electrolyte
 - c) Reduce the overall impedance
 - d) Separate both anode and cathode from the electrolyte
13. The catalyst used for anode in phosphoric acid fuel cells is
- a) Pt/C
 - b) Ni/ZrO₂
 - c) Pt-Ru
 - d) Raney Ni
14. The intermediate product formed during two-electron pathway oxygen reduction reaction (ORR) in alkaline medium is
- a) Only H₂O₂
 - b) Both H₂O₂ and H₂O
 - c) Only HO₂⁻
 - d) Both HO₂⁻ and OH⁻
15. The cathodic reaction of leclanché cell is
- a) $MnO_{2(s)} + NH_{4(aq)}^+ + H_{(aq)}^+ + 2e^- \rightarrow MnO_{(s)} + NH_{3(aq)} + H_2O_{(l)}$
 - b) $MnO_{2(s)} + 2NH_{4(aq)}^+ + O_2 + 2e^- \rightarrow MnO_{4(s)} + 2NH_{3(aq)} + H_2$
 - c) $2MnO_{2(s)} + 2NH_{4(aq)}^+ + 2e^- \rightarrow Mn_2O_{3(s)} + 2NH_{3(aq)} + H_2O_{(l)}$
 - d) $Mn_2O_{3(s)} + 2NH_{4(aq)}^+ + 3e^- + 3O_2 \rightarrow 2MnO_4^- + 2NH_{3(aq)} + H_2O_{(l)}$
16. The working principle of metal-air batteries is
- a) Oxygen is oxidized at the anode; while metal is reduced at the cathode
 - b) Oxygen is reduced at the anode; while metal is oxidized at the cathode
 - c) Metal is oxidized at the anode; while oxygen is reduced at the cathode
 - d) Metal is reduced at the anode; while oxygen is oxidized at the cathode
17. The aqueous Li-air battery requires a protective layer on the anode to
- a) Avoid the reaction of Li metal with H₂O
 - b) Prevent heat loss during operation
 - c) Avoid the formation of Li salts on the anode
 - d) Avoid mixing the Li metal with O₂
18. Which of the following statements is *incorrect* about lead-acid batteries?
- a) The electrolyte is H₂SO₄
 - b) Produce of a total 12 V
 - c) When fully charged both of the plates becomes Pb₂O₂
 - d) Used in automobiles
19. The specific capacitance of double-layer capacitors is dependent on
- a) Specific surface area of the electrode
 - b) Redox reaction at the electrode
 - c) Weight of the electrode
 - d) Size of the electrode
20. The fuel used in alkaline fuel cells is
- a) Alkali hydroxides
 - b) Methanol
 - c) Hydrogen
 - d) Both methanol and hydrogen
21. The activated carbons and carbon aerogels are capacitors.
- a) Hybrid
 - b) Double-layer
 - c) Pseudo
 - d) Electrolytic
22. According to most studies, the final discharge product of aprotic Li-O₂ batteries is
- a) Li₂O
 - b) Li₂O₂
 - c) LiO₂
 - d) LiOH
23. In associative mechanism, which of the following is the potential limiting step for the strongly *OH bonded metals?
- a) O₂ → *OOH
 - b) *OH → H₂O
 - c) *O → *OH
 - d) *OOH → *O
24. Which of the following batteries shows memory effect?
- a) Li-air
 - b) Zn-C
 - c) Li-ion
 - d) Ni-Cd
25. In some types of cells, the chemical reaction can be reversed by applying an external current, which type of cell can this occur in?
- a) Rechargeable batteries
 - b) Alkaline batteries
 - c) Fuel cells
 - d) All of the previous

Good Luck

DR. THARWAT H. MANSOURE



Chemistry Department



C 441 Analytical Chemistry (II) Final Exam Jan 2024

Time allowed: 2hrs

Answer **Five Only** from the following questions (50 Marks)

1. A) Define the following: (5 marks)
Biosensors - Significance testing - Chemical sensor - F-test - Null hypothesis.
B) State the different Techniques of enzyme immobilization. (5 marks)
2. A) What is the minimum level of analysis that should be tested for indicators of faecal pollution of water? (5 marks)
B) State the requirements for an HPLC Column Packing Materials. (5 marks)
3. What are the most common detectors for GC analysis? Explain-in brief – the basics for each detector with its applications. (10 marks)
4. If you are provided with an air sample, write how you can determine the following: (10 marks)
 - i) Ozone by ultraviolet spectroscopy
 - ii) Oxides of nitrogen by chemiluminescence
 - iii) Sulfur dioxide by pulsed fluorescent spectrophotometry
 - iv) Carbon monoxide by infrared spectrometry
 - v) Fine particles (PM10).
5. Discuss in detail how you can separate proteins using polyacrylamide gel electrophoresis. (10 marks)
6. A) Discuss in brief- how you can purify mixture of a proteins using isoelectric precipitation. (5 marks)
B) What are the most important parameters for characterizing or validating a chemical sensor or a biosensor? (5 marks)

Good Luck

Prof. Nagwa Abo El-Maali



First term exam 405-Cement raw materials (2 h)

الكيمياء الصناعية التطبيقية - الترم الاول 2023\2024



Name: _____

Date : _____

A- Choose the correct answer from the given options:-

- 1- Pozzolanic material is used in cement manufacture as : ()
- A- Primary raw materials
 - B- Corrective raw materials
 - C- Alternate raw materials
 - D- All the previous.
- 2- For the pozzolanic raw material the reactive silicon dioxide content shall be: ()
- A- Exceed 70% by mass
 - B- React at with C3A
 - C- Exceed 25% by mass.
 - D- All the previous.
- 3- One from the most of important points of raw meal and its design is: ()
- A- Workability.
 - B- very soft.
 - C- Homogenization.
 - D- All the previous.
- 4- Silica fume is: ()
- A- A fine powder, having hydraulic and/or pozzolanic properties
 - B- From the reduction of high purity quartz with coal in electric arc furnace
 - C- Content of (SiO₂), (Al₂O₃), (Fe₂O₃) and other oxides.
 - D- All the previous.
- 5- Control the cement setting time by using: ()
- A- Lime stone
 - B- Gypsum
 - C- Sand
 - D- All the previous.
- 6- Factors that affect the activity of Pozzolana: ()
- A- SiO₂ + Al₂O₃ + Fe₂O₃ content.
 - B- The degree of Amorphousness of its structure
 - C- Fineness of its particle.
 - D- All the previous.

- 7- The common cement strength: ()
A- 32.5, 42.5, 52.5 Mpa
B- 30.5, 42.5, 50.5 Mpa
C- 32.5, 42.5, 62.5 Mpa
D- All the previous.
- 8- Granulated blast furnace slag is a waste product: ()
A- Cement industry
B- The steel industry
C- Electrostatic or mechanical precipitation of dust
D- All the previous.
- 9- Pozzolanas consist essentially of reactive silicon dioxide (SiO_2) and aluminum oxide (Al_2O_3) and loss on ignition must be ()
A- < 70%
B- < 10%
C- < 7%
D- < 25%
- 10- Raw materials in cement divided to: ()
A- Primary raw materials
B- Corrective raw materials.
C- Alternative raw materials.
D- All the previous.
- 11- How can we control Gypsum hydration during cement production? ()
A- Gypsum type.
B- C3S value in cement.
C- Control Cement mill temperature.
D- All the previous.
- 12- C3S in clinker phases is important for: ()
A- Early strength
B- Durability
C- Heat of hydration
D- All the previous.
- 13- The Ettringite is formed during cement hydration when mixed with water. ()
A- Because of cement temperature.
B- Because of interaction of SO_3 and C3A .
C- Because of interaction of SO_3 and C2S .
D- All the previous.

- 14- The Activity Index tested (by mass) 50 % of ground granulated blast furnace slag with 50 % of test cement and the result should be achieved:** ()
- A- At 28 days is not less than 45% and at 90 days shall be not less than 70 %.
 - B- At 7 days and at 90 days shall be not less than 75 %.
 - C- At 7 days is not less than 45% and at 28 days shall be not less than 70 %.
 - D- All the previous.
- 15- Nitrogen Oxide (NOx) Pollution in clinker production due to** ()
- A- The Nitrogen in limestone and other raw materials
 - B- Reducing emissions from the calcination process
 - C- Because of the high temperatures involved in the burning of clinker
 - D- All the previous.
- 16- Cement standard strength achieved at:** ()
- A- 28 days
 - B- 2 days
 - C- 7 days
 - D- All the previous.
- 17- CO2 Emissions in Cement Manufacture has direct emissions of 50% of CO2 emissions.** ()
- A- Burning fuels to heat the kiln.
 - B- The transportation of cement represents another emissions.
 - C- Occur through a chemical process during clinkerization.
 - D- All the previous.
- 18- Factors affecting cementitious properties of GGBFS:** ()
- A- Chemical composition of GGBFS
 - B- Glass content of the GGBFS.
 - C- The fineness of the final product.
 - D- All the previous.
- 19- The CEM III products in a mix of Clinker, Gypsum and:** ()
- A- limestone
 - B- Silica fume
 - C- Blast furnace slag.
 - D- All the previous.
- 20- The advantage of pozzolanic cement:** ()
- A- Reduce CO2 emissions.
 - B- More resistance against sulfate attack
 - C- lower heat of hydration.
 - D- All the previous.

21- For cement durability and low hydration heat:

()

- A- Increase C3A content
- B- Decrease C3A content
- C- Increase C3S content
- D- All the previous.

22 - POZZOLANIC REACTIONS :

()

- A- $C_2S + CaO_{free} \leftrightarrow C_3S$
- B- Calcium Hydroxide+ Silica+ Water
- C- $C_3A + H_2O + CaSO_4$
- D- All the previous

23- One of the clinker phases is the "C2S" :

()

- A- It affects the durability
- B- It affects the early strength
- C- It effect setting time, early strength
- D- It has slow strength development

24- Added value of GBFS using in concrete applications

()

- A- Improved resistance to sulfate attack
- B- Reduced heat of hydration in mass concrete
- C- Reduced chloride permeability
- D- All the previous.

25- The Iron raw material considered as:

()

- A- Corrective raw materials.
- B- Primary raw materials.
- C- Alternate raw materials.
- D- All the previous.

26- During pozzolanic reaction, which responsible the hydraulic binding property:

()

- A- Calcium hydroxide ($Ca(OH)_2$)
- B- Calcium silicate and calcium aluminate compounds.
- C- C3S
- D- All the previous.

27- Clay is a primary raw material, source of

- A- Hematite (Fe_2O_3) and Limonite ($\text{FeO}(\text{OH})$)
- B- CaO
- C- The silica-aluminous component
- D- All the previous.

28 - clinker must contain substantial portions of

- A- The elements of calcium, silicon, aluminum and iron.
- B- Calcium silicate hydrates (C-S-H)
- C- CaSO_4
- D- All the previous

29- Fast setting in cement because of

- A- High $\text{C}_3\text{S}\%$
- B- low gypsum content and high C_3A
- C- High $\text{C}_2\text{S}\%$
- D- All the previous

30- Sulphur dioxide emission in cement production due to

- A- using high Gypsum % in cement
- B- High temperatures are involved in the burning of the clinker formation step
- C- Sulfite impurities in the raw materials and Sulphur contained in fuel.
- D- Oxidation of nitrogen compounds present in the fuel.

31- Sulfate resisting cements (SR-Cements)

- A- Low Tricalcium silicate.
- B- Low Tricalcium Aluminate
- C- Tetracalcium ferro aluminate
- D- All the previous.

32- Decrease the CO_2 emission in cement by:

- A- Using GBFS
- B- Using Pozzolanic materials
- C- Clinker substitution
- D- All the previous.

*Good luck
to you*

Assiut University Faculty of Science Chemistry Department	First Semester Final Examination Instrumental Analysis (C-445) Credit Hours System	Date: 11-1-2024 Time: 2 hour
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Section (A) (25 Marks)

Answer the Following Questions:

Part I: Choose the correct answer: (10 points)

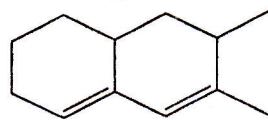
- 1- The AAS interference of the presence PO_4^{3-} or SO_4^{2-} in the determination of Ca^{2+} can be eliminated by:
 - (a) Addition of excess concentration of Cu^{2+}
 - (b) Addition of excess concentration of Al^{3+}
 - (c) The presence of releasing agent (Sr^{2+} or La^{3+})
 - (d) All of these.
- 2- Which of the following methods is used for the determination of analytes in a complex matrix where interferences in the UV/Vis for the analyte will occur: i.e. blood, sediment, human serum, etc.
 - (a) Calibration curve method
 - (b) Standard addition method
 - (c) Gravimetric method
 - (d) All of these.
- 3- Which of the following is (are) disadvantages of graphite furnace technique?
 - (a) Analyte sample may be lost at the ashing stage and not completely atomized.
 - (b) Background absorption effects.
 - (c) The precision was poor than the flame method and the analytical range is relatively narrow.
 - (d) All of these.
- 4- Which is the correct order of AAS instrumentation?
 - (a) Atomization – Lines source – Monochromator – Detector – Read-out
 - (b) Lines source – Monochromator – Atomization – Detector – Read-out
 - (c) Lines source – Atomization – Monochromator – Detector – Read-out
 - (d) Lines source – Atomization – Read-out – Monochromator – Detector
- 5- Considering Zeeman background correction for AAS, which one of the following statements is correct?
 - (a) When the magnetic field is off, both the atomic and the background absorption occurs.
 - (b) When the magnetic field is on, only background absorption occurs.
 - (c) The background signal is subtracted from the combined atomic and background signal to obtain a net atomic absorption signal.
 - (d) All of these.
- 6- Hollow cathode lamp is used as a light source in one of the following techniques:
 - (a) Nuclear magnetic resonance spectrophotometers
 - (b) X-rays diffractometers.
 - (c) UV/visible spectrophotometers.
 - (d) Atomic Absorption spectroscopy.
- 7- In AAS, which of the following is the atomization method used for determination of arsenic (As)?
 - (a) Hydride generation method.
 - (b) Cold-Vapor method.
 - (c) Flame method.
 - (d) Electrothermal method.
- 8- Which of the following statements is correct?
 - (a) Endo cyclic double bond: double bond present in a ring.
 - (b) Homo annular diene: cyclic diene having conjugated double bond in the same ring.
 - (c) Exocyclic double bond: double bond in which one of the double bond atoms is a part of a ring.
 - (d) All of these.

9- In AAS, the atomization by cold vapor technique is used for determination of

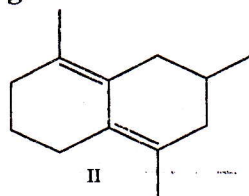
- (a) Mercury (Hg) (b) Antimony (Sb)
 (c) Lead (Pb) (d) All of these.

10- Rank each of the following molecules from highest to lowest λ_{max} (nm).

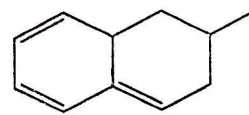
- (a) II > III > I
 (b) I > II > III
 (c) III > II > I
 (d) III > I > II



I



II



III

1	2	3	4	5	6	7	8	9	10

Part II: Problems and Questions:

(15 points)

1- Compare between the single-beam and double-beam spectrometer. (2 points)

A single-beam spectrometer	A double-beam spectrometer

2- Define what is meant by a hypsochromic shift and a bathochromic shift. (2 points)

Hypsochromic shift:

.....

Bathochromic shift:

.....

3- Limitations (deviations) from the Beer-Lambert Law can be classified into three categories: (3 points)

a)

b)

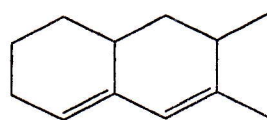
c)

9- In AAS, the atomization by cold vapor technique is used for determination of

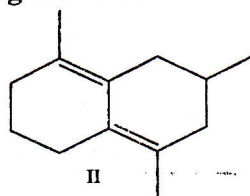
- (a) Mercury (Hg) (b) Antimony (Sb)
 (c) Lead (Pb) (d) All of these.

10- Rank each of the following molecules from highest to lowest λ_{max} (nm).

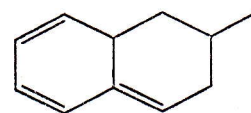
- (a) II > III > I
 (b) I > II > III
 (c) III > II > I
 (d) III > I > II



I



II



III

1	2	3	4	5	6	7	8	9	10

Part II: Problems and Questions:

(15 points)

1- Compare between the single-beam and double-beam spectrometer. (2 points)

A single-beam spectrometer	A double-beam spectrometer

2- Define what is meant by a hypsochromic shift and a bathochromic shift. (2 points)

Hypsochromic shift:

.....

Bathochromic shift:

.....

3- Limitations (deviations) from the Beer-Lambert Law can be classified into three categories: (3 points)

a)

b)

c)

- 4- The concentration of Cu^{2+} is being determined by atomic absorption spectroscopy using a N_2O - acetylene flame and measuring absorption at 450 nm. Analysis of the pure sample results in an absorbance reading of 0.753. Analysis of the same sample with the addition of 1000 ppm Potassium (K^+) results in an absorbance reading of 0.987. Explain why the addition of potassium to the sample increased the absorbance of Cu^{2+} in the sample. (3 points)

- 5- A mixture containing MnO_4^- and $\text{Cr}_2\text{O}_7^{2-}$ was analyzed spectrophotometrically at 440 and 545 nm, the observed absorbances were 0.385 and 0.653, respectively, at each wavelength for a 1.00 cm cell. The molar absorptivities ($\text{M}^{-1} \text{cm}^{-1}$) for MnO_4^- and $\text{Cr}_2\text{O}_7^{2-}$ at the two wavelengths are summarized in the following table:

	$\epsilon_{440} (\text{M}^{-1} \text{cm}^{-1})$	$\epsilon_{545} (\text{M}^{-1} \text{cm}^{-1})$
MnO_4^-	93.8	2350
$\text{Cr}_2\text{O}_7^{2-}$	370	0.0

Determine the molar concentrations of MnO_4^- and $\text{Cr}_2\text{O}_7^{2-}$ in the mixture. (5 points)

Section (B) (25 Marks)

**Question 1: (10 Marks)**

Mark True (T) for right statement and False (F) for wrong statement. (Only Ten)

- 1- Current of polarizable electrode remains unchanged with changes in the electrode potential.
- 2- Heyrovsky-Illkovic equation determines the number of electrons from the intercept.
- 3- For reversible systems E_{pa} and E_{pc} are dependent on the scan rate.
- 4- The presence of O_2 often interferes with the accurate determination of other species.
- 5- Glassy carbon electrode is a type of working electrode.
- 6- Polarizable electrode such as Ag/AgCl can take up any potential applied to it.
- 7- Hg forms soluble amalgams with many metals, hence lowering their reduction potentials.
- 8- The main instrumental parameter in the cyclic voltammetry is the scan rate.
- 9- Normal pulse is about 5-10 times more sensitive than differential pulse polarography.
- 10- Various functional groups, such as $-OH$ and $-NO_2$ are reduced in the polarography.
- 11- Microelectrodes reach the state of polarization very rapidly.
- 12- One important application of amperometry is in the construction of electrochemical biosensors.
- 13- Cyclic voltammogram of a reversible process is characterized by $\Delta E_P > 59/n$ (mV).
- 14- In polarography KCl is added to analyte solution to eliminate migration current.
- 15- Non-faradaic current exist in an electro- chemical cell is related to any redox reaction.

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

Question 2: (5 Marks)

Write the mathematical equations for the following:

(A) Randles-Sevcik equation:

(B) Ilkovic equation:

Question 3: (5 Marks)

(A) Write on the principle of electrochemical biosensor (Give an example).

(B) Advantages of stripping voltammetry:

Question 4: (5 Marks)

(A) The reversible oxidation of Paracetamol (PCM) is a $2e^-$ process. A cyclic voltammetric anodic peak current (I_{Pa}) of $2.2 \mu A$ is observed for 0.4 mM solution of PCM in acetate buffer at a pencil graphite electrode of 2.6 mm^2 with a scan rate of 25 mV/s . What will I_{Pa} be for $v = 100 \text{ mV/s}$ and 1.2 mM PCM?

(B) Write on the advantages of solid electrodes based on carbon:

♣ GOOD LUCK ♣

*Examiners: Prof. Dr. Mohamed Sayed Ibrahim
Prof. Dr. Hossieny Ibrahim*



Assiut University
Faculty of Science
Chemistry Department



Jan.: 2024
Time: 2 hours

First Semester Examination for Biological Students
Subject: Analytical Chemistry (C- 460)

Answer Four only from the following questions: (50 Marks)

Q1) Answer the following: (12.5 Marks)

- a) Write on the following:
- Limitation of volumetric precipitation.
 - Standard hydrogen electrode.
 - Acid base indicator.
- b) Define Ilkovic equation. Calculate the diffusion current (i_d) for the reduction of $5 \times 10^{-4} \text{ M Zn}^{+2}$ which has diffusion coefficient $D = 0.72 \times 10^{-5} \text{ cm}^2 \text{ sec.}$, $m = 15 \text{ mg / sec.}$ and $t = 4 \text{ sec / drop.}$

Q2) Answer the following: (12.5 Marks)

- a) If you are provided with $0.1 \text{ M CH}_3 \text{ COOH}$ (100ml) and titrated with 0.1 M NaOH . calculate the pH value: ($k_a = 1.86 \times 10^{-5}$)
- at the beginning of the titration.
 - after the addition of 50 ml 0.1 M HCl .
 - at the end point.
- b) Complete:
- The indicators used in the titration of strong acid with strong base are , and indicator used in the titration of weak base with strong acid is
 - In Mohr method the indicator is while in Volhard method are , and in Fajan method is
 - The oxidation is and the reduction is

Q3) Answer the following: (12.5 Marks)

- a) Write on the following:
- Concentration cell with an example.
 - Specific conductivity, molar conductivity and equivalent conductivity.
- b) Give the reason for:
- Mohr method is applicable in neutral solution.
 - Supporting electrolyte is used in polarographic analysis.
 - Nitrobenzene is added in the titration of Halide in acidic medium.

Q4) Answer the following: (12.5 Marks)

- a) During the titration of 100 ml of NaCl (0.1 N) using AgNO_3 (0.1 N), Calculate the pCl
- before the titration.
 - after the addition of 50 ml AgNO_3 .
 - after the addition of 100 ml AgNO_3 .
 - after the addition of 120 ml AgNO_3 .
- b) Write Lingane equation and show how you can use polarographic analysis in qualitative and quantitative analysis.

Q5) Answer the following: (12.5 Marks)

- a) Write on the following :
- Advantage of dropping mercury electrode.
 - Nernst equation.
- b) Calculate the equivalent weight for:
- KMnO_4 in acidic and basic medium.
($K = 39$, $Mn = 55$, $O = 16$, $Cr = 52$)
 - $\text{K}_2\text{Cr}_2\text{O}_7$ in acidic medium.

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

Examiner: Prof. Dr. Azza M.M.Ali



Petroleum Chemistry & Petroleum Industry (Chem 408)

Final Exam of First Semester (2023-2024)

Please answer the entire following questions

Q-1) Multiple Choices:-

(1x25=25 Marks)

- 1) Chemistry of oil is hydrogen atoms attached to a backbone with.....
 - a) Carbon
 - b) Nickel
 - c) Oxygen
 - d) All of them
- 2) Meaning of PETROLEUM Original is.....
 - a) Petraoleum
 - b) Hydrocarbons
 - c) Heavy oil
 - d) None of them
- 3) Stock for oil is
 - a) Reservoir
 - b) Water
 - c) Heavy oil
 - d) All of them
- 4)is the following has desirable component
 - a) Hydrocarbon
 - b) Vanadium
 - c) Nickel
 - d) All of them
- 5)is the following has undesirable component.
 - a) Hydrocarbon
 - b) Vanadium
 - c) Paraffin's
 - d) All of them
- 6)is the following has more expensive of crude oil.
 - a) Petrochemical
 - b) Fuel oil
 - c) Naphtha
 - d) All of them
- 7)is manly compositions of hydrocarbons.
 - a) RON
 - b) MON
 - c) PONA
 - d) All of them



Petroleum Chemistry & Petroleum Industry (Chem 408)

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- 8) Alkanes (Paraffin) $C(n)H(2n+2)$ is
- Pentane
 - Aromatic
 - Ethylene
 - All of them
- 9) No problems of sulfur content as.....
- RSSR
 - RSH
 - H_2S
 - Sulfur
- 10) In hydrogenation process for NHT what is the process occur.....
- Saturation of the oils.
 - Saturation of the paraffin.
 - Saturation of the olefins.
 - None of them.
- 11) Which of these functions affecting on catalyst life is.....?
- Temperature.
 - Metal content.
 - H_2/HC ratio.
 - All of them.
- 12) is mixing to obtain maximum commercial characteristics.
- Desalting.
 - Refining.
 - Blending.
 - None of them.
- 13) Crude oil isn't presence
- Water
 - Inorganic salts
 - Triple bond
 - All of them
- 14)is contains water washing to remove impurities.
- Desalting
 - Refining
 - Blending
 - Reforming.

15).....is type of vacuum towers that are used.

- a) Dry.
- b) Wet without stripping.
- c) Wet with stripping.
- d) All of them.

16)..... are unsaturated hydrocarbons and benzene molecule.

- a) Alkanes.
- b) Aromatics.
- c) Olefins.
- d) All of them.

17).....is using to generated high octane number

- a) Naphtha.
- b) LPG.
- c) Solar.
- d) Another answer

18) API gravity =

- a) (141.5/S.G)-131.5.
- b) (151.5/S.G)-131.5.
- c) (141.5/S.G)-121.5.
- d) (161.5/S.G)-131.5.

19)..... is the product has highest octane structure.

- a) Purification.
- b) Hydrogenation.
- c) Isomerization.
- d) Reformate.

20) Naphtha has RON

- a) 55
- b) 80
- c) 92
- d) 104

21) Isomerization unit has RON

- a)87
- b)55
- c)80
- d)92

22) Reformate unit has RON

- a)104
- b)55
- c)80
- d)92

23)..... Gas is very risk

- a)H₂S
- b)HCL
- c)LPG
- d)Kerosene

24)..... is source of Jet

- a)LPG
- b)Kerosene
- c>Solar
- d)Naphtha

25).....source in cracking unit

- a)LPG
- b)Kerosene
- c>Solar
- d)Mazeot

Q-2) Marks right (✓) or wrong(X) the following statement:- (1x25=25 Marks)

- 1) Nitrogen in petroleum oil is considered undesirable compounds. ()
- 2) Aims of Naphtha hydrotreating (NHT) is cleaning of Naphtha ()
- 3) American Petroleum Institute has related with Specific Gravity. ()
- 4) Mainly reaction of C₅/C₆ Isomerization is branched of products ()
- 5) Naphtha (without any treatment) has low octane number ()
- 6) Classification of petroleum oil is light, Medium and heavy ()
- 7) Heavy petroleum oil has not grade in octane number ()
- 8) Isomerization unit is worked with used catalyst ()
- 9) Sulfur in Naphtha hydrotreating (NHT) that make poison of catalyst ()
- 10) Accumulation of coke is causes of catalyst deactivation ()

- 11) Knock out (K.O) is important of recycle gas system ()
- 12) Can be classification of crude according to sulphur is sweet and sour ()
- 13) If the crude of a high density is termed heavy crude ()
- 14) Distillation is a physical processes ()
- 15) Thermal and catalytic units are the chemicals processes ()
- 16) Stripping is a column, removed undesirable gases ()
- 17) LPG, which consists principally of propane and butane ()
- 18) The purpose of the C5/C6 isomerization is convert of light naphtha ()
- 19) In petroleum industrial double bond is undesirable component. ()
- 20) Splitter is a column, separation light and heavy ()
- 21) Problems of distillation tower in chemicals ()
- 22) Reactors isn't importance in chemicals units ()
- 23) Tripe bond is found in petroleum compositions ()
- 24) Desalter isn't important in petroleum industrials ()
- 25) The weakest of area for distillation tower in medium area ()

(Good luck)

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(Good luck)

Chemistry Department

Jan 2024

Faculty of Science

Time: 3h

Assiut University

Final exam of course code 453C (industrial chemistry)
for 4th level students

Part I (33 Marks)

Answer the following questions

1. Give reasons for FIVE of the following (10 Marks)

- A) Phosphatic rock calcination before use in phosphatic fertilizers manufacturing.
- B) Chalk is qualified to be a good raw material for the wet process in cement industry
- C) Calciumaluminoferrite (C_4AF) forms a continuous phase around other cement clinker compounds.
- D) Importance of vitreous phase in ceramic products.
- E) Ageing of superphosphate fertilizers after reaction of phosphoric acid with phosphatic rock .
- F) Firing too hot and too long causes devitrification of glass.

2. Answer the following (6 Marks)

- A) Compare between alite and belite after cement hydration in terms of:
 - i) strength ii) heat of hydration iii) hardening
- B) Define sintering of ceramics and then give three of the properties resulting after such sintering.
- C) During the manufacture of glass CO_2 and SO_2 that are of environmental impact are evolved. Give the possible sources of these two gases.

3. Complete the following (5 Marks)

- A) $3(Al_2O_3 \cdot 2SiO_2 \cdot 2H_2O) \rightarrow \dots + \dots + 6H_2O$ (a ceramic reaction)
- B) C_3A can be converted to C_4AF by addition ofbefore

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heating where C_4AF makes cement more resistant to.....

C) Tempering of tempered glass puts the outer surfaces into.....and the interior into.....

D) The LAS system of glass-ceramics is characterized by the composition.....

E) When the amount of lead oxide in the lead glass is high a lowering of glass melting occurs besides a decrease in.....which gives glass a soft surface.

4. Choose the correct answer in the following (3Marks)

A) Interaction of magnesium sulphate solutions with cement concrete produces:

- i) Magnesium hydroxide ii) magnesium silicate hydrate
- iii) gypsum iv) all the aforementioned three items.

B) The use of B_2O_3 in glass components is

- i) to increase the resistance to compressive forces
- ii) to increase the chemical durability
- iii) to produce a glass of high the thermal expansion coefficient.

C) Fluorapatite rock should be almost free from chloride content in order to avoid the following during fertilizer manufacture:

- i) reaction with sulphuric acid
- ii) reaction with phosphoric acid
- iii) its oxidation with iron III impurities producing the harmful Cl_2 .
- iv) corrosion of equipment.

5. Mark the correct answer with (✓) and the wrong one with (X)

(9 Marks)

A) In ceramic industry mullite is not the only the stable compound of alumina and silica at high temperatures.

B) Laminated glass when breaks produces a "spider web" cracking pattern.

- C) Annealing of glass articles is a process performed to completely remove the strain in the glass products.
- D) Froth floatation of phosphatic rocks does not require a deslimed feedstock.
- E) Fiberglass is characterized by its ability for rusting.
- F) Cullet is one of the major raw materials in glass manufacture
- G) Sodium nitrate is applied in tank furnaces to remove scum.
- H) Sulphuric acid (75%) used for the reaction with apatite in the production of phosphatic fertilizers is continuously diluted to 64%.
- I) The difference between devitrification and tin bloom in glass is that devitrification occurs after a short time while tin bloom appears after a long time.

Part II

(17 Marks)

Answer the following questions:

1. Discuss briefly the Modern Theory for the relationship between color and constitution?
2. What is the Pulp? Discuss the stages of paper manufactures?
3. Write on the composition, applications and advantages of water-based printing inks.
4. Explain the classification, properties, and applications of the Pigments
5. Discuss and define **Three Only** from the following Dyes:
 - a) Vat Dyes
 - b) Mordent Dyes
 - c) Direct Dyes
 - d) Disperse Dyes

Examinars:

Prof. Dr. Aref A. M. Aly

Prof. Dr. Kamal Ibrahim

Assiut University
Faculty of Science
Chemistry Department

Date: 20/1/2024
Time: 2 hours

Colloids and Surface Chemistry Examination for 3rd Level Applied Industrial Chemistry Students (Chem.303).

Q1: Shade (T) for True statements or (F) for False statements:(1 Mark each)

No.	Phrase
1	Detergents are examples of solids dispersed in liquid.
2	Water-insoluble soaps favor the formation of emulsions of oil in water.
3	The colloidal silicate ions move to the cathode.
4	Proteins at their isoelectric points do not move either to the anode or to the cathode.
5	In benzosols, the dispersed phase is solid and the dispersion medium is benzene.
6	A silver sol may be produced by reduction of dilute silver nitrate solution with nitric acid.
7	A gel of Ca-acetate can be obtained by change of solvents.
8	An emulsifier at the water- oil interface increases the surface tension on the side of one liquid more than does on the other one.
9	A freshly prepared AgCl can be changed to colloidal solution by dissolution.
10	Shaving lather is an example of gas dispersed in liquid.
11	The function of an emulsifier is to stabilize a sol.
12	The size of the pinpoints of light seen in the ultra-microscope is an indication of the actual diameter of the particles.
13	Hysteresis loop of type H2 indicates the presence of ink-bottle shaped pores.
14	Absorption is the phenomenon in which particles of gas or liquid get uniformly distributed throughout the body of the solid.
15	In volume -thickness plots, the upward deviation is an indication for the presence of mesopores.
16	Activation of activated carbon is the process that produces the porous structure essential for effective adsorption by oxidation of carbon with water vapor or CO ₂ .