	TANTA UNIVERSITY FACULTY OF SCIENCE DEPARTMENT OF CHEMISTRY			
	FINAL EXAMINATION for Special Chemistry & Material Science Groups			
	COURSE TITLE:	POLYMER CHEMISTRY		COURSE CODE: CH 4105
DATE:	25 JAN 2023	TERM: FIRST	TOTAL ASSESSMENT MARKS: 50 DEGREE	TIME ALLOWED: 2 HOURS

- 1) Write the **name & structure** of monomers for each of the following polymers: **(10 marks, 2 marks for each)**
- Polycarbonate,
 - Aliphatic polyamide,
 - Poly(vinyl chloride),
 - Polyurethanes,
 - Epoxy resin.
- 2) Write short notes on the following: **(10 marks, 5 marks for each)**
- Suspension polymerization techniques,
 - Phenol-formaldehyde resin.
- 3) How can you prepare the following: **(10 marks, 5 marks for each)**
- Ion exchange resins,
 - Block copolymers.
- 4) Write short notes on the following: **(10 marks, 5 marks for each)**
- Vulcanized rubber,
 - Isomerization polymerization.
- 5) Choose the correct answers: **(10 marks, one mark for each)**
- What is the name of the organic compound used to prevent the polymerization of the monomers during storage?
 - Accelerator,
 - Initiator,
 - Inhibitor.
 - What are the monomers used for the formation of Bakelite?
 - Urea & formaldehyde,
 - Melamine & formaldehyde,
 - Phenol & formaldehyde.
 - What is the type of the initiator used in cationic polymerizations?

- a) Acid,
 - b) Base,
 - c) Free radical.
- iv) Which of the following is common anionic initiator?
- a) Benzoyl peroxide,
 - b) Azobisisobutyronitrile,
 - c) Na-metal.
- v) What are the monomers used for the formation of polyurethanes?
- a) Isobutylene & isoprene,
 - b) Diisocyanate & diol,
 - c) Diisocyanate & diamine.
- vi) What is the type of the polymerization of styrene with BuLi?
- a) Ring-opening polymerization,
 - b) Condensation polymerization,
 - c) Living polymerization.
- vii) Which is the characteristic of cross-linked polymers?
- a) Melting on heating,
 - b) Insoluble in all solvent,
 - c) Soluble in organic solvent.
- viii) Which is true regarding addition polymerization?
- a) Monomers contain three functional groups,
 - b) Monomers contain two functional groups,
 - c) Monomers contain olefinic groups.
- ix) What is the type of the polymerization used for the formation of polystyrene?
- a) Condensation polymerization,
 - b) Addition polymerization,
 - c) Stepwise polymerization.
- x) Which is the characteristic of thermoplastic s?
- a) Can be molded,
 - b) Cross-linking between chains,
 - c) Can not be melted.

With best regards,

EXAMINER	DR. AHMED AKELAH	
-----------------	------------------	--



Tanta University – Faculty of Science – Chemistry Department		
Final Exam for Fourth year students (Chemistry, Material Science Section)		
Code: CH4123	Course Title: Industrial Chemistry	
January 2023	Note: Exam consists of 6 pages	
Date: 28/12/2022	Total Assessment Marks: 100	Time Allowed: 2 h

Part I: Organic Industrial Chemistry (50 Marks) تصحيح إلكتروني

Choose the correct answer: -

- Formaldehyde is as a feedstock for industry
a. dyes b. detergents c. Plastic d. explosives
- Dehydrogenation of methanol by catalytic oxidation is an industrial method for the manufacture of
a. Methane b. formalin c. ethanol d. acetic acid
- Cyclohexanone is a starting material for the synthesis of
a. tramadol b. aspirin c. prilocaine d. sildenafil
- Liquefied petroleum gases (LPG) consists of mixture
a. pentane and propane c. propane and hexane
b. propane and butane d. butane and pentane
-are unstable and also improve the anti-knock tendencies of gasoline
a. Olefins c. Sulfur Compounds
b. Paraffins d. Aromatics
- Synthesis gas is a mixture of
a. CO₂ & H₂O b. NH₃ & O₂ c. H₂ & CO d. H₂ & NH₃
- Acetylation of p-aminophenol gives
a. Pethidine b. Paracetamol c. Novocain d. Aspirin
- Determining the amount of hydrogen required for a compound to be converted into a saturated
a. acid hydrolysis c. saponification Value
b. cracking test d. unsaturation test
- is the most common solvent used for vegetable oil extraction
a. Ethyl acetate b. Hexane c. Ethanol d. Methanol

من فضلك إقلب الصفحة

20. When 2,6 dimethylaniline reacts with chloroacetyl chloride followed by reaction with diethyl amine gives
- a. pethidine b. Lidocaine c. cocaine d. tramadol
21. The spent lye in soap manufacturing process is.....
- a. brine solution layer c. brine/NaOH layer
b. NaOH/H₂O layer d. brine/glycerin layer
22. Sulphapyrimidine is used as
- a. antibacterial agent c. anticancer agent
b. anesthetic agent d. anti-inflammatory agent
23. In vegetable oil extraction, NaOH is used for
- a. separation of glycerol c. soap formation
b. neutralization of fatty acids d. b,c
24. During the manufacture of solid detergents, raw materials are mixed together during
- a. postdosing step c. slurry making step
b. spray drying step d. none of these
25. Palmitic acid is
- a. CH₃(CH₂)₁₂COOH c. CH₃(CH₂)₁₀COOH
b. CH₃(CH₂)₁₆COOH d. none of these
26. Alkylation of barbituric acid gives
- a. hypnotic drug c. antibacterial drug
b. anticancer drug d. antifungal drug
27. According to inorganic hypothesis, petroleum could be formed in the form of
- a. carbides c. hydrocarbons
b. carbon dioxide d. a,b
28. is used to reduce engine knocking and increase the fuel's octane rating
- a. LPG c. Anti-knock agent
b. Octane number d. None of these

29. For $C_{14} - C_{20}$ fraction, it is used for
- | | |
|----------------|---------------------|
| a. jet fuel | c. lubricating oils |
| b. diesel fuel | d. ships fuel |
30. During Cativa process for the production of acetic acid, is used as catalyst
- | | |
|-------------|--------------|
| a. Platinum | c. Ruthenium |
| b. Rhodium | d. Iridium |
31. Phenylglycine is a starting material for the synthesis of
- | | |
|---------------|----------------|
| a. Ampicillin | c. Amoxicillin |
| b. Pirocaine | d. Novocaine |
32. Tedious, , energy sapping , rough , largely unscientific, inefficient, and yielding poor quality extracted oil. All these are in accordance with
- | | |
|---------------------------------|------------------------------|
| a. conventional method | c. solvent extraction method |
| b. mechanical expression method | d. old traditional method |
33. Partial oxidation of methane gives
- | | |
|-----------|------------------|
| a. H_2O | c. Syn-gas |
| b. CO_2 | d. none of these |
34. Sulfonation of acetanilide followed by reaction with 2-aminopyrimidine and hydrolysis gives
- | | |
|---------------------|-------------------|
| a. Sulphapyrimidine | c. Sulphanilamide |
| b. sulphathiazole | d. Sildenafil |
35. Reaction of benzyl cyanide with methyl-bis(2-chloroethyl)amine followed by hydrolysis and esterification with ethanol gives
- | | |
|--------------|---------------|
| a. Tramadol | c. Ibuprofen |
| b. Pethidine | d. Sildenafil |
36. In vegetable oil processing, degumming process is carried out using
- | | |
|--------------------|---------------------|
| a. glycerol | c. hot water |
| b. Phosphoric acid | d. sodium hydroxide |

من فضلك إقلب الصفحة

37. In viscous rayon production, wood pulp is treated with aqueous sodium hydroxide then treated with carbon disulfide to form
- Formaldehyde
 - Methanol
 - Acetic acid
 - Xanthate
38. One example for unsaturated fatty acids is
- Lauric acid
 - Myristic acid
 - Palmitic acid
 - none of these
39. When propene reacts with chlorine and hypochlorous acid followed by hydrolysis with sodium hydroxide is formed
- Glycerol
 - Methane
 - Acetic acid
 - Urea-formaldehyde resin
40. Deodorizing step in vegetable oil refining is carried out to remove volatile components, mainly
- soap
 - Glycerol
 - aldehydes & ketones
 - free fatty acids

Mark (✓) or (×) (10 Marks)

- In oil refining, small amount of NaOH is added to remove the remaining phospholipids.
- Lidocaine is considered as a strong antibiotic.
- Methane is an undesirable component because of its strong offensive odor, corrosion, air pollution by some of its compounds.
- In oil refining, bleaching process is done by the addition of citric acid.
- Brine solution is used during soap manufacturing for soap neutralization.
- The starting material for pethidine preparation is aniline hydrochloride
- The saponification process is an exothermic process.
- Detergents are structurally like soaps but differ in the water-soluble part.
- Aspirin inhibits the production of cell walls of bacteria.
- Olefins are unstable and improve the anti-knock tendencies of gasoline.

من فضلك إقلب الصفحة

Part I: Inorganic Industrial Chemistry (50 Marks)

Question one:

(A) Describe with chemical equations the reactions that occur to produce **Only Two** of the following:

1. H_2SO_4 by contact process
2. H_3PO_4 by wet process.
3. Syn gas by autothermal reforming of methane.

(B) Mention three uses of each of the following (H_2SO_4 - H_3PO_4 - Syn gas).

Question two:

(A) In the production of ammonia by Haber process in industry

- 1) write the balanced chemical equation for the manufacture of ammonia.
- 2) How much hydrogen would be in 400 liters (L) of gaseous mixture.

(B) Choose the correct answer:

1- Carrying out this reaction at high temperature in the presence of a catalyst is in order to.....

- a) Speed up the conversion reaction to reach equilibrium soon, even though with low amount of ammonia
- b) Increase the conversion to ammonia in each pass
- c) Decrease the speed of the conversion reaction, so the evolved energy could be dissipated as the reaction goes on
- d) b and c

2- The reaction $2\text{NaCl} + 2\text{H}_2\text{O} \rightarrow 2\text{NaOH} + \text{Cl}_2 + \text{H}_2$ is

- a) Oxidation-reduction reaction
- b) Electrochemical reaction.
- c) Used in industry for coproduction of Cl_2 and caustic soda.
- d) All the above.

3- In industrial production of phosphoric acid by the wet process, the crushed phosphate rock (apatite) is acidified with phosphoric acid before adding sulphuric acid. This is to prevent

- a) Formation of soluble salts such as MgSO_4 or iron sulphate in the produced phosphoric acid solution.
- b) precipitation of other salts with gypsum.
- c) formation of the Plaster gypsum layer on the surface of the crushed apatite.
- d) all the above three


(C) A plant that consumes 1170 tons of NaCl produces how many tons of NaOH.

(D) Describe the main uses of NH_3 - Cl_2 - H_2 .

إنتهت الأسئلة كل الأمنيات بالتوفيق والنجاح

Prof. Dr Samer Kandel

Dr. Hamada Mandour

	Tanta University, Faculty of Science, Department of Chemistry		
	Final Exam of Solid State Chemistry [4 th Level] Chem-Bio, Micro, Bot, Ent, Geo, Zol, and Mat Science		
Course Title: Solid State Chemistry – جميع الشعب المذدوجه		Code: CH4143	
Date: 21-January -2023	1 st Semester		Time: 2 Hours

Part(I).....30 Marks

Answer the following:

Q1. True or False (√ & x), and if it is false correct it:20 Marks

- 1) Graphite is Sp^2 hybridization and good insulator.
- 2) Deliquescent materials are not vapor absorption matter.
- 3) Stoichiometric defects are belonging to point defect type.
- 4) Covalent crystals are bonded to each other by ionic bonds.
- 5) Interstitial defects are belonging to stoichiometric ionic solids.
- 6) Metal deficient defects are belonging to stoichiometric point defects.
- 7) Smectic liquid crystal phase is not ordered crystals.
- 8) Monoclinic crystals are maximum symmetry crystals type.
- 9) Conduction in solids is hole mechanism-only.
- 10) Liquid crystals (LC) are not obeying Bragg's law for X-ray diffraction.
- 11) Conductors have no energy gab (Eg).
- 12) n-type semiconductors are electron conduction mechanism.
- 13) Diamagnetic materials have no unpaired electron.
- 14) Polymerized crystalline arrays obey Bragg's law.
- 15) Potassium chloride is belonging to Ionic solids.
- 16) Population-inversion is the base of Laser-generation.
- 17) Semiconductors conduction is enhancing via raising of temperature.
- 18) Sol-Gel technique produces a microstructure better than other techniques.
- 19) Annealing rates controlled in the formed crystalline phases.
- 20) Volume of lattice cell is greater than volume of atoms present within lattice.

تابع باقى الاسئله..... خلف الورقه.....



QII. Write the Scientific Term/or Sentence equal to each of the following;(10 Marks)

- ❖ Allotrope
- ❖ Type of defects are present specially in ionic solids.
- ❖ Laser.
- ❖ The smaller ions are dislocated from its sites to interstitial sites.
- ❖ Bragg's law.
- ❖ Materials with the same chemical composition but differ in crystal form.
- ❖ Capability and efficiency of crystal form to insert more atoms.
- ❖ The zone in matter controlled in conduction mechanism.
- ❖ Application of electricity to produce chemical reaction.
- ❖ Crystalline Polymorphism.

Part (II).....20 Marks

QIII. Write a brief account on, Only Five Items:(10 marks)

- III.1. Photo-Voltaic Devices & Semiconducting Lasers.
- III.2. Polymorphism in iron/carbon.
- III.3. Atomic Packing efficiency (APF) .
- III.4. Doping in semiconductors (*n-type and p-type*) semiconductors.
- III.5. Techniques applied for solid state synthesis.
- III.6. Different phases of liquid crystal.

QIV. Compare with drawing between each couple of the following;.....(10 Marks)

1. Crystalline and Amorphous solids.
2. Diamond and Graphite.
3. Frenkel and Schottky defects.
4. Polymorphism in carbon and calcium silicates.
5. Linear defects, Edge and Screw dislocations.

Best Wishes
Prof.Dr. Khaled M. Elsabawy
Professor of Materials Sciences
2023

TANTA UNIVERSITY- Faculty of Science -Department of Physics				
EXAM FOR SENIORS STUDENTS OF MATERIALS SCIENCE				
COURSE TITLE		Materials Design		COURSE CODE:MS4121
DATE:31	DECEMBER 2022	TERM: FIRST	TOTAL ASSESSMENT MARKS: 100	TIME ALLOWED: 2 HOURS

answer the following questions:

First Question:

[20 marks }

- I) Cite the criteria that are important in the Selection consideration of materials. [10Marks]
- II) Using the selection consideration developed for minimum material mass and minimum cost, describe the acceptable candidates from the following Five Engineering Materials. [10Marks]

Material	ρ (Mg/m ³)	τ_r (MPa)	\bar{c} (\$/\$/)
Carbon fiber-reinforced composite(CF-RC)	1.5	1140	80
Glass fiber-reinforced composite(GFRC)	2.0	1060	40
Aluminum alloy (2024-T6)(Al.A)	2.8	300	15
Titanium alloy (Ti-6Al-4V)(Ti-AL.A)	4.4	525	110
4340 Steel.	7.8	780	5

Density (ρ), Strength (τ_r), and Relative Cost(\bar{c}) for Five Engineering Materials.

Second Question:

[20 marks }

- I) Find the shear stress of a helical spring has been constructed of wire having a circular cross section diameter (d), the coil center to center diameter (D), a compressive force (F) and force independent constant $k_w = 1 + \frac{1}{2C}$. [10Marks]
- II) Prove that the Stiffness of spring is $\left(\frac{G \cdot d}{8n \cdot C^3}\right)$. Where (G) and (C) are the rigidity and spring constant of coil material. [10Marks]

Third Question:

{ 30 marks }

- I) List and briefly explain the biocompatibility considerations relative to materials that are employed in artificial hip replacements. [15Marks]
- II) Compare between the specific properties of the three materials are employed in the femoral stem of the artificial hip replacement. [15Marks]

Forth Question:

{ 30 marks }

- I) Write the Required mechanical properties of the hip joint replaced components. [10Marks]
- II) List the Requirements of the Thermal Protection System Design on the Space Shuttle Orbiter. [10Marks]
- III) Write short notes about reinforced carbon-carbon used in the Design of Space Shuttle Orbiter. [10Marks]

EXAMINERS	DR. TALAAT MEAZ	DR. REDA ELSHATER
-----------	-----------------	-------------------

© BEST WISHES



COURSE TITLE:	ELECTRON MICROSCOPY		COURSE CODE: MS4123
DATE:	04/01/2023	TERM: FIRST	TOTAL ASSESSMENT MARKS:100
			TIME ALLOWED: 2 HOURS

ANSWER THE FOLLOWING QUESTIONS:

Q1 (20 Marks)

A) Define the spatial resolution and mention the factors that affect it. (10 Marks)

B) Write in brief about the advantages and disadvantages of SEM regarding sample preparation. (10Marks)

Q2 (25 Marks)

A) Discuss in brief the importance of the vacuum systems in electron microscopes and write about one of the common vacuum pumps that are used in electron microscopy. (10 Marks)

B) Draw a simple schematic that shows the possible processes in the interaction between an energetic electron beam and the sample. (15 Marks)

Q3 (25 Marks)

A) List the different types of lens defects and write briefly about one of them. (10 Marks)

B) Discuss in brief the principle of electron generation in electron microscopes. (15 Marks)

Q4- CHOOSE THE CORRECT ANSWER

(30 Marks, 2 marks each)

1) The eye controls the amount of light reaching the retina by varying the diameter of the aperture of the.....

- A) Receptor cells B) Iris C) Cornea D) Pupil

2) Two points separated by a distance of 0.2 mm can just be inspected in a microscope when light of a wavelength of 500 nm is used. If light of a wavelength of 400 nm is used, this limit of resolution will be.....

- A) 0.8 mm B) 0.08 mm C) 0.12 mm D) 0.16 mm

3) Chromatic aberration of a lens can be corrected by...

- A) Suitably combining it with another lens B) Proper polishing of its two surfaces
C) Providing different suitable curvature to its two surfaces D) Reducing its aperture

4) What causes chromatic aberration?

- A) Variation of the focal length of the lens with color B) Marginal rays
C) Difference in radii of curvature of its surfaces D) Central rays

← انظر باقي الأسئلة خلف الصفحة →

- 5) Chromatic aberration in a lens is caused by
 A) Reflection B) Dispersion C) Interference D) Diffraction
- 6) In which of the following, the emission of electrons does not take place
 A) Thermionic emission B) X-rays emission
 C) Photoelectric emission D) Secondary emission
- 7) Which of the following light is suitable for maximum resolution
 A) Red B) Green C) Blue D) orange
- 8) The resolving power of the unaided human eye is
 A) 1 cm 200 μm C) 100 μm 400 nm
- 9) The process of emission of electrons from hot metal surfaces is called
 A) Thermionic emission B) X-rays emission
 C) Photoelectric emission D) Secondary emission
- 10) Which particle escapes from the surface of the metal when it is heated at a high temperature?
 A) Electrons B) Protons C) Neutrons D) Nucleon
- 11) Transmission electron microscopy is best for high-magnification viewing of
 A) Internal structure of fixed cells. B) Internal structure of live cells.
 C) Surface structure of fixed cells D) Surface membranes of live cells
- 12) A microscope in which an image is formed by passing an electron beam through a specimen and focusing the scattered electrons with magnetic lenses is called a
 A) Scanning electron microscope B) Transmission electron microscope
 C) Phase-contrast microscope D) Atomic force microscope
- 13) All of the following are true about field emission except:
 A) The emitted electrons have very well-defined energies.
 B) Evaporation from the surface that takes place during operation shortens the tip's lifetime.
 C) Thermal excitation is not required
 D) Field emission requires a very high vacuum to achieve a stable operation.
- 14) In electron optics, the device that corrects for astigmatism is called...
 A) An electrostatic lens B) A condenser lens C) An electron probe D) A stigmator
- 15)is the ability to distinguish between two adjacent objects.
 A) Magnification B) Ionization C) Spherical aberration D) Resolving power

EXAMINERS	PROF. MOHAMED E SHAHEEN
-----------	-------------------------

أطيب التمنيات بالتوفيق والنجاح



TANTA UNIVERSITY- Faculty of Science - Department of Physics

FINAL TERM EXAM FOR SENIOR'S STUDENTS OF MATERIAL SCIENCE- 4TH LEVEL

COURSE TITLE:

Microprocessing of Materials

COURSE CODE: MS4131

DATE:

2 JANUARY 2023

TERM: FIRST

TOTAL ASSESSMENT MARKS: 100

TIME ALLOWED: 120 MINS

Answer the following questions:

Please indicate your answers clearly in the space provided. Useful constants and conversion factors are provided. (25 marks/question)

Question one

SECTION I: Choose the correct answer

- 1- In Ion implantation process the dose flux (ϕ) has a unit of while ion beam concentration has a unit

 - a) # of atoms/cm³ & # of atoms/cm²
 - b) # of atoms/cm¹ & # of atoms/cm²
 - c) # of atoms/cm² & # of atoms/cm³
 - d) # of atoms/cm⁻² & # of atoms/cm⁻³

- 2- Dislocations in line defects in crystals move by two primary mechanisms,and glide.
 - a- climb
 - b- ascending
 - c- none of these
- 3- One of the advantages of the ion implantation process is:
 - a) Very expensive equipment (\$1M or more).
 - b) At high dose values, throughput is less than diffusion (chemical source pre-deposition on surface).
 - c) Ions damage the semiconductor lattice.
 - d) Excellent doping uniformity is achieved across the wafer (< 1% variation across 12" wafer) and from wafer to wafer.
- 4- Silicon On Insulator (SOI) wafers provide better performance forspeed circuits than conventional wafers.
 - a) High
 - b) low
 - c) intermediate
 - d) None of these
- 5- In ion implantation process, Rp projected range, is a function of
 - a) ion energy and mass
 - b) atomic number of impurities
 - c) target material
 - d) all of these
- 6- The materials used for microelectronics can be divided into three classifications, depending on the amount of atomic order they possess: single crystal, polycrystalline and amorphous materials
 - a) True
 - b) false

- 7- Diffusion is a time dependent process. Since, the diffusion movement is not based on kinetic energy(speed), charge, and mass of molecule
- a) True b) false
- 8- Lithography is a printing process that uses physical processes to create an image.
- a) True b) False
- 9- Hg vapor lamps have been used which generate many spectral lines from high intensity plasma inside a glass lamp.
- a) True b) False
- 10- In an ion implantation process a magnet bend the ion beam through an angle $\leq 45^\circ$, and select the desired impurity ion and purge undesired species.
- a) True b) False
- 11- The line defects in crystals extend in dimension and the most common example is a
- a- One & dislocation b- two & dissociation c- three & disintegration
- 12- Phosphorous with energy 200KeV is implanted into a silicon wafer. What should the implanted dose be if the peak concentration is $1 \times 10^{17} \text{ cm}^{-3}$ is desired? Also, the time required implanting this dose into 100 mm wafer using 3 μA beam current with single ionized phosphorous? (HINT: at 200 KeV: $R_p=0.23 \mu\text{m}$, and $\Delta R_p= 0.0725 \mu\text{m}$).
- a) $1.817 \times 10^{12} \text{ cm}^{-2}$, 76.06 S
b) $1.130 \times 10^{12} \text{ cm}^{-2}$, 24.00 S
c) $1.00 \times 10^{13} \text{ cm}^{-2}$, 1.27 min
d) None of these
- 13- 200 keV Phosphorous is implanted into P-type silicon wafer ($C_B= 10^{16} / \text{cm}^3$) with dose of $10^{13} / \text{cm}^2$. Then, the peak concentration (C_p) and the junction depth (x_j) are: (HINT: $R_p=0.254 \mu\text{m}$, and $\Delta R_p= 0.0775 \mu\text{m}$):
- a) $3.2 \times 10^{17} / \text{cm}^3$ & $0.574 \mu\text{m}$
b) $4.2 \times 10^{17} / \text{cm}^3$ & $0.274 \mu\text{m}$
c) $5.2 \times 10^{17} / \text{cm}^3$ & $0.474 \mu\text{m}$
d) $6.2 \times 10^{17} / \text{cm}^3$ & $0.374 \mu\text{m}$
- 14- Fick's second law cannot be applied if the crystal is not
- a- Isotropic b- Isothermal c- non isotropic d- all of these

SECTION II: answer the following

- 1- If the temperature gradient in Czochralski silicon is $100^{\circ}\text{C}/\text{cm}$, calculate the maximum pull rate {HINT: thermal conductivity of silicon = $2.84 \text{ W}/\text{cm}\cdot\text{K}$, latent heat of fusion of silicon is $430 \text{ cal}/\text{gm}$, and crystal density is $2.328 \text{ gm}/\text{cm}^3$ }.
- 2- A silicon wafer that has 10^{16} cm^{-3} of boron is found to have a neutral vacancy concentration of $2 \times 10^{10} \text{ cm}^{-3}$ at some processing temperature and a singly ionized vacancy concentration of 10^9 cm^{-3} at the same temperature. Determine the temperature and the activation energy of the charged vacancy with respect to the intrinsic level, (E_i) {activation energy of the neutral vacancy to be 2.6 eV , $\alpha = 4.73 \times 10^{-4} \text{ eV}/\text{K}$, $\beta = 637 \text{ K}$ }.

Question two

- 1- In optical lithography systems, the light source plays important roles explain this when an excimer laser is used?
- 2- Write about dry and wet etching, also the three etching processes?
- 3- Explain in details the Deal---Grove Model of thermal oxidation?
- 4- A silicon wafer has a 2000-\AA oxide on its surface, mathematically (a) How long did it take to grow this oxide at 1100°C in dry oxygen? { HINT: $B = 0.0236 (\mu\text{m})^2/\text{hr}$, and $B/A = 0.169 \mu\text{m}/\text{hr}$ }
(b) The wafer is put back in the furnace in wet oxygen at 1000°C . How long will it take to grow an additional 3000 \AA of oxide {HINT: $B = 0.314 (\mu\text{m})^2/\text{hr}$, and $B/A = 0.742 \mu\text{m}/\text{hr}$ }?

Question three:

- 1- Write about the advantages of ion implantation?
- 2- A boron implant is performed into silicon at 100 keV . The boron beam is aligned with the silicon crystal so that channeling is present. Estimate the range of the channeled boron profile, by considering that electronic stopping is the only mechanism for slowing the boron ions.
- 3- Explain the effect of channeling on ion implantation?
- 4- If the analyzing magnet bends the ion beam through 90° and $L = R = 60 \text{ cm}$, Find:-
 - a- The displacement D that would be seen if B_{10} is sent through the system when it is tuned for B_{11} .
 - b- The required field, if the extraction potential is 25 KV ,

Question Four:

- 1- You need a 300 mm diameter silicon ingot containing 5×10^{16} As atoms/cm³ and decide to use the Czochralski technique to grow it. You decide to: (1) grow at equilibrium growth conditions, (2) make the mass of the initial melt twice the mass of the final silicon ingot, (3) cut the wafers you need out of the middle of the final single crystal ingot, and (4) grow the final ingot a total of 1 meter in length. **What concentration of As atoms should be in the melt?**


- 2- A boule of B-doped single crystalline Si is pulled from the melt in a CZ process. Afterwards, it is sliced into wafers. The wafer taken from the top of the boule has a boron concentration of 3×10^{15} cm⁻³. What would the doping concentration of the wafer taken from the position corresponding to 90% of the initial melt solidified. The segregation coefficient for boron B in silicon Si is 0.8.

- 3- A 1000-Å gate oxide is required for some technology. It has been decided that the oxidation will be carried out at 1000°C, in dry oxygen. If there is no initial oxide, for how long should the oxidation be done? Is the oxidation in the linear regime, the parabolic regime, or between the two (HINT: at 1000° C in dry oxygen: $A = 0.165 \mu\text{m}$, $B = 0.0117 \mu\text{m}^2/\text{hr}$, and $t = 0.37 \text{ hr}$)?

EXAMINER

PROF. ALI IBRAHIM

☺ BEST WISHES ☺

	TANTA UNIVERSITY FACULTY OF SCIENCE DEPARTMENT OF PHYSICS			
	EXAMINATION FOR SENIORS (FORTH LEVEL) STUDENTS OF MATERIAL SCIENCE (SEMESTER 1)			
	COURSE TITLE:	INTRODUCTION TO NANO-TECHNOLOGY		COURSE CODE: MS4163
DATE:11	JANUARY, 2023	TERM: SUMMER	TOTAL ASSESSMENT MARKS: 100	TIME ALLOWED: 2 HOURS

Answer the following Questions:

First questions:

{25 Marks }

A) Define the following:

(14 Marks).

1-Nanomaterials. 2-Nanotechnology. 3- Quantum-dots 4- Crystallite size 5-Bulk materials.

B)-Read the following and show which is true and which is false, and give the reason why?

(11 Marks)

1. There are no nano-scale structures in nature.
2. Once nanotechnology is developed further, it will move to Pico-technology which structure is 1000 times smaller than nano structure.
3. Nanotechnology has become familiar now because we can see what we have made.
4. Surface force becomes stronger for nano-scale structure than its macro-scale counterpart.
5. The color of gold colloids solutions is decided by the diameter of gold nanoparticles.
6. The melting temperature of gold nanoparticles gets lower as the size becomes smaller.
7. CdSe nanoparticles can generate the entire visible spectrum (400nm~780nm) by tuning the particle size. In another word, nanoparticles can emit rainbow colors.
8. At the nanoscale, carbon has a new type of bonding which cannot be observed in bulk.
9. Nanoparticle based fluorescence markers offer longer emission time.
10. Material properties (e.g., melting temperature, energy band gap) will never change regardless of its size.
11. Some metal nanoparticles can be used for anti-microbial (e.g., kill bacteria) application.

Turn the page over



Second question:

{25Marks}.

- A)- Write short notes about the unique size dependent properties of nanomaterial (give examples). (12 Marks).
- B)- Discuss the fabrication methods of nano materials, (give examples) (13 Marks).

Third question:

{25 Marks}

Discuss and show the advantage of using nanotechnology of the following fields:

1- Medicine. (12 marks)

2- Environment. (13 marks)

Fourth Question:

{25 Marks}

Discuss briefly and show the advantage of using nanotechnology of the following fields:


1-Clean Energy. (10 marks).

2- Information and communications. (10 marks).

3- Consumer Goods. (5 marks).

<i>Examiner</i>	<i>Prof. Talaat M. Meaz</i>
-----------------	-----------------------------



	TANTA UNIVERSITY FACULTY OF SCIENCE DEPARTMENT OF PHYSICS			
	EXAMINATION FOR SENIORS (FORTH LEVEL) STUDENTS OF MATERIAL SCIENCE (SEMESTER 1)			
COURSE TITLE:	INTRODUCTION TO NANO-TECHNOLOGY		COURSE CODE: MS4163	
DATE:11	JANUARY, 2023	TERM: SUMMER	TOTAL ASSESSMENT MARKS: 100	TIME ALLOWED: 2 HOURS

Answer the following Questions:

First questions:

{25 Marks }

A) Define the following:

(14 Marks).

1-Nanomaterials. 2-Nanotechnology. 3- Quantum-dots 4- Crystallite size 5-Bulk materials.

B)-Read the following and show which is true and which is false, and give the reason why?

(11 Marks)

1. There are no nano-scale structures in nature.
2. Once nanotechnology is developed further, it will move to Pico-technology which structure is 1000 times smaller than nano structure.
3. Nanotechnology has become familiar now because we can see what we have made.
4. Surface force becomes stronger for nano-scale structure than its macro-scale counterpart.
5. The color of gold colloids solutions is decided by the diameter of gold nanoparticles.
6. The melting temperature of gold nanoparticles gets lower as the size becomes smaller.
7. CdSe nanoparticles can generate the entire visible spectrum (400nm~780nm) by tuning the particle size. In another word, nanoparticles can emit rainbow colors.
8. At the nanoscale, carbon has a new type of bonding which cannot be observed in bulk.
9. Nanoparticle based fluorescence markers offer longer emission time.
10. Material properties (e.g., melting temperature, energy band gap) will never change regardless of its size.
11. Some metal nanoparticles can be used for anti-microbial (e.g., kill bacteria) application.

Turn the page over



Second question:

{25Marks}.

- A)- Write short notes about the unique size dependent properties of nanomaterial (give examples). (12 Marks).
- B)- Discuss the fabrication methods of nano materials, (give examples) (13 Marks).

Third question:

{25 Marks}

Discuss and show the advantage of using nanotechnology of the following fields:

1- Medicine. (12 marks)

2- Environment. (13 marks)

Fourth Question:

{25 Marks}

Discuss briefly and show the advantage of using nanotechnology of the following fields:

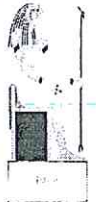
1-Clean Energy. (10 marks).

2- Information and communications. (10 marks).

3- Consumer Goods. (5 marks).


<i>Examiner</i>	<i>Prof. Talaat M. Meaz</i>
-----------------	-----------------------------



	TANTA UNIVERSITY FACULTY OF SCIENCE DEPARTMENT OF PHYSICS			
	EXAMINATION FOR FRESHMEN FOURTH LEVEL STUDENTS OF PHYSICS (MATERIAL SCIENCE)			
	COURSE TITLE:	(CERAMICS)		COURSE CODE: MS4171
DATE:	18/1/2023	TERM: FIRST	TOTAL ASSESSMENT MARKS: 100	TIME ALLOWED: 2 HOURS.

- 1) Define: (20 Marks)**
- a. Bulk density b. Piezoelectricity c. Hard ferrites
d. Hysteresis e. Coordination number f. Magnetic susceptibility
- 2) Write Short Notes On: (30 Marks)**
- a. Electrical properties of ceramics.
b. Factors affecting the cation distribution in spinel structure.
c. Paramagnetic materials.
d. Classification of ceramics based on their application (three only).
e. Types of dielectric polarization.
f. Types of ferrites (three only).
- 3) Put (✓) or (x) then correct the wrong answer: (20 Marks)**
- a. Diamond has high index of refraction.
b. The coordination number of cesium chloride structure (CsCl) is 6.
c. Large polaron occurs when the effective mass of the electron is large.
d. Oxygen positional parameter is the distance between oxygen ions and center of the cube.
e. Vacancy in ceramics exists for both cations and anions.
f. Ceramics have low density.
g. The inversion parameter equals one for completely normal spinel ferrite.
h. The unit cell of rock salt structure is FCC.
i. In ferrimagnets, the magnetic moments of the A and B sublattices are equal.
j. As the charge increases the size of the ion increases.
- 4) a. Compare between Frenkel and Schottky defect. (30 Marks)**
b. X rays of $\lambda = 0.1537$ nm from a Cu target are diffracted from the (111) planes of an FCC metal. The Bragg angle is 19.2° . Calculate the Avogadro number if the density of the crystal is 2698 kg/m^3 and the atomic weight 26.98 g/mol .

Good Luck
Dr. Basant Salem

	TANTA UNIVERSITY- Faculty of Science - Department of Physics			
	Physics & Biophysics - امتحان المستوى الرابع			
COURSE TITLE:	Defectors & Accelerators		COURSE CODE: PH4163	
DATE:	28 - 12 - 2022	TERM: FIRST	TOTAL ASSESSMENT MARKS: 100	TIME ALLOWED: 2 HOURS

Answer the following questions in Part A and Part B:

Part A: Choose the correct answer (1 mark each, Total 40 marks) Version: A001

- 1) To detect the fast electrons, slowing down the fast neutron in a moderating material is carried out before its detection as a _____.

(a) thermal neutron	<input type="checkbox"/>	(c) charged particle	<input type="checkbox"/>
(b) high energy neutron	<input type="checkbox"/>	(d) positive ion	<input type="checkbox"/>

- 2) _____ detectors can be sensitive to all types of radiation at all energies.

(a) Some	<input type="checkbox"/>	(c) All	<input type="checkbox"/>
(b) No	<input type="checkbox"/>	(d) Most	<input type="checkbox"/>

- 3) The relatively thick dead layer in diffused junction diode is a particularly disadvantageous as the energy lost in this layer _____.

(a) stays for long time in this area	<input type="checkbox"/>	(c) is always recoded	<input type="checkbox"/>
(b) produces electron-hole pairs	<input type="checkbox"/>	(d) goes unrecorded	<input type="checkbox"/>

- 4) The strong forces have a range of the order of _____ cm.

(a) 10^{-6}	<input type="checkbox"/>	(c) 10^{-13}	<input type="checkbox"/>
(b) 10^{-9}	<input type="checkbox"/>	(d) 10^{-15}	<input type="checkbox"/>

- 5) _____ efficiency is the ratio of the number of particles detected to the number of particles incident on the detector surface.

(a) Absolute detection	<input type="checkbox"/>	(c) Extrinsic detection	<input type="checkbox"/>
(b) Intrinsic detection	<input type="checkbox"/>	(d) Geometrical	<input type="checkbox"/>

- 6) In the _____ accelerator, a homogeneous magnetic field selects ions with a particular (e/m) to enters the accelerator.

(a) Van de Graff	<input type="checkbox"/>	(c) Cyclotron	<input type="checkbox"/>
(b) Cockcroft and Walton	<input type="checkbox"/>	(d) Tandem	<input type="checkbox"/>

- 7) Ionizing radiation, passing through the space between the electrodes in a gas-filled detector, dissipates part or all of its energy by generating _____.

(a) only electron	<input type="checkbox"/>	(c) electron-ion pairs	<input type="checkbox"/>
(b) only positive ion	<input type="checkbox"/>	(d) scintillation light	<input type="checkbox"/>

- 8) Neutrons are generally detected through _____.

(a) nuclear reactions	<input type="checkbox"/>	(c) molecular interactions	<input type="checkbox"/>
(b) atomic scattering	<input type="checkbox"/>	(d) electrostatic forces	<input type="checkbox"/>

- 9) _____ acts in proportional counter as ionizing gas.

(a) Argon	<input type="checkbox"/>	(c) Alcohol	<input type="checkbox"/>
(b) Krypton	<input type="checkbox"/>	(d) Water	<input type="checkbox"/>


- 10) At room temperature, the drift speed of electrons is _____ that for positive ions.

(a) thousand times	<input type="checkbox"/>	(c) ten times	<input type="checkbox"/>
(b) hundred times	<input type="checkbox"/>	(d) about the same as	<input type="checkbox"/>

- 11) The _____ accelerator consists of a belt made of isolated material looped around two rollers and an isolated dome.
- (a) Cyclotron (c) Van de Graff
 (b) Tandem (d) Cockcroft and Walton
-
- 12) Detector sensitivity is _____ for a given type of radiation and energy.
- (a) the capability of discriminating between different types of radiation (c) the capability of producing a usable signal
 (b) the ability to discriminate between closer energies (d) the ability to determine the Energy of the radiation
-
- 13) _____ are among the important influences on the operation of photomultiplier tubes.
- (a) Magnetic fields (c) Exposure to ambient light
 (b) temperature (d) all of the above
-
- 14) In pulse chamber, _____ may be measured.
- (a) charge produced by the radiation may be transformed into a pulse (c) motion of electrons induces a current on the electrodes
 (b) motion of charge carriers induces a current on the electrodes (d) All of the above
-
- 15) _____ acts as quenching gas in Geiger Muller counter.
- (a) Argon (c) Alcohol
 (b) Krypton (d) Water
-
- 16) _____ semiconductor is formed with equal amounts of donor and acceptor impurities.
- (a) Pure (c) Extrinsic
 (b) Intrinsic (d) compensated
-
- 17) Gas proportional counters can be used to measure fast neutrons through the recoil process where the fill gas is usually _____.
- (a) high-Z gas (c) water vapor
 (b) medium-Z gas (d) hydrogen or methane
-
- 18) Normally, gas detectors are manufactured to operate in _____.
- (a) only one region (c) ionization and recombination regions
 (b) ionization and proportional regions (d) all available regions
-
- 19) _____ are crystals of the alkali metals that contain a small concentration of an impurity.
- (a) gas (c) Inorganic scintillators
 (b) Plastic Scintillators (d) Organic scintillators
-
- 20) Ionization chamber is mainly used for measuring _____.
- (a) gamma-ray energy (c) beta particles energy
 (b) beta particles exposure (d) gamma-ray exposure
-
- 21) _____ consist of planar molecules made up of benzenoid rings and formed by combining appropriate compounds.
- (a) gas (c) Inorganic scintillators
 (b) Plastic Scintillators (d) Organic scintillators
-
- 22) Photomultiplier tubes are _____.
- (a) gas tubes (c) liquid tubes
 (b) fluid tubes (d) vacuum tubes

- 23) In proportional region of gas-filled detectors, _____ occurs very quickly near the anode.
 (a) non-localized avalanche (c) deionization
 (b) localized avalanche (d) recombination
- 24) A widely used detector for slow neutrons is the _____ proportional tube.
 (a) BCl_3 (c) BF_2
 (b) BF_3 (d) He
- 25) Elastic scattering of fast neutron by _____ aims to transfer some portion of the neutron kinetic energy to the target nucleus, resulting in a recoil nucleus.
 (a) light nuclei (c) atomic electrons
 (b) heavy nuclei (d) free electrons
- 26) Limitations of scintillation detectors include _____.
 (a) noise (c) range of energy
 (b) time response (d) all of the above
- 27) In a gas-filled detector, both electrons and ions move under the influence of _____.
 (a) the electrical field (c) their charge
 (b) their velocity (d) external force
- 28) Except for silicon, semiconductors generally require _____ before they can be operated.
 (a) no cooling (c) heating to high temperatures
 (b) cooling to low temperatures (d) no cooling or heating
- 29) In semiconductor detectors, the passage of ionizing radiation creates _____.
 (a) electrons (c) electron-hole pairs
 (b) electron-ion pairs (d) positive ions
- 30) The forbidden energy bandgap in conductors, semiconductors, and insulators are EG_1 , EG_2 , and EG_3 respectively. The relation among them is _____.
 (a) $EG_1 < EG_2 < EG_3$ (c) $EG_1 > EG_2 > EG_3$
 (b) $EG_1 = EG_2 = EG_3$ (d) $EG_3 < EG_1 < EG_2$
- 31) _____ band is above the Fermi level.
 (a) Conduction (c) Valence
 (b) Low energy (d) High energy
- 32) The amount of ionization produced by radiation in a detector should be _____ the energy it loses in the sensitive volume.
 (a) directly proportional (c) almost independent of
 (b) inversely proportional (d) not related to
- 33) _____ accelerator is a high voltage generator based on a system of rectifiers.
 (a) Van de Graff (c) Cyclotron
 (b) Cockcroft and Walton (d) all of the above
- 34) _____ such as gallium, boron and indium are used to make p-type semiconductors.
 (a) Donor impurities (c) n-elements
 (b) Acceptor impurities (d) p-elements
- 35) The advantage of diffusion junction detectors is _____.
 (a) their ruggedness (c) their color
 (b) their greater resistance to contamination (d) both (a) and (b)
- 36) Slow neutrons interact with ^3He and produce _____.
 (a) $^4\text{He} + p$ (c) $^3\text{H} + p$
 (b) $^4\text{H} + \alpha$ (d) $^3\text{He} + \alpha$

-
- 37) The _____ accelerator uses rapidly changing high frequency voltages instead of direct voltages.
- | | | | |
|------------------|--------------------------|----------------------|--------------------------|
| (a) Van de Graff | <input type="checkbox"/> | (c) linear | <input type="checkbox"/> |
| (b) Cyclotron | <input type="checkbox"/> | (d) both (b) and (c) | <input type="checkbox"/> |
-
- 38) In semiconductor materials, the average energy required to create a charge carrier is _____ than that required for gas ionization.
- | | | | |
|----------------------|--------------------------|-----------------------|--------------------------|
| (a) 100 times larger | <input type="checkbox"/> | (c) 10 times smaller | <input type="checkbox"/> |
| (b) 10 times larger | <input type="checkbox"/> | (d) 100 times smaller | <input type="checkbox"/> |
-
- 39) The spectrum of pulse heights will be _____ if a particle loses all its energy in the detector.
- | | | | |
|--|--------------------------|---|--------------------------|
| (a) a Gaussian peak with low energy tail | <input type="checkbox"/> | (c) a Gaussian peak with high energy tail | <input type="checkbox"/> |
| (b) a Gaussian peak | <input type="checkbox"/> | (d) a linear function | <input type="checkbox"/> |
-
- 40) _____ accelerators are now widely used in a variety of applications for scientific research, applied physics, medicine, industrial processing.
- | | | | |
|----------------------|--------------------------|-------------|--------------------------|
| (a) Charged particle | <input type="checkbox"/> | (c) Light | <input type="checkbox"/> |
| (b) Electromagnetic | <input type="checkbox"/> | (d) Neutron | <input type="checkbox"/> |
-

	TANTA UNIVERSITY- Faculty of Science - Department of Physics			
	Physics & Biophysics - امتحان المستوى الرابع			
COURSE TITLE:	Defectors & Accelerators		COURSE CODE: PH4163	
DATE:	28 - 12 - 2022	TERM: FIRST	TOTAL ASSESSMENT MARKS: 100	TIME ALLOWED: 2 HOURS

Part B: (Total 60 marks)

- 1) (a) What are the main components of the photomultiplier tube and what are their functions? (15 marks)
 (b) What are the sources of the dark current in photomultiplier tubes? (5 marks)
- 2) (a) Discuss and sketch the alpha-particles' spectrum from a large BF_3 tube and then explain the wall effect and it could be overcome. (10 marks)
 (b) Sketch and explain the relationship between charges collected and applied voltage for gas counters. (10 marks)
- 3) (a) Explain the mechanism of the scintillation process in organic scintillators. Use drawing for the energy levels. (10 marks)
 (b) Give an account of the acceleration process of ONLY one, either the linear accelerator OR the Cyclotron. (10 marks)

