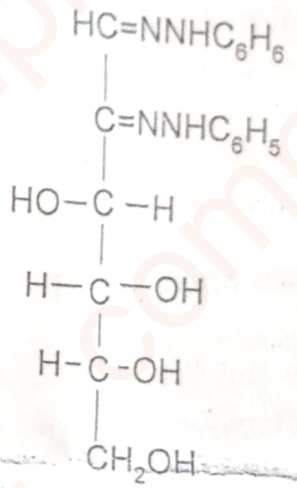
OBAFEMI AWOLOWO UNIVERSITY, ILE-IFE, NIGERIA
RAIN SEMESTER EXAMINATION 2015/2016 SESSION
CHM 308: NATURAL AND SYNTHETIC MACROMOLECULES
ANSWER SECTION A AND SECTION B IN A SEPARATE BOOKLET
TIME ALLOWED: 2 HOURS
Instructions:
Write your Name and Registration Number. Also, append your signature on your answer scripts.

SECTION A

Answer question 1 and any other one question

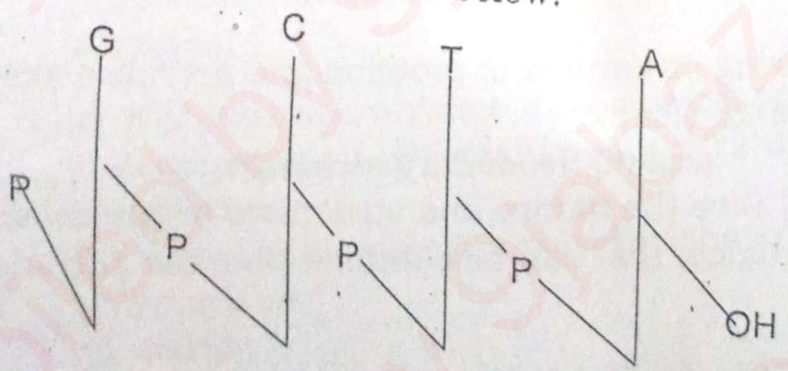
1. With the aid of suitable chemical equations, explain the following transformation:

(a) i. D-glucose $\longrightarrow$



(b) Draw the structures and provide the IUPAC names of the following: *(i)* Cellobiose (ii) α-Lactose (iii) Cytosine and (iv) Uridine monophosphate.

(c) Draw the primary structure of polynucleotide (DNA) represented with lines and alphabets below:



SECTION B

Answer question 4 and any other one question

4. (a) Give the structures of the monomers and initiators, catalyst and / or co-catalyst, where necessary, that would be needed in the formation of each of the following polymeric materials:
(i) poly (ethylene terephthalate) bottles (ii) polyhexamethylene suberamide fiber
(iii) rubber band and (iv) Phenol-formaldehyde resin. **(8 marks)**
(b) Draw labeled stress-strain curves to show the differential responses of the above polymeric materials in question 4a (i)-(iv). [Note: use only one graph using the same axes for all the curves] **(4 marks)**
(c) What is paint? What are the major components that you will require for making any white paint? **(5 marks)**
(d)(i) What do you understand by fibers?
(ii) Give **two** requirements for a fiber forming polymer. **(2 marks)**
(iii) State with **three** examples the criteria for classification of some polymers as melt spinning. **(6 marks)**

5. (a) Account for the following observations using examples, equations and / or illustrations, where necessary:
(i) In ionic chain addition polymerization, propylene goes by cationic whereas methyl methacrylate prefers anionic polymerization. **(4 marks)**
(ii) If a polymer material is to be utilized for making filters for laboratory *filtrations an inert atactic* polymer will be preferred to its isotactic *isomer.* **(3 marks)**
(b) Calculate the number degree of polymerization for a monodispersed *poly(isobutylene)* polymer having molecular weight of 4.47×10^6 g mol^{-1}. **(4 marks)**

6. (a) With reasons, arrange the following polymers in order of
(i) **decreasing** glass transition temperature (T_g): (A) Linear low density polyethylene
(B) branched low density polyethylene and (C) linear high density polyethylene.
(4 marks)
(ii) **increasing crystalline** melting point (T_m): (A) Linear low density polyethylene (B) branched low density polyethylene and (C) Nylon 66. **(4 marks)**
(b) Using structures **only** showing all bonds and atoms / groups of atoms, distinguish between alternate and block acrylonitrile-co-vinyl chloride. **(2 marks)**

OBAFEMI AWOLOWO UNIVERSITY, ILE-IFE

B.Sc. Degree Chemistry Test

Rain Semester 2016/2017 Session

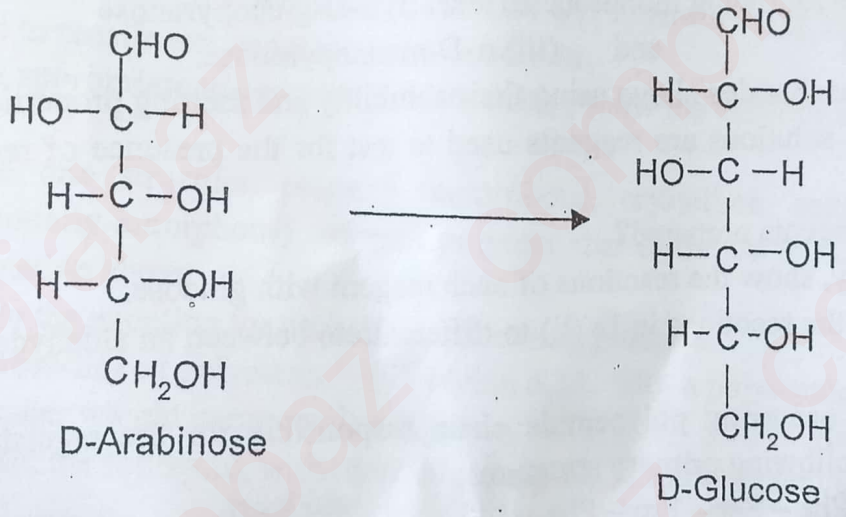
CHM 308: Natural and Synthetic Macromolecules

March, 2017

Time Allowed: 40 mins

1a. When D-glucose reacts with bromine water, a compound that produces CO_2 with $CaCO_3$ was formed.
(i) Draw the structure and give the name of this compound.
(i) With the aid of suitable equation, show the compound that is formed when the compound in 1a (i) above undergoes hemiacetal reaction. What is the IUPAC name of the compound?

b. With the aid of suitable chemical equations, explain the following transformation:



c. Draw the structures of the following:
(i) Adenosine and (ii) Guanosine monophosphate

Total mark is 15

OBAFEMI AWOLOWO UNIVERSITY,ILE-IFE

CHM 308 TEST 2017/2018 SESSION

INSTRUCTIONS: Attempt All questions. Answer question 1 by using the first half and question 2 in the second half of the answer booklet.

Time Allowed:1 hour

1.(a) Write the structure of (i) glucose and (ii) mannose

(b) Using the physical properties only distinguish between the two monosaccharides in question 1.a(i) and 1(ii) above.

(c) A monosaccharide was oxidized by Fehling's and Benedict's solutions. By equation only, show the reactants and the products.

(d) Can the reaction in question 1(c) above be used to distinguish between an aldose and a ketose? Explain

(e) Write the structures and names of the two naturally occurring disaccharides formed from D-gluccose.

2.(a) Using different monomers, write one equation to show (i) cationic and (ii) anionic chain addition polymerizations indicating their initiator(s) or catalyst(s), as appropriate.

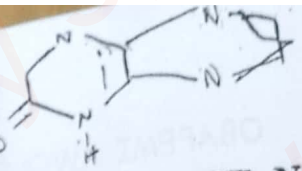
(b) Give the structure of polymer that can address the following:

(i) fibre making but dry spun (ii) paint making but heterochain (iii) thermoplastic wares but amorphous and (iv) formed by ring opening polymerization

(c) Draw the stress-strain curves, with correct labelings. that can be used to distinguish the following

(i) Poly(vinyl chloride) (ii) phenol-formaldehyde (iii) rubber band and (iv) Nylon 6,6 for wears.

(d) Give one chemical test (reagent(s), observations and inference) to distinguish between styrene and propylene monomers.



OBAFEMI AWOLOWO UNIVERSITY, ILE-IFE, NIGERIA

DEPARTMENT OF CHEMISTRY

B.Sc. Degree (Chemistry) Examination (Part III)

CHM 308: Chemistry of Natural and Synthetic Polymers

2017/2018 Rain Semester Examination

Time Allowed: 2 Hours **Date: January 21, 2019**

Instructions:

(i) Attempt ALL Questions

(ii) Answer Both Sections in the Same Booklet.

SECTION A

1a. Write the structure of the following monosaccharides: (i) α-D-glucopyranose (ii) α-D-galactopyranose and (iii) α-D-mannopyranose.

1b. Differentiate the monosaccharides above using their solubility and melting properties.

1c. Tollen's and Benedict's solutions are reagents used to test for the presence of reducing sugars.

(i) How are these reagents prepared?

(ii) By equations only, show the reactions of each reagent with glucose.

(iii) Can you employ the reactions in 1c (ii) to differentiate between an aldehyde and a ketose?

1d. Bradykinin, a naturally occurring polypeptide chain responsible for the regulation of blood pressure, has the following primary structure:

Arg – Pro – Pro – Gly – Phe – Ser – Pro – Phe – Glu.

Write the structure of

(i) the most basic amino acid (in Bradykinin) in acidic medium;

(ii) the C-terminal amino acid in basic medium; and

(iii) Phe in neutral medium; and

(iv) How would you synthesize this oligopeptide in the laboratory?

2a. Schematically show the bonds that hold the tertiary structure of proteins together.

2b. Draw the structure of the following bases found in nucleic acids

(i) Guanine (ii) Uracil (iii) Thymine

c. Which of the bases listed in question 2b above is / are not normally found in RNA?

d. Show the hydrogen bonds between complimentary nucleotides that make the DNA strong.

The hereditary information in human gene DNA for globin β-chain is contained in the genetic code 5'……ACT GCC CTG TGG GGC AAG GTG……..3'

(i) Write out the nucleotide sequence of the complimentary strand of the DNA

(ii) What is the sequence of the nucleotides on the messenger RNA?

---P.T.O---

$COOH(CH_2)_y NH_2 \xrightarrow{\Delta} [CO(CH_2)_y NH]_n + H_2O$

SECTION B

Answer ALL Questions in this section

3(a). Butyl lithium reagent was added separately to monomers **A, B and C** under appropriate reaction conditions.

Reaction with **A** gave polymer **D** which is useful in making automotive light covers, its reaction with **B** resulted in formation of **E** , a high molecular weight compound capable of decolourizing Br_2/CCl_4 useful in making tires.

Reaction with **C** gave polymer **F** useful in making wears whose filaments are dry spun and used in making paint.

(i) With appropriate equations, identify the structures of **A, B, C, D, E and F.**

(ii) Draw well- labeled stress-strain curves for **D, E and F** using the same axes when each is subjected to tensile test under the same condition.

(iii) With appropriate mathematical relationship, show the order of increasing **stiffness** of **D, E, and F.**

(iv) State **one** structural property (amorphous, crystalline, semi/essentially crystalline and semi/essentially amorphous) of each polymer that informed the use(s)/application(s) stated in the information above

(b) Write the equation for each of the following products:

(i) a cross-linked polyester, (ii) Nylon 6,10, (iii) a polycondensate formed without loss of low molecular weight compounds e.g. water, and (iv) polyethylene oxide.

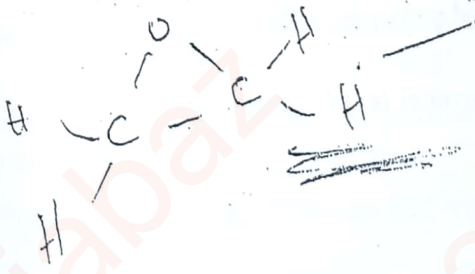
4(a) Explain the following with relevant examples, illustration and/or equations, where necessary:

(i) wet spinning (ii) self polycondensation, and (iii) glass transition temperature

(b) Give **two** differences between the following pairs (in a tabular form):

(i) syndiotactic and atactic polymers, and (ii) free radical and cationic chain addition polymerization

$COOH(CH_2)_y NH_2$



OBAFEMI AWOLOWO UNIVERSITY, ILE-IFE

Rain Semester 2018/2019 Session, Mid - Semester Test

CHM 308: Chemistry of Natural and Synthetic Macromolecules

October, 2019 Time Allowed: 1hr.

Instruction: Answer all Questions; sections A and B should be answered in separate booklets

Section A

1(a) Clearly define the following terms (i) Monomer (ii) Degree of polymerisation

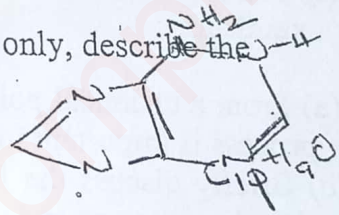
(b) What are polymers? Classify them based on processing behaviour with suitable examples

(c) Write brief explanatory notes on the following

(i) Addition polymers (ii) Condensation polymers

(d) From a chemical point of view, describe the term: - pre-ripening. Why do you think ripening process is important in the production of viscose rayon?

(e) Starting from cellulose and using appropriate chemical equation(s) only, describe the production of cellulose xanthate



15 Marks

Section B

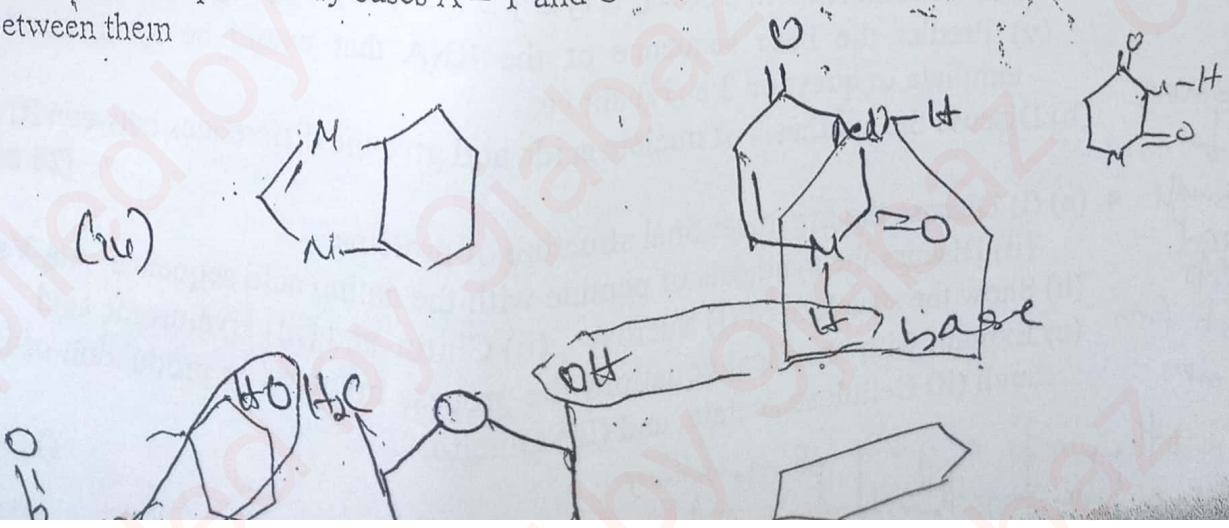
2(a) Draw the structures of anomers of D – glucose. Give the structures of and mention the anomers found in each of the following: (i) Starch (ii) cellulose (iii) chitin

(b) Show the equations for the reaction that takes place when starch is modified by (i) oxidation (ii) phosphorylation

(c) Draw the structure of a named (i) base found in RNA only (ii) base found in DNA only (iii) base found in both DNA and RNA (iv) Nucleoside (v) nucleotide

(d) Give the structure of complimentary bases A – T and C – G, to show how hydrogen bonds were formed between them

15 Marks



OBAFEMI AWOLOWO UNIVERSITY, ILE-IFE, NIGERIA
DEPARTMENT OF CHEMISTRY

B.Sc. Degree (Chemistry) Examination Part III

CHM 308: Chemistry of Natural and Synthetic Macromolecules

Rain Semester Examination 2018/2019 Session

Time Allowed: 2 Hours **Date: 9th December, 2019**

Instructions: Answer all Questions. Sections A and B should be answered in separate booklets.

Section A

1. (a) What are polymers? Classify them based on processing behaviour with suitable examples.
   (b) "Wool clothing and other wool products will last a long time but if they ever end up in the landfill they will break down and become part of the soil" Discuss.
   (c) Define the term **organic cotton**. Explain why long and extra staple cottons are increasingly used in textile production.
   (e) Define a protein in polymer science language. **Silk sericin** is a natural macromolecular protein derived from silkworm *Bombyx mori*! Describe in details, the chemistry of sericin.
   (f) Starting from cellulose, use chemical equations only to explain the production of cellulose xanthate.

(20 marks)

2. (a) From a chemical point of view, explain the term, pre-ripening. Why do you think ripening process is important in the production of viscose rayon?
   (b) Briefly discuss the following types of viscous rayon (i) flame retardant rayons (ii) super absorbent rayons and (iii) High wet modulus rayon.
   (c) Using phenol as a starting material, show by chemical reaction how Bakelite can be prepared. Why is Bakelite not used in forming molded object?

(15 marks)

Section B

3. (a) (i) Write the names and the structures of the bases that constitute nucleic acid.
   (ii) List the names of (A) base found in RNA only (B) base found in DNA only
   (iii) Show how hydrogen bond is formed among complementary bases found in nucleic acid.
   (iv) Predict the sequence of bases in the DNA strand that is complementary to the single DNA strand shown: 5'A – C – G – T – C – T – T – A – G – C – 3'
   (v) Predict the base sequence of the RNA that would be synthesized from the DNA template in question 3 a (iv) above.
   (b) Discuss the synthesis of nucleic acids and give the differences between RNA and DNA

(20 marks)

4. (a) (i) Discuss the organisational structure of proteins.
   (ii) Discuss the synthesis of peptide with the amino acid sequence: Ala-Val-Glu-Ser-Gly.
   (b) Show the structure of (i) Sucrose (ii) Chitin and (iii) Hyaluronic acid
   (c) Explain with chemical equations the process involved in production of (i) Phosphorylated starch (ii) Cellulose acetate and (iii) Glucitol

(15 marks)

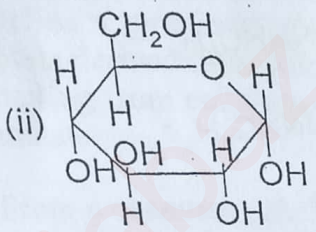
d) Using Gabriel's Phthalimide synthesis, show how alanine is obtained in the laboratory.

(ii) With the aid of a suitable chemical equation, explain how the following amino acids are obtained in the laboratory: (A) Alanine by **Strecker synthesis** and (B) Aspartic acid by **Gabriel phthalimide synthesis.**

20 MARKS

2. (a) With the aid of suitable equations, explain the following conversions and provide the structures and IUPAC names of the compounds represented with alphabets where applicable:

(i) D-glucose $\longrightarrow$ D-arabinose

(ii) 

$\xrightarrow{H^+ / H_2O}$ A $\xrightarrow{(CH_3)_2SO_4 \,.\, NaOH}$ B

(b) There are only two types of bases in nucleic acids, draw and name them.

(c) Discuss the ecological functions of lignin.

15 MARKS

3. (a) Provide the names and structures of compounds represented with alphabets in the following equation:

$$2\,C_6H_5CHO + C \xrightarrow{(CH_3CO)_2O} D \xrightarrow[P]{HI} 2\,C_6H_5CH_2\underset{\displaystyle NH_2}{\underset{|}{C}}HCOOH$$

(b) Discuss the following structures of proteins and provide a sketch of each structure where applicable:

(i) Primary structure and (ii) Secondary structure.

(c) i. Define lignin (ii) Give the names and structures of guaicol and any three derivatives of guaicol that can be obtained from the degradation of Lignin.

15 MARKS

OBAFEMI AWOLOWO UNIVERSITY, ILE-IFE

Mid-Semester Examination 2019/20 Session

CHM 308: Chemistry of Natural and Synthetic Macromolecules

September, 2021 **Time Allowed: 30min.**

Answer all

1. (i) Write the structure of monomers of:
   (a) Starch (b) cellulose (c) Chitin (c) Hyaluronic acid

(ii) Write out the structure of starch to explain the formation of α-1-4 and α-1-6 glycosidic bonds

(vi). Explain with chemical equations the process involved in production of (i) Phosphorylated starch (ii) Cellulose acetate

(iii) Give the names and the structure of: (i) a neutral amino acid (ii) a sulphur containing amino acid (iii) Aromatic amino acid

(iv) Show how peptide bond can be formed between two named amino acids.

(v) List the names of (i) base found in RNA only (ii) base found in DNA only (iii) base found in both DNA and RNA

(15 marks

2021/2022 Mid Semester Test (Rain)

CHM 308: Natural and Synthetic Macromolecules

June, 2024 **Time Allowed: 45 Min.**

SECTION A

1. (a) In term of structure, define a nucleotide.
2. (b) Draw the structure of ATP and give its IUPAC name. If the ATP is completely hydrolyzed by NaOH, provide the names and structures of the compounds obtained.
3. c. Translate the polynucleotide given below to line notation using letters and lines: pGpGpApTpCpA.
4. d. Use Chemical equations to explain the following transformations:
   (i) D - glucose ⟶ D – arabinose
5. What is the name of the reaction in question (1 d i) above?
6. (ii) Methyl – α – D – glucopyranose ⟶ Methyl – α – 2, 3,4,6 – tetra – o – methyl – D – glucopyranoside.
7. (iii) Use the structure of cellulose to explain how its monomer(s) combined. What is or are the IUPAC name(s) of its monomer(s)?

   Total mark is 15 marks

SECTION B

2 a. Write short notes on: (i) Thermoplastics (ii) Thermosets (iii) Elastomers and (iv) Ring opening polymerization.

b. List the different applications of Low Density Polyethylene (LDPE) that you have studied.

3 a. (i) With the aid of balanced equations only, describe the various routes for the preparation of acrylonitrile.

(ii)Write down the balanced equation stating all the conditions for the preparation of Poly(acrylonitrile).

(iii) What is the molecule weight (molar mass) of polystyrene with a degree of polymerization 1000.

b. In a tabular form only, give the corresponding monomer and repeat units for the following polymers: (i) Polystyrene (ii) polyethylene and (iii) Polycaprolactam.

Total mark is 15 marks

BSC DEGREE EXAMINATION

2021/2022 Rain Semester Examinations

CHM 308: Natural and Synthetic Macromolecules

June, 2023 Time Allowed: 2 hrs.

Instruction: Answer sections A and B in separate booklets

SECTION A

1. (a) Using the technique of oxidation, methylation and hydrolysis in this order, prove that the structure of lactose is made up of two saccharides and indicate the carbons involved in its glycosidic bond formation.

Note: The IUPAC names of all the products formed in these reactions must be provided.

(b) D-fructose is a non-reducing sugar but was observed to give positive test with Tollens' reagent. With the aid of a suitable mechanism, account for this observation.

c. (i) Using D-arabinose, show with mechanism how a reducing sugar reacts with cyanide and provide the name of the reaction.

(ii) If the product of the reaction in question 1 c. (i) above is hydrolysed using dilute HCl, draw and provide the name(s) of the product(s) formed.

d. (i) Draw the structures of the following polysaccharides and provide the structure(s) and IUPAC name(s) of the disaccharide(s) formed when they are partially hydrolysed with dilute HCl:

(i) Cellulose (ii) Amylose and (iii) Amylopectin.

2. (a) (i) A DNA was observed to have primary structure represented with alphabets as given below, draw the actual primary structure of the DNA:

pGpApCpT.

(b) List all the four bases found in DNA and draw the structures of how they are paired.

(c) 2 – amino pyridine is one of the important bases found in nucleic acid, explain with chemical equation how this compound can be synthesized from guanidine.

3. (a) Draw the structures of the following amino acids:

(i) Aspartic acid (ii) Cysteine and (iii) Lysine.

(b) With the aid of chemical equation only, explain how phenylalanine is obtained from Sodiomalonic ester using malonic ester synthesis.

(c) Sanger reagent (FDNB) is a useful reagent for the N-terminal analysis of proteins. With the aid of chemical equation, explain how this reagent function in this analysis.

Total mark is 30

4. a. Define an epimer.

b. Classify the following sugars as either reducing or non-reducing sugar and give reasons for your classification: (i) Sucrose (ii) maltose (iii) Gentiobiose and (iv) Fructose.

(c) In not more than one sentence, give reason why β - anomer of D-glucose is 64% while α - anomer of D-glucose is 36%.

(d) In one sentence, give reason why DNA is more stable than RNA and list the names of all the bases found in RNA.

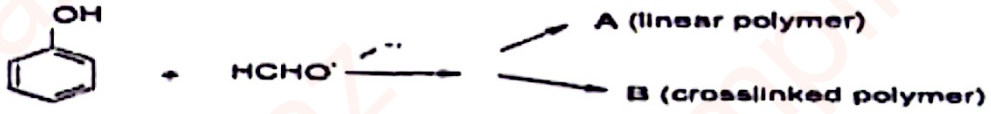
(e) Arrange in ascending order based on strength of protein structures given below and give reasons for your answer:

Secondary, Primary, Tertiary and Quaternary structures of protein.

Total mark is 10

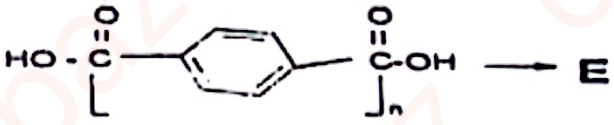
SECTION B

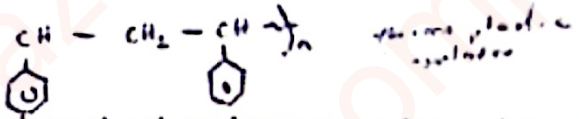
5. With the aid of suitable chemical equations, explain the following transformations and provide the names of all the polymers formed that are represented with alphabets (A to F).

(a) 

(b) $H_2N\text{-}C(=O)\text{-}NH_2 + HCHO \longrightarrow C$

(c) $H_2N\text{-}(CH_2)_6\text{-}NH_2 + HO\text{-}C(=O)\text{-}(CH_2)_4\text{-}C(=O)\text{-}OH \longrightarrow D$

(d) $HO\text{-}CH_2\text{-}CH_2\text{-}OH +$  $\longrightarrow E$

(e) $[C_6H_5\text{-}CH{=}CH_2]_n \longrightarrow F$ 

6. (i) Write the polymer chain of natural rubber showing how the three isoprene units are joined together.

(ii) Write down all the properties of natural rubber which make it unsuitable for commercial Purposes.

(iii) Discuss how the properties mentioned in 6(ii) above can be improved.

(iv) What do you understand by biodegradable polymers?

(v) State all the differences between chain growth (addition) polymerization and step growth (condensation) polymerization.

(vi) Discuss the Chemistry of resins taken into consideration their production, structures, and uses.

Total mark is 30

OBAFEMI AWOLOWO UNIVERSITY, ILE-IFE, NIGERIA
BSc DEGREE EXAMINATION
2022/2023 Mid Semester Test (Rain)

CHM 308: Natural and Synthetic Macromolecules

May, 2023 **Time Allowed: 1 hr.**

Instruction: Answer sections A and B in the same booklets

SECTION A

1. (a) A student on her final year project needs D-glucose for her study but only D-arabinose was available in the laboratory, as a carbohydrate Chemist, advise her on how she can convert D-arabinose to D-glucose using chemical equation only.
(b) The D-glucose formed in question 1 (a) above was observed to have undergone hemiacetal reaction using its hydroxyl group on position 5, draw the structure of the product of the reaction and provide the IUPAC name of the compound formed.
In one sentence, confirm with reason if the product of the reaction is a reducing sugar of not.

2. (a) Draw the structures for the following compounds:
(I) Adenosine and (II) Guanosine monophosphate.
(b) Write down the constituents of the following compounds:
(I) Nucleoside (II) Nucleotide and (III) Nucleic acid
(b) Starting from urea, use chemical equation to explain the synthesis of pyrimidine.

Using Strecker's synthesis, explain how you would obtain alanine in your laboratory.
20 marks

SECTION B

$CH_2=CH_2$ and $CH_2=C(CH_3)_2$

A B

4. (a) Compounds A and B above are monomers, using free radical mechanism for A and cationic mechanism for B, explain how each of the compounds could form addition polymers.
(b) Write a short note on each of the following:
i. Copolymers and homopolymers (II) Thermosetting plastics and thermoplastics polymers (III) Syndiotactic and Isotactic polymers (Iv) Elastomers and (v) Fibres
(c) Write down the differences between addition and condensation polymerization
Mark 10

Department of Chemistry
OBAFEMI AWOLOWO UNIVERSITY, ILE-IFE
B.Sc. Chemistry Degree Examination
RAIN SEMESTER EXAMINATION, 2022/2023 SESSION

CHM 308: Natural and Synthetic Macromolecules

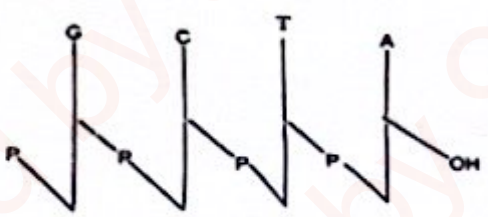
July, 2024 **Time Allowed: 2½ hrs.**

Instruction: Attempt all questions. Answer sections A and B in the same booklet

SECTION A

1. (a) Explain with suitable chemical equations the following transformations:
(i) D - fructose ⟶ D – glucose
(ii) D – arabinose ⟶ D- glucose
(b) The D – glucose formed in question (1a (ii)) above was observed to have undergone an intramolecular reaction leading to the conversion of its Fisher projection to its Haworth structure, write down this Haworth structure and provide its IUPAC name. What is the name of this intramolecular reaction?
(c) Draw the structures of the following polysaccharides and write down all the differences between them:
(i) Cellulose and (ii) Amylopectin.
(d) Using a suitable chemical method of structural elucidation, show that D – arabinose is made up of five (5) carbons chain. **(Note: all the steps must be shown in order to score the mark).**
(e) Using the technique of oxidation, methylation and hydrolysis in this order, prove that Gentiobiose is made up of two saccharides and indicate the carbons involved in its glycosidic bond formation. Provide the IUPAC name of Gentiobiose.

2. (a) A typical polynucleotide (DNA) is represented by line notation as given blow, if this DNA is completely hydrolyzed with a suitable base, provide the names and structures of all the products obtained. **(Note: the number of each product formed must also be provided):**



(b) There are two types of bases in nucleic acid, draw and name them.
~~(c) Starting from urea, use chemical equation to explain the synthesis of pyrimidine.~~

3. (a) Draw the structures of the following amino acids:
(i) Histidine (ii) methionine and (iii) proline.

(b) Using Gabriel's phthalimide synthesis, how would you synthesize **Glycine** using a suitable alpha halo ester and potassium phthalimide?

(c) (i) Draw the structure of the tripeptide given below:

Glycyl alanyl lysine.

(ii) If Phenylisothiocyanate is used for the N – terminal analysis of a tripeptide given in question 3. (c) (i) above, show with a suitable mechanism how this reagent reacts with the N – terminal amino acid in the peptide.

4. (a) Draw the structures and provide the names of the monomeric units of lignin that you know.

(b) Define lignin.

(c) (i) Write a short note that is not more than three sentences on ***Sulfite pulping.***

(ii) List all the benefits that can be derived from ***Sulfite pulping method***

Total mark is 35 marks

SECTION B

5. (a) (i) Suppose there are 50 polymer molecules of molecular weight 10^2, 200 polymer molecules of molecular weight 10^3 and 100 polymer molecules of molecular weight 10^4 calculate the number average molecular weight and weight average molecular weight.

(ii) Calculate the heterogeneity index and comment on your result.

(b) (i) In a tabular form only give the corresponding monomer and repeat units for the following polymers: (A) Polystyrene (B) polyethylene and (C) Polycaprolactam.

(ii) Illustrate the Isotactic, Syndiotactic and Atactic polymer structure using a chain of polystyrene.

(c) (i) With the aid of balanced equations only, describe the various routes for the preparation of acrylonitrile.

(ii) Write down the balanced equation stating all the conditions for the preparation of Poly (acrylonitrile)

6. (a) (i) Define fibre and list the six different classes of synthetic fibres you have studied.

(ii) With the aid of balanced equations describe the steps involved in the preparation of viscous rayon.

(b) (i) What is the molecule weight (molar mass) of polystyrene with a degree of polymerization of 1000?

(ii) write short notes on the ***Dry Spinning*** and ***Cold drawing.***

(c) (i) With the aid of balanced chemical equations stating all conditions required, describe the synthesis of Poly (Vinyl acetate).

Total mark is 35 marks

OBAFEMI AWOLOWO UNIVERSITY, ILE-IFE, NIGERIA
BSc DEGREE EXAMINATION
2023/2024 Mid Semester Test (Rain)
CHM 308: Natural and Synthetic Macromolecules

May, 2023 **Time Allowed: 45 Mins.**

Instruction: Answer sections A and B in the same booklets

SECTION A

1. (a) Provide the IUPAC name(s) and structure(s) of the disaccharide(s) formed when starch is partially hydrolyzed with dil. HCl.
(b) With the aid of equations, show keto – enol and amine – imine tautomerism in purine and pyrimidine.
(c) A segment of RNA molecule is made up of guanine, cytosine, uracil and adenine, show how the nucleotides of these bases are linked together in the polymer.
(d) 2-aminopyrimidine is one of the important bases found in nucleic acid, use chemical equation to show how this compound is synthesized from guanidine.
(e) Draw the structures of the following amino acids: (i) aspartic acid (ii) lysine and (iii) proline.
15 marks

SECTION B

2. a. (i) Define *polymerization (ii) with the aid of a flow diagram only classify polymers* on the basis of thermal properties.
b. Draw a labeled diagram of the molar mass distribution curve for a typical polymer.
c. With the aid of equations and starting from number average molar mass $\bar{M}_n$, deduce or proof that, the number average degree of polymerization is $\bar{X}_n = \frac{\bar{M}_n}{Mo}$

3. a. Write short notes on (i) Ring opening polymerization and (ii) Polymer tacticity.
b. Describe with relevant equations all the possible methods in the termination step of free radical (chain) addition polymerization.
c. What is the molecule weight (molar mass) of polystyrene with a degree of polymerization of 1000.
Mark 15

OBAFEMI AWOLOWO UNIVERSITY, ILE-IFE, NIGERIA
DEPARTMENT OF CHEMISTRY

B.Sc. DEGREE EXAMINATION
RAIN SEMESTER, 2023/2024 SESSION

CHM 308: Natural and Synthetic Macromolecules

TIME ALLOWED: 2 hours **DATE: Monday, 14th July 2025**

INSTRUCTIONS: Answer sections A and B in the same booklet

SECTION A

1. (a) (i) A student on her final year project needs D - glucose for her study but only D - arabinose was available in the store, as a carbohydrate Chemist, advise her on how D - arabinose can be converted to D - glucose using chemical equation only.
(ii) If the D - glucose obtained in question 1 (a) (i) above undergoes intramolecular reaction leading to ring formation. Write down this ring structure. What is the name of this reaction and the IUPAC name of the compound formed.
(b) Draw the structures and provide the IUPAC names of the following compounds where applicable: (i) α-Maltose (ii) α-Cellobiose and (iii) β-Isomaltose. Which of these sugars is or are reducing sugar(s)? Give a reason for your answer.
(c) Provide the name(s) of the polymer(s) from which each of the sugars in question 1 (b) above can be obtained. Draw the structure(s) of the polymer(s) you have chosen.
(d) Using the technique of oxidation, methylation and hydrolysis in this order, prove that sucrose is made up of two saccharides and indicate the carbons involved in its glycosidic bond formation. Provide the IUPAC name of sucrose.
(e) Write down the single strand structure of a DNA molecule consisting of guanosine, cytidine, thyimidine and adenosine in this order.
(f) Sketch how genetic information is copied from a template or non-coded strand of a DNA to give a complementary strand.

2. (a) With the aid of chemical equation, explain the following transformation:

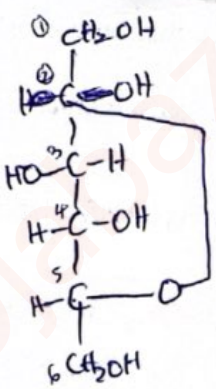
(b) With the aid of a suitable mechanism, show how alanine reacts with 1,2- Benzene dicarbonal.
(c) List all the names of protein structures that you know in increasing order of their strength.
(d) Provide names and structures of the three common monolignols which are components of lignin that you know.
(e) "Although lignin is a problem in pulping but it is a blessing in disguise". In not more than four lines, discuss on the aspect of its blessing.

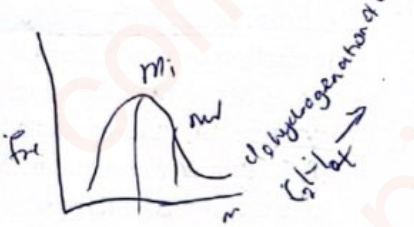
Total mark is 25

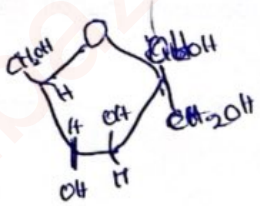
SECTION B

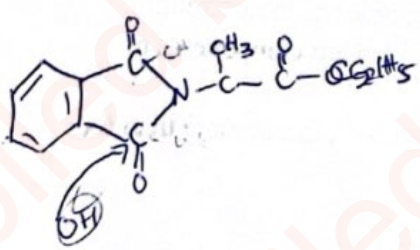
3. a. Write short notes on (i) Thermoplastics (ii) Thermosets and (iii) Elastomers.
b. (i) With the aid of correct structures only using Polystyrene describe tacticity.
(ii) Describe with relevant equations all the possible methods in the termination step of free radical (chain) addition polymerization.
c. Using Azobis Isobutyronitrile (AIBN) as an initiator, write down the reaction scheme for the polymerization of acrylonitrile showing all the steps involved. [Hint: Assume that termination takes place by combination and disproportionation]. **(17 marks)**

4. a. (i) With the aid of balanced equations only describe the preparation of ethylene.
(ii) Mention the most abundant Nigerian raw material you have studied in the preparation of polyethylene.
(iii) Give a stepwise procedure you will use with balanced equations to prepare polyethylene using the most abundant raw material you have mentioned in (ii) above.
b. (i) Draw a labeled diagram of the molar mass distribution curve for a typical polymer.
(ii) In a tabular form only give the corresponding monomers and repeat units of the following polymers: Polyethylene; polystyrene and polyisobutylene.
c. (i) With the aid of equations and starting from number average molar mass $\bar{M}_n$, deduce or proof that, the number average degree of polymerization is $\bar{X}_n = \frac{\bar{M}_n}{Mo}$.
(ii) In free radical (chain) addition polymerization, it is found out that not all the radicals produced go on to initiate chain growth, explain in not more than five lines why this is so.
(18 marks)









Atactic