Ministry of Higher Edu. & Sc. Res.
College of Science
Department of Chemistry
Subject: Heterocyclic compounds.

QUESTION BANK IN HETEROCYLIC COMPOUNDS / 4TH YEAR 2023-2024

Q1/ I- Define the following terms:

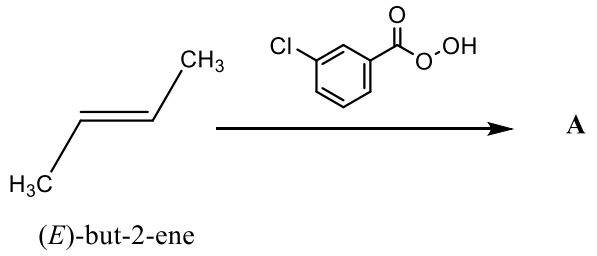
Heterocyclic Compounds, Heteroatoms, Five-member rings compounds, six-member rings compounds, three-member rings compounds

Q2/ Write the structure of the following names.

Coumarin, Pyridazine, Monobactam, oxacyclohexane, 2,3-dihydroazete, thiadizole

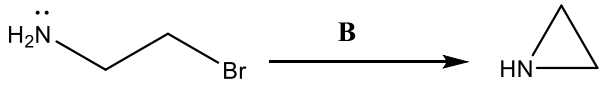
Q3/ Complete the following reactions:

i-



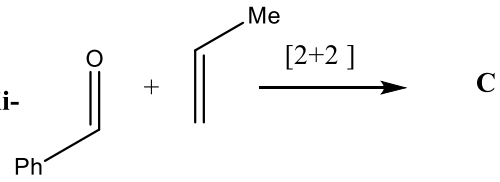
(*E*)-but-2-ene

ii-



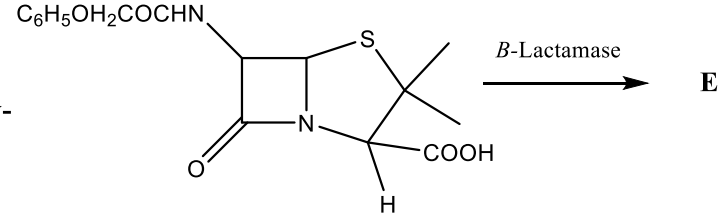
bromoethylamine Aziridine

iii-



iv- Azetdine $\xrightarrow{HNO_2}$ **D**

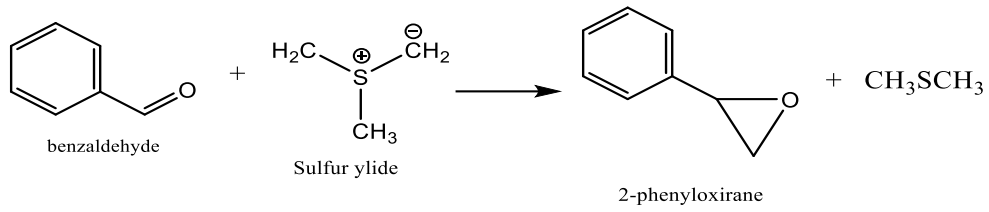
v-



Q4/ I- write the mechanism of the following: (

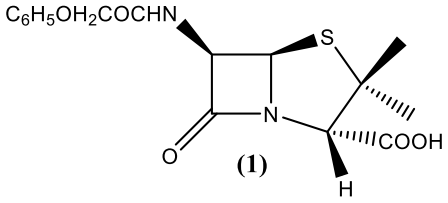
i- Paal Knorr synthesis of furan

ii-



Q5/ prepare the following products by reactions

a- Cephalosporin from 3,3-dimethyl-7-oxo-6-(2-phenoxyacetamido)-4-thia-1-azabicyclo [3.2.0] heptane-2-carboxylic acid **(1)**



(1)

b- Aziridine from Oxirane

Q6/ What is the principle of Hantzsch-Widman Nomenclature?

Q7/MCQ

1- Which of following is five membered heterocyclic compounds?

a- Pyrrole b- furan c- thiophene c- all of them

2- In pyrrole and pyridine, the number of electrons that the N atom contributes to n-system is

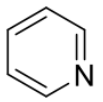
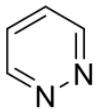
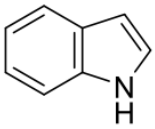
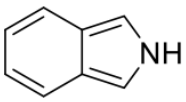
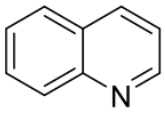
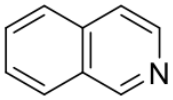
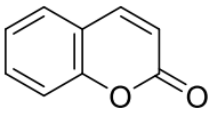
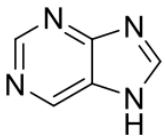
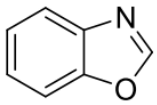
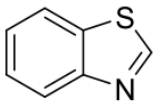
3- Which of the following is not true about the five membered rings?
a) Five membered rings are more stable than 4 membered rings
b) Five membered rings are more stable than 6 membered rings
c) Five membered rings are more stable than 7 membered rings
d) Five membered rings are more stable than 8 membered rings

4- Which of the following is a not a five membered ring?
a-Pyridine
b-Pyrrole
c-Furan
d-Thiophene

5/ Five membered rings come under which category of heterocycle classification on the basis of chemical behavior?

a-excessive heterocycle
b-deficient heterocycle
c-equivalent heterocycle
d-Can't say about the five membered rings

Q6/ Write the name of the following compounds

Q7/ write the reaction and mechanism of Gattermann reaction.

Q8/ Fill the following gaps with the correct words

I- In replacement nomenclature, the heterocycle's name is composed of the carbocycle's name and a prefix that denotes the ……., thus, "……..", "…..……", and "……." are prefixes for a nitrogen ring atom, an oxygen ring atom, and a sulfur ring atom, respectively.

II- Notice that heterocyclic rings are numbered so that the ……. has the lowest possible number.

III- The three-membered heterocyclic compounds with ……. hetero atom have been known for a long time and are important from the …….. and mechanistic point of view.

IV- The bond angles in all these systems fall far below the ideal …….. tetrahedral bond angle and therefore ……

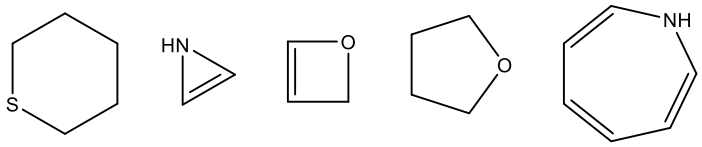
Q9/ Prepare Oxirane form an alkene (by chemical reaction)

Q10/ what is the product of the Epoxidation of Ethylene?

Q11/ How are Heterocyclic compounds classified?

Q12/ Give the Structure of two five-membered heterocyclics with numbering used for IUPAC nomenclature.

Q13/ Name the following compounds



Q14/ Write the structure of the following names

Cephalosporin, Pyridazine, oxazole, pyran, purine

Q15/ 1- Classify the antibiotics which act as inhibitors of cell wall synthesis

2- Antibiotics are ……

……., and antibiotics are divided: a- On type of action: like …… – …….

b. On spectrum of action – antibiotics of …….. – antibiotics of …….

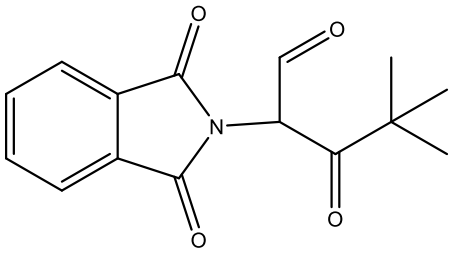
c. On clinical use – …….. – ……..

Q16/ I- write the reaction of the following

1- The Gabriel ring closure for aziridine

2- Epoxidation of an alkene

Q17/ prepare penicillin G from the t-butyl α-phtaliminomalonaldehyde (**A)**

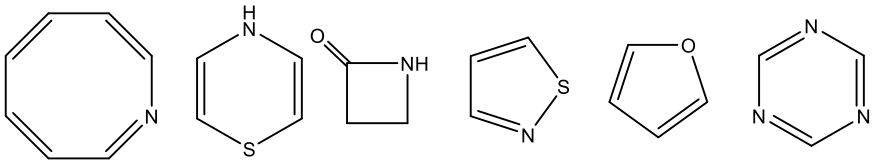


(**A)**

Q17 / I-Fill the following gaps with correct words

1- Hetero-atoms are those ……..
2- Aziridine and its derivatives are produced commercially and are employed in ……., coating and in the ……. industries.
3- The antibiotics of protein synthesis inhibitors acting on ribosomal subunit 50S are a.……...., b …….. , and c……..…….…
4- Ketorolac (Toradol, Roche) is an analgesic and …… drug

Q18/ Write the name the following compounds according to IUPAC nomenclature



Q19/ Draw the structure of the following chemical names

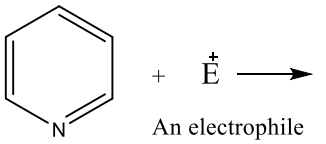
Coumarin, purine, carbapenem, thiirane, benzo[b]pyridine

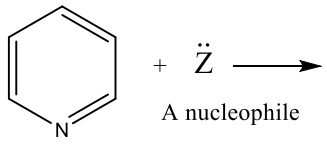
Q20/ write the reactions of Hassner Synthesis

Q21/ write the reactions of Chichibabin reaction

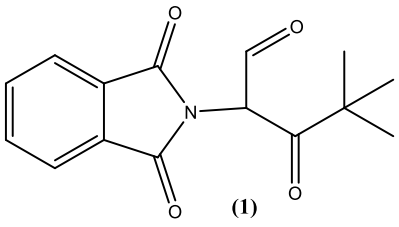
Q22/ Prove that pyridine is more stable than benzene

Q23/ write the all-possible products for the reaction mechanism of pyridine toward nucleophilic and electrophilic substitution reaction, and which position-attack is more stable and favor.

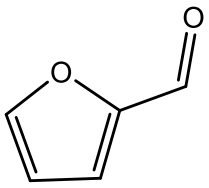




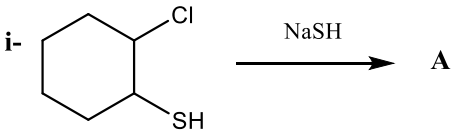
Q24/ Prepare Ampicillin from t-butyl α-phtaliminomalonaldehyde **(1)**

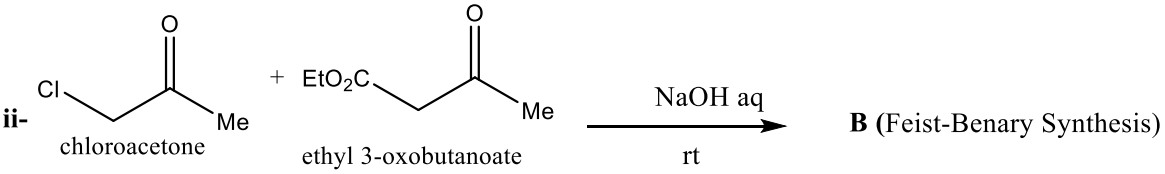


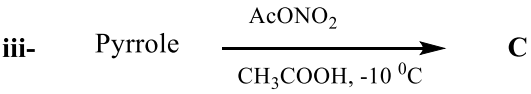
Q25/ Prepare Ranitidine from furfural.

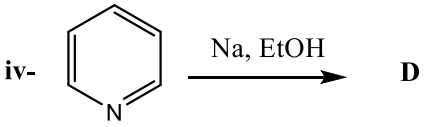

furfural

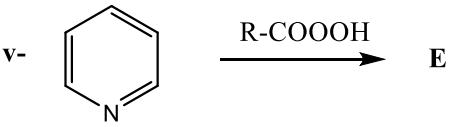
Q26/ Complete the following reactions:

i- 

ii- 

iii- 

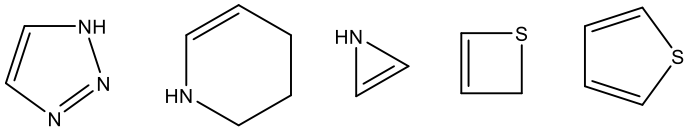
iv- 

v- 

Q 27/ Define the following items

1- Heterocyclic compounds.
2- Antibiotics.
3- Heteroatoms.

Q28/ Name the following compounds according to replacement nomenclature



Q29/ Write the structure of the following names

pyridine, benzo[b]furan, Monobactam, oxacyclohexane, oxirane

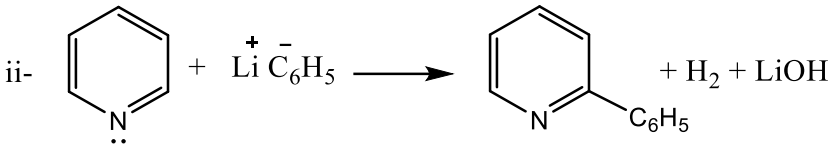
Q30 / write the reactions (all steps) of the following:

The Gabriel ring closure for aziridine

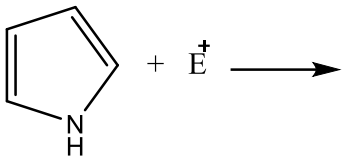
Q31/ Write the Synthesis of thiirane from 2-mercaptoethanol

Q32/ write the mechanisms of the following: Paal Knorr synthesis of furan

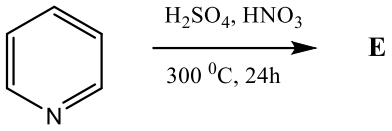
Q33/ write the mechanisms of the following

ii- 

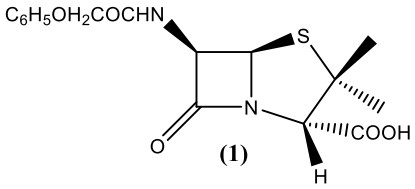
Q34/ Write all possible products for the reaction of pyrrole toward electrophilic substitution reaction and which position-attack is favor.



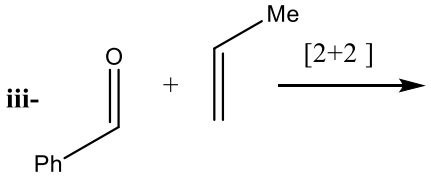
Q35/ Complete and write the name of the following reactions



Q36/ Prepare Cephalosporin from 3,3-dimethyl-7-oxo-6-(2-phenoxyacetamido)-4-thia-1-azabicyclo [3.2.0] heptane-2-carboxylic acid **(1)**



Q37/ Complete and write the name of the following reactions

iii- 

Q38/ Explain the Ring-opening reaction of Pyridine.

Q39/ How the product of Pyridine-N-Oxide formed?

Q40/ Write all possibilities of pyridine reactions toward **nucleophilic** substitution reaction.

Q41/ Write all possibilities of pyridine reactions toward **electrophilic** substitution reaction.

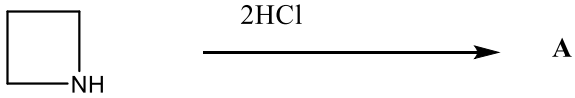
Q42/ Explain why pyridine less reactive than benzene in electrophilic substitution reaction.

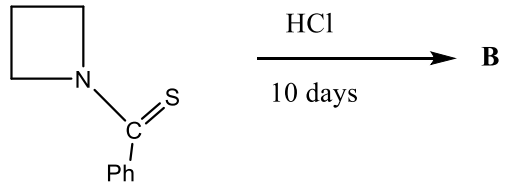
Q43/ Outline the synthesis of indole.

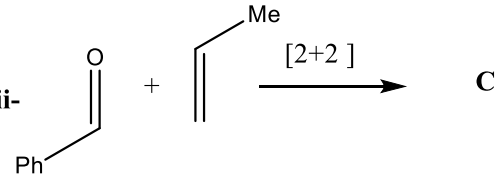
Q44/ Outline the synthesis (cycloaddition) of Oxy-pyridine

Q45/ Explain why quinoline does not give Friedel-craft reaction

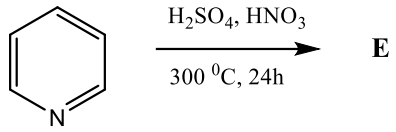
Q46/ Complete the following reactions:

i- 

ii- 

iii- 

iv- Azetdine $\xrightarrow{HNO_2}$ **D**

v- 

Q47/How will you convert furan to pyrrole?

Q48/ Explain why pyridine does not give Friedel-craft reaction.

Q49/ How will you convert furoic acid to furan?

Q50/ How will you convert pyrimidine to pyrazole?

Lecturer

Dr. Karzan Kh. Hameed