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**JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY**

**SCHOOL OF MATHEMATICS AND ACTUARIAL SCIENCE**

**UNIVERSITY EXAMINATION FOR DEGREE OF BACHELOR OF EDUCATION SCIENCE WITH IT**

**4TH YEAR 1STSEMESTER 2016/2017 ACADEMIC YEAR**

**MAIN CAMPUS**

**COURSE CODE:SCH 401**

**COURSE TITLE: HETEROCYCLIC CHEMISTRY**

**EXAM VENUE:**   **STREAM:**

DATE: EXAM SESSION:

TIME: 2.00 HOURS

**Section A: This section contains ONE COMPULSORY question**

# Question 1 (30 marks)

a. Suggest the Hantzsch-Widman name for compounds a-f shown below: (6 marks)

COOH MeMe

N

N

O

S N

H

N

a b c

O O

S

N N N H

d e f

b.

1. Draw the chemical structures for each of the following trivial names: (4 marks)
   1. Thiophene b. Piperizine c. Morphiline d. pyrole
2. What structural feature do the following stems that follow prefixes indicate in the

nomenclature of heterocylces: (6 marks )

* 1. –ir b. –et c. –oc d. –ol

1. Name five sulfonamides that are still in use as medicine. (2.5 marks )
2. Name five pharmaceuticals that contain the pyridine ring and what they treat. (2.5 marks)
3. State three natural heterocyclic compounds and their use in either medicine or

agriculture. (3 marks )

1. Draw the structures of the oxygen containing heterocycles namely furanose and pyranose.

(2 marks )

1. Antipyrine is a pyrazole analgesic and an antipyretic like aspirin. It can be obtained via the Knorr’s synthesis as outlined below. Write the intermediate and the product missing

in the scheme. (4 marks )

NH2 H 3C

H

N

O

O

? Antipyrine

+ O

**Section B: This section contains FOUR question s. Answer ONLY TWO questions.**

# Question 2 (20 marks)

1. Describe and Illustrate the Hofmann exhaustive methylation process for the identification

of cyclic amines using piperidine as an example. (10 marks)

N

H

1. Name three classes of alkaloids and give an example for each. (3 marks )
2. Name two common porphyrins and their associated uses in the living system. (4 marks)
3. Draw the structures of three bases of nucleic acids denoted by the letters **C**, **T** and **U**.

(3 marks )

# Question 3 (20 marks)

1. Briefly describe the Paal-Knorr Synthesis of Pyrroles and illustrate how the method can

be used for the synthesis of 3,4-dimethylthiophene. (8 marks )

MeMe

S

1. Few heterocycles are known in nature where sulfur is the sole heteroatom in the ring.

Draw the structure of two such compounds of thiophene derivatives. (4 marks )

1. What are the names of the five nucleosides that form the monomeric building blocks found in living systems? Draw the structures of their nucleobases. (5 marks )
2. Oxygen containing heterocycles may be cataloged as derivatives of Furan, pyran and

|  |  |
| --- | --- |
| benzofuran ring systems. Name an example for each.  **Question 4 (20 marks)** | (3 marks ) |
| a. Predict the products of the following Aza-Wittig reactions: | (8 marks) |

i.

N

O

R

1

R

2

R

3

P

P

h

3

R

.

T

N

O

R

2

C

O

O

M

e

O

M

e

P

P

h

3

R

1

R

.

T

iii.

N

R

C

O

O

E

t

P

(

O

E

t

)

3

R

.

T

ii.

R2

iv.

N

O

R

1

R

3

N

O

P

P

h

3

R

.

T

1. Name four vitamins in which heterocycles are incorporated in them. (4 Marks )
2. State the name of a chroman based heterocyclic derivative found in vegetable oils.

(2 marks )

1. The only phosphorus-containing ring system found in nature is a cyclic derivative of phosphoric acid.
   1. State its name (1 mark )
   2. Give the name of its phosphoric cyclic ring system (2 marks )
   3. Outline its activity in humans (3 marks )

# Question 5 (20 marks)

1. Outline using a scheme the synthesis of a 1,3-thiazole from a bromoketone and a

thioamide. (6 marks)

1. Give the products and reagents/reaction conditions for the following Heck intramolecular

cyclization reactions: (6 marks)

CH2

i.?

N

B

r

H PhCH2O

?

ii.

tosyl

N

COOEt

? iii.

B

r

O

1. Name three pyrimidine based agrochemicals. (3 marks )
2. Picloram (**a**) is a pyridine based herbicide that selectively kills broad leaf weeds. Outline its synthesis starting from compound the 2-methylpyridine given below. (5 marks )

NH2 Cl Cl

Cl N COOH

**a**

-END-