



**NATIONAL OPEN UNIVERSITY OF NIGERIA**  
**PLOT 91, CADASTRAL ZONE, NNAMDI AZIKIWE EXPRESSWAY, JABI - ABUJA**  
**FACULTY OF SCIENCES**  
**DEPARTMENT OF PURE & APPLIED SCIENCES**  
**2021\_1 EXAMINATION**

**COURSE CODE: CHM 421**

**CREDIT: 2 Units**

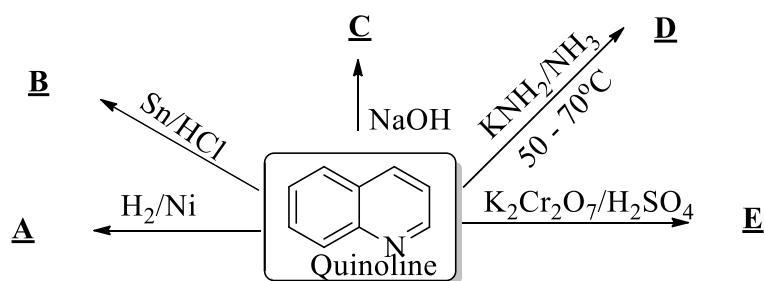
**COURSE TITLE: HETEROCYCLIC CHEMISTRY**    **TIME ALLOWED: 2 Hours**

**INSTRUCTION: Answer Question ONE (1) and any other Three (3) Questions**

- Q1. a) Give a detail account of Chichibabin-type reaction of quinoline (5 marks)  
b) State the general physical properties of indole (5 marks)  
c) With scheme alone, show conversion of indole to 3-chloropyridine (5 marks)  
d) Give account on discovery of chloroquine (5 marks)  
e) Provide structure of warfarin and its three brand names (5 marks)
- Q2. a) Expatriate on general physical properties of quinoline (5 marks)  
b) State advantage of modified Pomeranz-Fritsch synthesis of isoquinoline (5 marks)  
c) List the starting materials required for Reissert Synthesis of indole (5 marks)  
d) Provide products of nitration of benzofuran with  $N_2O_2$  in benzene at  $0^\circ C$  (5 marks)  
e) What are two uses of Raloxifene and the name of heterocycle in it (5 marks)
- Q3. a) In not more than 4 lines, explain what Fischer-Indole process entails (5 marks)  
b) Using scheme only, outline the synthesis of nicotinic acid from quinoline (10 marks)

Q4. Provide the structures of A to E in the reactions of quinoline below

(15 marks)



Q5. Outline scheme for synthesis of chloroquine using Conrad-Limpach approach (15 marks)