KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS
2022/2023 ACADEMIC YEAR

THIRD YEAR FIRST SEMESTER
MAIN EXAMINATIONS

FOR THE DEGREE OF BSC (CHEMISTRY)

COURSE CODE: SCH 317

COURSE TITLE: BIO-ORGANIC AND MEDICINAL CHEMISTRY

DATE: 14/12/2022 **TIME: 9:00-11:00AM**

INSTRUCTIONS TO CANDIDATES
Time: 2 Hours

Answer question ONE and any other TWO of the remaining

QUESTION ONE [30 MARKS]

a) Define the following terms as used in medicinal chemistry **[5 marks]**

i. Pharmacophore of drug

ii. Chromosome

iii. Structure activity relationship

iv. Cytochrome P450

v. Enzyme specificity

b) Enzymes may recognize and catalyze a single substrate, group of similar substrates or particular type of bond. Name one enzyme that performs functions indicated.

[3 marks]

i. Catalyze one type of reaction for a single substrate

ii. Catalyze one type of reaction for similar substrates

iii. Catalyze one type of reaction for a specific bond

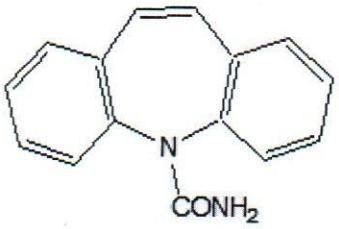
c) From the template strand of DNA below, write out informational strand of DNA sequence

[2 marks]

Template strand: 3'—C T A G G A T A C—5'

d) Recombinant DNA is synthetic DNA that contains segments from more than one source. Name three key elements are needed to form recombinant DNA **[3 marks]**

e) The drug below is carbamazepine which is used alone or in combination with other medications to control certain types of seizures in people with epilepsy. Draw phase I metabolites produced during its metabolism **[4 marks]**



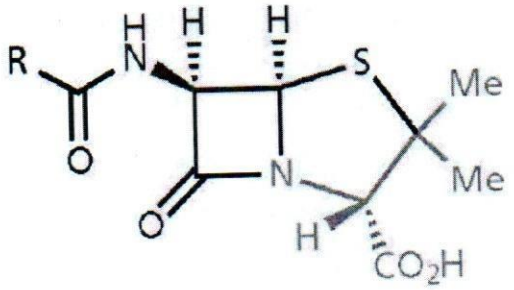
Carbamazepine

f) The main constituent of antifreeze is ethylene glycol, which is oxidized in a series of enzymatic reactions.

i. Provide one equation that summarized the series of enzymatic reactions of ethylene glycol to the final product **[2 marks]**

ii. Explain the cure for antifreeze poisoning **[2 marks]**

g) The structure of penicillin is given below



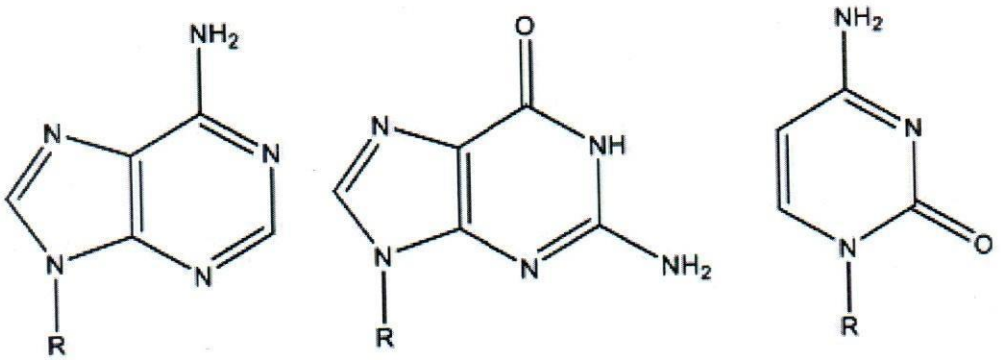
i. From the structure above, name the amino acid penicillin is biosynthesized from **[2 marks]**

ii. State any four features that are important for penicillin activity **[4 marks]**

h) Drug target is a molecule in the body, that is essential to a particular disease process and that could be addressed by a drug to produce a desired therapeutic effect. Name three protein drug targets **[3 marks]**

QUESTION TWO [20 MARKS]

a) The following represent the four bases of DNA. The 'R and X' indicate sugar moiety covalently attached to the base to form the nucleoside



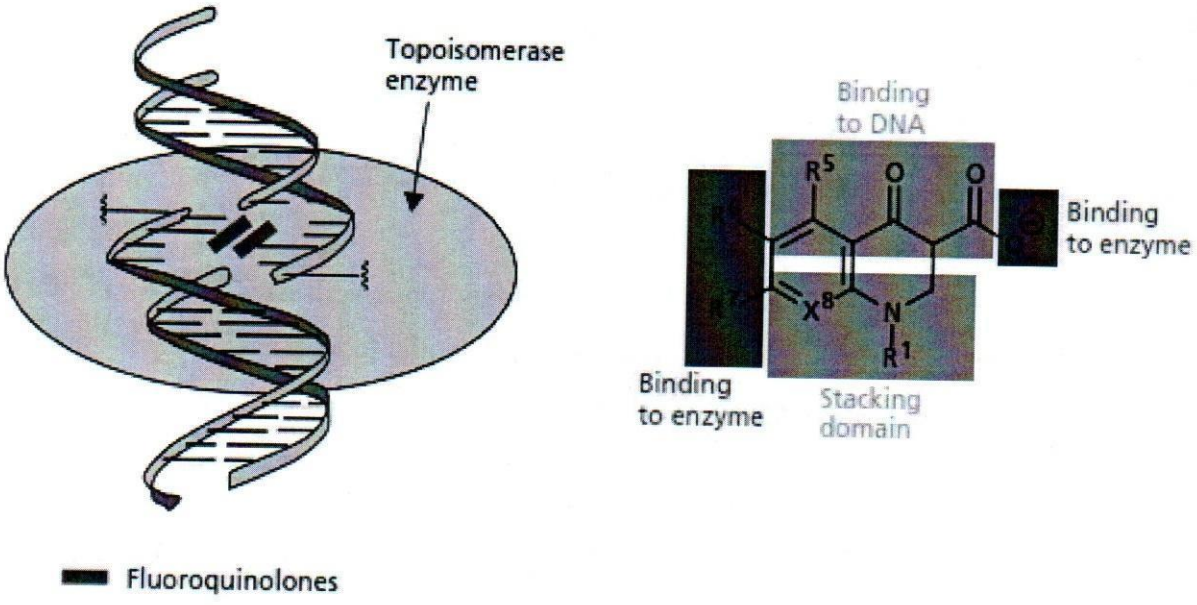
i. Name the three bases of DNA **[3 marks]**

ii. Draw each base and indicate on it nucleophilic groups **[3 marks]**

iii. State two ways in which drugs with two alkylating groups can react with a nucleic acid base **[2 marks]**

(30)

b) The following is mechanism of action of fluoroquinolones, study it and answer the qustions that follows



i. State name given to this mode of action **[1 mark]**

ii. Briefly explain the mode of action **[3 marks]**

iii. Apart from fluoroquinolones, name other three type of drug that exhibit this mode of action **[3 marks]**

c) Irreversible enzyme inhibitors form a covalent bond to a key amino acid in the active site and permanently block the affected enzyme.

i. Name two amino acids that must be present in active site for there to be irreverisble enzyme inhibition **[2 marks]**

ii. Name any threee electrophilic functional groups used in irreversible inhibitors **[3 marks]**

QUESTION THREE [20 MARKS]

a) Cephalosporins are antibacterial agents which inhibit bacterial cell wall synthesis.

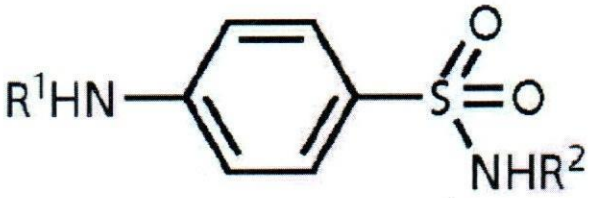
i. Breifly explain mode of action of cephalosporin **[2 marks]**

ii. Draw and lable basic structure of cephalosporin **[4 marks]**

iii. From the basic structure you have drawn above name the side chain which can allow modifications **[2 marks]**

iv. Considering you basic structure in (ii), name the feature responsible for structure activity relationship of cephalosporin **[4 makrs]**

b) The structure below is sulphonamide an antibacterial agents which acts against cell metabolism



i. Discuss structure activity relationship of sulphonamides **[8 marks]**

QUESTION FOUR [20 MARKS]

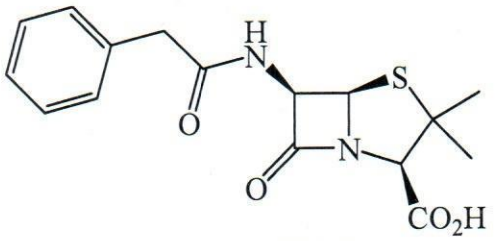
a) Drug targets are macromolecules while drugs are generally much smaller than their targets. Drugs interact with their targets by binding to binding site which typically involve intermolecular bonds

i. Define intermolecular bonds **[1 mark]**

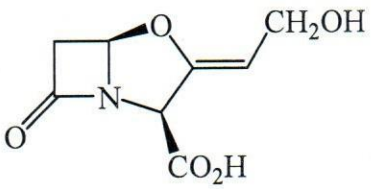
ii. Discuss with relevant diagrams how drugs interacts with active sites by ***electrostatic, induce dipole*** and ***dipole-dipole*** interactions **[9 marks]**

iii. 'Suicide substrates are *bona fide* visitors to an enzyme's active site that become stubborn squatters once they have arrived' Provide illustration of this statement using a suicide substrate *clavulanic acid,* used clinically in antibacterial medications to inhibit the bacterial β-lactamase enzyme in comparison to the mode of action of penicillin G.

[6 marks]



Penicillin G



Clavulanic acid

iv. Provide simple procedure on how you would carry out esterification of alcohol and acyl chloride using the principle of combinatorial chemistry **[4 marks]**