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UNIVERSITY OF RUHUNA – FACULTY OF ALLIED HEALTH SCIENCES

DEPARTMENT OF PHARMACY

FIRST BPHARM PART II EXAMINATION - AUGUST 2022

PH 1232 BIOCHEMISTRY II -SEQ

TIME: TWO HOURS

INSTRUCTIONS

- There are **four** questions in part **A** and **B** in this SEQ paper.
- Answer all the questions.
- No paper should be removed from the examination hall.
- Do not use any correction fluid.
- Use illustrations where necessary.

PART A

1.

1.1. What is meant by jaundice? (***20 marks***)

1.2. What are the two major types of jaundice? (***10 marks***)

1.3. Write two similarities and two differences between hemoglobin and myoglobin. (***20 marks***)

1.4. Draw the structure of an immunoglobulin molecule indicating its major structural elements. (***30 marks***)

1.5. Briefly describe the term 'acute phase proteins'. (***20 marks***)

PART B

2.

2.1.

2.1.1. Draw a labeled diagram of a replication fork that is formed during DNA replication. (***20 marks***)

2.1.2. Indicate clearly the 3′ and 5′ ends of each nucleic acid strand and the direction of synthesis with an arrow. (***20 marks***)

2.1.3. State the functions of DNA helicase, and ligase in the process of DNA replication. (***10 marks***)

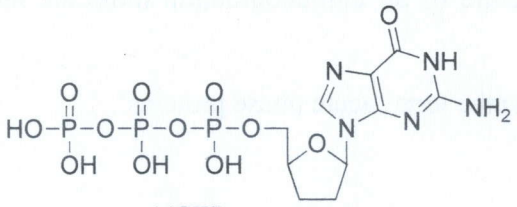
2.2. Two DNA molecules (**A** and **B**) that are partially single-stranded and partially double-stranded are shown below. These two DNA molecules were added into a test tube with DNA polymerase and a pool of nucleotides and allowed some time for a reaction to occur.

5′ GGATCCTTAT 3′	5′ CTAGTACTGGTGC 3′
3′ TAGGAATATTG 5′	3′ GAAGATCATGACCA 5′
A	**B**

2.2.1. If the reaction has taken place, draw the respective products by adding bases to the above molecule(s). (***10 marks***)

2.2.2. If there was no addition reaction, explain why. (***10 marks***)

2.3. Dideoxynucleotides (abbreviated as ddNTPs) are used in the Sangers method for DNA sequencing. The structure of a dideoxy nucleotide, ddGTP is shown below:



ddGTP

2.3.1. Identify whether this dideoxy nucleotide is a purine or a pyrimidine. (***05 marks***)

2.3.2. What is the key difference of this nucleotide compared to a normal nucleotide such as GTP? (***05 marks***)

2.3.3. If this would base-pair correctly, could it be possible for DNA polymerase to add this nucleotide to a synthesizing DNA strand during replication? Explain. (***10 marks***)

2.3.4. Assuming that DNA polymerase adds this nucleotide to a new DNA strand, could it then add another nucleotide onto the growing chain? Explain. (***10 marks***)

3.

3.1. Describe the major steps of protein biosynthesis. (***20 marks***)

3.2. The genetic code is described as degenerate. What is meant by this? Use an example from the codon table to illustrate your answer (a copy of the codon table is on the last page of this paper). (***10 marks***)

3.3. What is the initiation codon of every polypeptide chain in prokaryotes? (***05 marks***)

3.4.

3.4.1. Complete the following table pertaining to a protein biosynthesis. Assume that it is read left to right and the columns represent transcriptional and translational alignments. (***35 marks***)

DNA	**(a)**	C											
	(b)										T	G	A
mRNA	**(c)**		C	A							U		
tRNA anticodon	**(d)**							G	C	A			
Amino acid	**(e)**				Trp								

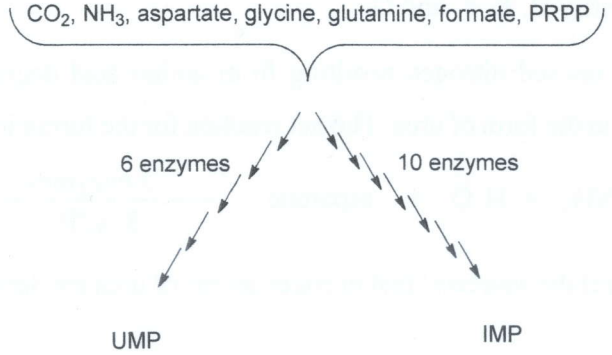
3.4.2. Indicate the polarity of the strands by labeling the 5' and 3' ends of DNA and RNA. (***15 marks***)

3.4.3. What are the amino and carboxyl ends of the protein? (***05 marks***)

3.4.4. Giving reasons, identify the coding and non-coding strands of the DNA. (***10 marks***)

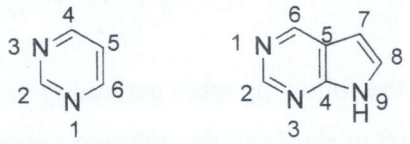
4.

4.1. Two major intermediate products in the *de novo* biosynthesis of pyrimidine and purine nucleotides are uridine-5'-monophosphate (UMP) and inosine-5'-monophosphate (IMP), respectively. In UMP, the nitrogenous base assembled is uracil while in IMP it is hypoxanthine (6-oxo-purine). Phosphoribosyl pyrophosphate (PRPP) is an essential precursor of both pathways. The simplified *de novo* pyrimidine (UMP) and purine (IMP) biosynthesis pathways are illustrated below:



4.1.1. Draw the structures of PRPP, UMP, and IMP **(*30 marks*)**

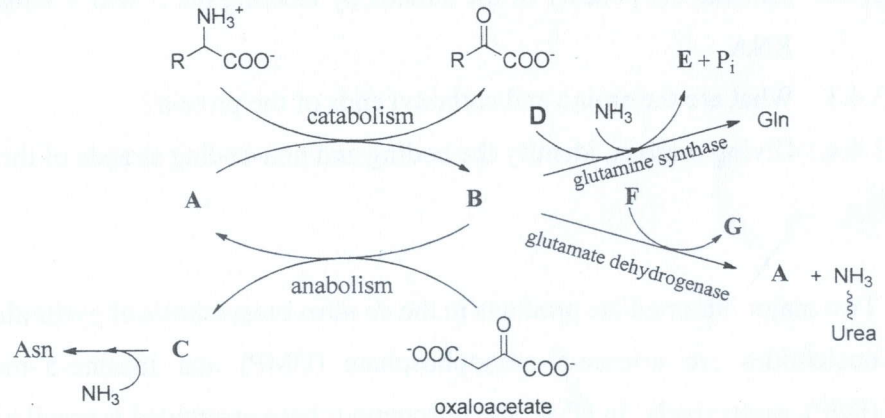
4.1.2. What are the sources of carbon and nitrogen atoms in the pyrimidine and purine ring systems? (generic pyrimidine and purine skeletons are shown below)



(*20 marks*)

4.1.3. State the major difference between purine and pyrimidine synthesis in terms of when and how the base is added? **(*10 marks*)**

4.2. The first and last chemical reaction occurs during the degradation and synthesis of amino acids, respectively, is a transamination. The following diagram shows main pathways of amino acid catabolism and the subsequent metabolic fate of the amino group.

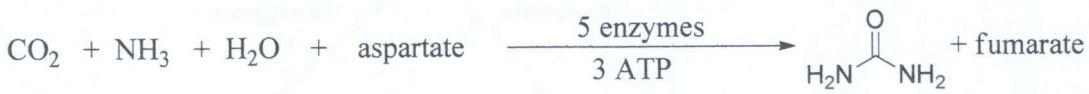


4.2.1. What is the co-enzyme participating in transamination reactions? **(*05 marks*)**

4.2.2. Draw the structures of **A**, **B** and **C**. **(*15 marks*)**

4.2.3. Identify **D**, **E**, **F**, and **G** **(*10 marks*)**

4.3. Excess or unused nitrogen resulting from amino acid degradation is excreted from mammals in the form of urea. The net reaction for the formation of urea is given below:



What is (are) the source(s) that nitrogen atoms of urea are derived from? **(*10 marks*)**

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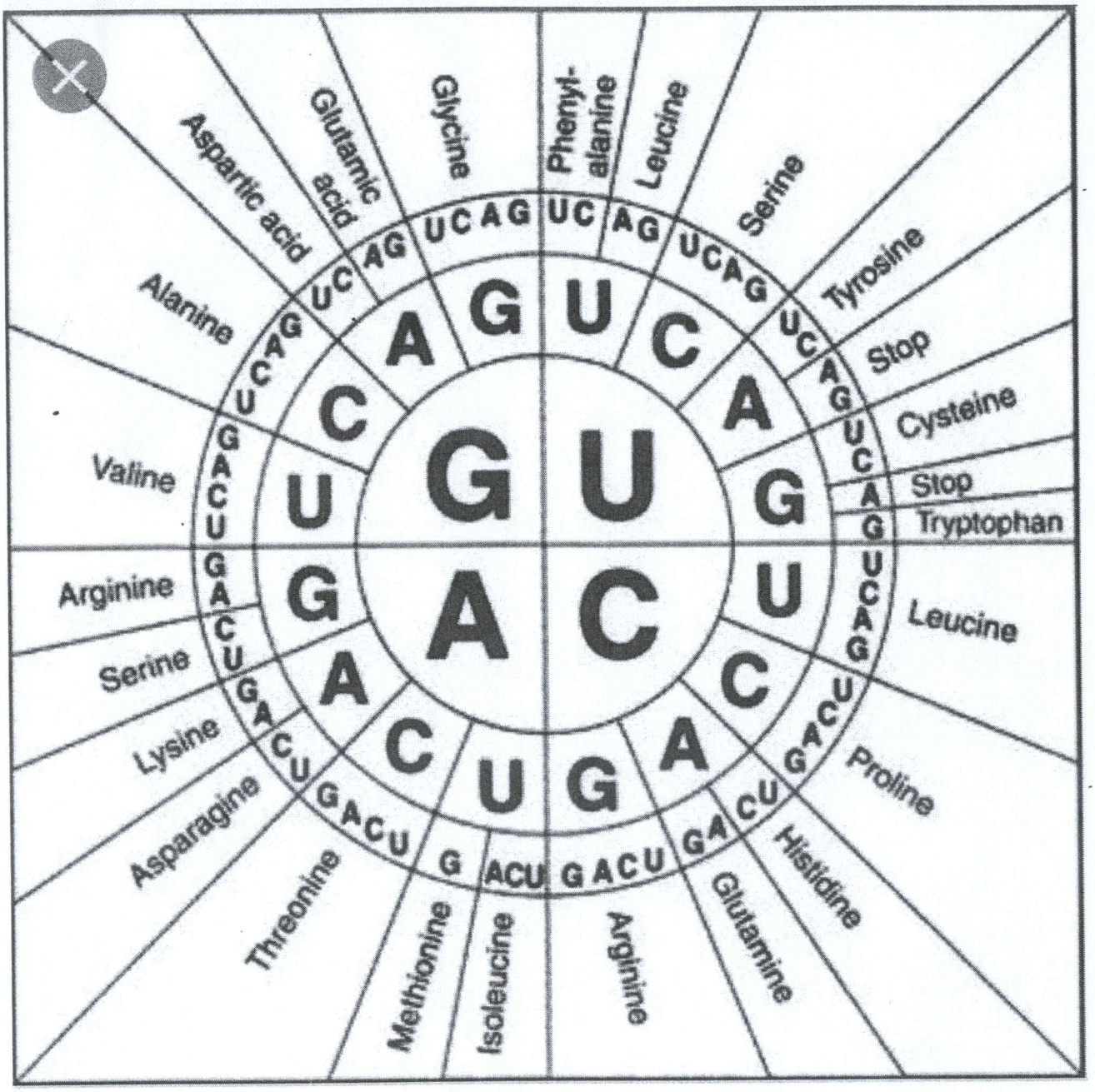
Aspartic acid
Glutamic acid
Glycine
Phenyl-alanine
Leucine
Serine
Tyrosine
Stop
Cysteine
Stop
Tryptophan
Alanine
Valine
Arginine
Serine
Lysine
Asparagine
Threonine
Methionine
Isoleucine
Arginine
Glutamine
Histidine
Proline
Leucine
U C A G
G U C A
A C G U