



UNIVERSITY OF RUHUNA – FACULTY OF ALLIED HEALTH SCIENCES

DEPARTMENT OF PHARMACY

FIRST BPHARM PART II EXAMINATION – NOVEMBER 2021

PH 1232 BIOCHEMISTRY II – SEQ

TIME: TWO HOURS

INSTRUCTIONS

- There are **four** questions in part **A** and **B** in this SEQ paper.
- Answer all 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. List major embryonic and fetal hemoglobin present in humans. (15 marks)
 - 1.2. Briefly describe the structure of an adult hemoglobin molecule. (25 marks)
 - 1.3. Name **two** organs where heme biosynthesis takes place. (10 marks)
 - 1.4. Briefly discuss how heme biosynthesis is regulated. (35 marks)
 - 1.5. Write **three** sources of bilirubin. (15 marks)

2.
 - 2.1. What are the **three** types of proteins found in the plasma? (15 marks)
 - 2.2. List **five** techniques used for protein separation. (20 marks)
 - 2.3. Briefly describe **one** technique that you mentioned in 2.2. (15 marks)

PART B

- 2.4. What are the **three** major excretory forms of nitrogenous wastes resulting from protein catabolism? How do they vary from one type of organism to another? (15 marks)

- 2.5. The urea cycle consists of five steps catalyzed by five enzymes, several substrates and products.
 Sketch a diagram for the urea cycle by selecting enzymes, substrates and products required for each step from the list given below.
Enzymes: arginase, argininosuccinase, argininosuccinate synthetase, carbamoyl phosphate, synthetase, and ornithine transcarbamoylase.
Substrates and products: CO₂, NH₃, arginine, argininosuccinate, aspartate, citrulline, fumarate, ornithine, urea. (35 marks)

3.

3.1. What are the **three** types of RNA and their functions? (20 marks)

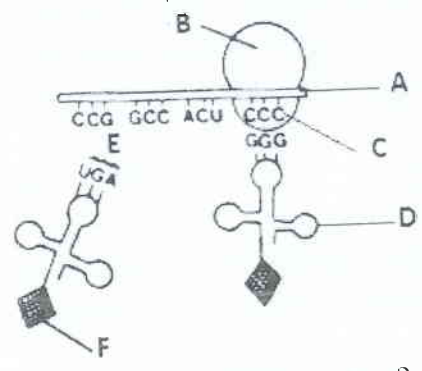
3.2. An *in vitro* RNA synthesis was set up and allowed to proceed in the presence of ribonucleotides (NTPs). After several minutes, **radioactive NTPs** were added and RNA synthesis was continued. The RNA molecules were isolated from the reaction mixture and analysed for the presence of radioactive nucleotides at the two ends. Which end of the RNA molecules were found to be radioactive? Explain briefly how you arrived at your answer. (15 marks)

3.3. An mRNA was synthesized and purified using a sample of DNA. The base composition of the purified mRNA and each strand of the DNA were determined. The obtained base percentages are given below:

%	A	G	C	T	U
DNA strand #1	19.1	26.0	31.0	23.9	0
DNA strand #2	24.2	30.8	25.7	19.3	0
mRNA	19.0	25.9	30.8	0	24.3

Giving reasons identify the coding strand of the DNA and the non-coding strand which is serving as a template for mRNA synthesis. (15 marks)

3.4. 3.4.1. Identify the labeled structures/parts on the following diagram of a cellular process. (20 marks)



3.4.2. What is the role of the part D in this cellular process? (05 marks)

3.4.3. Write are the **five** major steps of this cellular process **in order**. (15 marks)

3.5 Generally, the first two bases of a codon triplet are invariant for a particular amino acid. However, the third base, sometimes referred to as the "wobble" position of the codon, varies. It can be a purine (Pu) or pyrimidine (Py). Which tripeptide is specified by the mRNA sequence 5'-CAPu-UUPy-UUPu-3'? (10 marks)

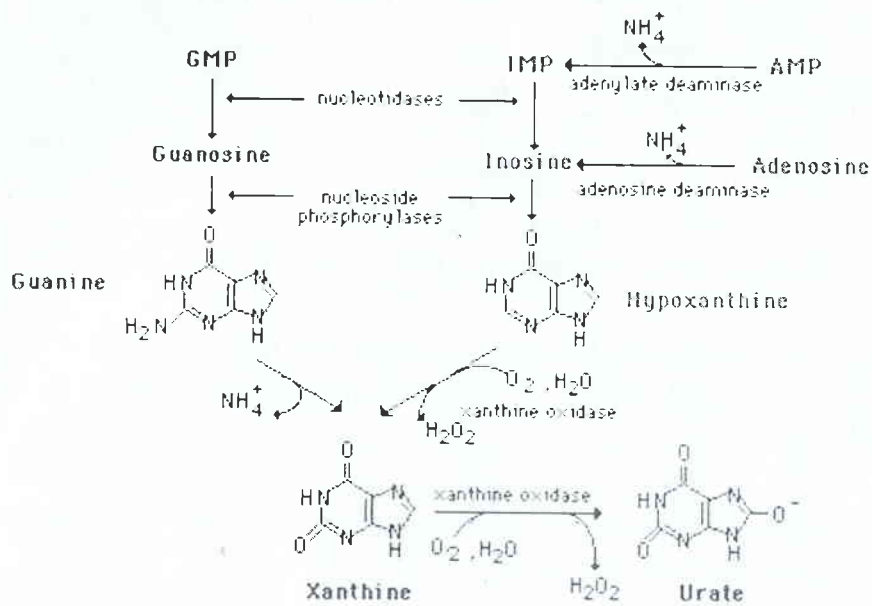
4.

4.1. Draw the structures of the following two nitrogen bases found in nucleic acids and give their trivial names. (20 marks)

4.1.1. 6-amino purine

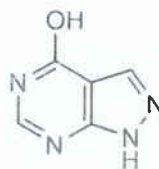
4.1.2. 2,4-dioxy pyrimidine

4.2. In the purine catabolism where the end product in human is uric acid, both adenine and guanine nucleotides converge at the common intermediate **xanthine** as shown in the reaction scheme below:



4.2.1. In one of the steps guanine is deaminated, with the amino group released as ammonia, to xanthine. If this process occurs in tissues other than liver, what would be the fate of ammonia? Use relevant reactions to explain this. (20 marks)

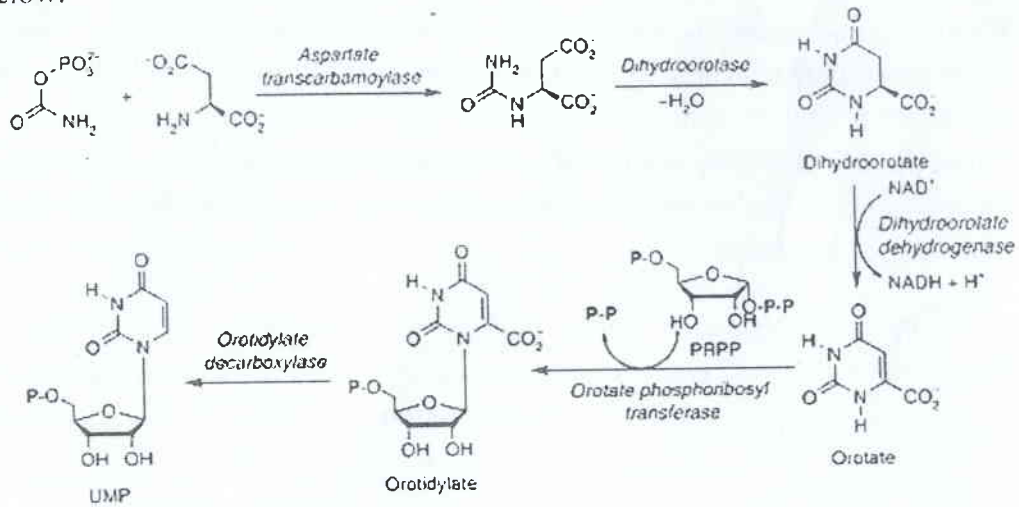
4.2.2. Gout is a disease caused by high level of urate in the blood and administration of allopurinol is one of the approaches for the treatment. Explain briefly the mechanism of action of allopurinol. (15 marks)



Allopurinol

4.3. What are **two** known pathways for the biosynthesis of purine and pyrimidine nucleotides? (10 marks)

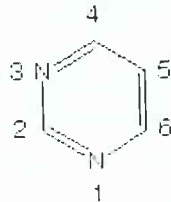
4.4. Pyrimidine nucleotides are synthesized via a single pathway which branches out from uridylic acid (uridine monophosphate, UMP). Biosynthetic pathway of UMP is shown below:



4.4.1. What are the starting substrates for pyrimidine biosynthesis? (10 marks)

4.4.2. Give a sequence of reactions to show how the first substrate is synthesized from ATP and bicarbonate, using either glutamine or ammonia as a nitrogen source. (10 marks)

4.4.3. What are the sources of carbon and nitrogen atoms in the pyrimidine ring system? (generic pyrimidine skeleton is shown below) (15 marks)



aa

