



UNIVERSITY OF JAFFNA, SRI LANKA
FIRST EXAMINATION FOR MEDICAL DEGREES - JUNE 2022
ACADEMIC YEAR 2019/2020
BIOCHEMISTRY PAPER II (43RD BATCH)

28.06.2022

Time: 3 Hours

Answer all 10 questions.

Marks allotted to each part are indicated in brackets.

Answer Each Question on Fresh Answer Sheet.

1. An eight year old boy developed respiratory distress. He was breathing deeply and a fruity smell in the breath was noted. Laboratory examinations demonstrated the blood glucose level of 40 mM (normal 3.5 to 6.0 mM), elevated serum ketone bodies with a pH of 7.0 (normal 7.4 to 7.45). The patient also showed increased Blood Urea Nitrogen (BUN) level. The boy showed positive response to intravenous rehydration and calculated insulin therapy.
 - 1.1 What could be the probable defect in this boy? (10 Marks)
 - 1.2 List the causes for the defect mentioned in Section 1.1. (15 Marks)
 - 1.3 Give the biochemical explanations for the changes in blood
 - 1.3.1 glucose (35 Marks)
 - 1.3.2 ketone bodies (20 Marks)
 - 1.3.3 pH (20 Marks)
2. Answer the questions based on the patient mentioned in Question 1.
 - 2.1 Explain how the intravenous rehydration and insulin therapy would have helped to correct acidosis in the patient. (35 Marks)
 - 2.2 Comment on the changes in serum Free Fatty Acid (FFA) level in the patient. (10 Marks)
 - 2.3 Explain how the changes in serum FFA level would alter the VLDL level in the patient. (20 Marks)
 - 2.4 Explain how acetyl CoA in this patient is preferentially getting converted to ketone bodies rather than getting completely oxidized to yield energy. (35 Marks)

3. 3.1 3.1.1 Explain how the serum amino acid levels are altered in the patient mentioned in Question 1. (25 Marks)

3.1.2 Explain how the BUN level was elevated in the patient mentioned in Question 1. (30 Marks)

3.2 A ten-year-old boy had elevated methionine and homocystine concentration in both blood and urine and undetectable plasma cysteine. Treatment with pyridoxine improved this condition.

3.2.1 What is the probable enzyme defect? (10 Marks)

3.2.2 Explain the above observation and the basis of this treatment. (35 Marks)

4. A 17 year old boy was admitted to a hospital and diagnosed to have sickle cell disease at the age of 3 years. The following reports were observed.

	Patient	Normal Range
Haemoglobin (gdL ⁻¹)	7.5	12-15
Packed Cell Volume (%)	23.4	41-53
Serum Bilirubin (mgdL ⁻¹)	2.3	0.2-1.0

4.1 Explain the molecular basis of sickle cell anaemia. (30 Marks)

4.2 Explain the biochemical basis of the altered laboratory findings. (20 Marks)

4.3 Name the biochemical tests which could be carried out to differentiate the type of bilirubin in serum and give the principle of the method. (20 Marks)

4.4 Explain how the administration of folic acid could help this patient. (30 Marks)

5. 5.1 5.1.1 List the different types of immunoglobulin. (10 Marks)

5.1.2 Explain how the structure of immunoglobulin is suited for its functions.

(25 Marks)

5.1.3 Explain the biochemical basis of autoimmune diseases taking myasthenia gravis as an example. (25 Marks)

5.2 Explain why cholesterol is important to the body. (20 Marks)

5.3 List the components that are required and their role in DNA transcription.

(20 Marks)

6. A 16-year-old female was presented with a slowly enlarging painless mass in her front neck. This mass was initially egg-shaped, symmetrically located over both side of the upper throat, but no swallowing difficulties or voice changes were complained. She was complaining of lack of concentration and attentiveness. She also had easy fatigability, but not complaining of palpitation. There were no complaints such as sudden loss of body weight loss or hair that easily falls off. Thyroid function test revealed the following results:

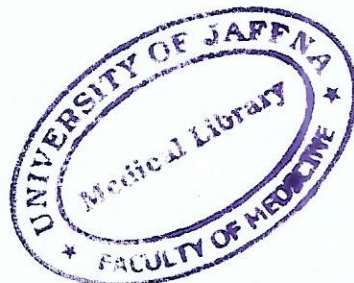
	Patient	Normal Range
T_4 (ngdL ⁻¹)	1.94	0.79-1.34
T_3 (pgdL ⁻¹)	2.97	2.27-4.47
TSH (μ IUmL ⁻¹)	0.21	0.35-4.94
Thyro Peroxidase Antibody (TPOAb) (IU/mL ⁻¹)	554.7	0
Thyroglobulin Antibody (TGAAb) (IU/mL ⁻¹)	5070	– 40

The patient was treated with 5mg of Thiamazole once daily with that the patient showed improvement.

- 6.1 Explain the above laboratory observations. (35 Marks)
- 6.2 Explain how the administration of 5mg of Thiamazole once daily would have helped the patient to show the improvement. (15 Marks)
- 6.3 Explain how the changes in the blood thyroxin levels would have led to reduction in body weight. (30 Marks)
- 6.4 Explain how the absorbed iron is distributed and stored in the reticuloendothelial system. (20 Marks)
7. 7.1 7.1.1 List the main classes of plasma proteins and give their functions. (30 Marks)
- 7.1.2 Give the serum electrophoretic pattern of a patient with nephrotic syndrome comparing with that of a normal person. (20 Marks)
- 7.1.3 Give reasons for the alterations in the serum electrophoretic pattern of the nephrotic syndrome patient. (20 Marks)
- 7.2 Explain how insulin controls the protein synthesis. (30 Marks)



8. A 40 year old male bank officer with a body weight of 125kg and a height of 160cm while maintaining his nitrogen equilibrium was diagnosed to have hypertension. He had tried different diets suggested by the dietician and regular exercise, but could not reach the ideal body weight expected for his height. Suddenly he had a retrosternal chest pain and was admitted to the hospital. He was diagnosed to have angina pectoris. The coronary obstruction was relieved by a Coronary Artery Bypass Graft. On discharge he was advised to take a single dose of aspirin at night and advised to reduce his weight.
- 8.1 Calculate the Body Mass Index of this bank officer. (10 Marks)
- 8.2 What would be the expected ideal weight for his height? (10 Marks)
- 8.3 Calculate a day's Total Energy Expenditure of this male bank officer. (20 Marks)
- 8.4 What would have been the dietary advice given by the dietician to this officer to reduce the body weight and hypertension while maintaining zero nitrogen balance. (40 Marks)
- 8.5 Explain the changes in nitrogen balance before, immediately after the coronary artery bypass graft and two weeks after his discharge from the hospital. (20 Marks)
9. Answer the following questions based on the bank officer mentioned in Question 8.
- 9.1 Diagrammatically show the changes in the serum enzymes, and the specific & less specific proteins which would have elevated in the patient after the sudden retrosternal chest pain. (30 Marks)
- 9.2 Explain the rationale of the aspirin therapy after coronary artery bypass graft. (35 Marks)
- 9.3 This bank officer was complaining pain over the big toe and ankle joints after high intake of beer. Explain how high intake of beer influenced the hyperuricemia. (35 Marks)



10. The bank officer mentioned in Question 8 had tried different diets suggested by the dietician and the regular exercise, but could not reach the ideal body weight expected for his height. To reduce his body weight he underwent bariatric surgery (Gastric bypass surgery). His body weight was reduced to expected value. After two years he felt tiredness on exertion and consulted his family physician. The physician suggested the patient to obtain a Full Blood Count report and observed that the patient had a mixed type of anaemia.

10.1 Give the types of anaemia which were observed in the bank officer. (10 Marks)

10.2 Give the biochemical basis of developing mixed type of anaemia. (30 Marks)

10.3 Give reasons for developing the anaemia after two years of bariatric surgery. (20 Marks)

10.4 Of the types of anaemia mentioned above, which one would have occurred first? Give reasons. (15 Marks)

10.5 Give the digestive complications which are expected in the bank officer who had undergone the bariatric surgery. (25 Marks)

