UNIVERSITY OF BOLTON

SCHOOL OF CLINICAL AND BIOMEDICAL SCIENCES

BSC (HONS) MEDICAL BIOLOGY
BSC (HONS) BIOMEDICAL SCIENCE

SEMESTER ONE EXAMINATION 2024/25

MEDICAL BIOCHEMISTRY

MODULE NO: BIO5009

Date: Wednesday 8 January 2025 **Time: 14:00 – 16:30**

INSTRUCTIONS TO CANDIDATES:

Candidates are advised that the examiners attach importance to legibility of writing and clarity of expression. YOU ARE STRONGLY ADVISED TO PLAN YOUR ANSWERS.

This examination paper carries a total of 150 marks.

This examination is 2 hours and 30 minutes long.

There are THREE sections on this paper.

Section A: Answer ALL questions.

Section B: Answer ONE question.

Section C: Answer ONE question.

School of Clinical and Biomedical Sciences
BSc (Hons) Medical Biology and BSc (Hons) Biomedical Science
Semester One Examination 2024/25
Medical Biochemistry
Module No. BIO5009

Section A: Case study. You are advised to spend around 50 minutes on this section

Answer ALL questions from this section; 50 marks in total.

Patient 1 is a 34 year-old male who attends his GP with symptoms of fatigue and shortness of breath. The GP notices that the patient is visibly pale and jaundiced. Further questioning reveals that the patient has been passing dark-coloured urine for a few days. The GP advises the patient to attend hospital urgently. In urgent care, a set of routine blood tests are ordered. Some of the results can be seen in Table 1.

Table 1

Test	**Result**	**Reference range**
Haemoglobin	80 g/L	130-170 g/L
Red blood cell count	3.1 $x10^{12}$/L	4.5-6.5 $x10^{12}$/L
White blood cell count	5.2 $x10^{9}$/L	4.0-11.0 $x10^{9}$/L
Platelets	156 $x10^{9}$/L	150-400 $x10^{9}$/L
Reticulocyte %	6%	0.5-2.5%
Bilirubin (total)	45 µmol/L	<20 µmol/L
Bilirubin (conjugated)	25 µmol/L	<6.8 µmol/L
Bilirubin (unconjugated)	20 µmol/L	<13 µmol/L

1. Referring to the reference range, comment on the haemoglobin levels, red blood cell count, and reticulocyte percentage.

(3 marks)

2. What are reticulocytes and what is the significance of the reticulocyte result?

(2 marks)

Please turn the page

School of Clinical and Biomedical Sciences
BSc (Hons) Medical Biology and BSc (Hons) Biomedical Science
Semester One Examination 2024/25
Medical Biochemistry
Module No. BIO5009

3. Identify which of the patient's signs/symptoms are explained by the haemoglobin levels and relate your answer to the function of haemoglobin and red blood cells.

(4 marks)

4. Referring to the reference range, comment on the bilirubin results.

(3 marks)

5. What is bilirubin and what is the significance of these results?

(5 marks)

6. The bilirubin measurement was carried out using a colorimetric enzyme assay. Using a specific example, explain how biomarkers can be measured using this technique. You may use an example other than bilirubin in your answer.

(7 marks)

7. Identify which of the patient's signs/symptoms are explained by the bilirubin test results and why this occurs.

(2 marks)

School of Clinical and Biomedical Sciences
BSc (Hons) Medical Biology and BSc (Hons) Biomedical Science
Semester One Examination 2024/25
Medical Biochemistry
Module No. BIO5009

The patient is admitted to hospital and further tests are requested. The results are shown in Table 2.

Table 2

Test	**Result**	**Reference range**
Lactate dehydrogenase	600 U/L	140-280 U/L
Serum haptoglobin	<0.1 g/L	0.3-2.0 g/L
Direct Antiglobulin Test	Positive for IgG only	-

8. Comment on these test results and explain the significance of each of them, as follows:
   a. Lactate dehydrogenase.

      (4 marks)

   b. Serum haptoglobin.

      (3 marks)

   c. Direct Antiglobulin Test.

      (4 marks)
9. Speculate which condition patient 1 may be suffering from.

   (1 mark)

10. Following on from your speculated diagnosis in Q9, what red cell features would you expect to see if blood film analysis was performed? Give specific examples of expected morphology.

    (3 marks)

School of Clinical and Biomedical Sciences
BSc (Hons) Medical Biology and BSc (Hons) Biomedical Science
Semester One Examination 2024/25
Medical Biochemistry
Module No. BIO5009

Blood samples are sent to the transfusion laboratory and 2 units of red cells are ordered for the patient. The blood grouping results are shown in Table 3.

Table 3

Test:	Anti-A	Anti-B	Anti-D	A cells	B cells
Result:	O	+	+	+	O

11. Identify the patient's ABO and Rh D type.

(2 marks)

12. Outline the principle and method of ABO Rh D typing. Include both forward and reverse grouping in your answer.

(7 marks)

[Total 50 marks]

School of Clinical and Biomedical Sciences
BSc (Hons) Medical Biology and BSc (Hons) Biomedical Science
Semester One Examination 2024/25
Medical Biochemistry
Module No. BIO5009

Section B: Homeostasis and disease. You are advised to spend around 50 minutes on this section

Answer ONE question from this section; 50 marks per question.

1. Give an account of haemostasis and explain how various diseases can result from abnormalities in this process.

(50 marks)

2. Describe how humans regulate their blood glucose levels, and explain how this can go wrong in sufferers of diabetes mellitus.

(50 marks)

3. Describe how a human cell controls cell division and explain how cancer can develop if this control goes wrong.

(50 marks)

Section C: Laboratory techniques. You are advised to spend around 50 minutes on this section

Answer ONE question from this section; 50 marks per question.

1. Outline the laboratory techniques available in a clinical biochemistry laboratory to analyse patient samples and describe how they work. In your answer, you should give examples of how these test results may be abnormal in various **non-haematological** diseases.

(50 marks)

School of Clinical and Biomedical Sciences
BSc (Hons) Medical Biology and BSc (Hons) Biomedical Science
Semester One Examination 2024/25
Medical Biochemistry
Module No. BIO5009

2. Account for the different types of tests and procedures that take place in a typical NHS haematology laboratory. In your answer, you should explain how these techniques are able to diagnose a range of **haematological** diseases.

(50 marks)

3. Explain in detail, with the help of diagrams, how the techniques SDS-PAGE and western blotting work, and give examples of how they can be used to analyse proteins.

(50 marks)

[WHOLE PAPER TOTAL: 150 marks]

END OF QUESTIONS