UNIVERSITY OF GREATER MANCHESTER

SCHOOL OF HEALTH, SCIENCE AND SOCIETY

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

SEMESTER ONE EXAMINATION 2025/2026

MEDICAL BIOCHEMISTRY

MODULE NO: BIO5009/BIO5029

Date: Friday 16 January 2026 **Time: 10.00 am – 12.30 pm**

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.

You should be provided with graph paper for this exam. If this isn't provided, please notify an invigilator.

This examination paper carries a total of 150 marks.

There are THREE sections on this paper.

Section A: Answer ALL questions.

Section B: Answer ONE question.

Section C: Answer ONE question.

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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.

Sarah is a 65-year-old female. At a check-up with her GP, she reports that she has been feeling tired and has been urinating more frequently than usual. The doctor suspects a UTI and performs a urine dipstick, which rules out infection but is positive for glucose. Blood tests are ordered, and the results are shown in Table 1.

Table 1: Initial blood test results for Sarah

Test	**Result**	**Reference Range**
Random glucose	9.9 mmol/L	<7.8 mmol/L
HbA1c	47 mmol/mol	20-48 mmol/mol
Lipid profile		
Total cholesterol	5.6 mmol/L	<5.0 mmol/L
LDL	4.7 mmol/L	<3.0 mmol/L
HDL	0.9 mmol/L	>1.0 mmol/L
Triglycerides	2.1 mmol/L	<1.7 mmol/L

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1. Comment on the glucose and haemoglobin A1c results from Table 1 and explain the significance of the results in relation to diabetes mellitus.

3 marks

2. With the aid of a labelled diagram of a Beta cell, explain how insulin is secreted from pancreatic Beta cells in response to glucose.

7 marks

3. Comment on the lipid profile results from Table 1. What do these results suggest clinically?

2 marks

Sarah is booked in for an oral glucose tolerance test and advised to fast from the evening before the test. Plasma glucose levels are measured before, and 2 hours after, the patient is given a glucose drink. The results are shown in Table 2.

Table 2: Sarah's Oral Glucose Tolerance Test results

Oral Glucose Tolerance Test	**Result**	**Reference range**
Fasting plasma glucose	7.9 mmol/L	3.9-5.5 mmol/L
2 hours post glucose load	12.8 mmol/L	<7.8 mmol/L

4. Analyse the glucose tolerance test results from Table 2. Explain the biological basis of the expected results in a healthy individual and the significance of these results for Sarah.

8 marks

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Table 3 shows a set of absorbance data which was used to produce a calibration curve for the glucose assay. The blank has already been accounted for in this data.

Table 3: Absorbance data of glucose calibration standards

Standard Number	**Glucose concentration (mmol/L)**	**Absorbance at 540 nm (after deduction of blank)**
1	0	0.00
2	2	0.15
3	4	0.31
4	8	0.59
5	16	1.22

5. Use the data in Table 3 and graph paper to produce a standard curve (make sure you put your student number on the graph paper and insert it into your answer book at the end of the exam).

5 marks

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Table 4 shows oral glucose tolerance test results for two patients. The blank has already been accounted for in the data.

Table 4: Oral Glucose Tolerance Test results for patients A and B

	Absorbance at 540 nm (after deduction of blank)	Result (mmol/L)	Reference range
i) Patient A (fasting glucose)	0.33	*Calculate this value for Q6.*	3.9 - 5.5 mmol/L
ii) Patient A (2 hours post glucose)	0.49	*Calculate this value for Q6.*	<7.8 mmol/L
iii) Patient B (fasting glucose)	0.57	*Calculate this value for Q6.*	3.9 - 5.5 mmol/L
iv) Patient B (2 hours post glucose)	0.97	*Calculate this value for Q6.*	<7.8 mmol/L

6. Use the standard curve you drew in Q5 and the absorbance data in Table 4 to determine glucose concentrations for the four samples (i-iv) listed in Table 4 (write the results in your answer book, not on the question paper).

4 marks

7. Interpret the results you obtained (in Q6) for Patient A and Patient B in relation to a diagnosis of diabetes mellitus.

4 marks

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Sarah is given a treatment and management plan and returns to her GP 3 months later for a routine follow-up. Blood tests are done for monitoring purposes, as shown in Table 5.

Table 5: Follow-up test results for Sarah

Test	**Result**	**Reference Range**
Random glucose	7.7 mmol/L	<7.8 mmol/L
HbA1c	55.0 mmol/mol	20.0 - 48.0 mmol/mol

8. What is haemoglobin A1c? Justify why it would be chosen over random plasma glucose as a monitoring test for diabetes mellitus.

5 marks

9. Identify a situation in which the HbA1c is not a suitable test for diabetes mellitus diagnosis.

1 mark

10. Discuss the significance of Sarah's follow-up results from Table 5. In your answer you should compare the results with the previous results shown in Table 1.

4 marks

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11. Haemoglobin A1c is most commonly measured using ion exchange high performance liquid chromatography (HPLC). Using an example, explain how HPLC can be used to identify and/or measure proteins for diagnostic purposes. You should include a diagram as part of your answer. You may use an example other than HbA1c if you wish.

7 marks

Total 50 marks

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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.

12. Describe in detail the role proteins play in the control of cell division and explain how cancer can develop if this control goes wrong.

50 marks

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

50 marks

14. Describe in detail, with the help of diagrams, the different stages of haemostasis, and explain how various diseases can result from abnormalities in this process.

50 marks

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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.

15. Discuss, with specific examples, the variety of laboratory techniques that can be used to analyse proteins and explain how each of these techniques detect the target protein.

50 marks

16. 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

17. 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

WHOLE PAPER TOTAL: 150 marks

END OF QUESTIONS