



Higher Specialist Diploma

Medical Microbiology

September 2025

Short-Answer Questions

60 minutes

Attempt all Four Questions

Instructions to Candidates

1. Record your candidate number and HSD discipline on the front sheet of the answer booklet.
2. Record your candidate number, the question number and the page number in the spaces provided on the answer sheets.
3. Begin each new answer on a new page.
4. Each question is worth 25 marks.

1. Following a clinical audit one of the Consultant Microbiologists has noticed that a lot of Enterobacterales and Psuedomonads have been reported inappropriately with antimicrobial susceptibility results from superficial and soft tissue infections. They have asked you to create some guidance for when these isolates should be reported as significant. Outline the guidance you would issue for other Biomedical Scientists and how this information could be cascaded.
2. During the processing of orthopaedic joint revision samples, it is noticed that there has been an increase in culture contaminants, causing difficulty with interpretation. The current process deployed is inoculation onto solid culture media plus Fastidious anaerobe broth. Which additional testing can be performed to indicate the isolate is contamination and identify potential sources of contamination and measures that can be implemented to reduce this.
3. Your department would like to implement a molecular identification system for the detection of pathogens in cerebral spinal fluid (CSF). You have been asked to take the lead on the validation and verification process. Discuss what factors you would need to consider.
4. Your department has failed to detect/identify correctly, parasites in the last three EQA distributions using parasep concentration methodology and microscopy. Outline possible root causes and corrective actions.



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Essay Paper

120 minutes

Attempt 2 out of 5 Questions

Instructions to Candidates

1. Record your candidate number and HSD discipline on the front sheet of the answer booklet.
2. Record your candidate number, the question number and the page number in the spaces provided on the answer sheets.
3. Begin each new question on a new page.
4. Each question is worth 100 marks.

1. Describe how human activity, natural disasters and extinction level events have contributed to the increase in fungal disease.
2. UKHSA recently published that 637 cases of *Candidozyma (Candida) auris* were reported across England between January 2013 and December 2024. Critically discuss the clinical significance, laboratory screening/detection methods, patient management and public health significance of this organism.
3. As a potential alternative to combat antibiotic resistance, discuss the benefits and disadvantages of bacteriophage therapy.
4. The World Health Organisation priority pathogen list was updated in 2024. Critically discuss three of the organisms included and their clinical relevance.
5. A rise in vaccine preventable infectious bacterial diseases has been reported in the UKHSA's March report. Critically discuss the factors that may be contributing to this.



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Case Studies

120 minutes

Attempt all Case Studies

Instructions to Candidates

1. Record your candidate number and HSD discipline on the front sheet of the answer booklet.
2. Record your candidate number, the question number and the page number in the spaces provided on the answer sheets.
3. Begin **each new case study** on a new page.
4. Each question is worth 100 marks.
5. For these case study questions you are strongly advised to answer the questions as they arise during the case study to avoid later information impacting adversely on your answers to the earlier questions by presuming an “outcome”.

SEEN CASE STUDY

1.

A 64-year-old female patient with a past medical history including multiple myeloma and well controlled diabetes was taken to the Emergency Department by her family due to a significant headache.

The symptoms had started that morning. However, she had subsequently become lethargic and confused. Her family explains that 16 months previously the patient had received a stem cell transplant as part of her treatment for multiple myeloma and is now taking pomalidomide and dexamethasone. Although she has significant health challenges, she tries not to let these affect her day to day activities and only a few days previously she was at a barbecue eating what they would have considered quite rare meat.

On examination, the patient was suffering from pyrexia (temperature of 39.5°C), had a heart rate of 127 beats per minute and a respiratory rate of 22 breaths per minute. She appeared to be slightly confused however, could answer questions if spoken to directly.

a. Based only on the information provided above, evaluate the past medical history, the current symptoms, possible infection present and devise an investigative strategy. (25 marks)

Due to the initial symptoms observed, a blood sample, urine sample and blood cultures were collected. A CT scan of the head was also performed. The results are as follows:

Assay	Test Result	Reference Range
Haemoglobin concentration	120g/L	115.0-160.0g/L
White blood cell count	11.2 x 10 ⁹ /L	4.0 – 11.0 x 10 ⁹ /L
Neutrophils	7.8 x 10 ⁹ /L	2.0 – 7.0 x 10 ⁹ /L
Lymphocytes	1.9 x 10 ⁹ /L	1.0 – 4.0 x 10 ⁹ /L
Monocytes	0.55 x 10 ⁹ /L	0.2 – 1.0 x 10 ⁹ /L
Eosinophils	0.14 x 10 ⁹ /L	0.0 – 0.4 x 10 ⁹ /L
Erythrocyte Sedimentation Rate	25mm/hr	0 – 20mm/hr
C-reactive protein	85mg/L	0.0 – 5.0mg/L

Urine microscopy illustrated increased white blood cells, the culture grew an *Escherichia coli*, as did the blood cultures. The CT scan of the head was normal.

b. Discuss the significance of these results and how the patient should be managed because of these pathology findings. (15 marks)

The patient was admitted to the medical ward for general observation and to receive intravenous piperacillin tazobactam. Unfortunately, after a short period of time the patient deteriorated becoming unresponsive and suffering from acute hypoxic respiratory distress. Over a period of three days the patient continued to experience pyrexia and tachycardia and, no improvement in her mental status was observed.

A further MRI scan of her brain revealed hydrocephalus. As a result of these findings a cerebrospinal fluid sample was collected and analysed. Results revealed a clear and colourless sample with 30 white blood cells and 20 red blood cells. The differential revealed 55% lymphocytes and 45% polymorphonuclear leukocytes. The CSF biochemistry revealed a decreased level of glucose and an increased level of protein.

c. Discuss the significance of these clinical and laboratory findings and suggest some examples of bacteria that could be causing this patient's hydrocephalus. (20 marks)

The CSF culture revealed small translucent haemolytic colonies on the blood agar plate that when Gram stained were Gram positive bacilli. The organism was catalase positive and demonstrated motility. A subsequent PCR BioFire investigation showed a positive result for *Listeria monocytogenes*.

d. Discuss a definitive diagnosis for this patient. In your answer consider the potential origin of each of the organism's associated with this patient's infection and how any risk factors associated with this patient history may have been contributing factors. (10 marks)

e. Consider the advantages and disadvantages of rapid identification techniques for organisms causing central nervous system infections. (20 marks)

f. Consider the treatment regimen that this patient would benefit from. (10 marks)

UNSEEN CASE STUDIES

2.

A 43 year old male presented to his local Emergency Department with severe swelling along the length of his left arm. It was reddish in colour and hot to touch. The patient is tachycardic and has high blood pressure.

a. Based on the symptoms suggested alone suggest with justification, what would be included in the differential diagnosis. (10 marks)

A venogram is conducted and rules out deep vein thrombosis. The patient continues to have swelling and inflammation along his arm, with signs of worsening. The patient is started on flucloxacillin as empirical antibiotic treatment.

b. Explain what diagnostics tests would be performed and how will they help a diagnosis to be reached. (15 marks)

Some of the patient's blood tests have come back and can be seen in the table below:

Assay	Test Result	Reference Range
Haemoglobin concentration	120g/L	115.0-160.0g/L
White blood cell count	$32 \times 10^9/L$	$4.0 - 11.0 \times 10^9/L$
Neutrophils	$31 \times 10^9/L$	$2.0 - 7.0 \times 10^9/L$
Lymphocytes	$1.1 \times 10^9/L$	$1.0 - 4.0 \times 10^9/L$
Monocytes	$0.3 \times 10^9/L$	$0.2 - 1.0 \times 10^9/L$
Eosinophils	$0.1 \times 10^9/L$	$0.0 - 0.4 \times 10^9/L$
Alanine aminotransferase (ALT)	900u/L	0.0-40.0u/L
C-reactive protein	120mg/L	0.0 – 5.0mg/L

c. Based on the information provided so far, describe what conclusions can be made including the likely pathogens and explain what, if any, additional tests should be performed. (15 marks)

Further patient history identifies that the patient consumes a high excess of alcohol (approx. 30 units per day) engages in frequent marijuana use, suffers from depression and as a result has low self-care. A detailed examination of the arm identifies puncture marks consistent with a bite. The patient is reluctant to disclose the circumstances of how the bite was acquired.

d. Which additional pathogens should be included based on this information and which animal are they related to? (15 marks)

The patient deteriorates clinically, and the CRP increases to 179 and his ALT reaches 3300. Wound swabs of the bite area isolate skin flora only and blood cultures are negative at 48 hours. At day five the blood cultures flag positive and long slender Gram negative bacilli are seen in the Gram stain. There is no growth on the subcultures at 48 hours.

e. Based on this information describe what is the most likely causative organism and justify your answer. (5 marks)

An aliquot of the blood is tested by 16s PCR. The report indicates a likely match to *Capnocytophaga canimorsus*.

f. Describe which animal is likely to have caused this infection. (5 marks)

g. Describe the usual risk factors for *Capnocytophagia canimorsus* infection. (20 marks)

h. The patient deteriorated whilst in care. Discuss how the antibiotic selection may have contributed to this and the antibiotic regime that should be considered for dealing with a *Capnocytophagia canimorsus* infection. (15 marks)

3.

A 25-year-old male visits his GP with a 3-week history of a productive cough and fatigue. The patient is normally fit and well, has a normal BMI but admits to being a heavy drinker. After listening to the patient's chest and detecting reduced breath sounds, the GP prescribes 7 days of oral amoxicillin and asks the patient to come back if there is no improvement.

a. What is the presumptive diagnosis and what are the main causative pathogens? (10 marks)

The patient returns with worsening symptoms after completing the course of antibiotics as described. The patient mentions that the cough is still productive and occasionally stained with blood. They are also complaining of profuse sweating at night and some weight loss.

When questioned he mentions that he smoked when younger but stopped a few years earlier. The patient is a student at a multicultural university and due to financial difficulties, he currently does not have a fixed abode and is staying at various friend's houses in shared student accommodation.

b. How have the additional risk factors altered the differential diagnosis at this point and what clinical tests should be considered? (20 marks)

The patient's x-ray shows cavitating lesions in the left upper lobe, consistent with TB infection. The sputum is processed for routine M,C&S and reported as "No pathogens isolated". The sputum is also processed for TB.

c. Describe how microscopy and culture are used to diagnose TB in a laboratory. (25 marks)

AAFBs are seen in the direct microscopy so the patient is admitted to a side room on an infectious disease ward in hospital. They are commenced on treatment and counselled for a HIV test.

- d. Discuss how TB is treated, why a HIV test is recommended and the wider public health management required. (20 marks)

- e. Despite a global commitment to the elimination of TB, UKHSA reported the largest increase of TB in 2023 in this reporting period (1971 – 2023). Discuss the difficulties in the prevention and control of TB. (25 marks)