The Royal College of Pathologists
Pathology: the science behind the cure

FRCPath Part 2 examination

Medical Microbiology - Second Written paper

22 September 2014

Candidates must answer ALL questions in Section A (short-answer questions) and TWO questions in Section B (journal article evaluation questions).

You must use separate answer books for Section A and Section B.

You must NOT remove this question paper from the examination hall, nor copy any question and remove it from the examination hall.

Section A and Section B carry equal marks.

Time allowed - THREE HOURS

Section A: Short-answer questions

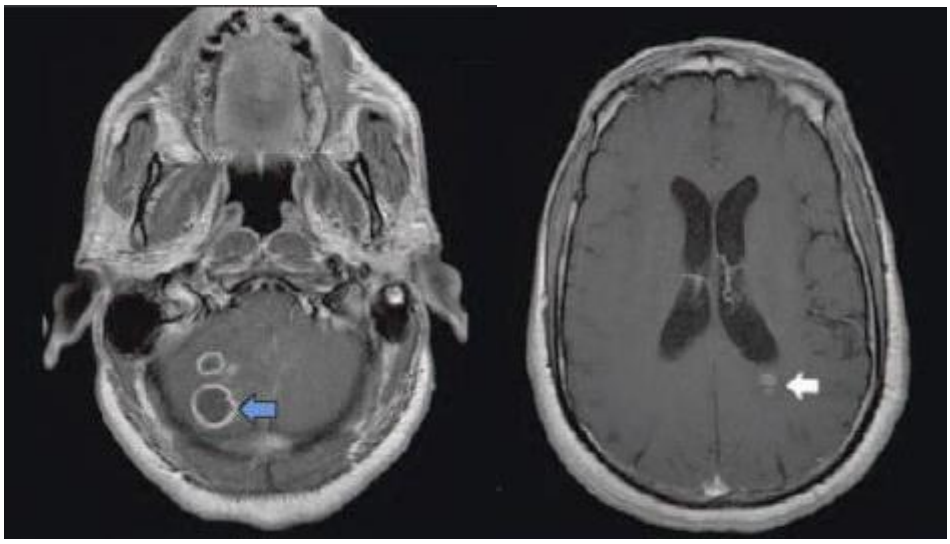
Answer all questions.

The answers will usually be a single word or a few words.

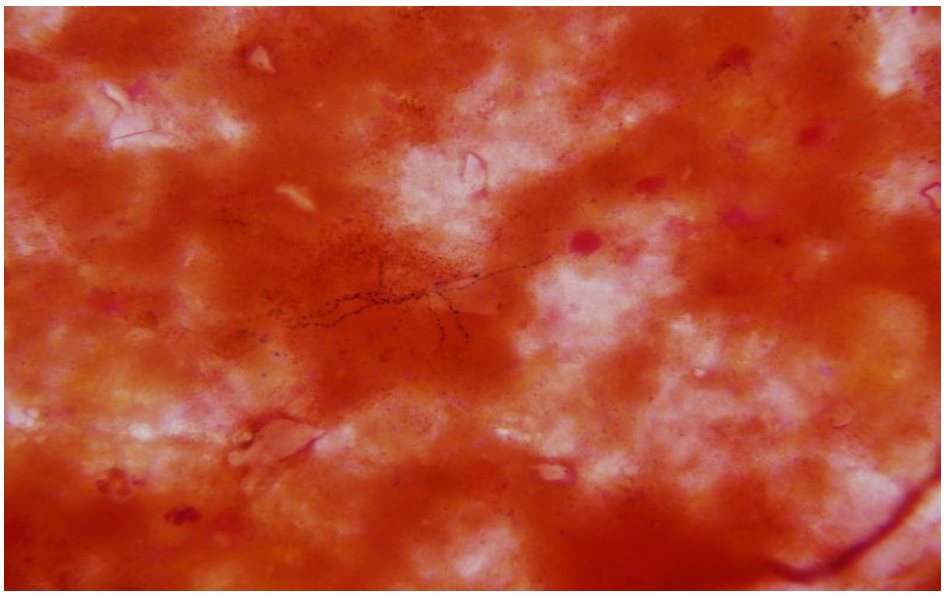
There are no negative marks.

When the number of responses is specified **DO NOT give additional responses** as these will **NOT be marked.**

Question 1



a)



b)

A 55 year old man presents with headache, difficulty in walking and loss of balance 1 year after a renal transplant. An MRI of his brain is shown in (a). The cerebellar lesion shown in (a) is biopsied and the Gram stain of the tissue is shown in (b).

a) Name the most likely pathogen (1 mark)
b) What is the most common infection caused by this pathogen? (1 mark)
c) State the antimicrobial treatment of choice (1 mark)
d) State the cultural characteristics of this organism (2 marks)

Question 2

An 11 month old boy is admitted with a 12 day history of cough and low grade fever. The cough has been getting worse, and is associated with vomiting.

a) What specimens/methods could be used to investigate for pertussis infection? (2 marks)

b) Describe a suitable treatment regimen (1 mark)

c) His aunt, who lives in Spain, is 34 weeks pregnant. She has been staying with him for 3 days. Describe the appropriate management of his aunt to prevent pertussis infection. (2 marks)

Question 3

A 70 year old man develops ventilator associated pneumonia. A pure growth of *K. pneumoniae* is cultured from his endotracheal aspirate on two occasions. The strain is found to be *Klebsiella pneumoniae* carbapenemase (KPC) positive and susceptible only to polymyxin.

a) Name the pro-drug that would be administered intravenously to treat this isolate (1 mark)

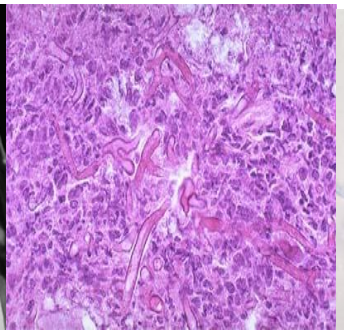
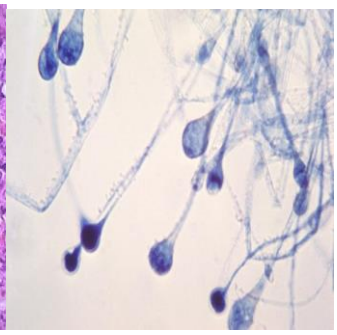
b) State the site of action of the drug (1 mark)

c) The patient is noted to have renal impairment, with a creatinine clearance of 40 ml/min. How does this affect the dosage regimen? (2 marks)

d) Name one member of the Enterobacteriaceae which is intrinsically resistant to the drug (1 mark)

Question 4

A thirty year old woman is neutropenic following bone marrow transplantation. She develops acute onset unilateral facial pain, fever and nasal discharge. A CT scan of her sinuses is shown, together with histology and the microscopy of the fungus cultured from her sinus biopsy.

a) What is the likely diagnosis? (1 mark)

b) What is the likely pathogen? (1 mark)

c) How should this infection be managed? (2 marks)

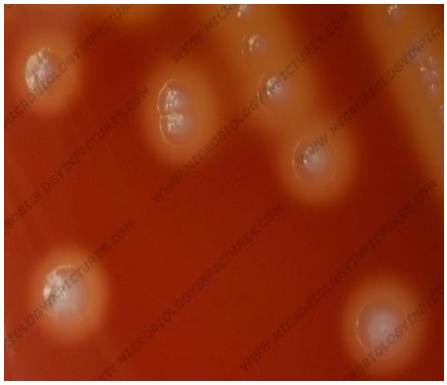
d) State one common complication (1 mark)

Question 5

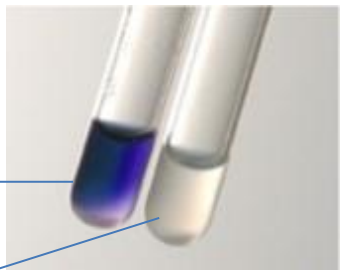
A 60 year old man with peripheral vascular disease secondary to diabetes mellitus develops necrotic toes in his left foot. A foot X-ray is shown below (a). A bone biopsy is taken from his hallux. The photographs below show the results of b) culture and c) biochemical testing.

a) Left foot X-ray:

b) Colonial appearance on blood agar:



c) Tubes of brain heart infusion broth containing 1% hippurate:



a) Name the most likely pathogen (1 mark)

b) Describe an appropriate management plan (3 marks)

c) What pathogen is the most common in bone infection in the diabetic foot. (1 mark)

Question 6

a) What species is the most common cause of this condition? (1 mark)

b) Give two reasons why it is important to seek a microbiological diagnosis (2 marks)

c) Give two systemic treatment options (2 marks)

Question 7

This device is a point-of-use filter designed to remove potentially pathogenic bacteria such as Pseudomonas and Legionella.

a) What are two disadvantages of using this method? (2 marks)

b) Give three other means by which the microbiological quality of the distributed water supply might be maintained in the hospital environment (3 marks)

Question 8

A pus sample from an appendix abscess yields two isolates:

(i) a chaining Gram positive coccus that grows both aerobically and anaerobically and forms tiny colonies surrounded by a small zone of beta-haemolysis, reacts with a latex test for Lancefield group A antigen and has a sweet, caramel odour.

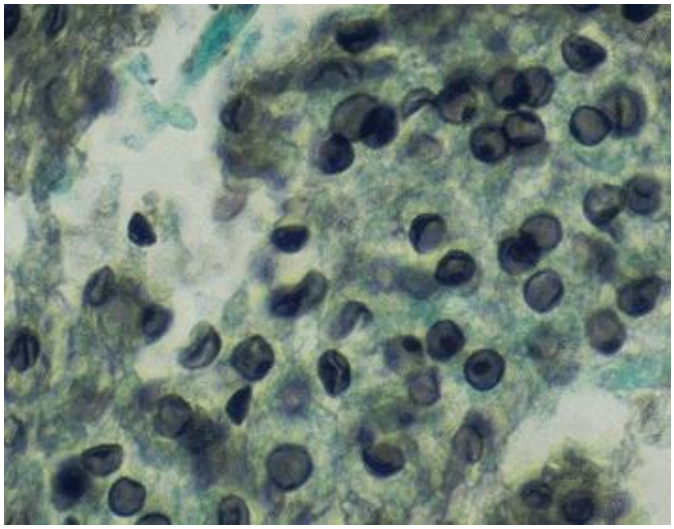
ii) a Gram negative rod that grows anaerobically and is inhibited by metronidazole but not penicillin

a) Pending formal speciation, what is the most likely identity of the organism described in (i) (1 mark)

b) Give three species that it might prove to be (3 marks)

c) Suggest appropriate antimicrobial treatment (1 mark)

Question 9



This is a micrograph of a specimen of broncho-alveolar lavage fluid processed using a silver stain. The sample was taken from a patient with progressive pneumonitis following immunosuppressive treatment for vasculitis.

a) What is the organism shown? (1 mark)

b) What stage of its life cycle is shown? (1 mark)

c) What phylogenetic kingdom is it in? (1 mark)

d) What is the antimicrobial treatment of choice? (1 mark)

e) Give one alternative drug treatment? (1 mark)

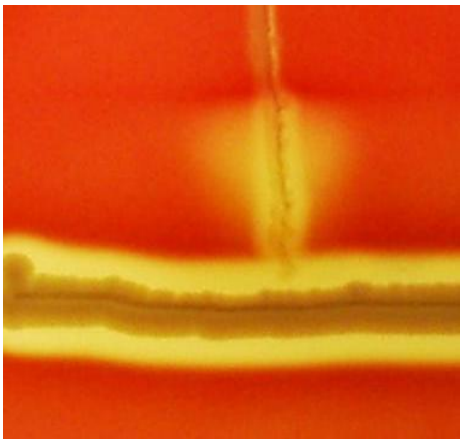
Question 10

An elderly man with severe penicillin allergy presents with meningitis. A lumbar puncture is performed and yields a Gram positive coccobacillus with a weakly beta-haemolytic appearance on blood agar:

a) 

The organism is oxidase negative, catalase positive and non-reactive using a Lancefield streptococcal grouping kit.

A member of the laboratory staff decides to perform some additional tests. When streaked perpendicular to a streak of *Staphylococcus aureus* on sheep blood agar an enhanced area of haemolysis is noted:

b) 

a) What is the likely species? (1 mark)

b) What is the preferred treatment in this patient? (1 mark)

c) What is the name of the test shown in b) ? (1 mark)

d) What other organism demonstrates the same phenomenon? (1 mark)

e) Would you expect the isolate to be motile at 37 degrees C? (1mark)

Section B: Journal article evaluation questions

Answer **TWO** of the following **THREE** questions.

You should justify your answers by reference to the article wherever possible. In addition, you should include your knowledge of relevant literature when this is available.

Each question carries equal marks.

Question 1

Osman H A, Hasan H and Suppian R et al.: Evaluation of the Atlas *Helicobacter pylori* Stool Antigen Test for Diagnosis of Infection in Adult Patients.

***Asian Pac J Cancer Prev* 2014; 15: 5245–5247**

1. Write a summary of the paper in no more than 200 words.

2. Explain the following terms with reference to the Atlas *H. pylori* stool antigen test in this paper:

   (a) Sensitivity and specificity

   (b) Positive and negative predictive values (PPV and NPV)

   (c) Accuracy

3. Demonstrate how sensitivity, specificity, PPV, NPV and overall accuracy are calculated for a hypothetic new diagnostic test compared to a 'gold standard' method.

4. How would the prevalence of *H pylori* infection affect the sensitivity, specificity, PPV and NPV of the Atlas test in populations with different prevalence rates?

5. List the weaknesses of the study design

Question 2

Intravenous ceftriaxone, followed by 12 or three months of oral treatment with trimethoprim-sulfamethoxazole in Whipple's disease

Feurle GE et al. J Infect. 2013 ;66:263-70.http://dx.doi.org/10.1016/j.jinf.2012.12.004

1. (a) What was the hypothesis being tested?

   (b) Summarise the main results of this study (maximum 100 words)

   (c) Do you agree with the authors' main conclusion?

2. Comment on the number of patients studied.

3. What are the strengths and weaknesses of the primary outcome measurement?

4. What sources of potential bias, arising from the design of this study, undermine the conclusions reached?

Question 3

Sequential introduction of single room isolation and hand hygiene campaign in the control of methicillin-resistant Staphylococcus aureus in intensive care unit

Cheng et al. BMC Infectious Diseases 2010, 10:263

1. Write an abstract summarising this study in no more than 200 words

2. What do you see as the problems in investigating the effectiveness of infection control interventions in a routine health service context, and how should such investigations be reported?

3. What are the major limitations of this study?

4. What messages would you take away from this study, if any, which might influence your own practice?