CLINICAL THERAPEUTICS 5: INFECTIOUS DISEASES

PHA-3HK1

Time allowed: 2 hours

Part ONE.

Answer ALL questions. Mark the correct answer CLEARLY in the answer grid provided.

Part TWO.

Answer THREE of the FOUR questions.

Use a SEPARATE answer book for EACH question in Part TWO.

Each question has the same value.
The marks distribution is shown as a percentage for each section of the question.
Answer ALL parts of each of the individual questions you select.

The mark allocation for the paper is:
• Part ONE carries 50% of the total mark
• Part TWO carries 50% of the total mark

You are advised to spend approximately 1 hour on Part ONE and 1 hour on Part TWO.

This paper consists of 12 pages in total.

Dictionaries are not permitted in this examination.
Notes are not permitted in this examination.
Do not take this question paper out of the examinations room.
Do not turn over until you are told to do so by the Invigilator.
PART ONE

TYPE 1 MCQs

For each question, there is ONE correct answer

1. Which ONE of the following statements is FALSE?
   Hepatitis B virus can cause a variety of clinical manifestations. These include:
   
   A) Primary Hepatocellular carcinoma  
   B) Liver cirrhosis  
   C) Glomerulonephritis  
   D) Fulminant hepatitis  
   E) Subacute sclerosing panencephalitis

2. Which ONE of the following statements about the polio virus and the disease it causes is FALSE?
   
   A) The infection is asymptomatic in 90% of all cases  
   B) 1-2% of polio virus infections will develop into aseptic meningitis  
   C) Progression of the virus into the CNS is linked to non-paralytic poliomyelitis  
   D) Paralytic polio occurs in 0.1-2% of patients  
   E) Paralysis is one of the first symptoms to occur after an infection

3. Which ONE of the following statements about rhinoviruses is FALSE?
   
   A) They can form a latent infection in neuronal cells  
   B) The virion is resistant towards drying  
   C) One viral particle is enough to cause infection  
   D) They are transmitted via aerosols  
   E) They are unable to replicate in the GI tract

4. Which ONE of the following statements about the influenza viruses is FALSE?
   
   A) Only influenza A and influenza B cause significant human disease  
   B) The virus has a segmented RNA genome  
   C) The virus transcribes its RNA into DNA in the cytoplasm of the infected cell  
   D) The M2 protein is targeted by amantadine  
   E) Each viral particle has about 500 haemagglutinin proteins on the surface
5. Which ONE of the following statements about hepatitis C is FALSE?

A) It is the predominant cause of Non-A Non-B hepatitis cases
B) The virus contains a positive-sense RNA genome
C) 15% of all infections result in acute hepatitis with resolution and recovery
D) The treatment options are recombinant interferon-α or pegylated interferon alone or with ribavirin
E) A minority of all infections lead to chronic persistent infections with possible progression to disease later on in life

6. Which ONE of the following statements about opportunistic mycoses is TRUE?

A) Organisms in this group can infect both normal and immunocompromised hosts
B) Aspergillosis is a major cause of bloodstream infections after surgery
C) Some opportunistic mycoses cause meningitis in neonates
D) Opportunistic mycoses only pose a problem in South America, Africa and South-East Asia
E) Candida albicans is one of the most well-known opportunistic mycoses

7. Which ONE of the following is a bacteriostatic antibiotic?

A) Trimethoprim
B) Penicillin G
C) Penicillin A
D) D-cycloserine
E) Cephalosporin C

8. Why are some penicillins inactivated when exposed to the acidic environment in the stomach?

A) Because the beta-lactam ring can be hydrolysed under acidic conditions and is facilitated by a neighbouring group participation effect
B) Because the carboxyl sidechain is deprotonated under acidic conditions making them insoluble
C) Because they are prone to enzyme catalysed degradation in the stomach
D) Because they are prone to acid catalysed oxidation in the stomach
E) Because they are prone to acid catalysed reduction in the stomach
9. What reaction is catalysed by transpeptidase enzymes in bacteria?

A) The hydrolysis of the four membered ring present in penicillins
B) The hydrolysis of the acyl side chain from penicillin structures
C) The hydrolysis of the six membered ring present in cephalosporins
D) The final crosslinking reaction to form the bacterial cell wall
E) The biosynthesis of the penicillin fused ring structure from the amino acids valine and cysteine

10. Which **ONE** of the following statements is **TRUE**?

A) Rifamycins can inhibit protein biosynthesis in Gram negative bacteria
B) Clavulanic acid is a potent antibiotic
C) Clavulanic acid is a potent antiviral drug
D) Clavulanic acid is a prodrug of a potent antibiotic
E) Rifamycins can inhibit RNA biosynthesis in Gram positive bacteria

11. Which **ONE** of the following statements about rabies is **TRUE**?

A) The virus is transmitted via excrement
B) The virus is found worldwide
C) Infection leads to vomiting, abdominal pain and diarrhoea
D) Rabies patients can die from hypovolemic shock
E) In the brain, the virus infects a large proportion of neurons

12. Which **ONE** of the following is not a prodrug?

A) Penciclovir
B) Sulfonamide
C) Aciclovir
D) Tamiflu™
E) Kanamycin A

13. Which **ONE** of the following statements is **FALSE**?

A) Sulfonamide drugs inhibit dihydropteroate synthetase activity in bacteria
B) Some of the undesirable side effects observed with sulfonamide drugs are due to inhibition of folic acid biosynthesis in humans
C) Sulfonamides reduce folic acid biosynthesis in bacteria
D) Antibacterial agents that inhibit cell metabolism are called anti-metabolites
E) Sulfonamide drugs do not inhibit dihydrofolate reductase activity in bacteria
14. Which **ONE** of the following statements is **TRUE**?

A) Bacteria are eukaryotes
B) The oral bioavailability of acid sensitive penicillins cannot be improved by co-administration with clavulanic acid
C) Gram negative bacteria produce two cell walls whereas Gram positive bacteria only produce one
D) Gram negative bacteria have a cell wall but no cell membrane
E) Peptidoglycan biosynthesis is a valid target for the design of new antiviral chemotherapies

15. Which **ONE** of the following statements is **TRUE**?

A) Kanamycins inhibit protein biosynthesis and D-cycloserine inhibits alanine racemase
B) Sulfonamides and chloramphenicol are both examples of effective inhibitors of folic acid biosynthesis
C) Cycloserine inhibits peptidoglycan biosynthesis and vancomycin inhibits cell membrane biosynthesis
D) Sulfonamides and erythromycin are both examples of bactericidal antibiotics
E) Antibiotics that kill bacteria are bacteriostatic

16. Which **ONE** of the following statements is **TRUE**?

A) Penicillins do not need to penetrate the cell membrane of Gram-positive bacteria to exert their antibacterial activity
B) Kanamycins are potent inhibitors of DNA replication
C) Vancomycin is a more potent antiviral drug than chlorotetracycline
D) Sulfonamides are antimetabolites, which inhibit ribosome biosynthesis
E) Vancomycin is a less potent antiviral drug than chlorotetracycline

17. Which **ONE** of the following statements about the biological targets of different antivirals is **TRUE**?

A) AZT is a potent HIV protease inhibitor
B) Haemagglutinin is a potent sialidase inhibitor
C) Kanamycins inhibit viral protein synthesis
D) Tamiflu™ is the prodrug of a potent neuraminidase inhibitor
E) AZT monophosphate is a potent HIV reverse transcriptase inhibitor

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**TURN OVER**
18. **Which ONE** of the following statements is **TRUE**?

A) Relenza™ is a weak neuraminidase inhibitor, because it is a transition state mimic  
B) AZT is a potent inhibitor of HIV reverse transcriptase, because it is a transition state inhibitor  
C) AZT triphosphate is a potent inhibitor of HIV reverse transcriptase  
D) HIV reverse transcriptase is a protease enzyme  
E) Neuraminidase is able to cleave haemagglutinin from cell-surface glycoproteins

19. **Which ONE** of the following statements is **TRUE**?

A) D-cycloserine is used by bacteria as a substrate for the incorporation of D-amino acids into the cell wall peptidoglycan  
B) D-cycloserine is an inhibitor of both alanine racemase and D-alanyl-D-alanyl synthetase  
C) L-cycloserine is an inhibitor of D-alanyl-D-alanyl synthetase, but does not inhibit alanine racemase  
D) L-cycloserine is an inhibitor of both alanine racemase and D-alanyl-D-alanyl synthetase  
E) L-cycloserine is an inhibitor of alanine racemase, but does not inhibit D-alanyl-D-alanyl synthetase

20. **Which ONE** of the following structural features of clavulanic acid is involved in its mechanism of action?

A) An epoxide  
B) An acyl sidechain  
C) A beta-lactam ring  
D) A thiazolidine ring  
E) A thioether linkage

21. **Which ONE** of the following statements is **FALSE**?

A) Some of the undesirable side-effects observed with sulfonamide drugs are due to inhibition of folic acid biosynthesis in humans  
B) Sulfonamide drugs inhibit dihydropteroate synthetase activity in the malaria parasite  
C) Sulfonamides reduce folic acid biosynthesis in the malaria parasite  
D) Sulfonamide drugs are classed as anti-metabolites  
E) Sulfonamide drugs do not inhibit dihydrofolate reductase activity in the malaria parasite
22. Mr Philips asks for advice for some soreness in his mouth. He uses a blue and a brown inhaler for his asthma and has recently noticed some white plaques in his mouth, which are red and sore underneath. Which ONE of the following would be most appropriate to suggest?

A) Tell him he has viral laryngitis and some warm drinks and an anaesthetic throat spray will help
B) Tell him it is likely to be a bacterial infection caused by his inhalers, support him to improve his inhaler technique and suggest he goes to the doctor for an antibiotic
C) Tell him it is likely to be a fungal infection caused by his inhalers, support him to improve his inhaler technique and suggest he uses an antifungal oral gel to manage the problem
D) Tell him it is likely to be a bacterial infection caused by his inhalers, tell him to go to the doctor to get the strength of his inhaler reduced and an antibiotic
E) Tell him it is likely to be a fungal infection caused by his inhalers, suggest he uses an antifungal oral gel and to stop using his inhalers until it has cleared up

23. Mrs De Silva comes in your pharmacy with an itchy head. Her son has also got several live headlice in his hair and she would like some treatment for the whole family. Which ONE of the following would be the most appropriate to suggest?

A) Treat her son with dimethicone lotion overnight and repeat in 7 days. For everyone else suggest she inspects their hair regularly and only treat individuals if several live lice are identified in their hair
B) Treat her son with dimethicone lotion overnight and repeat in 14 days. For everyone else suggest she inspects their hair regularly and only treat individuals if several live lice are identified in their hair
C) Treat her son with dimethicone lotion overnight. For everyone else suggest she inspects their hair regularly and only treat individuals if several live lice are identified in their hair
D) Treat the whole family with dimethicone lotion overnight and repeat in 7 days
E) Treat the whole family with dimethicone lotion overnight and repeat in 14 days

END OF TYPE 1 MCQs
TYPE 2 MCQs

Decide which of the responses to the following questions is/are correct and then choose:

A) if i, ii and iii are correct  
B) if i and ii only are correct  
C) if ii and iii only are correct  
D) if i only is correct  
E) if iii only is correct

24. Which of the following are appropriate in the management of ear wax in an adult male?
   i) To inspect the ear canal a pharmacist would need to pull the ear down and backwards  
   ii) Olive oil could be recommended using one drop in the affected ear each day  
   iii) When applying ear drops it is important they stay in the ear for at least an hour

25. Which of the following statements about mebendazole are TRUE?
   i) It has minimal side effects in humans because it is 250-400 times more potent in helminths  
   ii) It inhibits acetylcholine neurotransmitter in helminths causing paralysis  
   iii) It is licensed for adults and children over six months old

26. Which of the following factors need to be taken into account when deciding HIV treatment?
   i) Patient adherence  
   ii) Pre-existing diabetes  
   iii) Pre-existing psychiatric disease

27. Which of the following are appropriate monitoring parameters for HIV treatment?
   i) CD4 count  
   ii) Body temperature  
   iii) C-reactive protein

END OF TYPE 2 MCQs
TYPE 3 MCQs

Directions:
The following questions consist of a statement in the left-hand column followed by a second statement in the right-hand column

Decide whether the FIRST statement is TRUE or FALSE
Decide whether the SECOND statement is TRUE or FALSE

Then choose:

A) If both statements are TRUE and the second statement is a correct explanation of the first statement
B) If both statements are TRUE but the second statement is NOT a correct explanation of the first statement
C) If the first statement is TRUE but the second statement is FALSE
D) If the first statement is FALSE but the second statement is TRUE
E) If both statements are FALSE

Directions summarised

<table>
<thead>
<tr>
<th>1st statement</th>
<th>2nd statement</th>
<th>Notes</th>
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<tbody>
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<td>True</td>
<td>True</td>
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<td>True</td>
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<td>False</td>
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</tbody>
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28. FIRST STATEMENT
A patient with a red eye, pain and photophobia who says it is hard to read small print, may have iritis

SECOND STATEMENT
Patients with iritis need urgent treatment with aciclovir to prevent any loss of vision

29. FIRST STATEMENT
Smokers who present with a change in the nature of their cough should be referred to their GP

SECOND STATEMENT
A change in the nature of the cough could be due to lung cancer

TURN OVER
30. **FIRST STATEMENT**

A four year old child with a productive cough can be safely recommended an expectorant

**SECOND STATEMENT**

Expectorants have been demonstrated to be effective in children under the age of six

END OF PART ONE
PART TWO

31. Answer ALL parts: (a), (b) and (c)

Infections of the gastrointestinal (GI) tract can cause severe diseases and can even be fatal.

a) Give an overview about the main bacterial and viral pathogens of the GI tract and give a brief description about how the infection can spread from one person to the next. [30%]

b) Choose ONE GI pathogen and explain in detail the cellular/molecular mechanism of the infection. [40%]

Pneumonia can also be caused by both bacterial and viral infections.

c) Discuss the differences in pathogens, which cause pneumonia in children compared to adults. [30%]

32. Answer ALL parts: (a), (b) and (c)

John (who is 14 years old) comes in to the pharmacy with his mother. They would like some help in managing his acne.

a) Describe how you would assess John’s acne according to the mild moderate or severe scale? [30%]

b) You assess John as having mild acne. Describe the pharmacological and non-pharmacological management options including the practical advice you would provide to John and his mother [50%]

c) John has a sister Mary who has just been prescribed Isotretinoin for her severe acne. Outline the key messages you would want to explain to Mary when dispensing this medicine [20%]
33. Answer **ALL** parts: (a), (b), (c) and (d)

![Structure of Prontosil]

**a)** The sulphonamide derivative prontosil is inactive against bacteria *in vitro*, but show antibacterial activity *in vivo*. Explain why this is so. [15%]

**b)** Describe the function of the enzyme that is inhibited by this antibiotic and explain why it is a good biological target. [50%]

**c)** How does prontosil prevent this enzyme from working? [20%]

**d)** What factors in the bacteria and/or host can contribute to the reduction in prontosil’s potency? [15%]

34. Answer **ALL** parts: (a), (b) and (c)

**a)** Describe in detail the mode of action of TWO different antimalarial drugs that target the food vacuole of the parasite. [50%]

**b)** Explain in detail the pathogenesis of HIV. [40%]

**c)** Give an overview of the opportunistic infections that can be associated with the clinical onset of AIDS. [10%]

**END OF PAPER**