



UNIVERSITI KUALA LUMPUR
ROYAL COLLEGE OF MEDICINE PERAK

FINAL EXAMINATION
MARCH 2026 SEMESTER

COURSE CODE : RPD12603
COURSE NAME : MICROBIOLOGY IN PHARMACY
PROGRAMME NAME : DIPLOMA IN PHARMACY
DATE : 26 JUNE 2026
TIME : 02.30 PM – 04.30 PM
DURATION : 2 HOURS

INSTRUCTIONS TO CANDIDATES

1. Please CAREFULLY read the instructions given in the question paper.
2. This question paper has information printed on both sides of the paper.
3. This question paper consists of TWO (2) sections; Section A and Section B.
4. Answer ALL questions in Section A. For Section B, answer THREE (3) questions where Question 1 and Question 2 are COMPULSORY, answer either Question 3 or Question 4.
5. Please write your answers on the OMR answer script and answer booklet provided.
6. Answer all questions in English language ONLY.

THERE ARE 16 PAGES OF QUESTIONS, EXCLUDING THIS PAGE.

SECTION A (Total: 25 marks)

INSTRUCTION: Answer ALL questions.

Please use the objective answer sheet provided.

1. Which bacterial shape is rod-shaped?
 - A. Coccus
 - B. Bacillus
 - C. Vibrio
 - D. Spirillum
2. Why are fungi considered important decomposers in nature?
 - A. They infect plant roots in soil areas
 - B. They absorb mineral salts for growth
 - C. They break down dead matter for recycling
 - D. They release stored energy for movement
3. A microbiologist transfers bacteria into a new culture medium. During the first few hours, no cell division is observed.
Which phase of the bacterial growth curve best explains this condition?
 - A. Lag phase
 - B. Log phase
 - C. Stationary phase
 - D. Death phase
4. A filamentous algae breaks into several pieces, and each piece develops into a new organism.
What does this indicate about its reproduction?
 - A. It depends on spore formation under stress
 - B. It uses fragmentation as a reproductive strategy
 - C. It reproduces through binary fission
 - D. It forms buds before separation
5. A nurse cleans a patient's skin using 70% alcohol before an injection.
What is the primary purpose of this action?
 - A. To sterilize the skin by killing all microorganisms
 - B. To remove endospores from the skin surface
 - C. To reduce microbial load and prevent infection
 - D. To inhibit only viral replication on the skin

6. A pharmacist needs to sterilize an antibiotic solution before packaging. The solution is passed through a membrane filter.
What is the main reason for using filtration in this situation?
- A. Increasing the concentration of the antibiotic
 - B. Removing microorganisms without using heat
 - C. Filtration destroys endospores more effectively
 - D. Separating the antibiotic into smaller molecules
7. Which of the following substances is commonly used in mouthwashes and oral rinses as an antiseptic?
- A. Chlorhexidine
 - B. Phenol
 - C. Sodium hypochlorite
 - D. Formaldehyde
8. Which of the following best defines a pure culture?
- A. A culture containing different species of microorganisms
 - B. A culture grown in liquid medium only
 - C. A culture containing only one type of microorganism
 - D. A culture incubated at 37°C
9. Which of the following best describes a colony-forming unit (CFU)?
- A. A cluster of dead bacterial cells
 - B. A visible mass arising from a single viable microorganism
 - C. A group of different microorganisms growing together
 - D. A liquid culture containing bacteria
10. A microbiology student is calculating bacterial concentration using colony count. Why is it important to perform serial dilution before plating?
- A. To increase bacterial growth rate
 - B. To reduce contamination risk
 - C. To obtain countable number of colonies
 - D. To change bacterial morphology

11. A patient develops a bloodstream infection after insertion of a catheter. The causative organism is identified as *Staphylococcus epidermidis*, which is normally found on the skin.
- Which classification best describes the microorganism in this situation?
- A. Opportunistic pathogen causing infection in sterile tissue
 - B. Transient biota acquired from the hospital environment
 - C. Resident flora showing mutualistic interaction
 - D. Obligate pathogen with high virulence in healthy individuals
12. Which condition contributes to the low number of microorganisms in the stomach?
- A. Highly alkaline conditions
 - B. Presence of digestive enzymes only
 - C. Highly acidic conditions
 - D. Neutral pH environment
13. A pharmaceutical preparation contains a high amount of organic material, causing the antimicrobial agent to become less effective.
- Which is the most appropriate strategy to improve the antimicrobial activity?
- A. Increase the temperature
 - B. Increase the antimicrobial concentration
 - C. Increase the organic material
 - D. Increase the amount of the flavouring agent
14. Which group of compounds is most commonly used as preservatives in emulsions and creams?
- A. Alcohols
 - B. Parabens
 - C. Halogens
 - D. Heavy metals
15. Identify the primary purpose of designing a cleanroom with double doors and an air-lock system in the pharmaceutical industry?
- A. Increase airflow into the aseptic area
 - B. Facilitate faster movement of personnel
 - C. Prevent entry of contaminated external air
 - D. Improve temperature control inside the room

16. Which preservative characteristic is most important for patient acceptance of oral pharmaceutical products?
- A. Resistance to microbial degradation during storage
 - B. Acceptable odour and colour
 - C. Compatibility with the packaging materials
 - D. Stability in multiphase system
17. Why is the Most Probable Number (MPN) method considered less accurate than plate count methods?
- A. It requires incubation on solid agar
 - B. It detects only fungal microorganisms
 - C. It measures microbial growth directly
 - D. It estimates microbial count statistically
18. Which statement best explains the pour plate method in microbial limit test?
- A. The sample is mixed with warm molten agar before solidification
 - B. The sample is spread evenly onto the surface of solid agar
 - C. The sample is poured into liquid broth for turbidity measurement
 - D. The sample is filtered through a membrane before incubation
19. What instrument is used in the turbidimetric method?
- A. Microscope
 - B. Autoclave
 - C. Spectrophotometer
 - D. Colony counter

Question 20 to 25 requires the following answer.

A	B	C	D
I and III	II and IV	I, II and III	II, III and IV

20. Which of the following statements are correct about microorganisms?
- Algae contain chlorophyll and can perform photosynthesis
 - Fungal sporangioophores contain spores for reproduction
 - Helminths are multicellular eukaryotic worms
 - Bacterial shapes are polyhedral and helical
21. Which practices help prevent contamination during microbiological testing in the laboratory?
- Briefly open the Petri dishes
 - Performing work close to a Bunsen burner flame
 - Ensuring all materials are within reach before starting
 - Leaving containers open to improve ventilation
22. A student observes a stained bacterial smear using the 40X objective lens. The image is visible but not sharp. The student wants to improve the focus before moving to higher magnification. Which actions are appropriate?
- Use the fine adjustment knob to sharpen the image
 - Adjust the location of the microscope
 - Ensure the specimen is centered before changing the objective lens
 - Immediately rotate to 100X oil immersion objective
23. Which of the following are limiting factors for microbial growth on the conjunctiva?
- Stable temperature of the eyes
 - Presence of lysozyme
 - High nutrient availability
 - Flushing by tears

A	B	C	D
I and III	II and IV	I, II and III	II, III and IV

24. Which pharmaceutical products require sterility to prevent direct microbial entry into the body?

- I. Intravenous (IV) drips
- II. Oral lozenges
- III. Prefilled syringes
- IV. Linctus preparations

25. Select the products that commonly require sterility testing.

- I. Ophthalmic preparations
- II. Implants
- III. Injection
- IV. Suppository

SECTION B (Total: 75 marks)

INSTRUCTION: This section consists of **FOUR (4)** short answer question (SAQ).
You are required to answer **THREE (3)** questions in the answer booklet provided.
Question 1 and Question 2 are COMPULSORY.
Answer either **Question 3 OR Question 4.**

Question 1

- (a) i. Name **TWO (2)** motility structures found in protozoa. (2 marks)
- ii. Name **TWO (2)** types of helminths. (2 marks)
- iii. List **TWO (2)** examples of diseases caused by viruses. (2 marks)

A microbiology student isolates two bacteria from different environments:

- Bacterium A grows only in the presence of oxygen
- Bacterium B grows only in the absence of oxygen and dies when exposed to oxygen

- (b) i. Classify bacterium A and bacterium B. (2 marks)
- ii. Identify **TWO (2)** other factors that affect microbial growth besides oxygen. (2 marks)
- iii. For each of your answers in (b) ii, explain how the factors affect microbial growth. (2 marks)

A laboratory personnel compares two heat-based methods to treat contaminated materials:

Method X: Exposure to 100 °C for 10 minutes

Method Y: Exposure to 121 °C under pressure for 15 minutes

Both samples initially contain vegetative bacteria and endospores.

- (c) i. Identify method X and method Y. (2 marks)
- ii. Predict the outcome for both samples after treatment. Justify your answer. (3 marks)
- (d) Explain **ONE (1)** reason why a high number of microorganisms affects the effectiveness of antimicrobial treatment. (2 marks)
- (e) State **ONE (1)** advantage and disadvantage of normal flora in the human body. (2 marks)

Patient A, who lives in a rural area, develops malaria after being bitten by a mosquito.

Patient B develops cholera after consuming contaminated water.

- (f) i. Identify the mode of transmission for each case. (2 marks)
- ii. Based on your answer in (f) i, explain the differences between these two modes of transmission. (2 marks)

Question 2

- (a) State the function of attachment in virus replication. (2 marks)
- (b) State **TWO (2)** groups of microorganisms based on temperature classification. (2 marks)
- (c) i. List **TWO (2)** types of radiation used to control microbial growth. (2 marks)
- ii. Define pasteurization.
Give **ONE (1)** type of pasteurization technique. (2 marks)
- (d) i. State **TWO (2)** objective lenses used in a light microscope. (2 marks)
- ii. List **TWO (2)** rules for proper handling of a microscope during transportation or storage. (2 marks)

A student performed a streak plate technique to obtain isolated colonies. During the procedure, the inoculating loop was sterilized before continuing the streaking process. After incubation, some areas of the agar plate showed no bacterial growth.

- (e) i. Explain why no bacterial growth was observed in some areas of the agar plate. (2 marks)
- ii. Explain **THREE (3)** additional aseptic techniques that should be practiced during the streak plate procedure to avoid contamination. (3 marks)

- (f) Define the following terms:
- i. Bactericide (1 mark)
 - ii. Fungicide (1 mark)
 - iii. Bacteriostatic agent (1 mark)
- (g) Identify **THREE (3)** factors that affect the choice of an antimicrobial agent. (3 marks)
- (h) The floor of an aseptic room is made of rough concrete with visible cracks. Identify whether this type of flooring is suitable for an aseptic area. Justify your answer. (2 marks)

Answer either Question 3 OR Question 4

Question 3

Ingredient list of Vitamin C oral supplement syrup (100mL)

Ascorbic acid - 1 g

Honey flavour - 0.3 mL

Sucrose - 0.15g

Tartrazine - 0.008 g

Methylparaben - 0.18 g

Propylparaben - 0.02 g

Purified Water - q.s. to 100 mL

Glycerin - 8 mL

Based on the above formulation, answer the following questions.

- (a) i. Identify **TWO (2)** pharmaceutical ingredients that are susceptible to microbial spoilage. (2 marks)
- ii. Identify the function of pharmaceutical ingredients for your answer in (a) i. (2 marks)
- iii. Identify the preservatives in the above formulation. (2 marks)

In December 2025, WellVita® Pharmaceuticals received multiple complaints regarding its multivitamin oral syrup. Consumers reported a fermented odour, colour darkening, and slight gas formation when opening the bottles. Investigation revealed contamination with *Pseudomonas aeruginosa*, traced to the final stages of packaging. The product contained sodium benzoate as preservative.

Based on the statement above, answer the following questions.

- (b) i. Explain how microbial contamination could occur despite the presence of preservatives. (2 marks)

- ii. Explain **TWO (2)** possible sources of contamination in the multivitamin oral syrup.
(4 marks)
- iii. For each of your answers in (b) ii, suggest a preventive measure to be taken.
(2 marks)

Researchers investigated the effectiveness of extracts from five marine plants as natural preservatives for seafood products. The extracts were tested against food spoilage and pathogenic microorganisms isolated from contaminated fish samples. The antimicrobial activity was determined by measuring the diameter of the clear zone formed around each extract.

Table 1 - Antimicrobial activity of marine plant extracts against seafood-associated microorganisms

Microorganism	Antimicrobial activity (mm)			
	Sea lettuce (<i>Ulva lactuca</i>)	Sea grapes (<i>Caulerpa lentillifera</i>)	Red algae (<i>Gracilaria changii</i>)	Peacock's tail algae (<i>Padina pavonica</i>)
<i>Vibrio parahaemolyticus</i>	14.1	-	15.6	18.3
<i>Escherichia coli</i>	18.2	15.7	19.1	13.8
<i>Salmonella</i> sp.	11.0	-	-	10.1
<i>Staphylococcus aureus</i>	24.5	18.4	22.3	26.4
<i>Pseudomonas aeruginosa</i>	17.2	15.2	11.3	16.3

(-) No activity

- (c) Based on the results in Table 1, answer the following questions.
- i. Identify the marine plant extract that showed the strongest preservative potential.
Justify your answer.
(2 marks)
- ii. Name the most resistant bacterium toward the marine plant extracts.
Justify your answer.
(3 marks)
- (d) Sterility testing is described as a "destructive test."
Explain the meaning of this term.
(2 marks)

- (e) The Test for Specified Microorganisms is qualitative in the Microbial Limit Test.
State **TWO (2)** reasons microorganisms such as *Escherichia coli* and *Staphylococcus aureus* are included in this test.

(2 marks)

- (f) Compare the agar diffusion method and the turbidimetric method in terms of measurement and microbial growth assessment.

(2 marks)

Question 4

In July 2025, NovaCura® Pharmaceuticals received complaints regarding its antibiotic tablet product. Several hospitals reported reduced treatment effectiveness among patients. Pharmacists also found that some tablets from the same batch had become soft, partially melted and developed unusual odor inside the packaging. The company did an internal investigation and revealed that the warehouse temperature and humidity were higher than the recommended storage condition required for the product before distribution to hospitals and clinics.

Based on the statement above, answer the following questions.

- (a) i. Identify **TWO (2)** possible consequences of the complaints towards the company. (2 marks)
- ii. Explain **TWO (2)** possible factors that contributed to microbial spoilage of the product. (4 marks)
- iii. For each of your answers in (a) ii, suggest a preventive measure to be taken. (2 marks)

Ingredients list of Aloe Vera Skin Gel (50g)

Aloe vera extract – 2 g
Vitamin E acetate – 0.5 g
Propylene glycol – 3 g
Green tea fragrance – 0.1 mL
CI Green No. 3 – 0.003 g
Phenoxyethanol – 0.4 g
Methyl paraben – 0.08 g
Distilled Water – 10.0 g

Based on the above formulation, answer the following questions.

- (b) i. Identify **TWO (2)** pharmaceutical ingredients that are susceptible to microbial spoilage. (2 marks)

- ii. Identify the categories of pharmaceutical ingredients for your answer in (b) i.
(2 marks)
- iii. Identify the preservative in the above formulation.
(2 marks)

The antifungal activities of five tea extracts commonly consumed in Asia were investigated against several food spoilage and pathogenic fungi. The antifungal activity was determined using an agar diffusion assay by measuring the diameter of the inhibition zones produced by each tea extract.

Table 2 – Antifungal activity of tea extracts against selected fungi

Fungus	Antifungal activity (mm)				
	Green tea (<i>Camellia sinensis</i>)	Black tea (<i>Camellia sinensis</i>)	White tea (<i>Camellia sinensis</i>)	Chamomile tea (<i>Matricaria chamomilla</i>)	Oolong tea (<i>Camellia sinensis</i>)
<i>Aspergillus niger</i>	11.5	21.4	20.1	15.6	24.2
<i>Candida albicans</i>	13.1	20.4	22.5	-	27.2
<i>Penicillium sp.</i>	12.3	-	-	12.1	18.1
<i>Rhizopus sp.</i>	13.4	12.3	15.1	10.4	18.7
<i>Mucor sp.</i>	14.5	11.2	13.6	-	19.1
(-) No activity					

- (c) Based on the results in Table 2, answer the following questions.
- i. Identify the least potent tea extract against the tested fungi.
(1 mark)
- ii. Identify the tea extract that is ineffective against *Aspergillus niger*.
(1 mark)
- ii. Name the tea extract that demonstrated the broadest spectrum of antifungal activity.
Justify your answer.
(3 marks)

- (d) Explain the function and expected result of positive control in sterility testing.
(2 marks)
- (e) Describe how the membrane filtration method is performed in Microbial Limit Tests.
(2 marks)
- (f) State **TWO (2)** situations in which the effectiveness of a preservative system should be retested in Antimicrobial Effectiveness Testing (AET).
(2 marks)

END OF EXAMINATION PAPER