



**SIR ARTHUR LEWIS COMMUNITY COLLEGE
ACADEMIC YEAR (2024/2025) - SEMESTER TWO
END OF SEMESTER EXAMINATION**

ALTERNATE

COURSE CODE : BIO220
COURSE TITLE : Introduction to Microbiology
LECTURER(S) : Ms Christal Jean
DATE :
TIME :
DURATION : 2 Hours
STUDENT ID # : _____

GENERAL INFORMATION AND INSTRUCTIONS

- Students must sign **IN** and **OUT** on the examination class list.
- **This paper consists of TWO (2) sections. Section ONE (1) consists of forty (40) multiple choice questions and Section TWO (2) consists of twenty-eight (28) fill in the blanks questions.**
- Answer **ALL** questions found within both sections on this examination paper.
- Specific instructions are given at the beginning of each section.
- Ensure that your College Identification Number is on every sheet of paper that you submit.

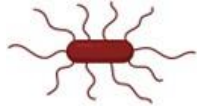
DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO

SECTION 1

Specific Instructions: Read each question carefully and circle the best answer for each of the following questions on this answer sheet provided.

1. A common bacterial shape is that of a rod, often called:
 - A. coccus
 - B. pleomorphic
 - C. bacillus
 - D. spirilla
2. Some bacteria are considered pleomorphic. This means
 - A. they are shaped like bent rods.
 - B. they have a corkscrew shape.
 - C. they are not either bacilli or cocci.
 - D. they do not have just one shape.
3. One way to determine the size, cell morphology and grouping of bacterial cells is to use a _____ technique.
 - A. nutrient broth culture
 - B. streak plate
 - C. simple stain
 - D. phenol red
4. In Pasteur's experiment, why was the neck of the flask specifically designed to have a swan-like curve?
 - A. To allow oxygen in but trap airborne particles and microbes.
 - B. To prevent air from entering the flask.
 - C. To accelerate the growth of microbes within the broth.
 - D. To prevent the broth from evaporating.
5. Which of the following statements is **MOST** correct about the differential Gram stain?
 - A. Saffron red differentially stains Gram positive cells.
 - B. Crystal violet differentially stains Gram negative cells.
 - C. Gram's iodine differentially stains Gram positive cells.
 - D. Alcohol differentially destains Gram negative cells.
6. The ability of a microscope to distinguish between two distinct points of a specimen is known as _____.
 - A. Inversion
 - B. Amplification
 - C. Magnification
 - D. Resolution
7. Bacteria do not always swim aimlessly but are attracted by such nutrients such as sugar and amino acids, and are repelled by harmful substances and bacterial waste products. Movement toward chemical attractants and away from repellents is called:
 - A. jerking
 - B. tumbling.
 - C. gliding motility.
 - D. chemotaxis.
8. Gram positive cells
 - A. have large amounts of teichoic acids.
 - B. do not have an outer membrane.
 - C. have thick, homogeneous cell walls.
 - D. all of the above are true.

9. Which of the following is **NOT** true about capsules and slime layers?
- A. They help bacteria resist phagocytosis by macrophages.
 - B. They are required for bacteria to grow normally in culture.
 - C. They consist of secreted material lying outside of the bacterial cell wall.
 - D. They can prevent desiccation of bacteria cells.
10. Because penicillin prevents peptidoglycan synthesis, it is more effective on ____ cells.
- A. Neither gram-positive nor gram-negative
 - B. Gram-positive
 - C. Gram-negative
 - D. There is insufficient information
11. In general, RNA viruses multiply in the cell _____, DNA viruses multiply in the cell _____.
- A. Vesicles, ribosomes
 - B. Endoplasmic reticulum, nucleolus
 - C. Cytoplasm, nucleus
 - D. Nucleus, cytoplasm
12. "Parfocal" refers to microscopes with multiple objectives where
- A. each objective is positioned to be in focus at the same stage height.
 - B. sequential objectives increase power by a factor of two.
 - C. objectives are used in pairs for stereoscopic effects.
 - D. each objective has the same working distance above the specimen.
13. Phage therapy is a technique that uses
- A. Chemicals to foster the growth of beneficial phages in the body
 - B. Phages to target pathogenic bacteria in the body
 - C. Chemicals to destroy phages infecting human cells
 - D. Phages to foster the growth of normal biota
14. *Staphylococcus* and *Streptococcus* are not in the same family. This indicates that which of the following is **NOT** sufficient to assign an organism to a taxon?
- A. Phage typing
 - B. Serology
 - C. Morphological characteristics
 - D. Biochemical characteristics
 - E. Amino acid sequencing
15. The yeast *Candida albicans* is responsible for most vaginal yeast infections but does not normally cause disease because of:
- A. Commensal bacteria.
 - B. Other fungi.
 - C. Antagonistic bacteria.
 - D. Symbiotic bacteria.
16. What are antigenic shifts?
- A. When a pathogen moves the antigens around on its surface to disguise itself from the immune system.
 - B. Sudden, significant changes to a major antigen of a pathogen that usually occur through reassortment and can cause a pandemic.
 - C. Gradual changes over time to a major antigen of a pathogen that occur through mutation.
 - D. Sudden, significant changes to a major antigen of a pathogen that make the pathogen easier for the immune system to recognize.
17. What are the **three (3)** main taxonomic groups of helminths that can cause infections in humans?
- A. Tapeworms, roundworms, and flukes
 - B. Flagellates, amoebae, and ciliates
 - C. Flagellates, cestodes, and nematodes
 - D. Flukes, ciliates, and flagellates

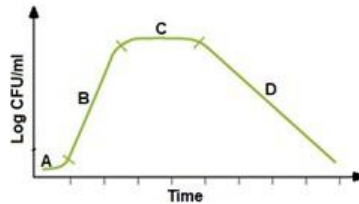
18. What role do biofilms **NOT** play? Please choose the **INCORRECT** statement:
- A. Biofilms can make many antibiotics less effective
 - B. Biofilms protects bacteria from chemical disinfectants
 - C. A biofilm can play a role in preventing phagocytosis
 - D. A biofilm helps prevent bacteria from attaching to any one specific surface
19. When flagella are distributed all around a bacterial cell, as seen below, the arrangement is called
- A. polar
 - B. random
 - C. encapsulated
 - D. peritrichous
- 
20. Which is **NOT** true of the name *Escherichia coli*
- A. Escherichia is the genus to which it belongs
 - B. coli is the strain to which it belongs
 - C. more characteristics have to be met to belong to the coli taxon compared to Escherichia taxon.
 - D. the name is based on binomial nomenclature
21. Which of the following is mismatched?
- A. Inclusions- excess cell nutrients and material
 - B. Nucleoid- hereditary material
 - C. Ribosomes- protein synthesis
 - D. Plasmids- genes essential for growth and metabolism
22. Which of the following is **TRUE** of prions?
- A. They can be reliably inactivated by an autoclave.
 - B. They can be inactivated by boiling at 100°C.
 - C. They contain a capsid.
 - D. They are a rogue form of protein, PrP
23. Yeasts are _____ fungi, and molds are _____ fungi.
- A. filamentous, unicellular
 - B. unicellular, filamentous
 - C. motile, nonmotile
 - D. macroscopic, microscopic
24. Adenosine triphosphate is a type of:
- A. amino acid.
 - B. enzyme.
 - C. nucleotide.
 - D. steroid.
25. In a viable plate count, each ___ represents a ___ from the sample population.
- A. colony, cell
 - B. cell, colony
 - C. colony, generation
 - D. cell, generation
26. You isolate a bacterium that grows well on both MacConkey and EMB Agar, producing colourless colonies on both media. What characteristic does this indicate?
- A. The organism is Gram-positive and ferments lactose.
 - B. The organism is Gram-negative and does not ferment lactose.
 - C. The organism ferments lactose, producing acid.
 - D. The organism is halotolerant and ferments mannitol.
27. Which of the following is **BEST** to sterilize heat labile solutions?
- A. Pasteurization
 - B. Dry heat
 - C. Membrane filtration
 - D. Autoclave
 - E. None of these processes is useful for sterilizing heat labile solutions.

28. Which of the following is the **BEST** definition of generation time?

- A. The length of time it takes for lag phase.
- B. The length of time it takes for a population of cells to double.
- C. The duration of log phase.
- D. The maximum rate of doubling divided by the initial count.
- E. The time it takes for nuclear division.

29. Which section shows a growth phase where the cells are dividing at their maximum rate of division?

- A. C
- B. B
- C. A
- D. D
- E. A and C



30. The specificity of an antibody is due to

- A. The Fc portion of the molecule
- B. The heavy chains
- C. Its valence
- D. The variable portion of the heavy and light chain

31. Which of the following would be a **virulence factor** of a pathogen?

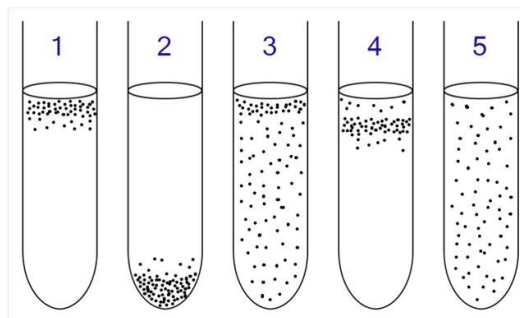
- A. a surface protein allowing the pathogen to bind to host cells
- B. a secondary host the pathogen can infect
- C. a surface protein the host immune system recognizes
- D. the ability to form a provirus

32. Extrinsic factors for microbial growth include:

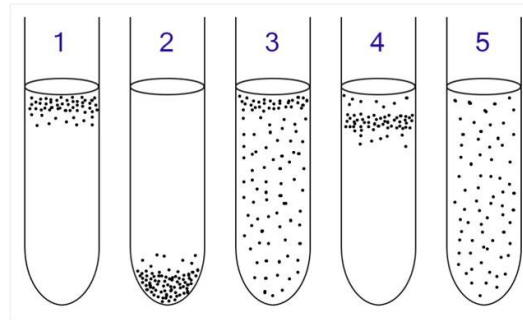
- A. Temperature of food
- B. Antimicrobial constituents
- C. Biological structure of food.
- D. All of the above.

33. The following results were obtained from an investigation of the effects of oxygen on the growth of various types of bacteria: Select the **MOST** appropriate description for Tube 3:

- A. Obligate Aerobes
- B. Aerotolerant Organisms
- C. Facultative Anaerobes
- D. Microaerophiles
- E. Obligate Anaerobes



34. The following results were obtained from an investigation of the effects of oxygen on the growth of various types of bacteria: Select the **MOST** appropriate description for Tube 5:



- A. Organisms grow with/without oxygen, metabolize energy aerobically/anaerobically
 - B. Organisms need oxygen, cannot ferment or breathe anaerobically.
 - C. Organisms are poisoned by oxygen
 - D. Organisms require oxygen because, cannot ferment or breathe anaerobically. They are poisoned by high concentrations of oxygen.
 - E. Organisms do not need oxygen because they metabolize energy anaerobically. They are not poisoned by oxygen.
35. You noticed that a **Fluid Thioglycollate** culture broth tube was **very turbid at the surface** and **turbid throughout** the rest of the tube. You can conclude that the:
- A. organisms cannot tolerate oxygen.
 - B. organisms should be put in a candle jar.
 - C. organisms are aerobes.
 - D. broth is sterile.
 - E. organisms are facultative anaerobes.
36. EMB agar is a medium used in the **identification and isolation of pathogenic bacteria**. It contains **digested meat proteins as a source of organic nutrients**. Two **indicator dyes**, eosin and methylene blue, **inhibit the growth of gram-positive bacteria** and **distinguish between lactose fermenting and non-lactose fermenting organisms**. Lactose **fermenters form metallic green or deep purple colonies**, whereas the **non-lactose fermenters form completely colourless colonies**. EMB agar is an example of which of the following?
- A. A differential medium only
 - B. A selective medium only
 - C. A selective medium and a chemically defined medium
 - D. A selective medium, a differential medium, and a complex medium
37. A culture of bacteria produces 6 generations in 2 hours. What is the generation time for this bacterium under those conditions.
- A. 10 minutes
 - B. 0.75 hours
 - C. 1 hour
 - D. 12 minutes
 - E. 20 minutes
38. An experiment began with **4 cells** and ended with **256 cells**. How many **generations** did the cells go through?
- A. 5
 - B. 32
 - C. 4
 - D. 6
 - E. 64

39. If you **start out with a population density of 100 CFU/ml** of a bacterium that **divides every 20 minutes**, what will the **population density be at the end of two (2) hours**, assuming the cells are in the log phase of growth.
- 1006 CFU/ml
 - 6400 CFU/ml
 - 3200 CFU/ml
 - 600 CFU/ml
 - 2000 CFU/ml
40. **Thirty-six (36)** colonies grew in nutrient agar from a **0.10 ml of sample withdrawn** from a solution **diluted to 10^{-3}** in a standard plate count procedure. How many cells were in the **original sample**?
- 3,600
 - 360,000
 - 1,800,000
 - 3,600,000
 - 360

Section One (1) Total: 40 Marks

SECTION 2

Specific Instructions: Read each statement carefully and fill in the blank(s) with the most appropriate word(s) or phrase(s) to complete the sentences accurately on the foolscap paper provided.

Fill in the Blanks: Bacterial Growth Curve

- The _____ phase is characterized by exponential growth. (1 mark)
- The _____ phase is marked by an exponential decrease in the number of living cells. (1 mark)
- The two (2) terms commonly used to describe the process by which bacteria reproduce, resulting in two genetically identical daughter cells is: (2 marks)
 - _____
 - _____
- A bacterial cell with a mean division time of 15 minutes will undergo _____ rounds of division in 3 hours. (1 mark)
- If 100 bacterial cells divide for 3 hours at a mean division time of 20 minutes, the final cell count will be

 (3 marks)

Total: 8 Marks

Fill in the Blanks: Viruses

6. A _____, is the term for a virus that follows both cycles. (1 mark)
7. The _____ cycle consists of the following steps: Phage infects cell, Phage DNA replicates, New phage particles are assembled, and Cell lysis. (1 mark)
8. A stressful condition, such as _____, can trigger the transition from the _____ cycle to the _____ cycle. (3 marks)
9. Complete the table below with the traits observed in Enveloped and Non enveloped viruses (5 marks)

Ensure to use the suggested phrases to distinguish between Enveloped and Non enveloped viruses where appropriate. Label the column headings appropriately based on the information already provided.

Enveloped or Non-Enveloped Viruses		
Sensitivity to extreme pH (Very sensitive or less sensitive)		
Sensitivity to heat, dryness and simple disinfectants (Very sensitive or less sensitive)		
Target for host 's immune system (Difficult target or easy target)		
Cell lysis	No cell lysis required	Cell lysis required

Total: 10 Marks

Fill in the Blanks: Enzymes

10. The _____ model describes an enzyme as rigid and able to bind only to a substrate that exactly fits its active site. (1 mark)
11. The _____ model describes the enzyme as flexible, with the active site becoming complementary only after substrate binding. (1 mark)
12. The minimum extra energy required to convert reactants into products is known as: _____ (1 mark)
13. An enzyme with its cofactor is called a _____, while an enzyme without its cofactor is called a _____. (2 marks)

Total: 5 Marks

Fill in the Blanks: Horizontal Gene Transfer

14. The horizontal gene transfer mechanism by which bacteria take up free-floating DNA from the environment is called: _____ (1 mark)
15. The horizontal gene transfer mechanism where bacteriophages transfer DNA between bacteria is called: _____ (1 mark)
16. The horizontal gene transfer mechanism where DNA is transferred via a pilus from one bacterium to another is called: _____ (1 mark)
17. The genetic element that enables bacteria to transfer antibiotic resistance is called the : _____ (1 mark)

Total: 4 Marks

Fill in the Blanks: Modes of Action of Antimicrobial Drugs and Antibiotic Combinations

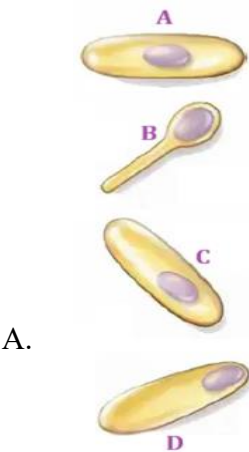
18. Antibiotic _____ occurs when the combination of two antibiotics results in enhanced activity, such as in the case of Ampicillin and Gentamicin in enterococcal carditis. (1 mark)
19. An additive effect results when the combination of antibiotics has a total effect equal to the _____ of each antibiotic's activity. (1 mark)
20. Antibiotic _____ occurs when the activity of one antibiotic interferes with the other, reducing the overall effectiveness. (1 mark)
21. Antimicrobial drugs that inhibit _____ interfere with the structural integrity of all possible types of bacterial cells. (1 mark)
22. Drugs that interfere with _____ synthesis affect the genetic material of all possible types of bacteria. (1 mark)
23. Antimicrobial drugs that disrupt _____ function prevent bacteria from synthesizing essential proteins. (1 mark)

Total: 6 Marks

Fill in the Blanks: Endospores

24. An endospore is a _____ structure produced by some bacteria. (1 mark)
25. Endospores form under extreme or stressful conditions such as: (2 marks)
1. _____
 2. _____

26. Based on endospore location, they are classified as: (4 marks)



A: _____

B: _____

C: _____

D: _____

27. _____ is the name of the specialized stain used to detect spore-forming bacteria. Endospores appear _____ under the microscope, while vegetative cells appear _____. (3 marks)

Total: 10 Marks

Fill in the Blanks: Toxins

28. Use the table below to distinguish between two (2) distinct types of toxins produced by bacteria. Insert the toxin type in the appropriate column and complete the table below: (7 marks)

FACTORS	Toxin Type:	Toxin Type:
Cellular Location		
Composition		
Temperature Resistance (Greater or Lesser)		
Denaturation (Resistant or Prone)		
Strain Specificity (Gram-negative or Gram-negative and		

Gram-positive or Gram- positive)		
Conversion to Toxoids	No	Yes

Total: 7 Marks

Section Two (2) Total: 50 Marks

END OF EXAMINATION