



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

COURSE CODE : BIO220
COURSE TITLE : Introduction to Microbiology
LECTURER(S) : Ms Christal Jean
DATE : May 2, 2025
TIME : 1 p.m.
DURATION : 2 Hours
STUDENT ID # : _____

GENERAL INFORMATION AND INSTRUCTIONS

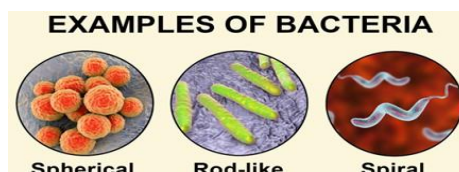
- Students must sign **IN** and **OUT** on the examination class list.
- **This paper consists of TWO (2) sections. Section ONE (1) consists of forty (40) multiple choice questions and Section TWO (2) consists of twenty- nine (29) fill in the blanks questions.**
- Answer **ALL** questions found within 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. "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.



2. The most commonly encountered bacteria are roughly **spherical**. The microbiological term describing this shape is:
 - A. coccus
 - B. pleomorphic
 - C. bacillus
 - D. spirilla
3. 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.
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. What is a plasmid?
 - A. Chromosomal DNA of bacterial cells
 - B. Self-replicating segment of single stranded RNA
 - C. A bacterial chromosome
 - D. Self-replicating segment of double stranded DNA
7. Gram positive cells
 - A. have multiple layers of peptidoglycan that help retain the crystal violet stain.
 - B. have a periplasmic space that traps the crystal violet.
 - C. have a thick capsule that traps the crystal violet stain.
 - D. have a second, outer membrane that helps retain the crystal violet stain.
8. 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.

9. 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
10. 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
11. Intrinsic factors for the microbial growth include:
- A. Water activity
 - B. Oxidation-Reduction potential
 - C. pH
 - D. All of the above
12. 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
13. R factors are _____ that contain a code for _____.
- A. Genes, replication
 - B. Plasmids, drug resistance
 - C. Transposons, interferon
 - D. Plasmids, conjugation
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. Sulfanilamide drugs are _____.
- A. Protein inhibitors
 - B. Antimetabolites
 - C. Cell wall inhibitors
 - D. DNA inhibitors
16. 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.
17. 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.
18. 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

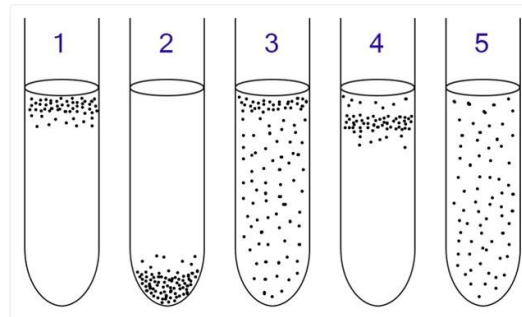
19. What role do biofilms **NOT** play? Please choose the **INCORRECT** statement:
- A. Biofilms can make many antibiotics less effective
 - B. Biofilms protects bacteria from chemical disinfectants
 - C. A biofilm can play a role in preventing phagocytosis
 - D. A biofilm helps prevent bacteria from attaching to any one specific surface
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. Yeasts are ____ fungi, and molds are _____ fungi.
- A. filamentous, unicellular
 - B. unicellular, filamentous
 - C. motile, nonmotile
 - D. macroscopic, microscopic
23. In a viable plate count, each _____ represents a ____ from the sample population.
- A. colony, cell
 - B. cell, colony
 - C. colony, generation
 - D. cell, generation
24. 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.
25. Which of the following is bactericidal?
- A. Ionizing radiation
 - B. Freeze-drying
 - C. Deep freezing
 - D. Membrane filtration
 - E. All of these processes kill bacteria.
26. A bacterium that grows on MacConkey Agar and produces pink colonies is likely:
- A. An anaerobic organism
 - B. A lactose fermenter
 - C. A Gram-positive organism
 - D. A non-lactose fermenter
27. A living microbe with reduced virulence that is used for vaccination is considered:
- A. Denatured
 - B. Attenuated
 - C. A toxoid
 - D. Dormant
 - E. Virulent
28. Cell-mediated immunity is carried out by _____ while humoral immunity is mainly carried out by_____.
- A. Epitopes, antigens
 - B. Antibodies, phagocytes
 - C. T cells, B cells
 - D. Antibodies, antigens
 - E. B cells, T cells

29. Immunity where the organism produces antibodies and specialized lymphocytes to fight an antigen is called
- active naturally acquired immunity
 - passive artificially acquired immunity
 - passive naturally acquired immunity
 - active artificially acquired immunity

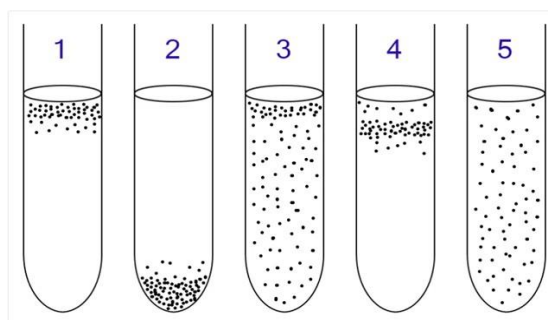
30. The specificity of an antibody is due to
- The Fc portion of the molecule
 - The heavy chains
 - Its valence
 - The variable portion of the heavy and light chain

31. Which of the following would be a **virulence factor** of a pathogen?
- a surface protein allowing the pathogen to bind to host cells
 - a secondary host the pathogen can infect
 - a surface protein the host immune system recognizes
 - the ability to form a provirus

32. 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:



- Organisms grow with/without oxygen, metabolize energy aerobically/anaerobically
 - Organisms need oxygen, cannot ferment or breathe anaerobically.
 - Organisms are poisoned by oxygen
 - Organisms require oxygen because, cannot ferment or breathe anaerobically. They are poisoned by high concentrations of oxygen.
 - Organisms do not need oxygen because they metabolize energy anaerobically. They are not poisoned by oxygen.
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 5:



- Obligate Anaerobes
 - Obligate Aerobes
 - Microaerophiles
 - Aerotolerant Organisms
 - Facultative Anaerobes
34. 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:
- organisms cannot tolerate oxygen.
 - organisms should be put in a candle jar.
 - organisms are aerobes.
 - broth is sterile.
 - organisms are facultative anaerobes.

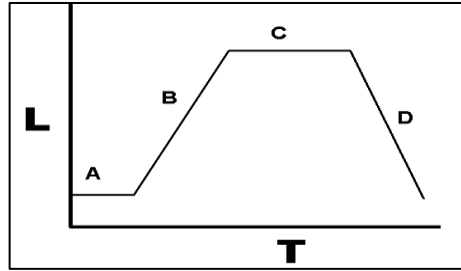
35. A newly discovered bacterium was found to live in an environment with an **extremely low pH** and **can only survive in high salt concentrations**. Which of the following options **BEST** describes this bacterium?
- Acidophilic and facultative halophilic
 - Acidophilic and obligate halophilic
 - Psychrophilic and acidophilic
 - Acidophilic and halophilic
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 differential medium only
 - A selective medium only
 - A selective medium and a chemically defined medium
 - A selective medium, a differential medium, and a complex medium
37. A culture of bacteria produces 5 generations in 2 hours. What is the generation time for this bacterium under those conditions.
- 30 minutes
 - 0.75 hours
 - 1 hour
 - 12 minutes
 - 24 minutes
38. An experiment began with **4 cells** and ended with **128 cells**. How many **generations** did the cells go through?
- 5
 - 32
 - 4
 - 6
 - 64
39. If you start out with a population density of **200 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.
- 12800 CFU/ml
 - 1200 CFU/ml
 - 2006 CFU/ml
 - 4000 CFU/ml
 - 3200 CFU/ml
40. **Thirty-six (36)** colonies grew in nutrient agar from **1.0 ml of sample withdrawn** from a solution **diluted to 10^{-5}** 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



1. As per the above diagram, the four (4) distinct stages of the bacterial growth curve are : (4 marks)
A: _____ C: _____
B: _____ D: _____
2. The _____ phase is where bacteria are metabolically active but not dividing. (1 mark)
3. The _____ phase occurs when growth reaches a plateau as the number of dying cells equals the number of dividing cells. (1 mark)
4. The two (2) terms commonly used to describe bacterial replication is: (2 marks)
(i) _____
(ii) _____
5. The phrase used to describe the time taken for a bacterial population to double is _____. (1 mark)
6. A bacterial cell with a mean division time of twenty (20) minutes will undergo _____ rounds of division in Three (3) hours. (1 mark)
7. If 100 bacterial cells divide for 3 hours at a mean division time of 30 minutes, the final cell count will be _____

_____ (3 marks)

Total: 13 Marks

Fill in the Blanks: Enzymes

8. The _____ model describes an enzyme as rigid and able to bind only to a substrate that exactly fits its active site. (1 mark)
9. The _____ model describes the enzyme as flexible, with the active site becoming complementary only after substrate binding. (1 mark)
10. The currently accepted model for enzyme action is the _____ model. (1 mark)
11. The region of an enzyme that interacts with the substrate is called the _____. (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: 7 Marks

Fill in the Blanks: Endospores

14. An endospore is a _____ structure produced by some bacteria. (1 mark)
15. Endospores form under extreme or stressful conditions such as: (2 marks)
- (i) _____
- (ii) _____
16. The specialized stain used to visualize endospores is _____ (1 mark)
- Total: 4 Marks

Fill in the Blanks: Viruses

17. The two (2) life cycles of bacteriophages are the: (2 marks)
- (i) _____
- (ii) _____
18. A _____, is the term for a virus that follows both cycles. (1 mark)
19. In the _____ cycle, the phage DNA integrates into the host genome and is passed on during cell division. (1 mark)
20. A stressful condition, such as _____, can trigger the transition from the _____ cycle to the _____ cycle. (3 marks)
21. 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 to extreme pH	Less sensitive to extreme pH
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 or Cell lysis required)		

Total: 12 Marks

Fill in the Blanks: Horizontal Gene Transfer

22. The horizontal gene transfer mechanism by which bacteria take up free-floating DNA from the environment is called: (1 mark)
- _____
23. The horizontal gene transfer mechanism where bacteriophages transfer DNA between bacteria is called: (1 mark)
- _____
24. The horizontal gene transfer mechanism where DNA is transferred via a pilus from one bacterium to another is called: (1 mark)
- _____
25. The genetic element that enables bacteria to transfer antibiotic resistance is called the : (1 mark)
- _____
- Total: 4 Marks

Fill in the Blanks: Antibiotic Combinations

26. 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)

27. An additive effect results when the combination of antibiotics has a total effect equal to the _____ of each antibiotic's activity. (1 mark)
28. Antibiotic _____ occurs when the activity of one antibiotic interferes with the other, reducing the overall effectiveness. (1 mark)
- Total: 3 Marks**

Fill in the Blanks: Toxins

29. 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	Gram-positive and Gram-negative
Conversion to Toxoids (Yes or No)		

Total: 7 Marks

Section Two (2) Total: 50 Marks

END OF EXAMINATION