

# MICROBIOLOGY FOR ICAR NET:

## A COMPREHENSIVE EXAM PREPARATION GUIDE



**Sunita Devi**  
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**Bentham Books**

# **Microbiology for ICAR NET: A Comprehensive Exam Preparation Guide**

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## CONTENTS

<b>FOREWORD</b> .....	i
<b>PREFACE</b> .....	iii
<b>CHAPTER 1 FROM PAST TO PRESENT: THE SCOPE OF MICROBIOLOGY</b> .....	1
A. Multiple Choice Questions .....	1
B. Fill in the Blanks Questions .....	12
C. True and False Questions .....	14
ANSWER KEY (CHAPTER -1) .....	15
A. Multiple Choice Questions .....	15
B. Fill in the Blanks Questions .....	16
C. True and False Questions .....	16
<b>CHAPTER 2 PROKARYOTES, ARCHAEBACTERIA, AND EUKARYOTES</b> .....	17
A. Multiple Choice Questions .....	17
B. Fill in the Blanks Questions .....	42
C. True and False Questions .....	45
ANSWER KEY (CHAPTER -2) .....	47
A. Multiple Choice Questions .....	47
B. Fill in the Blanks Questions .....	48
C. True and False Questions .....	49
<b>CHAPTER 3 SECOND ORDER DIFFERENTIAL EQUATIONS AND APPLICATIONS TO     SOME MODELS</b> .....	50
A. Multiple Choice Questions .....	50
B. Fill in the Blanks Questions .....	65
C. True and False Questions .....	66
ANSWER KEY (CHAPTER -3) .....	69
A. Multiple Choice Questions .....	69
B. Fill in the Blanks Questions .....	70
C. True and False Questions .....	70
<b>CHAPTER 4 IMPORTANT GROUPS OF PROKARYOTES</b> .....	71
A. Multiple Choice Questions .....	71
B. Fill in the Blanks Questions .....	92
C. True and False Questions .....	94
ANSWER KEY (CHAPTER -4) .....	95
A. Multiple Choice Questions .....	95
B. Fill in the Blanks Questions .....	96
C. True and False Questions .....	96
<b>CHAPTER 5 ROOTS AND MICROBES: THE INTERPLAY IN SOIL MICROBIOLOGY</b> .....	97
A. Multiple Choice Questions .....	97
B. Fill in the Blanks Questions .....	133
C. True and False Questions .....	137
ANSWER KEY (CHAPTER -5) .....	140
A. Multiple Choice Questions .....	140
B. Fill in the Blanks Questions .....	142
C. True and False Questions .....	143
<b>CHAPTER 6 ENVIRONMENTAL MICROBIOLOGY AND BASIC MICROBIOLOGICAL     TECHNIQUES</b> .....	144
A. Multiple Choice Questions.....	144
B. Fill in the Blanks Questions .....	170
C. True and False Questions .....	174
ANSWER KEY (CHAPTER -6) .....	178
A. Multiple Choice Questions .....	178
B. Fill in the Blanks Questions .....	179

C. True and False Questions .....	180
<b>CHAPTER 7 BIOTECHNOLOGY OF MICROBES: PROGRESS AND PROSPECTS .....</b>	<b>181</b>
A. Multiple Choice Questions.....	181
B. Fill in the Blanks Questions .....	206
C. True and False Questions .....	211
ANSWER KEY (CHAPTER -7) .....	215
A. Multiple Choice Questions .....	215
B. Fill in the Blanks Questions .....	216
C. True and False Questions .....	218
<b>CHAPTER 8 ENVIRONMENTAL MICROBIOLOGY AND BASIC MICROBIOLOGICAL TECHNIQUES .....</b>	<b>219</b>
A. Multiple Choice Questions.....	219
B. Fill in the Blanks Questions .....	250
C. True and False Questions .....	254
ANSWER KEY (CHAPTER -8) .....	259
A. Multiple Choice Questions .....	259
B. Fill in the Blanks Questions .....	261
C. True and False Questions .....	262
<b>BIBLIOGRAPHY.....</b>	<b>263</b>



## FOREWORD

The field of Microbiology is a rapidly evolving discipline, demanding precision, dedication, and expert guidance. It is with great pleasure that I write the Foreword for "**Microbiology for ICAR NET: A Comprehensive Exam Preparation Guide**," authored by Dr. Sunita Devi, Assistant Professor (Microbiology) in the Department of Basic Sciences, along with her team members Dr. Kumari Manorma, Ms. Megha Sharma, and Mr. Subhash Chand. This book is an invaluable resource for students preparing for the ICAR NET exam, offering a thorough and forward-looking approach to mastering microbiology.

This guide covers the entire ICAR NET syllabus across eight meticulously structured chapters: "From Past to Present: The Scope of Microbiology," "Prokaryotes, Archaeobacteria, and Eukaryotes," "The Art and Science of Microscopy," "Important Groups of Prokaryotes," "Roots and Microbes: The Interplay in Soil Microbiology," "Environmental Microbiology and Basic Microbiological Techniques," "Biotechnology of Microbes: Progress and Prospects," and "Microbial Physiology and Ecology."

More than just a roadmap to success, this book facilitates a deep understanding of microbiological principles. It employs a thoughtful mix of multiple-choice questions, true/false statements, and fill-in-the-blank exercises to transcend mere fact-recollection and foster critical thinking skills. The detailed answer key ensures that learners are thoroughly prepared and confident in their knowledge.

"Microbiology for ICAR NET: A Comprehensive Exam Preparation Guide" is designed to support students as they navigate the complex terrain of microbial science. It equips them with the necessary tools to excel in their examinations and future endeavors.

Embark on this transformative journey with "Microbiology for ICAR NET: A Comprehensive Exam Preparation Guide." Let the pages within be your steadfast companions as you explore the intricate landscapes of microbial science. May this resource empower you to overcome challenges, deepen your understanding, and ultimately, achieve excellence in your endeavors.

I extend my heartfelt congratulations and best wishes to the authors for their exemplary work in creating this comprehensive guide. Their dedication and

*ii*

expertise are evident in every page, and I am confident that this book will be an invaluable asset to students and educators alike.

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## PREFACE

As we delve into the pages of "Microbiology for ICAR NET: A Comprehensive Exam Preparation Guide", I am delighted to introduce a comprehensive guide meticulously crafted to meet the unique needs of students preparing for the ICAR NET exam in microbiology. This preface serves as an invitation into the realm of microbiological exploration, where the boundaries between learning and application blur, and understanding becomes the cornerstone of success.

This book emerges from a shared passion for microbiology and a commitment to providing students with more than just a preparatory guide. With each chapter, we aim to foster a deep appreciation for the diversity and complexity of microbial life. The strategic arrangement of multiple-choice questions, true/false questions, and fill-in-the-blank exercises serves not only to reinforce foundational knowledge but also to ignite curiosity and critical thinking.

The detailed answer key included in this guide is not merely a set of solutions but a companion that invites you to embark on a journey of discovery. It is our hope that this book will not only assist you in acing the ICAR NET exam but also inspire a lifelong love for the fascinating world of microbiology.

May "Microbiology Mastery" be your guide, mentor, and confidant as you navigate the challenges and triumphs of your academic journey. Happy learning!.

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**CHAPTER 1****From Past to Present: The Scope of Microbiology****A. Multiple Choice Questions**

<b>1.</b>	<b>Who coined the term "microbe"?</b>		
(A)	Louis Pasteur	(B)	C.E. Sedillot
(C)	Robert Koch	(D)	Antony Van Leeuwenhoek
<b>2.</b>	<b>Who is credited with originating the term "animalcules"?</b>		
(A)	Antony V. Leeuwenhoek	(B)	Louis Pasteur
(C)	Francesco Redi	(D)	Lazzaro Spallanzani
<b>3.</b>	<b>----- was the first scientist to disprove the theory of spontaneous generation.</b>		
(A)	John Tyndall	(B)	Francesco Redi
(C)	Robert Hooke	(D)	Louise Pasteur
<b>4.</b>	<b>A final blow to spontaneous generation was given by:</b>		
(A)	Louis Pasteur and Ferdinand Cohn	(B)	Robert Koch and Joseph Lister
(C)	Francesco Redi and Louis Pasteur	(D)	John Tyndall and Ferdinand Cohn
<b>5.</b>	<b>Who is credited with the invention of the microscope that allowed for significant advancements in microbiology?</b>		
(A)	Louis Pasteur	(B)	Johannes Gutenberg
(C)	Antonie van Leeuwenhoek	(D)	Zacharias Janssen
<b>6.</b>	<b>Who pioneered the technique of obtaining pure bacterial cultures through serial dilutions in a liquid medium for the first time?</b>		
(A)	Robert Koch	(B)	Joseph Lister

(C)	Louis Pasteur	(D)	None of the above
<b>7.</b>	<b>Who introduced the terms aerobic and anaerobic fermentation?</b>		
(A)	Louis Pasteur	(B)	C.J. Davaine
(C)	Robert Koch	(D)	Joseph Lister
<b>8.</b>	<b>Who is attributed with coining the term "antibiotic"?</b>		
(A)	Alexander Fleming	(B)	Joseph Lister
(C)	Domagk	(D)	Selman Waksman
<b>9.</b>	<b>Who is often referred to as the "Father of Soil Microbiology"?</b>		
(A)	Ivanowski	(B)	Pasteur
(C)	Beijerinck	(D)	Sergei Winogradsky
<b>10.</b>	<b>Who is credited with the introduction of the term "bacterium"?</b>		
(A)	Hooke	(B)	Ehrenberg
(B)	Pasteur	(D)	Leeuwenhoek
<b>11.</b>	<b>Who is credited with pioneering the concept of biological nitrogen fixation?</b>		
(A)	Martinus Beijerinck	(B)	Winogradsky
(C)	Ivanowski	(D)	None of the above
<b>12.</b>	<b>Who independently validated that <i>Bacillus anthracis</i> was the agent responsible for anthrax?</b>		
(A)	Louis Pasteur	(B)	John Needham
(C)	Joseph Lister	(D)	Robert Koch
<b>13.</b>	<b>Which genus was acknowledged as the first to include aerobic, free-living nitrogen-fixing bacteria?</b>		
(A)	<i>Arthrobacter</i>	(B)	<i>Azotobacter</i>
(C)	<i>Pseudomonas</i>	(D)	<i>Bacillus</i>

<b>14.</b>	<b>Who provided the evidence that the Great Potato Blight of Ireland was caused by a water mold?</b>		
(A)	de Bary in 1853	(B)	A. Bassi in 1856
(C)	M. Bigo in 1856	(D)	M.J. Berkeley in 1845
<b>15.</b>	<b>In 1688, who covered some jars of rotting meat with gauze, preventing the entry of flies, while leaving other jars uncovered?</b>		
(A)	John Needham	(B)	Louis Pasteur
(C)	Francesco Redi	(D)	Lazzaro Spallanzani
<b>16.</b>	<b>Which of the following is not a component of Robert Koch's pure culture technique?</b>		
(A)	Immunization	(B)	Inoculation
(C)	Incubation	(D)	Isolation
<b>17.</b>	<b>The causative agent responsible for Pebrine disease in silkworms is a:</b>		
(A)	Protozoan parasite	(B)	Fungal parasite
(C)	Bacterial parasite	(D)	Viral parasite
<b>18.</b>	<b>Who provided the first indirect evidence for the germ theory of diseases?</b>		
(A)	Robert Koch	(B)	Louis Pasteur
(C)	Joseph Lister	(D)	Elie Metchnikoff
<b>19.</b>	<b>Who demonstrated the role of microorganisms in putrefaction?</b>		
(A)	Louis Pasteur	(B)	John Tyndall
(C)	Robert Koch	(D)	Ferdinand Cohn
<b>20.</b>	<b>Who is considered the progenitor of modern immunology?</b>		
(A)	Louis Pasteur	(B)	Jenner
(C)	Robert Koch	(D)	Lister

**CHAPTER 2****Prokaryotes, Archaeobacteria, and Eukaryotes****A. Multiple Choice Questions**

<b>1.</b>	<b>The distinction between prokaryotes and eukaryotes was firmly established by:</b>		
(A)	Roger Stanier and CB Van Niel	(B)	Leeuwenhoek and R. Hooke
(C)	Edouard Chatton and CB Van Niel	(D)	None of the above
<b>2.</b>	<b>A layer of diffuse, unorganized, easily removed material lying outside the cell wall is known as:</b>		
(A)	S-layer	(B)	Slime Layer
(C)	Capsule	(D)	Glycocalyx
<b>3.</b>	<b>What is the term used to describe the rigid, spiral shape of a bacterial or archaeal cell?</b>		
(A)	Spirillum	(B)	Vibriosis
(C)	Diplococcus	(D)	Bacilli
<b>4.</b>	<b><i>Bacillus megaterium</i> exemplifies a bacterium with----- shape.</b>		
(A)	Spiral	(B)	Rod
(C)	Comma	(D)	Cocci
<b>5.</b>	<b>Peptidoglycan, also referred to as _____, is the primary constituent or backbone of the bacterial cell wall.</b>		
(A)	Murein	(B)	Muramic acid
(C)	Both A and B	(D)	None



<b>6.</b>	<b>Peptidoglycan is comprised of alternating units of N-acetylglucosamine and N-acetylmuramic acid bonded together by _____.</b>		
(A)	$\beta$ -1-4- linkages	(B)	$\beta$ -1-6- linkages
(C)	$\alpha$ -1-4- linkages	(D)	$\alpha$ -1-6- linkages
<b>7.</b>	<b>Mycoplasma are the _____ bacteria.</b>		
(A)	Largest	(B)	Longest
(C)	Smallest	(D)	None
<b>8.</b>	<b>The fibers, composed of protein, that serve as scaffolding onto which specific adhesive molecules are attached are known as _____.</b>		
(A)	Pilins	(B)	Porins
(B)	Flagellins	(D)	Adhesins
<b>9.</b>	<b>In prokaryotes, the hair-like outgrowths that attach to the surface of other bacterial cells are called_____.</b>		
(A)	Capsule	(B)	Flagella
(C)	Pili	(D)	Glycocalyx
<b>10.</b>	<b>What remarkable "nanomachine" do many prokaryotes use for motility?</b>		
(A)	Pili	(B)	Flagella
(C)	Fimbriae	(D)	Capsules
<b>11.</b>	<b>What composes each flagellum in the bacterial domain?</b>		
(A)	Filament	(B)	Hook
(C)	Basal body	(D)	All of above
<b>12.</b>	<b>What type of motility do cyanobacteria and myxobacteria exemplify?</b>		
(A)	Axial motility	(B)	Gliding motility
(C)	Twitching motility	(D)	Flagellar motility

<b>13.</b>	<b>What is the term for a molecule or structure produced by a pathogen that enables it to invade the immune system and potentially cause disease?</b>		
(A)	Antigen	(B)	Virulence factor
(C)	Antibiotic	(D)	Toxin
<b>14.</b>	<b>Which component of the bacterial flagellum is primarily responsible for anchoring it to the cell wall?</b>		
(A)	Basal body	(B)	Hook
(C)	Filament	(D)	Rings
<b>15.</b>	<b>What role does Lipid A, a major component of lipopolysaccharide, play in bacterial function?</b>		
(A)	Stabilizes the outer membrane	(B)	Acts as an endotoxin
(C)	Both A and B	(D)	None
<b>16.</b>	<b>According to the Fluid Mosaic Model, which component of the cell membrane forms a fluid matrix in which proteins are embedded?</b>		
(A)	Cholesterol	(B)	Phospholipids
(C)	Glycoproteins	(D)	Integral proteins
<b>17.</b>	<b>Teichoic acids are found in the cell walls of which type of bacteria?</b>		
(A)	Gram-positive cell walls	(B)	Gram-negative cell walls
(C)	Both A and B	(D)	Archaea
<b>18.</b>	<b>Which of the following metabolic pathways is commonly found in archaeobacteria but not in eubacteria?</b>		
(A)	Glycolysis	(B)	Methanogenesis
(C)	Krebs cycle	(D)	Photosynthesis
<b>19.</b>	<b>The domain Eukarya contains all the following groups except</b>		
(A)	Animal	(B)	Viruses

**CHAPTER 3****The Art and Science of Microscopy****A. Multiple Choice Questions**

<b>1.</b>	<b>The refractive index of air is_____.</b>		
(A)	1.00	(B)	0.60
(C)	1.25	(D)	0.65
<b>2.</b>	<b>All of the following are the components of a compound microscope except:</b>		
(A)	Binocular eyepiece	(B)	Condenser
(C)	Stage clips	(D)	Electron gun
<b>3.</b>	<b>When the power of the ocular lens is 10X and the objective lens is 40X, the magnification will be:</b>		
(A)	4000X	(B)	50X
(C)	4X	(D)	400X
<b>4.</b>	<b>What type of microscope is particularly useful for studying microbial motility, the shape of living cells, and bacterial structures such as endospores and inclusion bodies?</b>		
(A)	Electron microscope	(B)	Phase contrast microscope
(C)	Dark-field microscope	(D)	Fluorescent microscope
<b>5.</b>	<b>What component of the light microscope regulates the amount of light entering the viewing area?</b>		
(A)	Condenser	(B)	Both (A) and (B)
(C)	Diaphragm	(D)	Ocular lens

<b>6.</b>	<b>Total magnification is the product of:</b>		
(A)	Objective lens and eyepiece lens magnification	(B)	Condenser lens and objective lens magnification
(C)	Eyepiece lens and condenser lens magnification	(D)	Stage magnification and objective lens magnification
<b>7.</b>	<b>What is the numerical aperture value of an oil immersion objective lens?</b>		
(A)	1.00	(B)	0.33
(C)	0.65	(D)	1.25
<b>8.</b>	<b>Who is credited with building the first electron microscope?</b>		
(A)	Knoll and Ruska	(B)	Robert Hooke
(C)	Zacharias Janssen	(D)	Jacob and Monod
<b>9.</b>	<b>What is the minimum distance at which our eyes can focus on nearby objects?</b>		
(A)	11cm	(B)	25cm
(C)	50cm	(D)	70cm
<b>10.</b>	<b>Which substance is typically used as a fixative in light microscopy before staining?</b>		
(A)	Iodine	(B)	Safranin
(C)	Heat	(D)	All of these
<b>11.</b>	<b>What is the name of the mordant employed in Gram staining?</b>		
(A)	Crystal Violet	(B)	Ethyl alcohol
(C)	Iodine	(D)	Safranin
<b>12.</b>	<b>Which component of the microscope focuses light rays onto the specimen?</b>		
(A)	Ocular lens	(B)	Diaphragm
(C)	Objective lens	(D)	Condenser

<b>13.</b>	<b>What is the maximum magnification power achievable with an electron microscope?</b>		
(A)	1500X	(B)	15,000X
(C)	400,000X	(D)	100,000X
<b>14.</b>	<b>What is the correct sequence of staining reagents used in Gram staining?</b>		
(A)	Crystal violet-iodine-alcohol-safranin	(B)	Crystal violet-iodine-safranin-alcohol
(C)	Crystal violet-alcohol-safranin-iodine	(D)	Crystal violet-alcohol-iodine-safranin
<b>15.</b>	<b>What electron-dense material is used as a stain in negative staining?</b>		
(A)	Phosphotungstic acid	(B)	Uranyl acetate
(C)	Both (A) and (B)	(D)	None of these
<b>16.</b>	<b>What is the name of the red cationic dye used to counterstain bacteria in Gram staining?</b>		
(A)	Safranin	(B)	Methylene blue
(C)	Crystal Violet	(D)	Acidic Fuchsin
<b>17.</b>	<b>What is the metal used in electron microscopes?</b>		
(A)	Platinum	(B)	Silver
(C)	Tungsten	(D)	Copper
<b>18.</b>	<b>What role does iodine play in the Gram staining procedure?</b>		
(A)	Increase the affinity between cell and dye	(B)	To form a complex with crystal violet
(C)	Both (A) and (B)	(D)	None of the above
<b>19.</b>	<b>Which type of microscope is typically used to examine the surfaces of microorganisms in great detail?</b>		
(A)	Scanning electron microscope	(B)	Transmission electron microscope

**CHAPTER 4****Important Groups of Prokaryotes****A. Multiple Choice Questions**

<b>1.</b>	<b>Cyanobacteria differ from the other photosynthetic bacteria because they perform:</b>		
(A)	Oxygenic photosynthesis	(B)	Anoxygenic photosynthesis
(C)	Both A and B	(D)	None of these
<b>2.</b>	<b>Which type of photosystems do cyanobacteria possess?</b>		
(A)	Photosystem I only	(B)	Photosystem II only
(C)	Both Photosystems I and II	(D)	None of the above
<b>3.</b>	<b>What molecule serves as the electron donor in cyanobacteria during photosynthesis?</b>		
(A)	CO <sub>2</sub>	(B)	Water
(C)	Other reduced molecules	(D)	None of these
<b>4.</b>	<b>What kinds of photosystems do purple and green bacteria possess?</b>		
(A)	Photosystem I only	(B)	Photosystem II only
(C)	Both Photosystems I and II	(D)	None of these
<b>5.</b>	<b>What inorganic electron donors are used by purple and green sulfur bacteria?</b>		
(A)	Sulfur dioxide	(B)	Sulfuric acid
(C)	Both (A) and (B)	(D)	Hydrogen sulphide
<b>6.</b>	<b>What is the major photosynthetic pigment of both sulfur and non-sulfur bacteria?</b>		
(A)	Bacteriochlorophyll	(B)	Chlorophyll b
(C)	Chlorophyll a	(D)	Phycocerythrin

<b>7.</b>	<b>In which habitats do cyanobacteria generally inhabit?</b>		
(A)	Extreme cold environments	(B)	Deep ocean trenches
(C)	Freshwater and marine environments	(D)	Arid desert regions
<b>8.</b>	<b>Which phylum do green sulfur bacteria belong to?</b>		
(A)	Firmicutes	(B)	$\alpha$ -proteobacteria
(C)	Chlorobi	(D)	Cyanobacteria
<b>9.</b>	<b>In green sulfur bacteria, where are photosynthetic pigments primarily located?</b>		
(A)	Thylakoid membrane	(B)	Cytoplasm
(C)	Intracytoplasmic membrane	(D)	Chlorosomes
<b>10.</b>	<b>Which of the following is an example of green sulfur bacteria?</b>		
(A)	<i>Synechococcus elongatus</i>	(B)	<i>Bacillus subtilis</i>
(C)	<i>Escherichia coli</i>	(D)	<i>Chlorobium tepidum</i>
<b>11.</b>	<b>The members of the genus <i>Chloroflexus</i> belong to which group of photosynthetic bacteria?</b>		
(A)	Green nonsulfur bacteria	(B)	Green sulfur bacteria
(C)	Purple nonsulfur bacteria	(D)	Cyanobacteria
<b>12.</b>	<b>Green nonsulfur bacteria belong to which phylum?</b>		
(A)	$\alpha$ - Proteobacteria	(B)	$\gamma$ - proteobacteria
(C)	Firmicutes	(D)	Chloroflexi
<b>13.</b>	<b>Chlorophyll a, photosystem I &amp; II, and oxygenic photosynthesis are the main features of:</b>		
(A)	Cyanobacteria	(B)	Purple sulfur bacteria
(C)	Green sulfur bacteria	(D)	None of these

<b>14.</b>	<b>Where are the light harvesting and electron transport chain components of blue-green algae located?</b>		
(A)	Plasma membrane	(B)	Chlorosomes
(C)	Thylakoid membranes	(D)	Cytoplasm
<b>15.</b>	<b>Phycobilisomes are protein complexes made up of pigments, namely:</b>		
(A)	Chlorophyll a and chlorophyll b	(B)	Carotenoids and xanthophylls
(C)	Phycocyanin and phycocyanin	(D)	Bacteriochlorophylls and accessory pigments
<b>16.</b>	<b>Which pigment is mainly responsible for imparting the blue-green color of cyanobacteria?</b>		
(A)	Phycocyanin and Chlorophyll	(B)	Phycocyanin and Phycocyanin
(C)	Phycocyanin and Cyanophycin	(D)	Phycocyanin only
<b>17.</b>	<b>Which pathway is utilized by cyanobacteria for carbon dioxide fixation?</b>		
(A)	Glyoxylate cycle	(B)	Calvin- Benson cycle
(C)	Krebs cycle	(D)	Pentose phosphate pathway
<b>18.</b>	<b>What is the name of the polymer consisting of arginine and aspartic acid, used by some cyanobacteria to store extra nitrogen?</b>		
(A)	Cyanophycin	(B)	Phycocyanin
(C)	Phycocyanin	(D)	Phycobilin
<b>19.</b>	<b>What key enzyme responsible for carbon fixation is found in the carboxysomes of cyanobacteria?</b>		
(A)	ATP synthase	(B)	Phosphofructokinase
(C)	Rubisco	(D)	None of these
<b>20.</b>	<b>The name of cyanobacteria that produce geosmins, volatile organic compounds that have an earthy odor:</b>		
(A)	<i>Prochlorococcus &amp; Microcystis</i>	(B)	<i>Microcystis &amp; Synechococcus</i>



**CHAPTER 5****Roots and Microbes: The Interplay in Soil Microbiology****A. Multiple Choice Questions**

<b>1.</b>	<b>What are the components of soil?</b>		
(A)	Organic and inorganic matter	(B)	Soil microorganisms
(C)	Air and water	(D)	All of these
<b>2.</b>	<b>The greatest number of microorganisms is generally found in which layer of soil?</b>		
(A)	Topsoil	(B)	Deepsoil
(C)	Bedrock	(D)	All of these
<b>3.</b>	<b>The most dominant group of microorganisms in soil is:</b>		
(A)	Bacteria	(B)	Fungi
(C)	Algae	(D)	Protozoa
<b>4.</b>	<b>What term is used to describe a microbial population in soil that remains uniform and constant, deriving its nutrition from native soil organic matter?</b>		
(A)	Autochthonous	(B)	Heterochthonous
(C)	Zymogenous	(D)	Transient
<b>5.</b>	<b>What term is used to describe microorganisms in soil that require an external source of energy for fermentation and typically have a low population density?</b>		
(A)	<i>Pseudomonas</i>	(B)	<i>Bacillus</i>
(C)	Both (A) and (B)	(D)	<i>Arthrobacter</i>

<b>6.</b>	<b>What type of soil microorganism exhibits characteristics shared by both bacteria and fungi?</b>		
(A)	Cyanobacteria	(B)	Myxobacteria
(C)	Actinomycetes	(D)	Protozoa
<b>7.</b>	<b>Which characteristic of microorganisms is indicated by colonies that generally grow slowly, exhibit a powdery consistency, and adhere firmly to the agar surface?</b>		
(A)	Bacteria	(B)	Fungi
(C)	Actinomycetes	(D)	None of the above
<b>8.</b>	<b>Which fungal structure is primarily involved in nutrient absorption in soil fungi?</b>		
(A)	Mycelium	(B)	Hyphae
(C)	Spores	(D)	Stroma
<b>9.</b>	<b>What term describes a dark-colored, amorphous substance composed of residual organic matter that is not easily decomposed by microorganisms?</b>		
(A)	Humic acid	(B)	Fulvic acid
(C)	Humus	(D)	None of the above
<b>10.</b>	<b>How do soil fungi contribute to soil structure and stability?</b>		
(A)	By breaking down organic matter	(B)	By producing extracellular enzymes
(C)	By forming mycorrhizal associations with plant roots	(D)	By secreting glues that bind soil particles together
<b>11.</b>	<b>What role do soil fungi play in the ecosystem?</b>		
(A)	Pollination	(B)	Photosynthesis
(C)	Both (A) and (B)	(D)	Decomposition
<b>12.</b>	<b>Which type of photosynthetic bacterium grows on freshly exposed rocks, leading to the accumulation of their cells and subsequent decomposition of organic matter?</b>		
(A)	Cyanobacteria	(B)	Actinobacteria

(C)	Purple sulfur bacteria	(D)	Spirochetes
<b>13.</b>	<b>What term describes the collective action of microbial, physical, and chemical processes that govern the movement of elements between sediments, water, and the atmosphere?</b>		
(A)	Biological cycling	(B)	Biochemical cycling
(C)	Biogeochemical cycling	(D)	Biophysiological cycling
<b>14.</b>	<b>Which of the following is NOT a major reservoir for phosphorus in the biogeochemical cycle?</b>		
(A)	Rocks and minerals	(B)	Soil
(C)	Atmosphere	(D)	Sedimentary rocks
<b>15.</b>	<b>What term describes the process by which organic matter breaks down into simpler, inorganic compounds?</b>		
(A)	Assimilation	(B)	Mineralization
(C)	Absorption	(D)	Adsorption
<b>16.</b>	<b>Which process releases sulfur into the atmosphere as sulfur dioxide (SO<sub>2</sub>), despite its essential role in the synthesis of certain amino acids and vitamins in living organisms?</b>		
(A)	Nitrogen fixation	(B)	Photosynthesis
(C)	Plant respiration	(D)	Volcanic eruptions
<b>17.</b>	<b>How do algae contribute to soil fertility?</b>		
(A)	Fixing atmospheric carbon dioxide	(B)	Increasing soil pH
(C)	Providing organic matter for nutrient cycling	(D)	Producing antibiotics to suppress soil pathogens
<b>18.</b>	<b>Which of the following bacteria have the capability to oxidize sulfur to sulfates?</b>		
(A)	<i>Thiobacillus thiooxidans</i>	(B)	<i>Thiobacillus ferrooxidans</i>
(C)	Both (A) and (B)	(D)	<i>Rhodospirillum rubrum</i>

**CHAPTER 6****Environmental Microbiology and Basic Microbiological Techniques****A. Multiple Choice Questions**

<b>1.</b>	<b>How are pure cultures of microorganisms that form discrete colonies on solid media most commonly obtained?</b>		
(A)	Agar slant method	(B)	Pour plate method
(C)	Spread plate method	(D)	Streak plate method
<b>2.</b>	<b>Which technique entails the plating of diluted samples combined with molten agar medium?</b>		
(A)	Streak plate method	(B)	Pour plate method
(C)	Spread plate method	(D)	Serial dilution method
<b>3.</b>	<b>Which method of culturing microorganisms involves the uniform distribution of microbial cells throughout an agar medium by pouring the mixture into a Petri dish?</b>		
(A)	Streak plate method	(B)	Spread plate method
(C)	Pour plate method	(D)	Serial dilution method
<b>4.</b>	<b>What are the disadvantages of the pour plate method?</b>		
(A)	It may result in inaccurate colony counts due to overlapping colonies	(B)	Not suitable for heat-labile organisms
(C)	Both (A) and (B)	(D)	It requires a large volume of agar medium
<b>5.</b>	<b>Which of the following techniques proves unsuitable for the isolation of psychrophilic microorganisms?</b>		
(A)	Pour plate method	(B)	Spread plate method
(C)	Streak plate method	(D)	Serial dilution method

<b>6.</b>	<b>Which of the following statements is incorrect about the spread plate method?</b>		
(A)	The spread plate method involves spreading a diluted sample on the surface of an agar plate	(B)	It is commonly used for isolating pure cultures of microorganisms
(C)	The spread plate method is suitable for anaerobic microorganisms	(D)	The colonies grow on the surface of the agar, making them easy to count and observe
<b>7.</b>	<b>Which of the following is not a method of preservation?</b>		
(A)	Serial dilution	(B)	Lyophilization
(C)	Cryopreservation	(D)	Canning
<b>8.</b>	<b>What method involves rapidly freezing microbial cultures in liquid nitrogen at -196°C?</b>		
(A)	Lyophilization	(B)	Cryopreservation
(C)	Pasteurization	(D)	Canning
<b>9.</b>	<b>Which of the following is not a cryoprotective agent?</b>		
(A)	DMSO	(B)	Paraffin
(C)	Glycerol	(D)	Ethylene glycol
<b>10.</b>	<b>Which preservation method involves the sublimation of cell water?</b>		
(A)	Lyophilization	(B)	Cryopreservation
(C)	Desiccation	(D)	Refrigeration
<b>11.</b>	<b>Which of the subsequent components is not found in nutrient agar medium?</b>		
(A)	Beef extract	(B)	NaCl
(C)	Peptone	(D)	Dextrose
<b>12.</b>	<b>What is the primary function of a cryoprotective agent?</b>		
(A)	To prevent dehydration of medium	(B)	To prevent microbial contamination

(C)	To protect microbial cells from damage during freezing and thawing	(D)	To facilitate the freezing process of microbial cultures
<b>13.</b>	<b>What is the temperature of lyophilization?</b>		
(A)	-20°C to -40°C	(B)	-50°C to -80°C
(C)	-100°C to -120°C	(D)	0°C to 10°C
<b>14.</b>	<b>What is the most common method of food preservation that involves storing food at temperatures above freezing but below room temperature?</b>		
(A)	Chilling	(B)	Refrigeration
(C)	Freezing	(D)	Canning
<b>15.</b>	<b>Which of the following methods can be used to determine the number of bacteria quantitatively?</b>		
(A)	Streak plate method	(B)	Agar slopes/slants
(C)	Both (A) and (D)	(D)	Serial dilution and viable plate count
<b>16.</b>	<b>In which microbiological method is an inoculating loop typically used?</b>		
(A)	Pour plate method	(B)	Streak plate method
(C)	Spread plate method	(D)	All of the above
<b>17.</b>	<b>Which microbiological tool is commonly used for transferring bacterial cultures?</b>		
(A)	Inoculating loop	(B)	Microcentrifuge tube
(C)	Petri dish	(D)	Pipette
<b>18.</b>	<b>Preserved cultures should be assessed for the following traits before use except:</b>		
(A)	Purity	(B)	Viability
(C)	Productivity	(D)	Odor
<b>19.</b>	<b>What is the term for the destruction of microorganisms by burning?</b>		
(A)	Sterilization	(B)	Disinfection

**CHAPTER 7****Biotechnology of Microbes: Progress and Prospects****A. Multiple Choice Questions**

<b>1.</b>	<b>Which organism is most widely used for citric acid production?</b>		
(A)	<i>Lactobacillus bulgaricus</i>	(B)	<i>Micrococcus luteus</i>
(C)	<i>Gluconobacteroxydans</i>	(D)	<i>Aspergillus niger</i>
<b>2.</b>	<b>In which phase of microbial growth are secondary metabolites produced?</b>		
(A)	Stationary phase	(B)	Death phase
(C)	Lag phase	(D)	Log phase
<b>3.</b>	<b>Metabolites that play a direct role in the growth, development, and reproduction of microbes are referred to as:</b>		
(A)	Primary metabolites	(B)	Secondary metabolites
(C)	Tertiary metabolites	(D)	Quaternary metabolites
<b>4.</b>	<b>Which of the following is not a distilled beverage?</b>		
(A)	Rum	(B)	Wine
(C)	Whiskey	(D)	Brandy
<b>5.</b>	<b>Which enzyme facilitates the breakdown of starch into fermentable sugars?</b>		
(A)	Protease	(B)	Cellulase
(C)	Amylase	(D)	Oxidase
<b>6.</b>	<b>Which step in beer fermentation encourages grain germination?</b>		
(A)	Mashing	(B)	Fermenting
(C)	Malting	(D)	Maturing

<b>7.</b>	<b>Which term is used for the crushed fruit along with its juice utilized in wine production?</b>		
(A)	Malt	(B)	Hop
(C)	Wort	(D)	Must
<b>8.</b>	<b>What is the term for the anaerobic breakdown of organic matter, including proteins, resulting in foul-smelling compounds?</b>		
(A)	Proteolysis	(B)	Putrefaction
(C)	Putrefaction	(D)	Deamination
<b>9.</b>	<b>In what terms is the availability of water in food usually measured?</b>		
(A)	Water activity	(B)	Water potential
(C)	Water density	(D)	Water content
<b>10.</b>	<b>Which term is used to describe microbes thriving in environments with low water activity?</b>		
(A)	Osmophiles	(B)	Thermophiles
(C)	Hydrophiles	(D)	Xerophiles
<b>11.</b>	<b>Which of the following temperatures is used for the High Temperature Short Time (HTST) method of pasteurization?</b>		
(A)	62.8 °C for 30 min	(B)	100 °C for 30 seconds
(C)	138°C for 3 seconds	(D)	72°C for 15 seconds
<b>12.</b>	<b>The use of high hydrostatic pressure to preserve food is known as:</b>		
(A)	Pascalization	(B)	Pasteurization
(C)	Hydrogenation	(D)	Appertization
<b>13.</b>	<b>The use of gamma radiation for food preservation is known as:</b>		
(A)	Pascalization	(B)	Appertization
(C)	Radappertization	(D)	Canning



<b>14.</b>	<b>Which of the following fermented foods commonly does not use shredded cabbage as a key ingredient?</b>		
(A)	Kimchi	(B)	Kombucha
(C)	Tempeh	(D)	Sauerkraut
<b>15.</b>	<b>Which fungal genus is primarily responsible for the production of aflatoxin?</b>		
(A)	<i>Aspergillus</i>	(B)	<i>Rhizopus</i>
(C)	<i>Penicillium</i>	(D)	<i>Candida</i>
<b>16.</b>	<b>Which fungal contaminants of corn are responsible for the production of fumonisins?</b>		
(A)	<i>Fusarium oxysporum</i>	(B)	<i>Fusarium verticillioides</i>
(C)	<i>Aspergillus flavus</i>	(D)	<i>Penicillium chrysogenum</i>
<b>17.</b>	<b>Which type of toxins are responsible for Staphylococcal intoxication?</b>		
(A)	Neurotoxins	(B)	Exotoxins
(C)	Endotoxins	(D)	Enterotoxins
<b>18.</b>	<b>Who is known as the 'Father of Canning'?</b>		
(A)	Thomas Edison	(B)	Nicolas Appert
(C)	John Mason	(D)	Clarence Birdseye
<b>19.</b>	<b>Which organism is responsible for causing the ropiness of bread?</b>		
(A)	<i>Serratia marcescens</i>	(B)	<i>Aspergillus niger</i>
(C)	<i>Geotrichum aurantiacum</i>	(D)	<i>Bacillus licheniformis</i>
<b>20.</b>	<b>What is the term for the centrifugal procedure utilized to eliminate bacteria from milk?</b>		
(A)	Bactofugation	(B)	Bacteriofugation
(C)	Centrifugation	(D)	Pasteurization

**CHAPTER 8****Microbial Physiology and Ecology****A. Multiple Choice Questions**

<b>1.</b>	<b>Which of the following is a common method used by bacteria to regulate their internal osmotic pressure?</b>		
(A)	Accumulation of compatible solutes	(B)	Osmosis
(C)	Active transport	(D)	Facilitated diffusion
<b>2.</b>	<b>What is a synchronous culture in microbiology?</b>		
(A)	A culture containing only one type of microorganism	(B)	A culture where microorganisms are in the same phase of the growth cycle
(C)	A culture where all microorganisms grow at the same rate	(D)	A culture maintained under constant environmental conditions
<b>3.</b>	<b>Which of the following best describes a synthetic medium in microbiology?</b>		
(A)	Medium containing natural ingredients obtained from living organisms	(B)	Medium formulated using chemically defined components
(C)	Medium enriched with complex nutrients for microbial growth	(D)	Medium containing specific inhibitors to select for certain microorganisms
<b>4.</b>	<b>What defines a complex medium in microbiology?</b>		
(A)	Medium enriched with undefined, natural sources of nutrients	(B)	Medium containing chemically defined components
(C)	Medium formulated with synthetic nutrients	(D)	Medium supplemented with antibiotics for selective growth
<b>5.</b>	<b>What is the primary advantage of using synthetic media in microbial culture?</b>		
(A)	It supports the growth of a wide range of microorganisms	(B)	It allows for precise control over the composition of nutrients

(C)	It is inexpensive and readily available	(D)	It provides complex nutrients for the fast growth of microbes
<b>6.</b>	<b>What defines enriched medium in microbiology?</b>		
(A)	Medium containing only basic nutrients required for microbial growth	(B)	Medium supplemented with specific inhibitors to select for certain microorganisms
(C)	Medium enriched with additional nutrients to support the growth of fastidious microorganisms	(D)	Media formulated with chemically defined components
<b>7.</b>	<b>What is the primary purpose of enrichment culture media in microbiology?</b>		
(A)	To provide nutrients for the growth of a wide range of microorganisms	(B)	To isolate and cultivate microorganisms present in low numbers or with specific growth requirements
(C)	To select specific microorganisms based on their metabolic properties	(D)	To inhibit the growth of unwanted contaminants in the culture
<b>8.</b>	<b>Non-synthetic culture medium is also referred to as:</b>		
(A)	Complex medium	(B)	Defined medium
(C)	Enriched medium	(D)	Differential medium
<b>9.</b>	<b>Which of the following is an example of differential media?</b>		
(A)	Xylose Lysine Deoxycholate agar (XLD) medium	(B)	Luria-Bertani agar
(C)	Stuart's medium	(D)	All of these
<b>10.</b>	<b>Deoxycholate-citrate agar medium is an example of:</b>		
(A)	Selective and differential medium	(B)	Transport medium
(C)	Differential medium	(D)	Selective and enriched medium
<b>11.</b>	<b>Which of the following is an example of transport media?</b>		
(A)	Stuart's medium	(B)	Pike's medium

(C)	Glycerol- saline medium	(D)	All of these
<b>12.</b>	<b>Which indicator is used to detect acid production by Staphylococci in a mannitol-salt agar medium?</b>		
(A)	Phenol red	(B)	Methyl red
(C)	Bromothymol blue	(D)	Bromocresol green
<b>13.</b>	<b>Wilson and Blair's medium is primarily employed for the selective cultivation of:</b>		
(A)	<i>Staphylococci</i> spp.	(B)	<i>Salmonella</i> spp.
(C)	<i>Yersinia</i> spp.	(D)	<i>Shigella</i> spp.
<b>14.</b>	<b>MacConkey agar medium is an example of:</b>		
(A)	Selective medium	(B)	Differential medium
(C)	Both (A) and (B)	(D)	Enrichment medium
<b>15.</b>	<b>Which materials are inoculating loops typically made of?</b>		
(A)	Stainless steel	(B)	Glass
(C)	Platinum or nichrome wire	(D)	Plastic
<b>16.</b>	<b>Which of the following methods can be used to determine the number of bacteria quantitatively?</b>		
(A)	Pour plate and spread plate	(B)	Streak plate
(C)	Spread plate, pour plate, and streak plate	(D)	Pour plate and streak plate
<b>17.</b>	<b>What is the streak plate method?</b>		
(A)	A method for inoculating liquid media	(B)	A method for obtaining pure cultures from a mixed population of microorganisms
(C)	A method for identifying bacterial species based on colony morphology	(D)	A method for sterilizing laboratory equipment

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