

EXAM CODE **558**

CATALOG NUMBER **BIOx220**

TAKE ADVANTAGE OF ONLINE
PRACTICE EXAMS
SEE PAGE 1 FOR DETAILS

Microbiology

CREDIT HOURS

3

LEVEL

LOWER

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SECTION ONE

Preparing for the Exam

Before You Choose This UExcel Exam

Uses for the Examination

- Excelsior College, the test developer, recommends granting three (3) semester hours of lower-level undergraduate credit to students who receive a letter grade of C or higher on this examination.
- Other colleges and universities also recognize this exam as a basis for granting credit or advanced standing.
- Individual institutions set their own policies for the amount of credit awarded and the minimum acceptable score.

Examinees who have applied to Excelsior College should ask their academic advisor where this exam fits within their degree program.

Examinees **not enrolled** in an Excelsior College degree program should check with the institution from which they wish to receive credit to determine whether credit will be granted and/or to find out the minimum grade required for credit. Those who intend to enroll at Excelsior College should ask an admissions counselor where this exam fits within their intended degree program.

For more information on exam availability and actual testing information, see the [Exam Registration and Information Guide](#).

Examination Length and Scoring

This examination consists of 130 multiple choice and other type questions. You will have three (3) hours to complete the exam. Your score will be reported as a letter grade. Questions are scored either correct (1) or incorrect (0). There is no partial credit. Each credit-bearing exam contains pretest questions, which are embedded throughout the exam. They are indistinguishable from the scored questions. It is to your advantage to do your best on all the questions. Pretest questions are being tried out for use in future versions of the exam.

The UExcel exams do **not** have a fixed grading scale such as A = 90–100%, B = 80–90%, and so forth, as you might have seen on some exams in college courses. Each UExcel test has a scale that is set by a faculty committee and is different for each exam. The process, called standard setting, is described in more detail in the [Technical Handbook](#). Excelsior puts each exam through a standard setting because different test questions have different levels of difficulty. To explain further, getting 70% of the questions right on the exam when the questions are easy does not show the same level of proficiency as getting 70% of questions correct when the questions are hard. Every form of a test (a form contains the test questions) has its own specific grading scale tailored to the particular questions on each exam form.

Please also note that on each form, some of the questions (referred to as pretest questions) count toward the score and some do not; the grading scale applies only to those questions that count toward the score. The area with percentage ratings on the second page of your score report is intended to help identify relative strengths and weaknesses and which content areas to emphasize, should you decide to take the examination again. Your grade

is **based on only the scored questions**. Therefore, the percentage ratings do not necessarily reflect the total percentage that counted toward your grade.

For the best view of the types of questions on this exam, see the sample questions in the back of this guide. Practice, practice, practice!

Score Reporting

For most of our examinations, based on performance, an examinee is awarded a letter grade of A, B, C, or F. A letter grade of D can be given, but credit is awarded for A, B, and C letter grades only. The letter grades reported to examinees indicate that their performance was equivalent to the performance of students who received the same letter grade in a comparable, on-campus course.

More specifically, the letter grade indicates the examinee's proficiency relative to the learning outcomes specified in the exam content guide. Following are general descriptions of examinee performance at each level:

Letter Grade Description

- A Highly Competent: Examinee's performance demonstrates an advanced level of knowledge and skill relative to the learning outcomes.
- B Competent: Examinee's performance demonstrates a good level of knowledge and skill relative to the learning outcomes.
- C Marginally Competent: Examinee's performance demonstrates a satisfactory level of knowledge and skill relative to the learning outcomes.
- D Not Competent (no credit recommended): Examinee's performance demonstrates weak knowledge of the content and minimal skill relative to the learning outcomes.^①
- F Fail (no credit recommended): Examinee's performance demonstrates no knowledge of the content and no skill in the subject relative to the learning outcomes.

Credit is transcribed by Excelsior College for examinees who achieve letter grades of C or higher.

We encourage colleges and universities to use the Excelsior College letter grades of A, B, and C as acceptable standards for awarding credit.

^① In general, two-hour exams do not award a D letter grade.

See page 29, at the back of this content guide, for a sample UExcel Grade Report for Examinations.

Excelsior College Bookstore

The Excelsior College Bookstore offers recommended textbooks and other resources to help you prepare for UExcel exams.

The bookstore is available online at (login required): www.excelsior.edu/bookstore

Excelsior College Library

Library services are available to students enrolled in a degree program at Excelsior College. Created through our partnership with the Sheridan Libraries of The Johns Hopkins University, the library provides access to journal articles, books, websites, databases, reference services, and many other resources. To access the Excelsior College Library, visit www.excelsior.edu/library (login is required). Access to the library is available 24/7.

Take Charge of Your Own Learning

At Excelsior College, independent, self-directed study supported by resources we help you find is not a new concept. We have always stressed to students who take exams that they are acting as their own teacher, and that they should spend as much time studying for an exam as they would spend in a classroom and on homework for a corresponding college course in the same subject area.

Begin by studying the content outline contained in this content guide, at its most detailed level. You will see exactly which topics are covered, and where chapters on those topics can be found in the Recommended Resources. You will see exactly where you might need to augment your knowledge or change your approach.

The content outline, along with the learning outcomes for this exam and recommended textbooks, will serve as your primary resources.

How Long Will It Take Me to Study?

Study for a UExcel exam is comparable to an equivalent college-level course. As an independent

learner, you should study and review as much as you would for the same subject in a campus-based college course. If you already have a background in the subject, you may be able to pass the exam successfully with fewer hours of study. It depends upon the learner as well as the subject, the number of credits (for example, a 6- or 8-credit exam will require more hours of study than a 3-credit exam), and the length of the exam. We strongly encourage you to create a long-term action or study plan, so that you have a systematic approach to prepare for the exam. We've included guidelines for creating such a plan.

How Can I Create an Effective Long-Term Study Plan?

1. Determine the time you will require to complete your preparation for this exam. If you have not studied the subject before, you should plan to budget approximately 45 hours of study time for every credit: 135 hours for 3 credits, 180 hours for 4 credits, 270 hours for 6 credits, and 360 hours for 8 credits. These hours are rules of thumb based on expectations for a student taking a course in the subject; it may take you more or less time, depending on how familiar you are with the material and how easily you absorb the information studying on your own. Aside from the content review, you should then factor in time to search for and use other resources, and to complete any projects and assignments in the study materials that will clarify your understanding of the topics in the content outline (that part in the content guide where the specific areas of study are spelled out). Spend more time on concepts and areas in which you feel you are weak. Totaled, this is approximately the amount of time you should expect to devote to a three-credit, campus-based course. The actual amount of time you require depends on many factors, and will be approximate. If your background is weak, you may need to set aside substantially more than 135–150 hours. If your background is strong, you may budget less time.

Take a few minutes to review the content outline to assess your familiarity with the content. Then, in the space below, write the number of hours you will allocate to complete preparing for the exam.

Hours Required =

2. Determine the time you will have available for study.

In self-study, you need structure, as well as motivation and persistence, and a methodical approach to preparation. There is no set class to keep you on task. You have to do that yourself. Construct a time-use chart to record your daily activities over a one-week period. The most accurate way to do this is to complete the chart on a daily basis to record the actual amount of time you spend eating, sleeping, commuting, working, watching television, caring for others and yourself, reading, and everything else in an adult's life. However, if your schedule is regular, you might prefer to complete the chart in one sitting and, perhaps, by consulting your appointment book or planner.

After you have recorded your activities, you will be ready to schedule study periods around these activities or, perhaps, instead of some of them. In the space below, write the number of hours you will be able to set aside for study each week.

Hours Required =

3. Divide the first number by the second number.

This will give you the number of weeks you will need to set aside for independent study. For example, if you think you will require 170 hours of study and you have 10 hours available to study each week, divide 170 hours by 10 hours and you will get 17. This means that you will need about 17 weeks to complete this course of study. However, you will also need to allow about a week for review and self-testing. Moreover, to be on the safe side, you should also add two weeks to allow for unforeseen obstacles and times when you know you will not be able to study (e.g., during family illnesses or holidays). So, in this case, you should allot a total of 18 to 19 weeks to complete your study.

4. Schedule your examination to coincide with the end of your study period.

For example, if you plan to allow 18 weeks for study, identify a suitable examination date and begin study at least 18 weeks before that date. (The date you begin study assumes that you will have received all of your study materials, particularly textbooks, by that time.)

5. Format a long-term study plan.

You will need to use a calendar, planner, or some other tool to format and track your long-term study plan. Choose a method that is convenient and one that keeps you aware of your study habits on a daily basis. Identify the days and exact hours of each day that you will reserve for study throughout your whole independent study period. Check to see that the total number of hours you designate for study on your long-term study plan adds up to the number of hours you have determined you will need to complete this course of study (Step 1).

6. Record in your long-term study plan the content you plan to cover during each study period.

Enter the session numbers, review, and examination preparation activities you will complete during each study period. While it is suggested that approximately 160–170 hours of study is required for this exam, each and every student may require different timelines based on their comfort with, and comprehension of, the material.

You now have a tentative personal long-term study plan. Keep in mind that you will have to adjust your study plan, perhaps several times, as you study. It is only by actually beginning to work systematically through the material, using the content outline, that you will be able to determine accurately how long you should allow for each unit.

What Learning Strategy Should I Use?

The following guidelines are intended to help you acquire the grounding in the knowledge and skills required for successful completion of this examination.

1. Approach learning with a positive attitude.

Most students are capable of learning subject content if they devote enough time and effort to the task. This devotion will give you a positive edge and a feeling of control.

2. Diligently complete the exact work you specified in your study plan.

Your study plan is being designed for the specific purpose of helping you achieve the learning outcomes for this exam.

3. Be an active learner.

You should actively engage in the learning process. Read critically, take notes, and continuously monitor your comprehension. Keep a written record of your progress, highlight content you find difficult to grasp, and seek assistance from someone in your learning community who can help you if you have difficulty understanding a concept.

4. Be patient: you may not understand everything immediately.

When encountering difficulty with new material, be patient with yourself and don't give up. Understanding will come with time and further study. Sometimes you may need to take a break and come back to difficult material. This is especially true for any primary source material (original letters, documents, and so forth) that you may be asked to read. The content outline will guide you through the material and help you focus on key points. You will find that many concepts introduced in earlier sessions will be explained in more detail in later sessions.

5. Apply your learning to your daily life.

Use insights you gain from your study to better understand the world in which you live. Apply the learning whenever you can. Look for instances that support or contradict your reading on the subject.

6. Accommodate your preferred way of learning.

How do you learn best? Common ways to learn are reading, taking notes and making diagrams, and by listening to someone (on video or live). Others learn by doing. Do any of these descriptions apply to you? Or does your learning style vary with the learning situation? Decide what works for you and try to create a learning environment to accommodate your preferences.

Study Tips

Become an active user of the resource materials. Aim for understanding rather than memorization. The more active you are when you study, the more likely you will be to retain, understand, and apply the information.

The following techniques are generally considered to be active learning:

- **preview or survey** each chapter

- **highlight or underline text** you believe is important
- **write questions or comments** in the margins
- **practice re-stating content** in your own words
- **relate what you are reading** to the chapter title, section headings, and other organizing elements of the textbook
- **find ways to engage** your eyes, your ears, and your muscles, as well as your brain, in your studies
- **study with a partner or a small group**
- **prepare your review notes** as flashcards or create recordings that you can use while commuting or exercising

When you feel confident that you understand a content area, review what you have learned. Take a second look at the material to evaluate your understanding. If you have a study partner, the two of you can review by explaining the content to each other or writing test questions for each other to answer. Review questions from textbook chapters may be helpful for partner or individual study, as well.

Study smart for your UExcel exam! Success starts with establishing a relationship with your advisor.

Using UExcel Practice Exams

The official UExcel practice exams are highly recommended as part of your study plan. They can be taken using any computer with a supported web browser such as Google Chrome.

The practice exam package comes with two sets of questions. Please be aware that there will be fewer questions on the practice exams than there will be on the exam you take for credit. Generally, the practice questions will not be the same as the ones you will see when you take the actual exam for credit. They are intended to expose you to the types of questions you'll encounter in the actual exam. Practice questions are a tool, and do not provide a full exam experience. For example, the practice question sets do not have time limitations. Begin with the Content Guide, especially the detailed content outline. Memorizing specific questions and answers on the practice sets is not as effective as using the questions to practice, along with the content outline, to see which concepts you may need to study further. To register for the practice exam, visit www.excelsior.edu and log into your MyExcelsior

account. **Please note: You must be registered for the corresponding credit-bearing exam before you can register for the practice exam.**

Practice exams are not graded. Rather, they are intended to help you make sure you understand the subject and give you a sense of what the questions will be like on the exam for credit. Ideally, you would check any questions you got wrong, look at the explanations, and go back to the textbook to reinforce your understanding. After taking both forms of the practice exam, you should feel confident in your answers and confident that you know the material listed in the content outline.

Practice exams are one of the most popular study resources. Practice exams are typically shorter than the credit-bearing exam. Since the questions are drawn from the same pool of questions that appear on the credit-bearing exam, what you will see when you sit for the graded exam will be roughly the same. Used as intended, these practice exams will enable you to:

- Review the types of questions you may encounter on the actual exam.
- Practice testing on a computer in a timed environment.
- Practice whenever and wherever it is convenient for you.

Take two different forms of a practice exam within a 180-day period. (We highly recommend that you take the first form of the practice exam as a pretest, early in the study period. Use the results to identify areas to further study and carry out a plan. Then take the second form as a post-test and see how much you have improved.)

Although there is no guarantee, our research suggests that exam takers who do well on the practice exams are more likely to pass the actual exam than those who do not take advantage of the opportunity. Note that since the practice exams are not graded (calibrated) the same way as the scores on the credit-bearing exam, it will be hard for you to use the practice exams as a way to predict your score on the credit-bearing exam. The main purpose of the practice exams is for you to check your knowledge and to become comfortable with the types of questions you are likely to see in the actual, credit-bearing exam.

About Test Preparation Services

Preparation for UExcel® exams and Excelsior College® Examinations, though based on independent study, is supported by Excelsior College with a comprehensive set of exam learning resources and services designed to help you succeed. These learning resources are prepared by Excelsior College so you can be assured that they are current and cover the content you are expected to master for the exams. These resources, and your desire to learn, are usually all that you will need to succeed.

There are test-preparation companies that will offer to help you study for our examinations. Some may imply a relationship with Excelsior College and/or make claims that their products and services are all that you need to prepare for our examinations.

Excelsior College does not endorse the products and services of any tutorial or test preparation firm. We do not review the materials provided by these firms for the content or compatibility of their material and resources with UExcel® exams or Excelsior College Examinations®. No test preparation vendor is authorized to provide admissions counseling or academic advising services, or to collect any payments, on behalf of Excelsior College. Excelsior College does not send authorized representatives to a student's home nor does it review the materials provided by test preparation companies for content or compatibility with Excelsior College examinations.

To help you become a well-informed consumer, we suggest that before you make any purchase decision regarding study materials provided by organizations other than Excelsior College, you consider the points outlined on our website at www.excelsior.edu/testprep.

Exam Preparation Strategies

Each learner is different. However, all learners should read the content outline in the exam's Content Guide and ensure that they have mastered the concepts. For someone with no prior knowledge of the subject, a rule of thumb is 135 hours of study for a 3-credit exam—this number is just to give you an idea of the level of effort you will need, more or less.

Content Guides

This content guide is the most important resource. It lists the outcomes, a detailed content outline of what is covered, and textbooks and other study resources. It also has sample questions and suggestions for how to study. Content guides are updated periodically to correspond with changes in particular examinations and in textbook editions. Examinees can download any of the latest free UExcel content guides by visiting the individual exam page or from the list at www.excelsior.edu/contentguides.

Using the Content Outline

Each content area in the content outline includes the most important sections of the recommended resources for that area. These annotations are not intended to be comprehensive. You may need to refer to other chapters in the recommended textbooks. Chapter numbers and titles may differ among textbook editions.

This content outline contains examples of the types of information you should study. Although these examples are many, do not assume that everything on the exam will come from these examples. Conversely, do not expect that every detail you study will appear on the exam. Any exam is only a broad sample of all the questions that could be asked about the subject matter.

Using the Sample Questions and Rationales

Each content guide provides sample questions to illustrate those typically found on the exam. These questions are intended to give you an idea of the level of knowledge expected and the way questions are typically phrased. The sample questions do not sample the entire content of the exam and are not intended to serve as an entire practice test.

Recommended Resources for the UExcel Exam in Microbiology

The resources listed below were selected by the faculty members on the examination committee for use in developing this exam.

Resources listed under “Strongly Recommended” were used by the committee to verify all the questions on the exam. Please refer to the Content Outline to see which parts of the exam are cross-referenced to these resources.

Resources listed under “Optional” provide additional material that may deepen or broaden your understanding of the subject, or that may provide an additional perspective on the exam content. Textbook resources, both Strongly Recommended and Optional, may be purchased from the [Excelsior College Bookstore](#).

You should allow ample time to obtain the necessary resources and to study sufficiently before taking the exam, so plan appropriately, with an eye towards your own personal learning needs. See the sections in this guide on the Excelsior College Bookstore and the Excelsior College Library, and under Reducing Textbook Costs, to help you secure the Strongly Recommended resources successfully.

Textbook Editions

Textbook editions listed in the UExcel content guides may not be the same as those listed in the bookstore. Textbook editions may not exactly match up in terms of table of contents and organization, depending upon the edition. However, our team of exam developers checks exam content against every new textbook edition to verify that all subject areas tested in the exam are still adequately available in the study materials. If needed, exam developers will list additional Strongly Recommended resources to ensure that all topics in the exam are still sufficiently covered. Public libraries may have the textbooks you need, or may be able to obtain them for you through interlibrary loan to reduce textbook costs. You may also consider financial aid, if you qualify, to further help defray the steep cost of textbooks. A section on open educational

resources (OER) has been included in this guide to help you locate additional, possibly free resources to augment your study.

Strongly Recommended

Tortora, G. et al. (2019). *Microbiology: An introduction*. (13th ed.). San Francisco: Benjamin/Cummings (distributed by Addison Wesley).

Tortora, G. et al. (2013). Study guide for *Tortora, Funke & Case Microbiology: An introduction*. (11th ed.) San Francisco: Benjamin/Cummings (distributed by Addison Wesley).

Library Resources for Microbiology

This content guide is the first place to start to study. Excelsior's Library has also developed an Exam Resources page for the exam, based on this content guide. The [Exam Resources page](#) provides additional materials that complement the resources in this guide.

Optional Resources

These textbooks were identified by the examination development committee as additional resources to help you gain a deeper understanding of the subject.

Pommerville, J. (2018). *Fundamentals of microbiology* (11th ed.). Sudbury, MA: Jones and Bartlett.

Black, J. (2018). *Microbiology: Principles and exploration* (10th ed.). New York, NY: Wiley.

Madigan, M. et al. (2018). *Brock Biology of microorganisms and Student companion website access card* (15th ed.). Upper Saddle River, NJ: Prentice Hall.

Talaro, K.P., & Talaro, A. (2018). *Foundations in microbiology* (10th ed.). Boston: McGraw Hill.

There is an enhanced product available for the Pommerville text. It is listed in the bookstore for this exam, but you will need an access code. You can sign up directly for this product from the [publisher website](#).

Reducing Textbook Costs

Many students know it is less expensive to buy a used textbook, and buying a previous edition is also an option. The Excelsior College bookstore includes a buyback feature and a used book marketplace, as well as the ability to rent digital versions of textbooks for as

long as students need them. Students are encouraged to explore these and the many other opportunities available online to help defray textbook costs.

Open Educational Resources

There are many resources available online free of charge that may further enhance your study for the exam. Known as Open Educational Resources (OER), these may be textbooks, courses, tutorials, or encyclopedias. Any additional OER that you find independently should be used to augment study—not as replacements for the Strongly Recommended resources.

Most sites for university-based OER can be searched through www.ocwconsortium.org and/or www.oercommons.org.

Sites that specialize in web courses designed by college professors under contract with the website sponsor, rather than in web versions of existing college courses, include:

www.education-portal.com

www.opencourselibrary.org (abbreviated as OCL)

We have included specific courses that cover material for one or more UExcel® exams from the sites in the listings above. It's worth checking these sites frequently to see if new courses have been added that may be more appropriate or may cover an exam topic not currently listed.

Sites like Khan Academy (www.khanacademy.com) and iTunes U feature relatively brief lessons on very specific topics rather than full courses. Full courses are also available on iTunes U (<http://www.apple.com/education/ipad/itunes-u/>). We have chosen a few courses and collections for this listing.

Open Online Textbooks

BookBoon

<http://bookboon.com/en/textbooks-ebooks>

Flatworld Knowledge

<http://catalog.flatworldknowledge.com/#our-catalog>

College Readiness

Khan Academy

<http://www.khanacademy.org/>

Hippocampus

<http://www.hippocampus.org/>

Open Course Library

<http://opencourselibrary.org/collg-110-college-success-course/>

Study Aids

Education Portal

<http://education-portal.com/>

Khan Academy

<http://www.khanacademy.org/>

Annenberg Learner

<http://www.learner.org/>

OpenCourseWare

<http://ocwconsortium.org/en/courses/search>

OER Commons

<http://www.oercommons.org/>

Open Course Library

<http://www.opencourselibrary.org/>

To achieve academic success, rate yourself at Excelsior College's Self-Regulated Learning Lab. Visit the Diagnostic Assessment & Achievement of College Skills site at <https://srl.daacs.net/>

It's free!

SECTION TWO

Content Outline

General Description of the Examination

The UExcel Microbiology examination is based on material typically taught in a one-semester, three-credit, lower-level course in microbiology for those majoring in science or an applied science field such as nursing.

The examination measures the knowledge and understanding of concepts and principles related to microbiology, including biology and control of microorganisms, disease, resistance, and the immune system, the biology of infectious disease, and environmental, food, and industrial microbiology, and the ability to apply this information to real-life examples.

Those beginning to study for this exam should be familiar with the concepts generally covered in chemistry, biology, or anatomy and physiology.

Learning Outcomes

After you have successfully worked your way through the recommended study materials, you should be able to demonstrate the following learning outcomes:

1. Summarize the basic concepts of microbiology and its historical development. (Aligns to GECC 2.1)
2. Examine microbial laboratory techniques. (Aligns to GECC 2.1)
3. Examine the anatomy, growth and nutrition, metabolism, and genetics of microorganisms. (Aligns to GECC 2.1)
4. Recognize the principles of microbial control. (Aligns to GECC 2.1)
5. Recognize diseases, resistance to diseases, and the role of the immune system. (Aligns to GECC 2.1)
6. Summarize the biology of infectious diseases. (Aligns to GECC 2.1)
7. Interpret environmental, food, and industrial microbiology. (Aligns to GECC 2.1)

General Education Career Competencies Addressed in this Exam

GECC-2: Mathematical and Scientific Problem Solving: Apply scientific knowledge and reasoning to make evidence-based decisions.

Content Outline

The content outline describes the various areas of the test, similar to the way a syllabus outlines a course. To fully prepare requires self-direction and discipline. Study involves careful reading, reflection, and systematic review.

The major content areas on the Microbiology examination, the percent of the examination, and the hours to devote to each content area are listed below.

| Content Area | Percent of the Examination | Hours of Study* |
|------------------------------------------------------|----------------------------|-----------------|
| I. Introduction to Microbiology | 5% | 7 |
| II. Biology of Microorganisms | 25% | 34 |
| III. Control of Microorganisms | 15% | 20 |
| IV. Disease, Resistance, and the Immune System | 20% | 27 |
| V. Biology of Infectious Disease | 25% | 34 |
| VI. Environmental, Food, and Industrial Microbiology | 10% | 14 |
| Total | 100% | |

*Approximate: For those examinees who know the topic well, less time may be needed to learn the subject matter. For those who are new to the subject matter, more time may be required for study.

NOTE ON CHAPTERS: Chapters relevant to the major content areas are listed. Some chapters may be relevant to more than one area and are listed in each area. In some cases, only parts of a given chapters are relevant. The content outline will guide you as to which sections of a chapter to focus on.

NOTE ON TOPICS: Occasionally, examples will be listed for a content topic to help clarify that topic. However, the content of the examination is not limited to the specific examples given.

I. Introduction to Microbiology

5 PERCENT OF EXAM

Tortora

Ch. 1, The Microbial World and You

Ch. 3, Observing Microorganisms Through a Microscope

Ch. 10, Classification of Microorganisms

Ch. 11, The Prokaryotes: Domains Bacteria and Archaea

Ch. 12, The Eukaryotes: Fungi, Algae, Protozoa, and Helminths

Ch. 13, Viruses, Viroids, and Prions

A. Early history

1. Discovery of microorganisms
2. Disproving spontaneous generation
3. Development of germ theory of disease
4. Discovery of immunity
5. Discovery of viruses
6. Development of chemotherapeutic agents

B. Place of microorganisms in the world

1. Prokaryotes vs. eukaryotes

2. Prokaryotae
 - a. Bacteria
 - b. Cyanobacteria
3. Archaeobacteria
4. Eukaryotae
 - a. Protista
 - 1) Protozoa
 - 2) Simple algae
 - b. Fungi
5. Viruses

C. Microbial laboratory techniques

1. Microscopy
2. Stain procedures
3. Media preparation and growth
4. Pure culture and aseptic techniques

II. Biology of Microorganisms

25 PERCENT OF EXAM

Tortora

Ch. 4, Functional Anatomy of Prokaryotic and Eukaryotic Cells

Ch. 5, Microbial Metabolism

Ch. 6, Microbial Growth

Ch. 8, Microbial Genetics

Ch. 9, Biotechnology and DNA Technology

Ch. 10, Classification of Microorganisms

Ch. 11, The Prokaryotes: Domains Bacteria and Archaea

Ch. 12, The Eukaryotes: Fungi, Algae, Protozoa, and Helminths

Ch. 13, Viruses, Viroids, and Prions

A. Anatomy

1. Prokaryotes
 - a. Bacteria
 - 1) Gross morphology — cell size, shape, and arrangement

- 2) Component parts — name, chemistry, function, and importance
 - a) Cell envelope
 - i) Capsule
 - ii) Cell wall
 - iii) Cell membrane
 - b) Cytoplasm
 - i) Chromosome and plasmids
 - ii) Ribosomes
 - iii) Cell inclusions
 - c) Spores
 - d) Appendages
 - i) Flagella
 - ii) Pili

b. Cyanobacteria — special features

2. Eukaryotes

- a. Fungi
 - 1) Cellular and vegetative structures
 - 2) Reproductive structures
- b. Algae
 - 1) Cellular structures
 - 2) Photosynthetic apparatus
- c. Protozoa
 - 1) Structures for locomotion — flagella, cilia, pseudopodia
 - 2) Vacuoles

B. Growth and nutrition

1. Patterns of nutrition
2. Requirements for growth (increase in numbers/mass)
 - a. Physical — pH, temperature
 - b. Chemical — nitrogen, carbon, energy sources; vitamins; trace elements
 - c. Gaseous — anaerobic, aerobic, facultative

3. Cultivation
 - a. Selective, enrichment, and differential media
 - b. Mixed and pure cultures
 - c. Culture techniques — solid and liquid media
 4. Dynamics of populations
 - a. Growth mechanisms — binary fission, mycelial growth, budding
 - b. Growth rates, generation times
 - c. Growth curve: lag, exponential growth, and stationary phases
 - d. Enumeration of cell number and culture mass — viable and total counts, turbidity
- C. Metabolism — basic mechanisms of metabolism and energy conversion**
1. Enzymes (mediators of all reactions)
 - a. Structures and function
 - b. Factors that influence enzyme activity
 2. Photosynthetic vs. chemosynthetic metabolism
 3. Cellular respiration
 - a. Aerobic
 - b. Anaerobic
 - c. Fermentation
 4. Photosynthesis
 5. Biosynthetic mechanisms
 - a. Macromolecular synthesis
 - 1) Nucleic acid
 - 2) Gene expression and protein synthesis
 - b. Regulation
 - 1) Control of enzyme activity (feedback regulation)
 - 2) Control of enzyme synthesis
- D. Genetics**
1. Variation in populations of cells and viruses
 - a. Genotype and phenotype
 - b. Haploidy and diploidy
 - c. Asexual and sexual
 2. Mutations
 - a. Spontaneous, induced
 - b. Selection of mutants
 - c. Types of mutations
 3. Recombination
 - a. Transformation
 - b. Transduction (generalized, specialized)
 - c. Conjugation
 4. Gene manipulation
 - a. Plasmids
 - b. Genetic elements
 - c. Genetic engineering/recombinant DNA techniques
 - d. Applications of genetic engineering
- E. Viruses**
1. Structure
 - a. Type of nucleic acid
 - b. Capsid, envelope, specialized structures
 2. Multiplication of viruses
 - a. Lytic cycle
 - b. Lysogenic cycle
 - c. Retroviruses
 3. Effects of viruses on cells
 - a. Isolation and detection of viruses
 - b. Cytopathological effects
 - c. Transformation and oncogenesis
 - d. Control of viral replication

III. Control of Microorganisms

15 PERCENT OF EXAM

Tortora

[Ch. 7, The Control of Microbial Growth](#)

[Ch. 20, Antimicrobial Drugs](#)

A. Principles of microbial control

1. Factors influencing success of control methods
 - a. Number and nature of microorganisms
 - b. Strength of control agent
 - c. Time, temperature, and pH
2. General methods of control
 - a. Bactericidal vs. bacteriostatic
 - b. Sterilization
 - c. Asepsis
 - d. Disinfection and antiseptics
 - e. Sanitation
 - f. Antibiosis and chemotherapy

B. Physical methods of control

1. Incineration
2. Dry heat
3. Moist heat
 - a. Boiling water
 - b. Pressurized steam (autoclave)
 - c. Pasteurization
4. Radiation
 - a. Ultraviolet
 - b. Ionizing
5. Filtration

C. Chemical methods of control

1. Chemical agents
 - a. Halogens
 - b. Alcohols
 - c. Phenols
 - d. Heavy metals

- e. Aldehydes
- f. Gases
- g. Detergents
- h. Peroxides

2. Tests for effectiveness of antiseptics and disinfectants
 - a. Phenol coefficient test
 - b. Use-dilution test

D. Chemotherapeutic agents and antibiotics

1. Modes of action
2. Chemotherapeutic agents (nucleic acid analogs and others)
 - a. Antiviral agents
 - b. Antifungal agents
 - c. Antiparasitic agents
3. Antibiotics (penicillin and others)
 - a. The problem of antibiotic resistance
 - b. Antibiotic sensitivity assays

IV. Disease, Resistance, and the Immune System

20 PERCENT OF EXAM

Tortora

[Ch. 14, Principles of Disease and Epidemiology](#)

[Ch. 15, Microbial Mechanism of Pathogenicity](#)

[Ch. 16, Innate Immunity: Nonspecific Defenses of the Host](#)

[Ch. 17, Adaptive Immunity: Specific Defenses of the Host](#)

[Ch. 18, Practical Applications of Immunology](#)

[Ch. 19, Disorders Associated with the Immune System](#)

A. The disease process

1. Host-parasite relationships
 - a. The concepts of infection and disease
 - b. The normal flora
 - c. Commensalism

- d. Mutualism
 - e. Antibiosis
 - f. Opportunists
 - g. Virulence
2. Progress of disease
 - a. Periods of disease
 - b. Clinical and subclinical disease
 3. Types of diseases
 - a. Communicable and noncommunicable diseases
 - b. Endemic, epidemic, and pandemic diseases
 - c. Acute and chronic diseases
 - d. Primary and secondary diseases
 - e. Local and systemic diseases
 - f. Nosocomial diseases
 4. Establishment of disease
 - a. Transmission
 - b. Portal of entry
 - c. Dose
 - d. Virulence factors
- B. Nonspecific resistance to disease**
1. Mechanical and chemical factors
 - a. Skin
 - b. Mucous membranes
 - c. pH (cell, tissue, organ)
 - d. Lysozyme
 2. Phagocytosis
 - a. Types of phagocytes
 - b. Mechanism of phagocytosis
 - c. Reticuloendothelial system (mononuclear phagocytic system)
 3. Inflammation
 4. Individual, species, and racial immunities
- C. Principles of immunology**
1. Antigens
 - a. Definition, composition, and types of antigens
- b. Haptens
 - c. Immunologic tolerance
 - d. Self vs. nonself
2. The immune system
 - a. B lymphocytes
 - b. T lymphocytes
 - c. Location and operation of the immune system
 - d. Cell-mediated immunity — process, stimulation, lymphokines
 - e. Antibody-mediated (humoral) immunity — antibody structure and origin, five types of antibodies, primary and secondary antibody responses, opsonization, antigen-antibody reactions, neutralization, precipitation, agglutination
 - f. The complement system
 - g. The alternative pathway
 3. Types of immunity
 - a. Naturally acquired, active immunity
 - b. Artificially acquired, active immunity
 - c. Naturally acquired, passive immunity
 - d. Artificially acquired, passive immunity
 4. Serological and diagnostic reactions
 - a. Radioimmunoassays
 - b. Neutralization reactions
 - c. Precipitation and agglutination
 - d. Complement fixation
 - e. Monoclonal antibody
 - f. Fluorescent antibody tests
 - g. Enzyme-linked immunosorbent assay (ELISA)
 - h. Western-blot analysis
 - i. Polymerase chain reaction (PCR)
 - j. Gene probe
- D. Disorders of the immune system**

1. Type I anaphylactic hypersensitivity
 - a. Allergens and IgE
 - b. Basophils and mast cells
 - c. Degranulation and mediator release
 - d. Atopic diseases
2. Type II cytotoxic hypersensitivity
 - a. Transfusion reactions
 - b. Hemolytic disease of the newborn
 - c. Autoimmune reactions
3. Type III immune complex hypersensitivity
 - a. Immune complex formation
 - b. Serum sickness
 - c. Systemic lupus erythematosus (SLE)
4. Type IV cellular hypersensitivity
 - a. Infection allergy
 - b. Contact dermatitis
 - c. Tuberculin skin test
5. Immune-deficiency diseases

- unique morphological characteristics of the agent(s)
- unique physiological characteristics of the agent(s)
- unique cultural characteristics of the agent(s)

- Mode of transmission and portal of entry
- Methods of immunization
- Methods of prevention, control, and/or treatment

A. Respiratory tract diseases

1. Bacterial diseases
 - a. Tuberculosis
 - b. Diphtheria
 - c. Pertussis
 - d. Streptococcal diseases
 - e. Bacterial pneumonia
 - f. Primary atypical pneumonia
 - g. Legionnaires' disease
 - h. Bacterial meningitis
 - i. Chlamydial diseases
2. Viral diseases
 - a. Common cold
 - b. Influenza
 - c. Measles
 - d. Mumps
 - e. Chickenpox
 - f. Rubella
 - g. Viral pneumonia
3. Fungal diseases
 - a. Cryptococcosis
 - b. Histoplasmosis
 - c. Aspergillosis
4. Protozoan diseases — *Pneumocystis carinii* pneumonia

B. Gastrointestinal tract diseases and intoxications

1. Bacterial diseases and intoxications
 - a. Typhoid fever

V. Biology of Infectious Diseases

25 PERCENT OF EXAM

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Ch. 19, Disorders Associated with the Immune System

Ch. 21, Microbial Diseases of the Skin and Eyes

Ch. 23, Microbial Diseases of the Cardiovascular and Lymphatic Systems

Ch. 24, Microbial Diseases of the Respiratory System

Ch. 25, Microbial Diseases of the Digestive System

Ch. 26, Microbial Diseases of the Urinary and Reproductive Systems

Parameters for the study of infectious disease:

- Recognition of the disease syndrome (symptoms)
- Etiology of the disease

- b. Cholera
 - c. Salmonellosis
 - d. *Escherichia coli* disease
 - e. *Campylobacter* disease
 - f. *Helicobacter pylori* disease
 - g. Shigellosis
 - h. Botulism
 - i. Staphylococcal food poisoning
 - j. *Clostridium perfringens* food poisoning
 - k. Brucellosis
2. Viral diseases
 - a. Hepatitis A
 - b. Enteroviral infections
 3. Protozoan diseases
 - a. Amoebiasis
 - b. Giardiasis
 - c. Cryptosporidiosis
- C. Urogenital tract diseases**
1. Bacterial diseases
 - a. Gonorrhea
 - b. Syphilis
 - c. Chlamydia
 2. Viral diseases
 - a. Genital herpes
 - b. Genital warts
 3. Fungal diseases — candidiasis
 4. Protozoan diseases — trichomoniasis
- D. Skin and wound diseases**
1. Bacterial diseases
 - a. Tetanus
 - b. Staphylococcal diseases
 - c. Anthrax
 - d. Leprosy
 - e. Gas gangrene
 2. Viral diseases
 - a. Smallpox
- b. Rabies
 - c. Warts
 - d. Herpes simplex infections
3. Fungal diseases
 - a. Ringworm (tinea)
 - b. Candidiasis
- E. Blood diseases**
1. Bacterial diseases
 - a. Plague
 - b. Tularemia
 - c. Spotted fevers
 - d. Typhus fevers
 - e. Q fever
 - f. Lyme disease
 - g. Toxic shock syndrome
 2. Viral diseases
 - a. Yellow fever
 - b. Viral encephalitis
 - c. Hepatitis B and hepatitis C
 - d. Infectious mononucleosis
 - e. Hemorrhagic fevers
 3. Protozoan diseases
 - a. Malaria
 - b. Sleeping sickness
 - c. Toxoplasmosis
- F. Nosocomial diseases**
- G. Acquired immunodeficiency syndrome (AIDS)**
1. Human immunodeficiency virus (HIV)
 2. Transmission and epidemiology
 3. Pathology (including opportunistic infections)
 4. Diagnosis
 5. Treatment

VI. Environmental, Food, and Industrial Microbiology

10 PERCENT OF EXAM

Tortora

Ch. 27, Environmental Microbiology

Ch. 28, Applied Industrial Microbiology

A. Environmental (ecological) microbiology

1. Terrestrial environment (soils)
 - a. Flora of soil
 - b. Biogeochemical cycles (carbon, nitrogen, sulfur, phosphorus)
 - c. Biodegradation and recycling
2. Aquatic environment
 - a. Fresh water and marine environment
 - b. Aquatic pollution (eutrophy, human waste, food waste, industrial waste)
 - c. Pollution abatement
 - (1) Waste water treatment
 - (2) Preparation of drinking water

B. Food microbiology

1. Foods produced using microorganisms
2. Spoilage of food by microorganisms
3. Preservation methods

C. Industrial microbiology

1. Alcoholic beverages (beer, wine, distilled spirits)
2. Production of organic compounds (organic acids, amino acids, vitamins, enzymes, steroids, antibiotics, other pharmaceuticals)
3. Biological insecticides
4. Genetically engineered or recombinant DNA products

SECTION THREE

Sample Questions

The sample questions give you an idea of the level of knowledge expected in the exam and how questions are typically phrased. They are not representative of the entire content of the exam and are not intended to serve as a practice test.

Rationales for the questions can be found on pages 22–25 of this guide. In that section, the correct answer is identified and each answer is explained. The number in parentheses at the beginning of each rationale refers to the corresponding section of the content outline. For any questions you answer incorrectly, return to that section of the content outline for further study.

You will be provided with an erasable white board to use during your exam, and you will have access to a basic 8-function calculator on the computer. The calculator button is located in the top left-hand corner of the screen, as each question is presented. A picture of a typical 8-function calculator is provided on page 26.

1. Which microorganisms are classified as prokaryotes?
 - 1) algae
 - 2) archaeobacteria
 - 3) protozoans
 - 4) yeasts
2. The Gram stain is an example of which type of stain?
 - 1) differential
 - 2) lipid granule
 - 3) negative
 - 4) simple
3. The presence of a spore in a vegetative bacterial cell helps establish that the organism is of which genus?
 - 1) *Bacillus*
 - 2) *Erwinia*
 - 3) *Pseudomonas*
 - 4) *Salmonella*
4. *Euglena gracilis* is generally classified as having which nutrition process?
 - 1) autotrophic
 - 2) heterotrophic
 - 3) parasitic
 - 4) saprophytic
5. In a mixed culture, a particular bacterial species represents 0.01% of the total cell population. What is the best way to isolate this species in a pure culture?
 - 1) Use the pour plate isolation method.
 - 2) Grow the culture on a minimal medium.
 - 3) Grow the culture on an enrichment medium and then use the streak plate method.
 - 4) Use the streak plate method directly.
6. A barrier that prevents the passage of bacteria, but not smaller particles, is placed between a genetic donor and a genetic recipient. Which gene transfer will be stopped by this barrier?
 - 1) conjugation
 - 2) generalized transduction
 - 3) specialized transduction
 - 4) transformation

7. If a bacterial gene coding for a repressor protein were to be mutated so that it would no longer bind to the operator site on the DNA, what would happen to the structural genes controlled by that repressor?
The structural genes would be
- 1) permanently turned on.
 - 2) turned on only in the presence of the inducer.
 - 3) turned on only in the absence of the inducer.
 - 4) turned off.
8. What can be determined from the one-step growth curve exhibited by lytic bacteriophage?
- 1) the extent of recombination during the latent period
 - 2) the site of the virion particles
 - 3) the average number of viruses released per infected cell
 - 4) the evolutionary relatedness of bacteriophage and animal viruses
9. Which method ensures sterilization because of its high sporicidal activity?
- 1) desiccation
 - 2) pasteurization
 - 3) pressurized steam
 - 4) ultraviolet light
10. How does moist heat kill bacteria?
- 1) by causing hemolysis of the cell
 - 2) by denaturing proteins in the cell
 - 3) by dissolving lipids in the cell
 - 4) by extracting water from the cell
11. In which form of radiation does the killing of cells result from inactivation of sensitive macromolecules by free radicals such as the hydroxyl radical (OH⁻)?
- 1) infrared
 - 2) ionizing
 - 3) ultraviolet
 - 4) visible
12. Why is the practice of adding antibiotics to animal feed controversial?
The practice
- 1) inflates the cost of meat.
 - 2) limits the supply of antibiotics for humans.
 - 3) lowers the natural resistance of the animal to disease.
 - 4) promotes development of bacterial resistance.
13. Which microorganism is a common, normal inhabitant of the human intestine?
- 1) *Escherichia coli*
 - 2) *Pseudomonas aeruginosa*
 - 3) *Staphylococcus aureus*
 - 4) *Vibrio cholerae*
14. How do tears and saliva disrupt the cell walls of gram-positive bacteria?
Tears and saliva
- 1) contain lysozyme, which weakens the cell wall.
 - 2) are basic and hydrolyze the cell wall.
 - 3) deprive the bacteria of oxygen.
 - 4) lower the ionic strength of the fluid in which the bacteria are suspended.
15. What do high serum titers of IgM indicate?
- 1) the typical primary response to an antigen
 - 2) a typical secondary response to an antigen
 - 3) the inability to produce IgG
 - 4) a disorder of the immune system
16. A child immunized with a polio vaccine will develop which type of immunity?
- 1) artificially acquired, active
 - 2) artificially acquired, passive
 - 3) naturally acquired, active
 - 4) naturally acquired, passive

17. Why is streptococcus pneumoniae resistant to destruction by phagocytosis?
Resistance is due largely to the
- 1) presence of a streptococcal capsule.
 - 2) chemical nature of the streptococcal cell membrane.
 - 3) secretion of streptococcal exotoxin by the rough strain.
 - 4) secretion of streptococcal endotoxin by the smooth strain.
18. A newborn in an intensive care nursery has low birth weight and shows signs of cataracts and a heart murmur. A history reveals that the mother had contracted an undiagnosed upper respiratory tract infection with a low-grade fever and a mild skin rash during the third week of pregnancy. Which microbial agent would most likely be responsible for these occurrences in both mother and newborn?
- 1) beta-hemolytic streptococci
 - 2) *Haemophilus influenzae*
 - 3) *Mycoplasma pneumoniae*
 - 4) rubella virus
19. A poultry processor comes to the clinic complaining of chronic cough and general malaise. Lung X rays show calcified nodules. A tuberculin test and acid-fast test are negative. Sputum samples show large fungus-like oval cells, often inside leukocytes. What is the most probable cause of the person's signs and symptoms?
- 1) an adenovirus
 - 2) *Histoplasma capsulatum*
 - 3) *Mycobacterium tuberculosis*
 - 4) *Treponema pallidum*
20. What is the mechanism that leads to death in patients with cholera?
- 1) cardiomyopathy
 - 2) endotoxin poisoning
 - 3) fluid and electrolyte losses
 - 4) renal failure
21. Why are there more female than male carriers of gonorrhea in the United States?
- 1) Acidity of the female reproductive tract enhances infectivity and growth of the gonococcus.
 - 2) Females are often asymptomatic and therefore fail to seek treatment.
 - 3) Increased use of condoms usually prevents male exposure.
 - 4) Males are more easily treated and cured than are females.
22. What does the presence of coliform bacteria in a drinking water supply indicate?
The water is
- 1) safe to drink, because coliform bacteria are not usually pathogenic.
 - 2) potentially dangerous to drink, because the water is contaminated with bacteriophage.
 - 3) potentially dangerous to drink, because the water is contaminated with soil or sewage.
 - 4) dangerous to drink, because coliform bacteria cause fatal intestinal disease.
23. Which disease may be prevented by immunizing with a toxoid?
- 1) smallpox
 - 2) tetanus
 - 3) tuberculosis
 - 4) typhoid fever
24. A microorganism used in an industrial setting to produce antibiotics should ideally exhibit which characteristic?
The microorganism should
- 1) be a small, slowly growing microbe.
 - 2) grow at low temperatures.
 - 3) excrete the secondary metabolite.
 - 4) produce large amounts of polysaccharide.

25. The conversion of ethanol in wine to acetic acid occurs under which circumstance?
- 1) Organisms are present in the wine that carry out malolactic fermentation.
 - 2) The ethanol concentration of the wine is too low to inhibit the growth of acetic acid bacteria.
 - 3) Too much fermentable carbohydrate is present in the wine.
 - 4) The wine has been exposed to aerobic conditions for too long.

SECTION FOUR

Rationales

1.(IB3)

- 1) Algae are classified as eukaryotes.
- *2) The archaeobacteria are classified as prokaryotes because they lack a nucleus, nuclear membrane, and organelles. Archaeobacteria also have other properties consistent with the prokaryotes.
- 3) Protozoans are classified as eukaryotes.
- 4) Yeasts are classified as eukaryotes.

2.(IC2)

- *1) The Gram stain is a differential stain because it stains separate parts of a cell differently. It is used to distinguish between gram-positive and gram-negative bacterial populations based on the distinctive staining characteristics of their cell walls.
- 2) The lipid granule stain does not separate bacteria into groups. It allows viewing of the structures within the cells.
- 3) The negative stain does not separate bacteria into groups. It is used to show clear bacteria on a dark background.
- 4) Although it is used to stain bacteria, the simple stain does not separate bacteria into groups.

3.(IIA)

- *1) Spore formation in the bacteria is limited almost exclusively to members of the genera ***Bacillus*** and ***Clostridium***.
- 2) Bacteria of the *Envinia* genus do not produce spores.
- 3) Bacteria of the *Pseudomonas* genus do not produce spores.
- 4) Bacteria of the *Salmonella* genus do not produce spores.

4.(IIB1)

- *1) *Euglena gracilis* is considered autotrophic because it uses its photosynthetic pigments to synthesize its own food materials.
- 2) Heterotrophic refers to an organism that uses preformed organic matter for food.
- 3) Parasitic refers to an organism that uses living preformed organic matter.
- 4) Saprophytic refers to an organism that uses nonliving preformed organic matter.

5.(IIB3)

- 1) The pour plate method would be inappropriate because the organism of interest is too rare.
- 2) This is an inappropriate method because not all species grow on minimal media.
- *3) The enrichment medium increases the relative percentage of the organism of interest when the population streak plate method is used afterward.
- 4) The organism of interest is too rare for the streak plate method to be used directly.

*correct answer

6.(IID3)

- *1) Conjugation requires cell-to-cell contact and would be blocked by the barrier.
- 2) Generalized transduction utilizes phage that can pass through the barrier.
- 3) Specialized transduction utilizes phage that can pass through the barrier.
- 4) Transformation uses DNA that can pass through the barrier.

7.(IID4c)

- *1) The RNA polymerase would always find an open promoter/operon region.
- 2) The repressor never binds to DNA.
- 3) The repressor never binds to DNA under the conditions described.
- 4) Operons are turned off when the repressor is bound. This cannot happen because the repressor is a mutant.

8.(IIE2a)

- 1) Information about the extent of recombination is not required.
- 2) The curve gives no indication of the location of virion particles.
- *3) The curve indicates the number of phage particles.
- 4) The curve shows the number of viruses released, but provides no information on the phylogeny of viruses.

9.(IIB3b)

- 1) Desiccation is not a reliable form of sterilization because it has low sporicidal activity.
- 2) Pasteurization is not a reliable form of sterilization because it has virtually no sporicidal activity.
- *3) Pressurized steam is used for sterilization in the autoclave where it penetrates tough bacterial spores and destroys them quickly.
- 4) Ultraviolet light is not a reliable form of sterilization because it has low sporicidal activity.

10.(IIB3b)

- 1) Bacteria cells are not blood, so hemolysis does not occur.

- *2) Small temperature increases lead to denaturation of some proteins.

- 3) Lipids are more resistant to moist heat than are proteins.
- 4) Water remains within a cell until driven off at increasingly higher temperatures.

11.(IIB4b)

- 1) Infrared radiation is not strong enough to induce the production of oxygen radicals.
- *2) Ionizing radiation is powerful enough to ionize water by causing atoms to change to ions.
- 3) Ultraviolet light is not strong enough to induce the production of oxygen radicals.
- 4) Visible radiation is not strong enough to induce the production of oxygen radicals.

12.(IID3a)

- 1) The practice of adding antibiotics to animal feed may actually reduce the cost of feed as animals gain weight faster.
- 2) The practice may lead to an oversupply of antibiotics needed for human beings.
- 3) The practice lowers the antibiotic resistance of the animals to disease.
- *4) The practice preferentially allows the growth of bacteria strains that are resistant to drugs used to treat human infections.

13.(IVA1b)

- *1) The intestine of most human beings contains a population of nonpathogenic *Escherichia coli* as part of its normal flora.
- 2) *Pseudomonas aeruginosa* is not commonly located in the intestine. It is a possible pathogen in individuals who are immunocompromised.
- 3) *Staphylococcus aureus* is not commonly located in the intestine. It is found in the nose and on the skin.
- 4) *Vibrio cholerae* is not commonly located in the intestine. It is a pathogen and the agent of cholera.

14.(IVB1d)

- *1) Lysozyme in tears and saliva weakens the cell wall by rupturing peptidoglycan layers.

*correct answer

- 2) The pH of tears and saliva is not basic enough to break the cell wall.
- 3) Oxygen is diffused, not deprived, through tears.
- 4) The ionic strength is increased due to NaCl in tears.

15.(IVC2e)

- *1) IgM antibodies are the primary response to exposure to an antigen.
- 2) IgG antibodies appear 24 to 48 hours after the primary response to exposure to an antigen.
- 3) Recent exposure to antigens does not induce the production of IgG.
- 4) There is no known disorder that only produces IgM.

16.(IVC3b)

- *1) Vaccination is an artificial means of introducing antigens to the body, and since the body produces its own antibodies, the immunity is active.
- 2) Artificially acquired, passive immunity results from an injection of antibodies.
- 3) Naturally acquired, active immunity results from an episode of disease, even if the disease is subclinical.
- 4) Naturally acquired, passive immunity results from antibodies passed from mother to child across the placenta.

17.(VA1d)

- *1) The large capsule of ***Streptococcus pneumoniae*** prevents the phagocyte from adhering to the cell.
- 2) The cell membrane of *Streptococcus pneumoniae* is not involved in resistance to phagocytosis.
- 3) The rough strain of *Streptococcus pneumoniae* is nonvirulent.
- 4) Endotoxins are only produced by gram-negative bacteria and *Streptococcus pneumoniae* is gram-positive.

18.(VA2b)

- 1) A beta-hemolytic infection is commonly associated with high-grade fever.
- 2) This organism, which can inhabit the mucous membranes of the upper respiratory tract, is not characterized by skin rashes.
- 3) This organism is the causative agent of “walking pneumonia,” and generally does not produce the signs described in the newborn.
- *4) Rubella often goes undetected and can produce the signs described in the newborn if contracted in the first trimester of pregnancy.

19.(VA3f)

- 1) Adenoviruses generally cause the common cold, characterized by swelling of the lymph nodes, or meningitis.
- *2) This causative organism is a dimorphic fungus that can appear in yeastlike form in macrophages, where it can multiply.
- 3) Both the tuberculin and acid-fast tests were negative, so this organism is not the causative agent.
- 4) This bacterium is the spirochete that causes syphilis and does not produce the signs described.

20.(VB1)

- 1) Cardiomyopathy is a disorder of the heart muscle and is often of unknown etiology.
- 2) Endotoxin is associated with typhoid fever, meningitis, and urinary tract infections, not cholera.
- *3) Because of the loss of fluids in persons with cholera, the blood becomes so viscous that vital organs cannot function properly.
- 4) In renal failure, abrupt reduction of renal function is accompanied by progressive retention of waste compounds and is not associated with cholera.

*correct answer

21.(VC1a)

- 1) The acidity of the female reproductive tract inhibits infectivity, it does not enhance it.
- *2) The disease in females is more insidious than in males.
- 3) The use of condoms would help prevent disease transmission to either sex.
- 4) Treatment is the same for both females and males.

22.(VIA2c)

- 1) Coliforms may be pathogenic and can cause diarrhea and opportunistic urinary tract infections.
- 2) Bacteriophages do not affect human beings.
- *3) Coliforms are indicator organisms for the presence of human waste in water.
- 4) Although coliforms can cause disease, the disease is not usually fatal.

23.(VD1a)

- 1) Smallpox vaccination develops after an injection of cowpox viruses.
- *2) Tetanus toxoid is used in the DPT vaccine to produce immunity against tetanus.
- 3) A toxoid is not used to render immunity to tuberculosis. A preparation of live bacteria called BCG is used.
- 4) A toxoid is not used to render immunity to typhoid fever. Instead, treated bacteria are used.

24.(VIC2)

- 1) A small, slowly growing microbe would slow the antibiotic process and provide greater likelihood of contamination.
- 2) Low temperatures would cause the microorganism to grow more slowly. [See 1) above].
- *3) Antibiotics are secondary metabolites that are easy to retrieve if in an appropriate growth medium.
- 4) Polysaccharide makes purification of a compound difficult.

25.(VIC2)

- 1) Malolactic fermentation is not involved in the conversion of ethanol in wine to acetic acid.
- 2) This condition does not lead to acetic acid production.
- 3) See 2).
- *4) When wine is exposed to the air (under aerobic conditions), acid-forming bacteria use the oxygen to convert the ethanol in wine to acetic acid.

*correct answer

SECTION FIVE

Taking the Exam

Registering for Your Exam

Register Online

www.excelsior.edu/examregistration

Follow the instructions and pay by Visa, MasterCard, American Express, or Discover Card.

Examination Administration

Pearson Testing Centers serve as the administrator for all Excelsior College computer-delivered exams.

Accessibility Services

Excelsior College is committed to the principle that every individual should have an equal opportunity to enroll in an Excelsior College degree program, to register for courses or examinations in order to demonstrate their knowledge and skills under appropriate conditions, and to complete a degree.

The Accessibility Services Office at Excelsior College is responsible for considering requests for reasonable accommodations for individuals with verifiable, documented disabilities. If you are requesting an accommodation due to a disability/condition, complete a [Request for Accommodation form](#).

Computer-Delivered Testing

The UExcel exams are delivered by computer. You can take this exam either in a [Pearson VUE testing center](#) or at your home or office with an online proctor. If you are interested in remote proctoring, visit [PearsonVUE OnVUE online proctoring](#).

The system is designed to be as user-friendly as possible, even for those with little or no computer

experience. On-screen instructions are similar to those you would see in a paper examination booklet. You will use either the keyboard or the mouse to submit your answers, depending upon the type of question.

Before taking your exam, we strongly encourage you to go on a virtual tour of the testing center. To access this tour, click the What to Expect in a Pearson VUE test center at the following link: home.pearsonvue.com/test-taker/security.aspx

You also will receive a small, erasable whiteboard if you need one.

Whiteboards

Examinees cannot bring scratch paper to the exam. Instead, one will be provided for you to write notes or calculations on: a small whiteboard if you are testing at a Pearson Testing Center, and an on-screen “whiteboard” if you are testing online. You can see what the [on-screen “whiteboard”](#) looks like, and even try it out.

Calculator

You may not take your own calculator, if the exam calls for it. One will be provided on the testing screen. See example below.

The screenshot displays a computer exam interface. At the top, it says "Statistics - Candidate Name" and "Calculator". Below this, there is a question: "What colour is the sky on a clear day?" with four radio button options: A. Blue, B. Green (selected), C. Purple, and D. Yellow. To the right of the question is a "Click to launch calculator" button. The calculator is a Texas Instruments TI-108. Below the calculator is a "Help" button and a "Periodic Table" button. To the right of these buttons is a "LightAndOptics" button. The "LightAndOptics" button is active, showing a list of formulas for light and optics:

- $v = f \lambda$
- $d = \frac{v}{f}$
- $n = \frac{c}{v}$
- $n_i \sin \theta_i = n_r \sin \theta_r$
- $\sin \theta_{crit} = \frac{n_2}{n_1}$
- $I = I_{max} \cos^2 \theta$
- $f = \frac{R}{2}$
- $\frac{1}{s} + \frac{1}{s'} = \frac{1}{f}$
- $m = \frac{y'}{y} = -\frac{s'}{s}$
- $d \sin \theta = m \lambda$
- $\sin \theta = \frac{m \lambda}{a}$

Breaks

Breaks are only permitted for exams taken at Pearson VUE Testing Centers, and are not permitted during exams delivered via online proctoring.

Online Proctoring

As of spring 2021, Excelsior is offering an [online delivery option for UExcel exams](#), using OnVUE, Pearson VUE's online delivery and proctoring service.

You must use a personal (vs. an employer's) computer if you want to take the exam online and not in a testing center, so the exam can be effectively delivered to you.

Breaks are not allowed during an exam taken online from home. You may not leave your seat during an online-proctored exam, so be prepared to sit for two or three hours. If you need extra time, the exam will have to be taken at a PearsonVUE Testing Center, and an accommodation formally requested.

NOTE: English Composition, Spanish, Music, and College Writing will NOT be available for online proctoring.

On the Day of Your Exam

Important Reminders

On the day of your exam, remember to:

- dress comfortably: the computer will not mind that you're wearing your favorite relaxation outfit
- arrive at the test site rested and prepared to concentrate for an extended period
- allow sufficient time to travel, park, and locate the test center
- be prepared for possible variations in temperature at the test center due to weather changes or energy conservation measures
- bring your ID, but otherwise, don't weigh yourself down with belongings that will have to be kept in a locker during the test.

Academic Integrity Nondisclosure Statement

- All examinees must agree to the terms of the Excelsior College Academic Integrity Policy before taking an examination. The agreement will be presented on screen at the Pearson VUE Testing Center before the start of your exam.
- Once the examinee agrees to the terms of the Academic Integrity Nondisclosure Agreement (NDA), the exam will begin.

If you choose not to accept the terms of the agreement

- your exam will be terminated
- you will be required to leave the testing center
- you will not be eligible for a refund. For more information, review the Student Policy Handbook at www.excelsior.edu/studentpolicyhandbook.

Student behavior is monitored during and after the exam. Electronic measures are used to monitor the security of test items and scan for illegal use of intellectual property. This monitoring includes surveillance of Internet chat rooms, websites, and other public forums.

UExcel Grade Report

After you complete the exam, you will be issued a UExcel Grade Report for Examinations. See the [sample UExcel Grade Report](#) in this content guide.

Grade Appeals

If you believe that your score grade is incorrect, you may appeal your grade to examcredit@excelsior.edu. Details about the appeals process are in the [Student Handbook](#).

What If I Miss My Appointment?

If you don't cancel or reschedule your testing appointment 24 hours before your test appointment, you will have to pay the full fee of the exam, even if you don't show up.

Late Arrivals

You will also forfeit the exam fee if you arrive to the test center more than 15 minutes late.

Information About UExcel Exams for Colleges and Universities

A committee of teaching faculty and practicing professionals determines the learning outcomes to be tested on each exam. Excelsior College Center for Educational Measurement staff oversee the technical aspects of test construction in accordance with current professional standards. To promote fairness in testing, we take special care to ensure that the language used in the exams and related materials is consistent, professional, and user friendly. Editorial staff perform systematic quantitative and qualitative reviews to ensure accuracy, clarity, and compliance with conventions of bias-free language usage.

Excelsior College, the test developer, recommends granting three (3) semester hours of lower-level undergraduate credit to students who receive a letter grade of C or higher on this examination. The examination satisfies the Nursing Science core requirement in microbiology for the Excelsior College associate and baccalaureate degrees in nursing. Other colleges and universities also recognize this exam as a basis for granting credit or advanced standing. Individual institutions set their own policies for the amount of credit awarded and the minimum acceptable score.

Microbiology Exam Development Committee

I. Edward Alcamo, PhD
(St. John's University, Microbiology, 1971)
Professor of Microbiology, State University of New York College of Technology at Farmingdale

Jean A. Douthwright, PhD
(University of Rochester, Biophysics, 1980)
Professor of Biology, Rochester Institute of Technology

Mark Gallo, PhD
(Cornell University, Microbiology, 1991)
Assistant Professor, Niagara University

Sample Grade Report

Excelsior College
GRADE REPORT FOR EXAMINATIONS

Contact ID:

Test Date: 11/21/2020

Letter Grade: C

Examination Code and Title: 210 Statistics

Recommended Credit:
3 Lower Level

Your examination results are expressed as a Letter Grade of A, B, C, or F. Your results are automatically verified when they are received at Excelsior College. If an error is detected, you will be notified immediately.

Recommended Credit is the number of semester hours credit that Excelsior College awards and recommends for your grade. Excelsior College awards and recommends credit for letter grades of C or better.

If you plan to take another examination, you may download free content guides and the User's Guide by visiting our website at www.excelsior.edu/exams/content-guides/.

If you need an Excelsior College Official Examinations Transcript to document the credit you have earned for this examination for another institution, the request can be made online by accessing the Excelsior College website (www.excelsior.edu), logging into your MyExcelsior account, and scrolling down to the For Exams Takers box and clicking on the Request transcripts link. If you do not already have a MyExcelsior username and password, you can obtain one at no cost by accessing the Excelsior College website, clicking the Log In to MyExcelsior button, and then clicking the link "Create a MyExcelsior User Account."



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excelsior.edu/exams