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Biological Technical Texts

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پیشگفتار ناشر

کتاب‌های دانشگاه پیام نور حسب مورد و با توجه به شرایط مختلف یک درس در یک یا چند رشته دانشگاهی، به صورت کتاب درسی، متن آزمایشگاهی، فرادرسی، و کمک‌درسی چاپ می‌شوند.

کتاب درسی ثمره کوشش‌های علمی صاحب اثر است که براساس نیازهای درسی دانشجویان و سرفصل‌های مصوب تهیه و پس از داوری علمی، طراحی آموزشی، و ویرایش علمی در گروه‌های علمی و آموزشی، به چاپ می‌رسد. پس از چاپ ویرایش اول اثر، با نظرخواهی‌ها و داوری علمی مجدد و با دریافت نظرهای اصلاحی و متناسب با پیشرفت علوم و فناوری، صاحب اثر در کتاب تجدیدنظر می‌کند و ویرایش جدید کتاب با اعمال ویرایش زبانی و صوری جدید چاپ می‌شود.

متن آزمایشگاهی (م) راهنمایی است که دانشجویان با استفاده از آن و کمک استاد، کارهای عملی و آزمایشگاهی را انجام می‌دهند.

کتاب‌های فرادرسی (ف) و کمک‌درسی (ک) به منظور غنی‌تر کردن منابع درسی دانشگاهی تهیه و بر روی لوح فشرده تکثیر می‌شوند و یا در وبگاه دانشگاه قرار می‌گیرند.

مدیریت تولید محتوا و تجهیزات آموزشی

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Introduction

All praise belongs to the beneficent and almighty God who gave my colleagues and me the opportunity to write this book so that we could play our role in the scientific promotion of our dear country, Iran. Regarding the fact that English is international, knowing and mastering the common technical words and expressions in the field of biological sciences is a must.

Motivating the students is the first step in paving the way to efficient learning. This book addresses the B.A students majoring in biology and is specifically written for them. Each chapter involves at least one grammatical point in brief. At the end of each chapter there is an English-Persian vocabulary.

There are eleven chapters of the following characteristics:

In **chapter 1**, biology and its various branches/categories are introduced.

In **chapter 2**, microscope, the most instrumental tool in biology and the way to use it are discussed.

In **chapter 3**, cells, as the smallest component parts of living things (animals and plants) and their structure, are dealt with.

In **chapter 4**, it is discussed that the difference in the cell types is determined by the kind of DNA in their nucleus. Besides, chromosome structure and kariotype are dealt with.

In **chapter 5**, it is shown that DNA molecules can control the cell features due to production of protein molecules. Proteins and their four biochemical structures are stated as well.

In **chapter 6**, cleavage and developmental stages in animals are the topics of consideration.

In **chapter 7**, the photosynthesis process and CAM metabolism are discussed.

In **chapter 8**, the structure of flowers and some families of the flowering plants (angiosperms) are introduced.

In **chapter 9**, the definitions of ecosystem and biomes in biology are presented.

In **chapter 10**, the characteristics of bacteria and the howness of reproduction in this class of prokaryotes are presented.

In **chapter 11**, blood, blood cells and blood groups are dealt with. Some information about the Bombay blood groups is given as well.

In **chapter 12**, taxonomy is discussed and some information about the Biological Species Concept is provided as well.

Undoubtedly, this book is not void of problems, so the authors are honestly emphasize the fact that they are looking forward to receiving the suggestions and criticisms of respected colleagues and students.

We would like to extend our gratitude to the head of the Biology Department, Ms. Maryam Zaman Pour, and also to Ms. Maryam Behzadfar, Dr. Ehsan Ehsani, and Ms. Akram Mobaraki who sincerely helped us to write this book.

We really appreciate the helping and patience of our family members, without whose help this task would have been impossible for us.

Mohabat Nadaf
Nasrollah Jafari
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Study Guide

The purpose of this volume is to improve the reading skills of Biology, and to help you to become autonomous readers in your field of study. This book is divided into twelve units and each unit consists of five parts:

Part one: Biography

At the beginning of each unit, the biography of an outstanding Iranian figure in the field of biology is presented.

Part two: Word study

At this part, a list of technical terms is presented which will help you become familiar with some technicalities and give you a warm – up before dealing with the passage.

Part three: Reading

In this part, a passage which is related to biology is discussed generally. Students are expected to study the text and try to figure out the meaning. There are kinds of comprehension questions in each unit.

1. True/ False Questions

2. Matching

3. Writing

4. Multiple-choice Items

Part four: Grammatical point

This part aims at introducing a grammatical point and making students understand it practically, so one grammatical point is introduced and

then discussed by giving a couple of examples as well as some examples taken from text.

Part five: Further reading

In each chapter, there is a further reading which is supposed to improve students reading ability and also there is a fill-in-the-blanks exercise for students to practically use their knowledge.

Part seven: The Answer Keys

In this part, the answers to the questions and exercises are presented.

Unit 1

What Is Biology?

General Objectives

This unit is designed to help you learn a number of Biology terms, and the skills involved in using context clues; to increase your reading comprehension ability; and to prepare you for reading similar passages.

Educational Objectives

After carefully reading this chapter, you are expected to

1. Learn about the biography of Mahmoud Behzad.
2. Understand the following technical terms and their definitions about biology: Biology, Biologist, Biologic Organism, Zoology, Botany, Microbiology, Cytology, Histology.
3. Study the text on biology and try to figure out the meaning.
4. Do the different types of exercises, including True/ False, matching, writing, multiple – choice items and fill in the blank.
5. Focus of grammatical points How to Get the Main Idea of Reading Passages and be able to figure them out in the passage practically.
6. Read the further reading which is on Biotechnology. It is supposed to improve your reading skill.
7. Write a short paragraph in English, the subject of which is related to the text provided.

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Mahmoud Behzad

Professor Mahmoud Behzad (1913 - 2007), born in Rasht, the Capital city of Gilan province, is known as the father of new Biology science in Iran. He has written more than 100 books in Persian and participated in the authorship of more than 200 books in Iran. He is the founder of Iran Scholarly Books Editing Organization and also fluent in English, French and German. Professor Behzad is famous because of the books he has translated of French science writer Jean Rostand and English naturalist Darwin. He worked for more than 5 years in Alborz High School as the vice president and the teacher of Biology. He died due to stomach cancer in his personal home in Rasht. In the last years of his life, Professor Behzad worked in Shargh pharmacy in Rasht where he was ready to answer his fans and former students. His senior son, Prof. Faramarz Behzad previous Lecturer of Persian at the German Otto-Friedrich University in Bamberg, and renowned lexicographer in Bamberg his only daughter Prof. Parichehr Behzad works in the research department of Ludwig Maximilians University of Munich and his junior son, Eng. Hooshang Behzad, lives and works in Shiraz as an architect.

Word study

Biology - the science of life or living matter in all its forms and phenomena, especially with reference to origin, growth, reproduction, structure, and behavior

Biologist - a specialist in biology

Biologic- pertaining to biology

Organism - a form of life considered as an entity; an animal, plant, fungus, protistan, or moneran

Zoology - the science or branch of biology dealing with animals

Botany - the science of plants; the branch of biology that deals with plant life

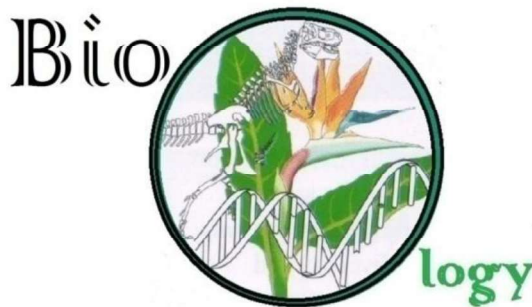
Microbiology - the branch of biology dealing with the structure, function, uses, and modes of existence of microscopic organisms

Cytology - the study of the microscopic appearance of cells, especially for the diagnosis of abnormalities and malignancies

Histology - the branch of biology dealing with the study of tissues

What is Biology?

The word biology is derived from the greek words “bios” meaning life and “logos” meaning study. Biology is the study of life (life in all of its grandeur, from the bacteria to the very large elephant). Alongside



physics and chemistry, biology is one of the largest and most important branches of science. At the highest level, biology is broken down based on the type of organism being studied: zoology, botany and microbiology. Subdivisions of each of these sciences include cytology, histology, anatomy or morphology, physiology, and embryology (the study of the embryonic development of an individual animal or plant). Also included in biological studies are the sciences of genetics, evolution, paleontology, and taxonomy or systematic, the study of classification.

The foundation of biology as it exists today is based on five basic principles. They are the cell theory, gene theory, evolution, homeostasis, and laws of thermodynamics.

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- **Cell Theory:** Cells are the basic unit of life.
- **Gene Theory:** nucleic acid is the basic unit of heredity.
- **Evolution:** New species and inherited traits are the product of evolution.
- **Homeostasis:** An organism regulates its internal environment to maintain a stable and constant condition.
- **Thermodynamics:** Living organisms consume and transform energy.

Studying biology teaches us to ask questions, make observations, evaluate evidence, and solve problems. Biologists learn how living things work, how they interact with one another, and how they evolve. They may study cells under a microscope, insects in a rainforest, viruses that affect human beings, plants in a greenhouse, or lions in the African grasslands. Their work increases our understanding about the natural world in which we live and helps us address issues of personal well being and worldwide concern, such as environmental depletion, threats to human health, and maintaining viable and abundant food supplies.

A) True/ False Statements: according to the passage, which of the following statements are true (T) and which are false (F) insert T or F.

- 1. Biology is the study of animal's life.
- 2. Biology is broken down based on the type of organism being studied.
- 3. Cytogenetic is the study of cells.
- 4. The foundation of biology as it exists today is based on five basic principles.
- 5. DNA is the basic unit of life.
- 6. New species and inherited traits are the product of ecology.

B) Matching: match the words in column I with their synonyms in column II.

Column I

Column II

1. Biochemistry	a) The study of internal structure, in plants, animals, and other organisms, or specifically in humans
2. Biomechanics	b) The study of the chemical reactions required for life to exist and function, usually a focus on the cellular level
3. Anatomy	c) The study of biology through the means of engineering with an emphasis on applied knowledge and especially related to biotechnology
4. Entomology	d) Often considered a branch of medicine, the study of the mechanics of living beings, with an emphasis on applied use through prosthetics or orthotics
5. Bioengineering	e) A new and sometimes controversial branch of biology that studies the manipulation of living matter, including genetic modification and synthetic biology
	f) The study of insects
	g) The study of the ocean, including ocean life, environment, geography, weather, and other aspects influencing the ocean

c) Writing: write a brief paragraph about “Importance of biology?”

[illegible]

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D) Multiple - choice items: Circle a, b, c, or d which best completes the following items.

1. Which of the following terms describes an organism's ability to maintain a stable internal environment?

- a) Homeostasis b) Isolation
- c) Reproduction d) Interaction

2. Living things are considered organisms if they possess which of the following characteristics?

- a) Incapability of adjusting to environmental changes
- b) Ability to grow and develop
- c) Inability to produce offspring
- d) Lack of orderly structure

3. Many types of trees lose their leaves in winter in order to avoid freezing. Which of the following terms is an example for this statement?

- a) An organization b) An environment
- c) A response d) A species

4. What are organisms able to get from?

- a) Energy b) Evolution
- c) Characteristics d) Homeostasis

5. Which of the following groups could be a species that can interbreed and successfully produce fertile offspring?

- a) Plants b) Organisms
- c) Animals d) Living and non-living organisms

6. Which of the following theories is NOT a basis for modern biology?

- a) Evolution b) Creationism
- c) Cell theory d) Gene theory

E) Grammar focus

How to get the main idea of reading passages

When you read a passage, it is very important that you get the main idea, and since most passages are generally written in a traditionally

organized manner, it is relatively easy to find the main ideas of the passage by studying the topic sentences, which are probably found at the beginning of each paragraph.

Remember that if you are asked to answer questions like

What is the **topic** of the passage?

What is the **subject** of the passage?

What is the **main idea** of the passage?

What is the author's **main point** in the passage?

With what is the author **primarily concerned**?

Which of the following would be the best **title**?

You can answer all of them in the same way. In the following you see a passage and the process of giving the answer is presented in detail:

The passage:

Nitrogen fixation is a process by which nitrogen is continuously fed into biological circulation. In this process, certain algae and bacteria convert nitrogen into ammonia (NH_3). This newly created ammonia is then for the most part absorbed by plants.

The opposite process of denitofication returns nitrogen to the air. During the process of denitofication, bacteria cause some of the nitrates from the soil to convert into gaseous nitrogen or nitrous oxide (N_2O). In this gaseous from the nitrogen returns to the atmosphere.

The question

Which of the following would be the following would be the best title for this passage?

(A) The Process of Nitrogen Fixation

(B) Two Nitrogen Process

(C) The Return of Nitrogen to Air

(D) The Effect of Nitrogen on Plant Life

In a passage with more than one paragraph, you should be sure to read the first sentence of each paragraph to determine the subject, title, or main idea. In above passage, the first sentence of the first paragraph

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indicates that the first paragraph is about the process of nitrogen fixation. If you look only at the first paragraph, you might choose the incorrect answer (A), which would be a good title for the first paragraph only. The first sentence of the second paragraph indicates that the process of denitrification is discussed in the second paragraph. Answer (C) is incorrect because *the return of nitrogen to the air* is the process of denitrification, and this is discussed in the second paragraph only. Answer (D) is incorrect because *the effect of nitrogen on plant life* is not discussed in this passage. The best answer to this question is answer (B); the two nitrogen processes are nitrogen fixation, which is discussed in the first paragraph, and denitrification, which is discussed in the second paragraph.

F) Further reading

What is Biotechnology?

Recent advances in biotechnology are helping us prepare for and meet society's most pressing challenges. At its simplest, biotechnology is technology based on biology - biotechnology harnesses cellular and biomolecular processes to develop technologies and products that help improve our lives and the health of our planet. We have used the biological processes of microorganisms for more than 6,000 years to make useful food products, such as bread and cheese, and to preserve dairy products.

Modern biotechnology provides breakthrough products and technologies to combat debilitating and rare diseases, reduce our environmental footprint, feed the hungry, and use less and cleaner energy, and have safer, cleaner and more efficient industrial manufacturing processes.

Currently, there are more than 250 biotechnology health care products and vaccines available to patients, many for previously untreatable diseases. More than 13.3 million farmers around the world use agricultural biotechnology to increase yields, prevent damage

from insects and pests and reduce farming's impact on the environment. And more than 50 biorefineries are being built across North America to test and refine technologies to produce biofuels and chemicals from renewable biomass, which can help reduce greenhouse gas emissions.

Recent advances in biotechnology are helping us prepare for and meet society's most pressing challenges. Here's how:

Heal the World

Biotech is helping to heal the world by harnessing nature's own toolbox and using our own genetic makeup to heal and guide lines of research by:

- Reducing rates of infectious disease;
- Saving millions of children's lives;
- Changing the odds of serious, life-threatening conditions affecting millions around the world;
- Tailoring treatments to individuals to minimize health risks and side effects;
- Creating more precise tools for disease detection; and
- Combating serious illnesses and everyday threats confronting the developing world.

Fuel the World

Biotech uses biological processes such as fermentation and harnesses biocatalysts such as enzymes, yeast, and other microbes to become microscopic manufacturing plants. Biotech is helping to fuel the world by:

- Streamlining the steps in chemical manufacturing processes by 80% or more;
- Lowering the temperature for cleaning clothes and potentially saving \$4.1 billion annually;
- Improving manufacturing process efficiency to save 50% or more on operating costs;

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- Reducing use of and reliance on petrochemicals;
- Using biofuels to cut greenhouse gas emissions by 52% or more;
- Decreasing water usage and waste generation; and
- Tapping into the full potential of traditional biomass waste products.

Feed the World

Biotech improves crop insect resistance, enhances crop herbicide tolerance and facilitates the use of more environmentally sustainable farming practices. Biotech is helping to feed the world by:

- Generating higher crop yields with fewer inputs;
- Lowering volumes of agricultural chemicals required by crops-limiting the run-off of these products into the environment;
- Using biotech crops that need fewer applications of pesticides and that allow farmers to reduce tilling farmland;
- Developing crops with enhanced nutrition profiles that solve vitamin and nutrient deficiencies;
- Producing foods free of allergens and toxins such as mycotoxin; and
- Improving food and crop oil content to help improve cardiovascular health.

G) Fill in the blanks: Use the words in the list below to complete the following sentences.

Mycotoxin	biomolecular
Reduce	biochemical
Increasing	health
Decreasing	

1. Biotechnology producing foods free of allergens and toxins such as.....
2. Using biotech crops allow farmers to tilling farmland.
3. Biotechnology water usage and waste generation.
4. biotechnology is technology based on biology - biotechnology harnesses cellular and processes

Unit 2

Microscope

General Objectives

This unit is designed to help you learn a number of Biology terms, and the skills involved in using context clues; to increase your reading comprehension ability; and to prepare you for reading similar passages.

Educational objectives

After carefully reading this chapter, you are expected to

1. Learn about biography of Bahram Jalali
2. Understand the following technical terms and their definitions:
Microscopy, optical microscope, Transmission electron microscopy (TEM), Scanning electron microscope (SEM), Scanning Probe Microscopy (SPM), Resolution.
3. Study the text on microscope and try to figure out the meaning.
4. Do the different types of exercises, including True/ False, matching, writing, matching, multiple - choice items and fill in the blank.
5. Focus of grammatical points adverbial connection and be able to figure them out in the passage practically.
6. Read the further reading which is on procedures. It is supposed to improve your reading skill.
7. Write a short paragraph in English, the subject of which is related to the text provided.

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Professor Bahram Jalali

Professor Jalali is the Northrop-Grumman Optoelectronics Chair Professor of Electrical Engineering at UCLA with joint appointments in the Biomedical Engineering Department, California NanoSystems Institute (CNSI) and the UCLA School of Medicine Department of Surgery. He received his PhD in Applied Physics at Columbia University in 1989 and was with Bell Laboratories in Murray Hill, New Jersey until 2002 before coming to UCLA. He is a Fellow of IEEE, the Optical Society of America (OSA), and the American Physical Society (APS). He is the recipient of the R.W. Wood Prize from Optical Society of America for the invention and demonstration of the first Silicon Laser. In 2005 he was elected into the Scientific American Top 50. He has published over 300 papers and holds 9 patents.

Word study

- **Microscopy**- is the technical field of using microscopes to view samples and objects that cannot be seen with the unaided eye (objects that are not within the resolution range of the normal eye)
- **optical microscope**- often referred to as the "light microscope", is a type of microscope which uses visible light and a system of lenses to magnify images of small sample Antibody - any of numerous Y - shaped protein molecules produced by B cells as a primary immune defense, each molecule and its clones having a unique binding site that can combine with the complementary site of a foreign antigen
- **Transmission electron microscopy (TEM)** - is a microscopy technique whereby a beam of electrons is transmitted through an ultra thin specimen, interacting with the specimen as it passes through
- **Scanning electron microscope (SEM)**- is a type of electron microscope that images a sample by scanning it with a high-energy beam of electrons in a raster scan pattern. The electrons interact

with the atoms that make up the sample producing signals that contain information about the sample's surface topography, composition, and other properties such as electrical conductivity

- **Scanning Probe Microscopy (SPM)** - is a branch of microscopy that forms images of surfaces using a physical probe that scans the specimen. An image of the surface is obtained by mechanically moving the probe in a raster scan of the specimen, line by line, and recording the probe-surface interaction as a function of position. SPM was founded with the invention of the scanning tunneling microscope in 1981
- **Resolution** - is the ability of an imaging device to separate (i.e., to see as distinct) points of an object which are located at a small angular distance

Microscope

"Micro" refers to tiny, "scope" refers to view or look at. A microscope is an instrument used to see objects that are too small for the naked eye. The science of investigating small objects using such an instrument is called microscopy. Microscopic means invisible to the eye unless aided by a microscope.

The first microscope to be developed was the optical microscope, although the original inventor is not easy to identify. An early microscope was made in 1590 in Middelburg, Netherlands.

There are many types of microscopes, the most common and first to be invented is the optical microscope which uses light to image the sample. Other major types of microscopes are the electron microscope (both the transmission electron microscope and the scanning electron microscope) and the various types of scanning probe microscope.

Conventional light, phase-contrast, different interference, polarizing, confocal, and fluorescence microscopy are all based on the interaction of light and tissue components. With the light microscope, stained preparations usually examined by means of light that passes

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through the specimen. The microscope is composed of mechanical and optical parts. The optical components consist of three systems of lenses: condenser, objective, and eyepiece (figure 2.1).

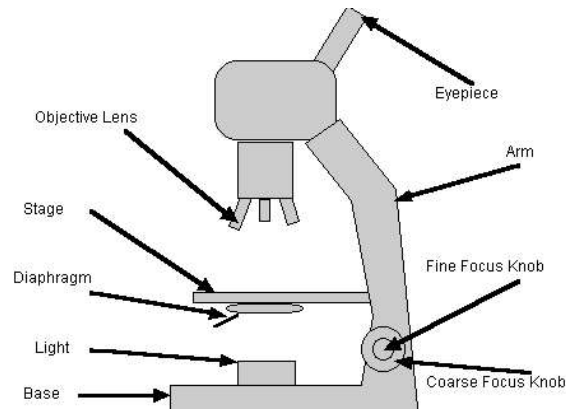


Figure 2.1: microscope Components

The condenser collects and focuses light, producing a cone of light that illuminates and object to be observed. The objective lenses enlarge and project the illuminated image of the object in the direction of the eyepiece. The eyepiece further magnifies this image and projects of onto the viewer retina, a photographic plate, or (to obtain a digital image) a detector such as a charged coupled device camera. The total magnification is obtained by multiplying the magnifying power of the objective and eyepiece.

The resolution of a microscope is the ability to clearly determine two separate points, or objects, as singular, distinguished entities. If closer together than appropriate for your resolution, the objects or points will blur together, making it impossible to differentiate. Adjust the resolution with the resolving power of the lens of the microscope. Resolution is not magnification, which is a microscope's ability to increase size--not clarity. Magnification also utilizes lenses, but if the resolving power is poor, increasing magnification will only magnify a blurry specimen.

A) True/ False Statements: according to the passage, which of the following statements are true (T) and which are false (F) insert T or F.

..... 1. The instrument of investigating small objects using such an instrument is called microscopy.

..... 2. The first microscope to be developed was the optical microscope

..... 3. Transmission electron microscope is based on the interaction of light and tissue components.

..... 4. The condenser collects and focuses light, producing a cone of light that illuminates and object to be observed.

..... 5. If the resolving power is poor, decreasing magnification will only magnify a blurry specimen.

B) Matching: match the words in column I with their synonyms in column II.

Column I	Column II
1. Microscope	a) The ability to clearly determine two separate points, or objects, as singular, distinguished entities.
2. Condenser	b) an instrument used to see objects that are too small for the naked eye
3. objective lens	c) is the technical field of using microscopes to view samples and objects that cannot be seen with the unaided eye
4. resolution	d) Enlarge and project the illuminated image of the object in the direction of the eyepiece.
	e) Is a type of electron microscope that images a sample by scanning it with a high-energy beam of electrons in a raster scan pattern.
	f) collects and focuses light

C) Multiple - choice items: Circle a, b, c, or d which best completes the following items.

1. What is called the circular area that you see when you look into a compound microscope?

- a) The Translucent Light Area.
- b) The Field Of View.

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- c) The Magnification Power.
- d) The area where the specimen is viewed.

2. What is the basic structure of microscope?

- a) Condenser
- b) Objective
- c) Eyepiece
- d) All of the above

3. Which is true of electron microscope?

- a) Are all based on the interaction of light and tissue components
- b) Forms images of surfaces using a physical probe that scans the specimen
- c) Images a sample by scanning it with a high-energy beam of electrons in a raster scan pattern
- d) b & c

4. How is the total magnification obtained?

- a) Multiplying the magnifying power of the condenser and eyepiece.
- b) Summing the magnifying power of the condenser and eyepiece.
- c) Multiplying the magnifying power of the objective and eyepiece.
- d) Summing the magnifying power of the objective and eyepiece.

D) Picture Naming: Insert the names of the microscope parts.



E) Grammar focus

Adverbial connector

When we want to connect two sentences to each other, there should be an adverbial connector such as *if*, *when*, *although* and *so on*. Sentences with adverb clauses have two basic patterns.

Example: I will sign the check *before* you leave

Before you leave, I will sign the check.

✓ **Some examples of Adverbial connector are presented from the passage above:**

- The first microscope to be developed was the optical microscope, although the original inventor is not easy to identify.
- *If* closer together than appropriate for your resolution, the objects or points will blur together....
- Magnification also utilizes lenses, but if the resolving power is poor, increasing magnification will only magnify a blurry specimen.

F) Further reading

Procedures

I. Microscope Handling

1. Carry the microscope with both hands --- one on the arm and the other under the base of the microscope.
2. One person from each group will now go over to the microscope storage area and properly transport one microscope to your working area.
3. The other person in the group will pick up a pair of scissors, newsprint, a slide, and a cover slip.
4. Remove the dust cover and store it properly. Plug in the scope. Do not turn it on until told to do so.
5. Examine the microscope and give the function of each of the parts listed on the right side of the diagram.