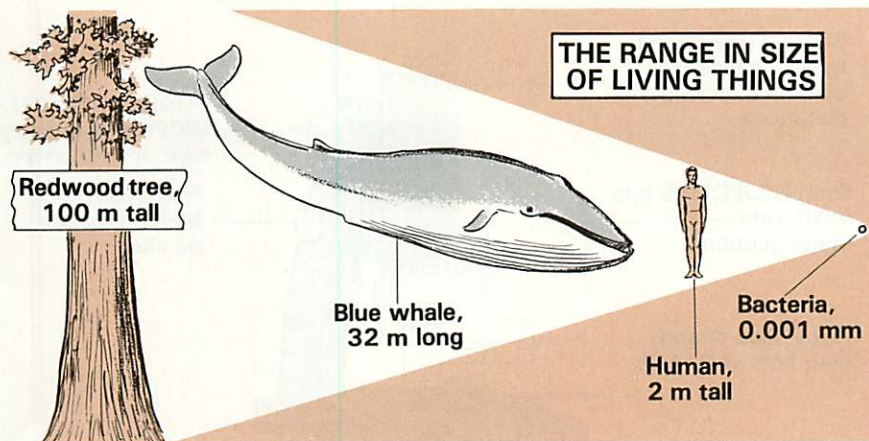


# 11 The Microscope

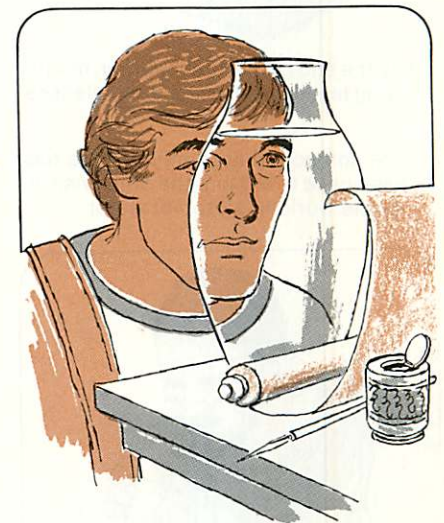
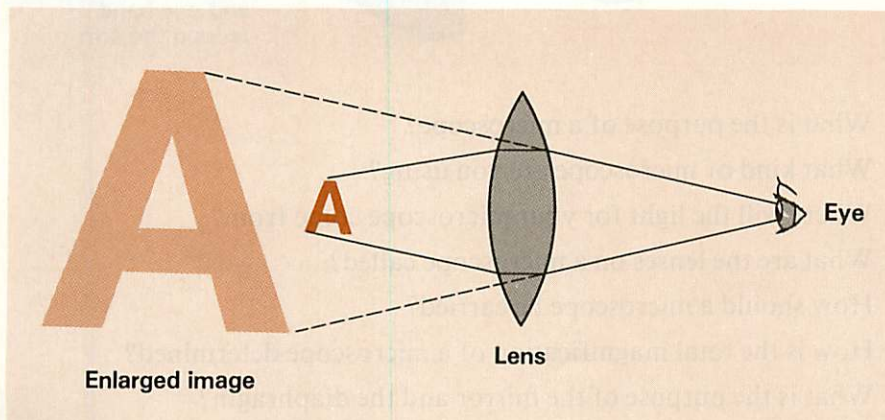
## Extending the Human Senses

### 11A INTRODUCTION

The subject of this chapter is the MICROSCOPE. The microscope is a tool used to study objects too small to be seen with the unaided eye. You will be using the microscope to discover a whole world of life too small to be seen with the eye alone. The study of the diversity of life will begin with microscopic organisms and progress to the largest organisms.



The microscope enlarges the image of a small object. In this class, you will be using the compound microscope. The compound microscope consists of two lenses, each fitted into the end of a tube within a tube.



The Chinese, Egyptians, and Romans discovered that small letters could be read more easily through a glass jar filled with water.

1. What is a microscope?
2. What is a compound microscope?



During the 11th century, Near East scholars invented the first lenses that were curved on both sides.



By the end of the 13th century, magnifying lenses were used as eyeglasses.

The compound light microscope has been used to explore the otherwise invisible world in a drop of water.

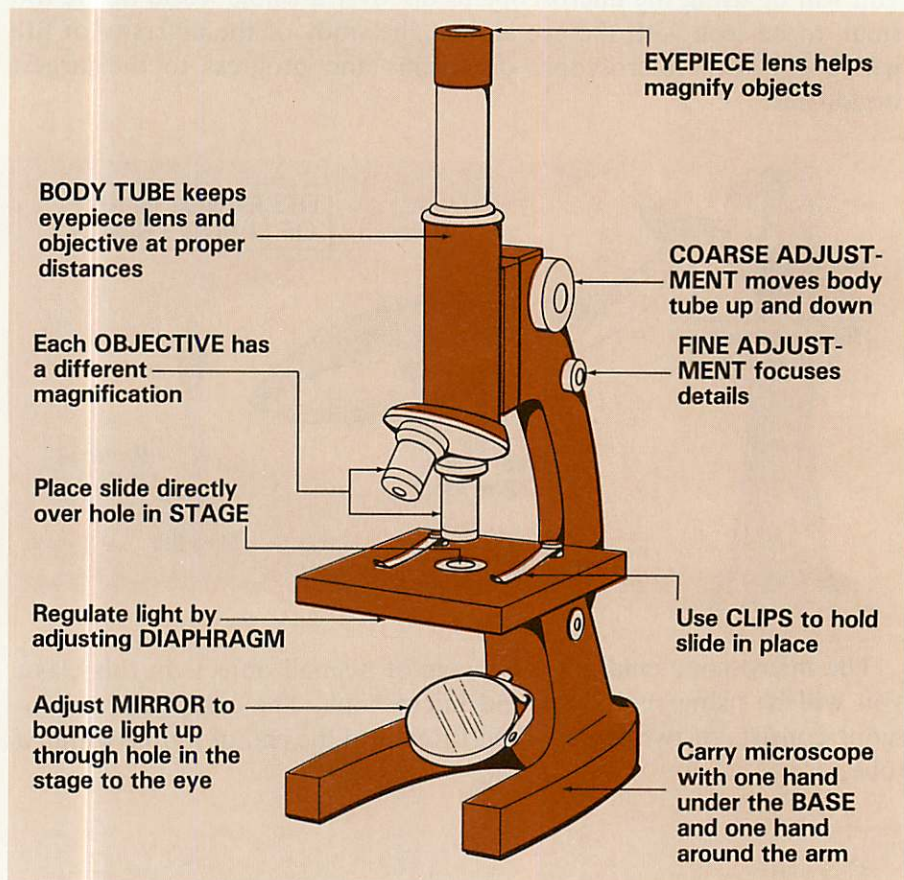


## 11B HOW TO PREPARE THE MICROSCOPE

The word *microscope* comes from the Greek words *micro* meaning “small” and *scopein* meaning “to see or view.” **The purpose of a microscope is to magnify small objects so that they can be seen.**

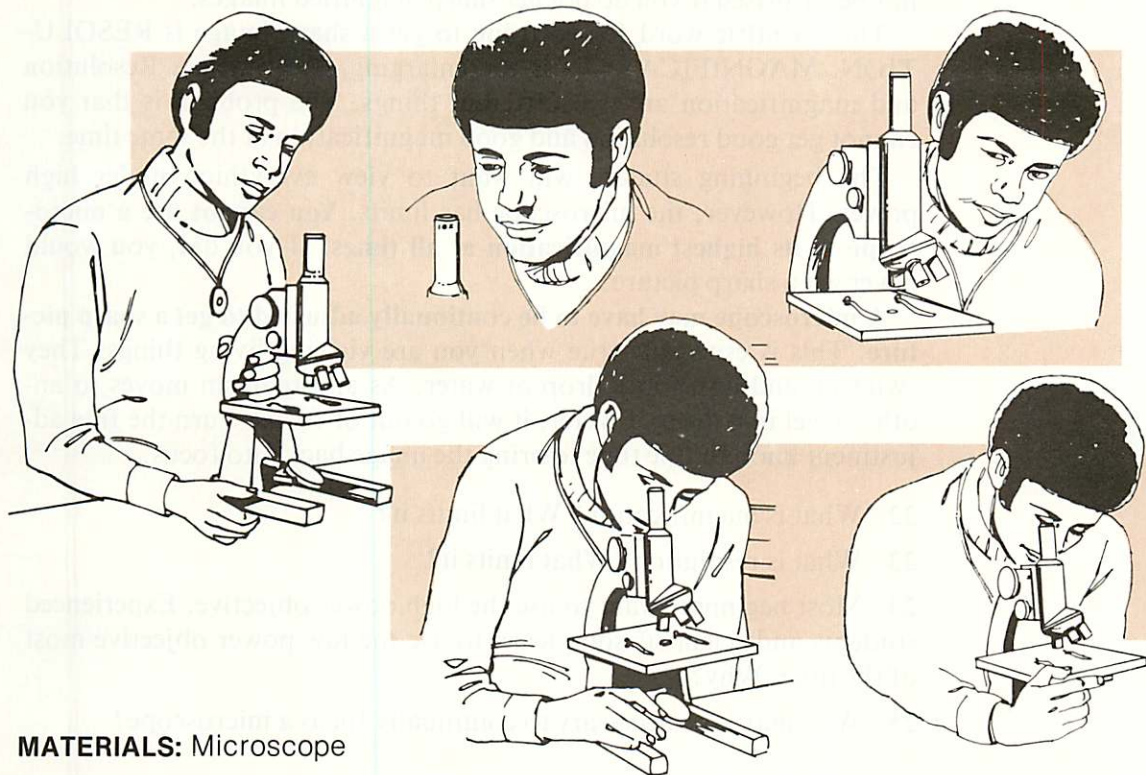
The microscope that you will be using is both a light and a compound microscope. The light for your microscope will come from either a light bulb or sunlight reflected by a mirror. The word *compound* refers to a microscope with two lenses or a set of lenses. There are two sets of lenses in a microscope, one set at each end of the body tube. The two sets of lenses are called the **EYEPIECE** and the **OBJECTIVE**.

The parts of the microscope and their functions are shown below. Study the picture and learn these parts and their functions.



3. What is the purpose of a microscope?
4. What kind of microscope are you using?
5. Where will the light for your microscope come from?
6. What are the lenses on a microscope called?
7. How should a microscope be carried?
8. How is the total magnification of a microscope determined?
9. What is the purpose of the mirror and the diaphragm?
10. What is the purpose of the coarse adjustment knob?
11. What is the purpose of the fine adjustment knob?
12. What do the clips hold?

## ACTIVITY: Care and Preparation of the Microscope



**MATERIALS:** Microscope

The microscope is an expensive and delicate instrument. It should be handled and used with great care. Treat it with care and it will enhance your sense of sight.

- Carry the microscope with both hands, one hand under the base, and the other on the arm.
- Set the microscope in front of you with the arm nearest you.
- If necessary, clean the lenses with lens paper only. The lens paper will not scratch the lenses.
- Look at the eyepiece and you will see a number with an "x" after it. The number is the magnification of the eyepiece. The "x" means "times". Record the magnification in question 13.
- Look at each of the objectives. Record the magnification of each objective in question 14.
- Turn the objective with the smallest magnification until it clicks into place under the body tube.
- If your microscope has a light, turn it on.
- If your microscope has a mirror, position it at an angle to reflect maximum light up to the eye.
- Adjust the diaphragm to the largest opening.

- What is the magnification of the eyepiece?
- In order, what are the magnifications of the objectives?

Multiply the magnification of the eyepiece by the magnification of each of the objectives. This will give you the total magnification of the microscope when a particular objective is in use.

- What is the lowest magnification of your microscope? This is commonly called low power.
- What is the middle power of your microscope?
- What is the highest power of your microscope? This is commonly called high power.
- Reread questions 3 to 7. What is the purpose of a microscope?

**For you to see anything, light must reach your eye.** While using a microscope, light must reach your eye through the eyepiece. This is why it is called a light microscope.

- If your microscope has a light or mirror, what must you do to it?
- What happens when the diaphragm is adjusted?
- For you to see anything, what must reach your eye?

## 11C HOW TO FOCUS THE MICROSCOPE

The purpose of adjusting or focusing the microscope is to produce a magnified image that is sharp. That is where the problem begins. Do not be surprised if you do not get sharp magnified images.

The scientific word for focusing to get a sharp image is RESOLUTION. MAGNIFICATION is the enlarging of an image. Resolution and magnification are two different things. The problem is that you cannot get good resolution and good magnification at the same time.

The beginning student will want to view everything under high power. However, the microscope has limits. **You cannot use a microscope at its highest magnification at all times.** If you did, you would never get a sharp picture.

**A microscope may have to be continually adjusted to get a sharp picture.** This is especially true when you are viewing living things. They swim up and down in a drop of water. As an organism moves to another level in a drop of water, it will go out of focus. Turn the fine adjustment knob to fine tune to bring the image back into focus.

22. What is magnification? What limits it?
23. What is resolution? What limits it?
24. Most beginners want to use the high power objective. Experienced students and scientists soon learn to use the low power objective most of the time. Why?
25. Why may it be necessary to continually focus a microscope?

## 11D HOW TO PREPARE A MICROSCOPE SAMPLE

The SAMPLE is the object to be magnified and viewed. The sample is first placed on a glass slide and then placed on the stage of the microscope. What you are about to prepare is called a WET MOUNT. This is because a drop of water is used along with the sample. Another small piece of glass, called a COVER SLIP, is then placed on top of the water.

**Most important, the sample must be flat, thin, and as transparent as possible. Light must pass through the sample to the eye.**

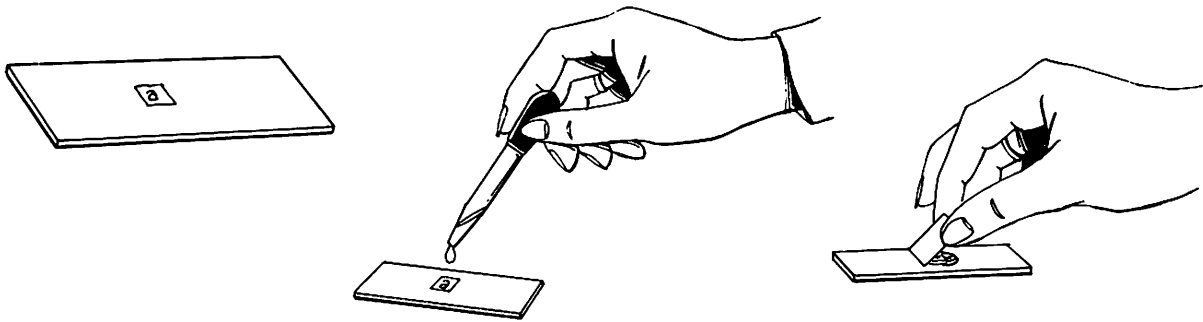
You need to know one more unusual thing about your microscope. **The microscope produces an image that is upside-down and reversed.** When you move your slide up, the image will move down. When you move your slide to the left, the image will move to the right.

### THE LIMITATIONS OF A MICROSCOPE

1. Resolution limits magnification.
2. Continual focusing is necessary if object moves.
3. Image will be upside-down and reversed.

26. What is a wet mount? Why is water used?
27. When you move the slide in one direction, which way does the image move?
28. Do you see more or less of the sample as the magnification is increased? Explain your answer.

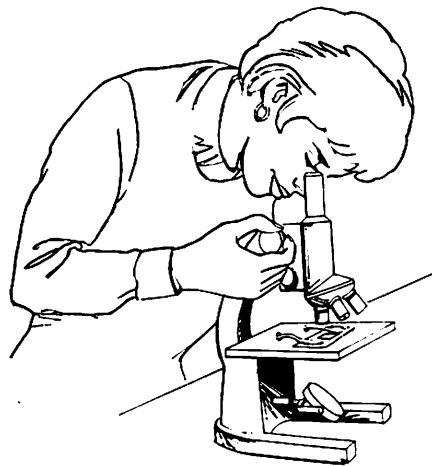
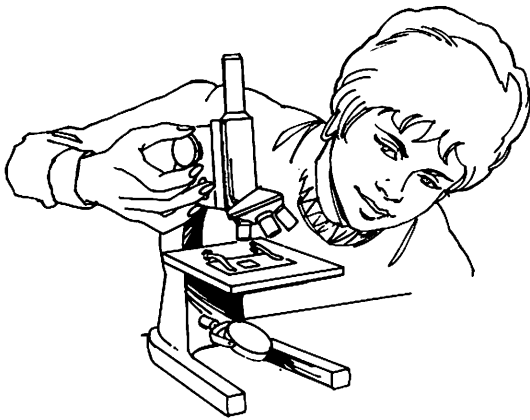
## ACTIVITY: Preparation of a Microscope Sample



**MATERIALS:** Microscope slide, cover slip, dropper

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- Cut out a small letter "a" from the classified section of the newspaper.
  - Place the "a" right side up on a microscope slide.
  - Add a drop of water on top of the "a."
  - If the letter moves, use a needle or pencil point to move it back to its right side up position.
  - Lower a cover slip at the angle pictured. This will push air out the side of the cover slip.
- 

## ACTIVITY: Adjusting and Focusing the Microscope



**MATERIALS:** Microscope

- a. Make a drawing of the letter "a" as it appears to the naked eye.
  - b. Carefully insert the slide under the clips.
  - c. Position the "a" directly over the hole in the stage. The "a" should still be right side up.
  - d. Looking at the low power objective from the side, lower the objective so that it almost touches the slide.
  - e. Look into the eyepiece and slowly turn the coarse adjustment to raise the tube. The "a" should come into focus. If you turn more than 1-2 cm, start again with step d.
  - f. Finish focusing by turning the fine adjustment.
  - g. Make a drawing of the "a" as it appears under the microscope. Indicate the magnification of the letter next to the drawing.
  - h. Turn the objective to the next higher power.
  - i. Do not touch the coarse adjustment. Focus with the fine adjustment only.
  - j. Make a drawing of what you see. Indicate the magnification of the letter.
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## SUMMARY

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### VOCABULARY

microscope  
eyepiece  
objective  
resolution

magnification  
sample  
wet mount  
cover slip

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### KEY FACTS AND CONCEPTS

A microscope enlarges small objects so that they can be seen.

A compound light microscope has several lenses that bend and magnify light.

The two sets of lenses in a compound microscope are the eyepiece and objective.

In order to see anything in a light microscope, light must reach the eye.

A microscope sample must be flat, thin, and as transparent as possible.

A wet mount is made by placing the sample in a drop of water on a slide.

A microscope must be focused to produce a magnified image that is sharp.

Resolution is the ability of a microscope to get a sharp image.

Magnification is the enlarging of an image.

A microscope must be continually focused when you are viewing living things.

The microscope produces an image that is upside-down and reversed.

The microscope is used to study the diversity of life.

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### CONCLUSION

The microscope enlarges the image of an object by bending light through a series of lenses. The microscope is used to study the diversity of life.

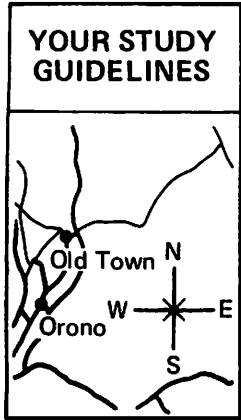
29. What is the KEY IDEA of this chapter?

CHAPTER **11** **The Microscope**  
**Extending the Human Senses**

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**The microscope is used to study the diversity of life.**

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1. Define all the vocabulary words.
2. Identify the parts of a microscope.
3. State the function of each part of a microscope.
4. Prepare a microscope sample.
5. Demonstrate that you can focus a microscope under low and high power.
6. Distinguish between resolution and magnification.
7. Explain the limits of a microscope.
8. State the Key Idea of the chapter.

**11A INTRODUCTION**

1. \_\_\_\_\_
2. \_\_\_\_\_

**11B HOW TO PREPARE THE MICROSCOPE**

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4. \_\_\_\_\_
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**ACTIVITY: Care and Preparation of the Microscope**

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**11C HOW TO FOCUS THE MICROSCOPE**

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23. \_\_\_\_\_

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24. \_\_\_\_\_

25. \_\_\_\_\_

**11D HOW TO PREPARE A MICROSCOPE SAMPLE**

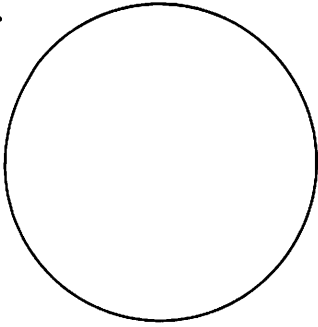
26. \_\_\_\_\_

27. \_\_\_\_\_

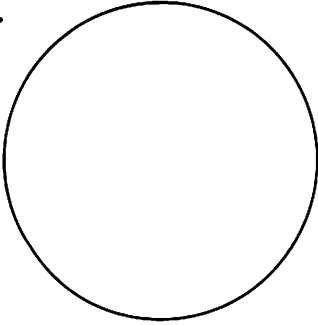
28. \_\_\_\_\_

**ACTIVITY: Adjusting and Focusing the Microscope**

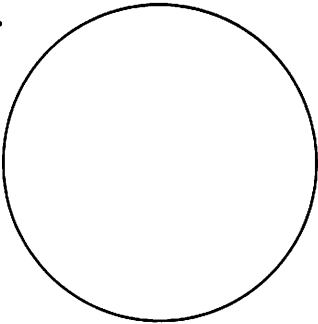
a.



g.



j.



**SUMMARY**

29. \_\_\_\_\_

**MASTERY LEARNING ACTIVITY**

Have a classmate place two or three strands of different color thread, crossed over each other, on a slide. Determine which thread is on top, which is in the middle, and which is on the bottom as viewed under a microscope. Do this and you have demonstrated that you can master the Key Idea of this chapter.