

# HOW FAR CAN YOU SEE?

## QUICK PEEK

Using periscopes students will read an eye chart at varying distances.

### SUGGESTED GRADE LEVELS: 3–6

### ILLINOIS STATE LEARNING GOALS

#### MATHEMATICS

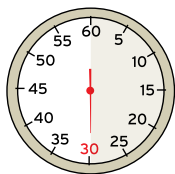
6A, 6B, 6C, 6D, 7A, 7B, 7C

#### SCIENCE

11A, 11B, 13A

### OBJECTIVES

- ★ Students will learn how a periscope works.
- ★ Students will use a periscope to see around a barrier.
- ★ Students will use a periscope to read at varying distances.



### PACE YOURSELF:

30 MINUTES  
WITH PERISCOPE  
ALREADY MADE,  
30 MINUTES TO  
MAKE PERISCOPE



### PREPARE YOURSELF

1. If you have not attended the Museum of Science and Industry's Submarine Lab, students will need to make periscopes.

#### DIRECTIONS:

[www.sciencetoymaker.org/periscope/assembl.html](http://www.sciencetoymaker.org/periscope/assembl.html)

#### BODY OF PERISCOPE:

[www.sciencetoymaker.org/periscope/images/periscpBody.gif](http://www.sciencetoymaker.org/periscope/images/periscpBody.gif)

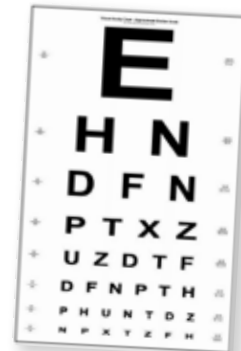
#### TRIANGLE MIRROR PIECES:

[www.sciencetoymaker.org/periscope/images/periscopTri.gif](http://www.sciencetoymaker.org/periscope/images/periscopTri.gif)

2. Make a large sign similar to a doctor's eye chart with three rows of letters or numbers.

**HELPFUL HINT:** make more than one board with different letters and numbers. This way you can change the boards throughout the activity so students don't memorize the letters and numbers, but really need to observe using their periscope.

3. Make copies of the worksheet for every student.



### MATERIALS

#### Per Student:

- Periscope
- Piece of paper
- Pencil

#### Per Class:

- "Eye chart" board
- Measuring tape
- Masking tape



## WHAT YOU NEED TO KNOW...

During World War II, German submarines like the U-505 destroyed millions of tons of cargo and killed thousands of American and Allied merchant men every year. The U-505 itself is responsible for sinking eight Allied ships carrying a total of 45,000 tons of cargo.

In order to find their targets, the U-505 and other submarines sometimes used a periscope. A periscope is a tool that submarines use to see objects not in their direct line of sight. Periscope comes from two words: peri meaning “around” and scope or scopus meaning “to look.” Periscopes use two mirrors placed at 45 degree angles, facing inward, to reflect the image to allow the looker to see the object. When submarines spent time submerged, the periscope worked as the sub’s eyes to see above the water.

The U-505 Submarine had 2 periscopes. After its capture, the periscopes were removed and relocated. One has been found and is on display at the Museum of Science and Industry. The other is lost.



## WARM UP!

Since periscopes are used to observe something that is not in your direct line of sight, have students start on the floor, under their desk. On each table place a small object. Using only their periscopes ask students to locate and identify the small object while they are seated on the ground under their table. Explain why this type of instrument is helpful for submarines and why it is important to have two mirrors at 45 degree angles so the viewer can see the object without “being seen” or if they are in a difficult spot to see properly (like under the water).



## THE HOW TO

1. In the classroom, have students place a piece of masking tape at the starting point. Your students will stand behind this tape to make their observations. Try to put this spot behind a bookshelf, or under a table so students have to use their periscopes.
2. Have students use a measuring tape to mark spots at 3 feet, 5 feet, 10 feet, and 15 feet from the “start” point.

## HOW FAR CAN YOU SEE?

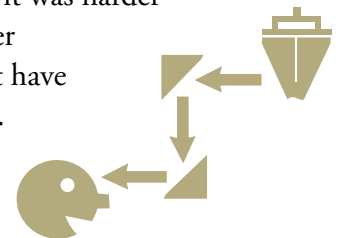
3. Students will stand at the “start” line behind the barrier (bookcase or under the table). Place the eye chart at the 3 foot mark. Can they read it using their periscope? How many lines can they read? Have students record their observations on their worksheet.
4. Move the eye chart back to the 5 feet line and have your students try to read it again. Students should record their observations on their worksheet.
5. Move to the 10 foot line, have your students read it again. Have students record their observations on the worksheet.
6. Move to the 15 foot line and try to have them read it again. Students should record their observations. (*Helpful hint:* You may want different signs so they aren't just memorizing the letters! This also can spread out your class so they aren't just working off one eye chart.)
7. Go out to the hallway and have your students set up a “start line” with tape. Have them measure out 30 feet.
8. Have students stand at start line behind barrier (maybe around a corner or under a table) and observe the board. Can they read it? Have them record their results.
9. Back in the classroom go over what the students saw and what was really written. Compare the students' results. Were they close?



### WHAT'S GOING ON HERE?

The periscopes are used for seeing things that are not in our direct line of sight. On the *U-505*, the crew members were able to look above the water with a periscope. To see, the crew member looks into the eye hole and the image is bounced off the mirrors and into the viewer's eye.

As your students got farther away from the eye charts, it was harder for them to read the letters and they probably got fewer correct. The periscope on the *U-505 submarine* doesn't have this problem because it has magnifying lenses inside it. This prevents images of objects that are really far away from getting too small to see. The students' periscopes don't have magnifying lenses inside so they don't see things far away very well.



The *U-505* periscope depth was 22-66 feet below the surface of the water.



## DID THEY GET IT?

Have the students share what they did in a whole group discussion.

1. At what distance could you read the eye chart best? *The closer you are to the board the easier it is to read.*
2. At what distance was it the hardest to get all the letters on the eye chart? *The farther away the harder it is to read.*
3. Why is a periscope important to submarines? *It helps them see potential threats or targets while under water.*
4. What does a periscope help us do? *See objects not in our direct line of sight.*
5. How could we change our periscopes to see farther away? *Build a bigger periscope, with larger mirrors or a magnifying lens inside.*

## ET CETERA

Have students calculate the percentage of letters they read off the board correctly for each distance. ((Number of letters correct divided by numbers of letters on the chart) multiply by 100 equals percentage of correct letters.)

$$\frac{\text{LETTERS CORRECT}}{\text{LETTERS ON THE CHART}} \times 100 = \text{PERCENTAGE OF CORRECT LETTERS}$$

The percentages should decrease as they get farther away.

# HOW FAR CAN YOU SEE?

How far away were you?	Row # 1 says:	Row # 2 says:	Row # 3 says:
3 feet			
5 feet			
10 feet			
15 feet			
30 feet			