

Measuring Length and Temperature

Teacher's Guide Middle School

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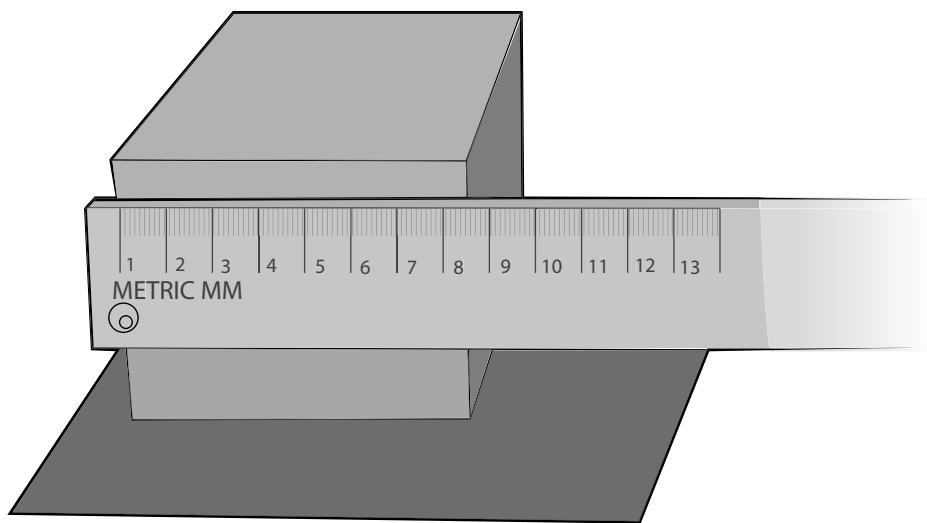
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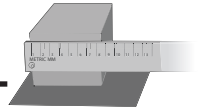


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ISBN 978-1-59234-145-4

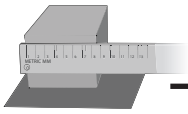
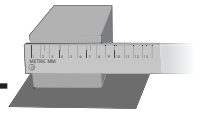


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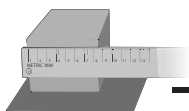
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A Message from our Company...

Dear Educator:

Thank you for your interest in the educational videos produced by the Visual Learning Company. We are a Vermont-based, family owned and operated business specializing in the production of quality educational science videos and materials.

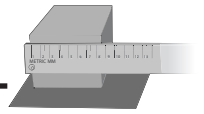
We have a long family tradition of education. Our grandmothers graduated from normal school in the 1920's to become teachers. Brian's mother was an elementary teacher and guidance counselor, and his father was a high school teacher and superintendent. This family tradition inspired Brian to become a science teacher, and to earn a Ph.D. in education, and led Stephanie to work on science educational programs at NASA.

In developing this video, accompanying teacher's guide, and student activities, our goal is to provide educators with the highest quality materials, thus enabling students to be successful. In this era of more demanding standards and assessment requirements, supplementary materials need to be curricular and standards based - this is what we do!

Our videos and accompanying materials focus on the key concepts and vocabulary required by national and state standards and goals. It is our mission to help students meet these goals and standards, while experiencing the joy and thrill of science.

Sincerely,

Brian and Stephanie Jerome



National Standards Correlations

National Science Education Standards

(Content standards: 5-8, National Academy of Sciences, c. 1996)

Science as Inquiry (Content Standard A)

Use appropriate tools and techniques to gather, analyze, and interpret data.

- The use of tools and techniques, including mathematics, will be guided by the questions asked and the investigations students design.

Communicate Scientific Procedures and Explanations

- With practice, students should become competent at communicating experimental methods, following instructions, describing observations, summarizing the results of the other groups, and telling other students about investigations and explanations.

Benchmarks for Science Literacy

(Project 2061 – AAAS, c. 1993)

Technology and Science (3A)

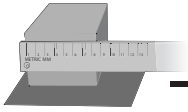
By the end of the 5th grade, students should know that:

- Measuring instruments can be used to gather accurate information for making scientific comparisons of objects and events, and for designing and constructing things that will work properly.

Manipulation and Observation (12C)

By the end of the 8th grade, students should be able to:

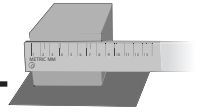
- Read analog and digital meters or instruments used to make direct measurements of length, volume, weight, elapsed time, rates and temperature, and choose appropriate units.



Student Learning Objectives

Upon viewing the video and completing the enclosed student activities, students will be able to do the following:

- Explain that scientists, including science students, use a wide variety of tools to gather information and make work easier.
- State that length and distance in the English system are measured in units of inches, feet, yards, and miles.
- State that length and distance in the metric system are measured in units of millimeters, centimeters, meters, and kilometers.
- Decide which units of measurement are most appropriate for measuring different kinds of objects.
- Demonstrate the appropriate use of a meter stick and metric ruler to measure length.
- Discuss how and when the following measuring devices are utilized: metric tape measure, odometer, meter stick, and calipers.
- Given an object, effectively and accurately measure its length with a metric ruler to the nearest millimeter.
- Understand that the metric system is a decimal system, meaning it is based on the number ten and multiples of ten.
- Differentiate between the Fahrenheit temperature scale and the Celsius temperature scale.
- Identify a thermometer as a tool used to measure temperature.
- Differentiate between a traditional thermometer and a digital thermometer.
- Demonstrate how to effectively, accurately, and safely utilize a traditional thermometer to measure temperature.



Assessment

Preliminary Assessment:

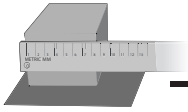
The Preliminary Assessment, provided in the Student Masters section, is an assessment tool designed to gain an understanding of students' pre-existing knowledge. It can also be used as a benchmark upon which to assess student progress based on the objectives stated on the previous pages.

Video Review:

The Video Review, provided in the Student Masters section, can be used as an assessment tool or as a student activity. There are two main parts. The first part contains questions that can be answered during the video. The second series of ten questions consists of a video quiz to be answered at the conclusion of the video.

Post Assessment:

The Post Assessment, provided in the Student Masters section, can be utilized as an assessment tool following completion of the video and student activities. The results of the Post Assessment can be compared against the results of the Preliminary Assessment to evaluate student progress.



Introducing the Video

Before showing the program to your students ask a student volunteer to stand up in front of the class. Next ask the class how tall they think the student is. Write their guesses on the board. Now ask the class what measuring tool they would use to find out the height of the student in centimeters. Suggest that a meter stick or a metric tape measure are the ideal tools for the job. Ask for a couple of student volunteers to use these measuring tools to find the height of the student. Write the measurement on the board. Tell students to pay close attention to the video to learn more about tools used for measuring length.

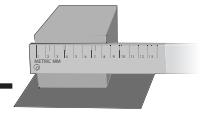
Now ask the class what they think the temperature is in the classroom. Also ask them what they think the temperature is outside. Write their answers on the board. If students are not familiar with the Celsius temperature scale this would be a good time to introduce it. Show the class a traditional thermometer that contains both the Fahrenheit and Celsius scale demarcations. Ask a student to state both readings. Write the temperature measurements on the board. Tell students to watch the video closely to learn more about the process of measuring temperature.

Video Viewing Suggestions

The student Master “Video Review” is provided for distribution to students. You may choose to have your students complete this Master while viewing the program or to do so upon its conclusion.

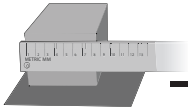
The program is approximately twenty minutes in length and includes a ten question video quiz. Answers are not provided to the Video Quiz on the video, but are included in this teacher’s guide. You may choose to grade student quizzes as an assessment tool or to review the answers in class.

The video is content-rich with numerous vocabulary words. For this reason you may want to periodically stop the video to review and discuss new terminology and concepts.



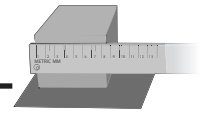
Video Script: Measuring Length and Temperature

1. What do the following things have in common: this measuring tape used to find the height of this dog,...
2. ...this ruler used to measure the length of an egg,...
3. ...these calipers used to find the size of this bird's leg,...
4. ...this metric ruler used to measure a piece of roofing slate,...
5. ...and this car odometer used to calculate the distance driven along a road?
6. That is right, all these different things are used to measure length or distance.
7. These devices can be referred to as measuring tools.
8. As you know, a tool is an instrument used to make a job easier.
9. The tools we just mentioned are used to measure length or distance.
10. Chances are you have used some of these measuring tools in your home or school.
11. During the next few minutes we are going to take a look at the process of measuring length, . . .
12. . . . with special emphasis on the safe and effective use of measuring tools in science.
13. We are also going to discuss some of the tools used to measure temperature.
14. But first let us take a look at some of the different measurement systems.
- 15. Graphic Transition – Length and Measurement Systems**
16. Depending on where you live in the world height can be described in different units.
17. For example if you live in Canada you might describe your height as being 178 centimeters.
18. But, if you live in the United States a person of similar height is described as being five feet, ten inches tall.
19. Length, in the English system of measurement, is measured in units of inches, feet, or yards.
20. And large distances are measured in miles.
21. Most other countries in the world use metric units of millimeters, centimeters, or meters to measure length.
- 22. You Decide!** In what metric units are long distances measured?
23. Large distances are measured in units called kilometers.
24. Metric units are also used in science to measure length and distance.



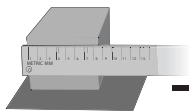
Script Cont.

25. The metric system is regarded as the international system of measurement and is used by scientists throughout the world.
26. The metric system is also the system of measurement used in your school science classroom.
- 27. Graphic Transition – Metric Units of Length**
28. The basic unit of length in the metric system is the meter.
29. Most students your age are generally 1 1/2 to 2 meters tall.
30. This tool called a meter stick is one meter long.
31. Larger objects such as furniture,
32. ...and the length of swimming pools are measured in meters.
33. Smaller units, called centimeters, are more useful for measuring shorter lengths.
34. Your fingernail, on your smallest finger for instance, is about a centimeter long.
35. There are 100 centimeters in one meter.
36. These chickens are about 30 centimeters tall.
37. And this animal skull has a length of 11 centimeters
38. Smaller objects are measured in units called millimeters.
- 39. You Decide!** How many millimeters are in a centimeter?
40. There are ten millimeters in one centimeter.
41. Kilometers are commonly used to measure larger distances in the metric system.
42. There are 1000 meters in one kilometer.
43. Now remember a measurement consists of two parts - the number and the units.
44. A number without a unit is meaningless.
45. For example, this flower has a width of 5.3 centimeters.
46. Therefore, we need to record both the numbers 5.3 and the units, which in this case are centimeters.
- 47. Graphic Transition – Tools for Measuring Length**
48. We already mentioned a common tool used by scientists, and one which is most likely in your science classroom – a meter stick.
49. There are 100 centimeters on a meter stick.
50. Meter sticks are used for measuring things that are too big to be measured with a smaller metric ruler seen here.
51. Metric rulers are usually 15 to 30 centimeters in length.
52. They are useful in measuring the length of smaller objects to the nearest millimeter.
53. Another tool used by scientists to measure length are calipers.
54. Calipers consist of two arms which are placed around an object such as this grapefruit.



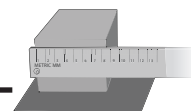
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55. The distance between the arms represent an object's length.
- 56. You Compare!** How might calipers be easier to use than a metric ruler?
57. Calipers are useful in measuring things, such as the diameter of this tree trunk, that are otherwise more difficult to measure with a metric ruler.
58. Metric tape measures are used to find the length of larger things such as the height of a small cliff . . .
59. . . . or the width of a stream.
60. An instrument called an odometer is useful when measuring longer distances.
61. Cars possess odometers which measure distance in kilometers or miles.
62. Technological advances now enable the use of lasers to very accurately measure length and distance.
- 63. Graphic Transition – Using a Metric Ruler**
64. Using metric rulers is a lot of fun. They are easy to use if you follow a few simple rules.
65. First, some metric rulers have English units along one edge, and metric units along the opposite edge.
66. Make sure your are using the edge containing metric units.
67. On some rulers, especially those which have been used a lot, the end can become damaged and difficult to read.
68. For this reason, it is often necessary to line up the edge of the object being measured with the one centimeter mark instead of the zero mark.
69. If you do this, just remember to subtract one centimeter from your final reading.
70. When measuring objects try to do so on a flat surface such as a lab table or desk.
71. Most metric rulers are numbered in one centimeter increments. The smaller lines indicate millimeters.
72. Let us say we want to measure the length of this feather from the tip of the quill to the end of the feather.
73. First, we will carefully align the tip of the quill with the zero centimeter mark.
74. Let us flatten the feather and straighten it right alongside the ruler.
75. Next, look straight down on the ruler so you can see exactly how the marks on the ruler line up with the end of the feather.
76. The end of the feather goes past the mark of 12 centimeters, but it falls short of 13 centimeters.
77. Just stating that the feather has a length of 12 centimeters is not making as accurate a measurement as possible.
- 78. You Observe!** At what millimeter mark does the feather line up?
79. That is right, it lines up with the second small line past 12 centimeters.



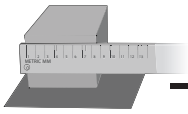
Script Cont.

80. This means the feather has a length of 12 centimeters and 2 millimeters.
81. We can also say it has a length of 12.2 centimeters.
82. Because the metric system is a decimal system, meaning that it is based on the number ten and multiples of ten, we can easily express fractions, such as fractions of centimeters as decimals.
83. So, 2 millimeters is really 2/tenths of a centimeter, or .2 centimeters.
84. Remember when recording a measurement it is not only important to correctly record the number, but it is critical to record the units as well.
- 85. Graphic Transition – Measuring Temperature**
86. If you have ever read the weather forecast in the newspaper, . . .
87. . . . or heard a weather report on the radio, you are undoubtedly familiar with air temperature.
88. In the United States, temperature is reported in degrees Fahrenheit, where water freezes at 32 degrees Fahrenheit, . . .
89. . . . and water boils at 212 degrees Fahrenheit.
90. In countries using the metric system, temperature is not usually recorded in degrees Fahrenheit, but in degrees Celsius.
91. On the Celsius scale, water freezes at zero degrees Celsius . . .
92. . . . and it boils at 100 degrees Celsius.
- 93. You Decide!** What is this instrument and what is its purpose?
94. This, of course, is a thermometer.
95. Thermometers are used to record temperatures.
96. There are several different types of thermometers.
97. Traditional thermometers such as the one you may have at your home,...
98. . . . or in your science classroom, consist of a glass tube, containing a liquid, and a scale of numbers.
99. As the temperature fluctuates, the liquid expands and contracts, moving up and down the glass tube.
100. Another type of common thermometer is a digital thermometer.
101. You may have seen digital thermometers, . . .
102. . . . or on thermostats in buildings.
103. Digital thermometers operate not by liquid expanding and contracting in a glass tube but via electronic temperature sensors.
104. Let us now take a few minutes to demonstrate how to use a traditional thermometer in the science lab.
- 105. Graphic Transition- Using a Thermometer**
106. Before we actually discuss the use of a thermometer, let us review a few safety points.



Script Cont.

107. Most traditional thermometers are made of glass, which can easily break if dropped.
108. When not using a thermometer, put it in a safe place where it won't fall or get knocked off the table.
109. Never use a thermometer as a stirring rod. This can crack or snap the thermometer.
110. And always wear safety goggles when measuring the temperature of hot substances or chemicals.
111. If a thermometer should break, tell your teacher immediately. Do not touch the broken glass or the liquid that was once inside the glass tube.
112. Let us say we want to measure the temperature of this bowl full of cooling jello.
113. Carefully place the thermometer in the bowl. Notice how the liquid in the thermometer is rising.
114. Wait until the liquid has stopped moving before recording the temperature.
115. Position yourself so you are eye level with the top of the liquid, and move the thermometer so it is straight up and down.
116. Twist the thermometer so you can see a broad band of liquid inside the glass tube.
117. Take your reading. If the liquid is halfway between 2 lines, then add half a degree to the number below the level.
- 118. You Observe!** What is the temperature?
119. That is right, the temperature is 36 and one half degrees.
120. Remember, when recording your reading do not forget the units, which in this case are degrees Celsius.
- 121. Graphic Transition- Summing Up**
122. During the past few minutes we have explored some of the interesting aspects of measuring both length and temperature.
123. We began by examining the various units of metric length including millimeters, centimeters, meters, and kilometers.
124. And we discussed some of the tools used for measuring length, including meter sticks, metric rulers, calipers, and odometers.
125. More specifically, the use of a metric ruler in measuring the length of objects was demonstrated.
126. A brief comparison between the Fahrenheit scale and the Celsius scale was made.
127. Some of the various tools used to measure temperature were highlighted.
128. And finally, the specific use of a traditional thermometer was demonstrated.
129. So, the next time you need to measure the length of something,...



Script Cont.

130. ...or look at a thermometer to see what the temperature is outside,
131. ...think about some of the things we discussed during the past few minutes.
132. You just might look at the process of measuring length and temperature a little differently.

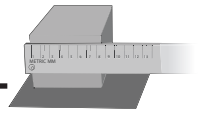
133. Graphic Transition-Video Assessment

Fill in the correct word to complete the sentence. Good luck and let us get started.

1. Scientists use the _____ system of measurement.
2. The _____ is the basic unit of metric length.
3. The distance between 2 and 3 on this metric ruler is a _____.
4. There are 1000 meters in one _____.
5. A measurement includes a number and a _____.
6. This paper clip has a length of _____ centimeters.
7. In the metric system, temperature is recorded in degrees _____.
8. This instrument is a traditional _____.
9. If a thermometer breaks, immediately tell your _____.
10. When reading a thermometer, position yourself at _____ - _____ with the top of the liquid.

Answers can be found on page 17.





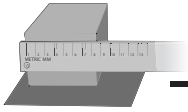
Student Assessments and Activities

Assessment Masters:

- Preliminary Assessment
- Video Review
- Post Assessment

Student Activity Masters:

- What Tool is Best?
- Using a Metric Ruler
- Using a Thermometer
- Vocabulary of *Measuring Length and Temperature*



Answers to Student Assessments

Preliminary Assessment (pgs. 20-21)

1. tool
2. odometer
3. ruler
4. decimal
5. meter
6. lasers
7. millimeters
8. traditional
9. digital
10. zero
11. true
12. false
13. false
14. false
15. true
16. false
17. true
18. false
19. true
20. true

Video Review (pg. 22)

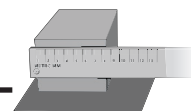
1. Long distances are measured in units called kilometers.
2. There are ten millimeters in one centimeter.
3. Calipers are useful in measuring things that would be more difficult to measure with a metric ruler, such as the diameter of a tree trunk.
4. The feather lines up with the second small line past 12 centimeters. This means the feather has a length of 12 centimeters and 2 millimeters.
5. The tool is a thermometer, and it is used to measure temperature.
6. The temperature is $36 \frac{1}{2}$ degrees Celsius.

Video Quiz (p. 22)

1. metric
2. meter
3. centimeter
4. kilometer
5. unit
6. four
7. Celsius
8. thermometer
9. teacher
10. eye-level

Post Assessment (pgs. 23-24)

1. lasers
2. digital
3. meter
4. traditional
5. zero
6. odometer
7. decimal
8. ruler
9. tool
10. millimeters
11. false
12. false
13. true
14. true
15. false
16. true
17. false
18. false
19. true
20. true



Answers to Student Activities

What Tool is Best? (p. 25)

1. Calipers are the best tool for measuring the dimensions of eggs. Because eggs cannot lay flat, and are oval shaped, they are most easily measured with calipers.
2. Due to the fact a meter stick is 100 centimeters long it would be ideal to measure a door of similar dimensions.
3. A metric ruler between 15 and 30 centimeters long would be best for this job.
4. Tape measures are good for measuring longer lengths, and would be a good choice for this task.

Using a Metric Ruler (p. 26-27)

Object	Length (in centimeters)	Length (in millimeters)
paper clip	6.3 cm	63 mm
moth	10.5 cm	105 mm
pencil	14 cm	104 mm
goggles (inside lenses)	10.3 cm	103 mm
pea pod (tip to tip)	7.7 cm	77 mm
graduated cylinder	8.4 cm	84 mm

Using a Thermometer (p. 28-29)

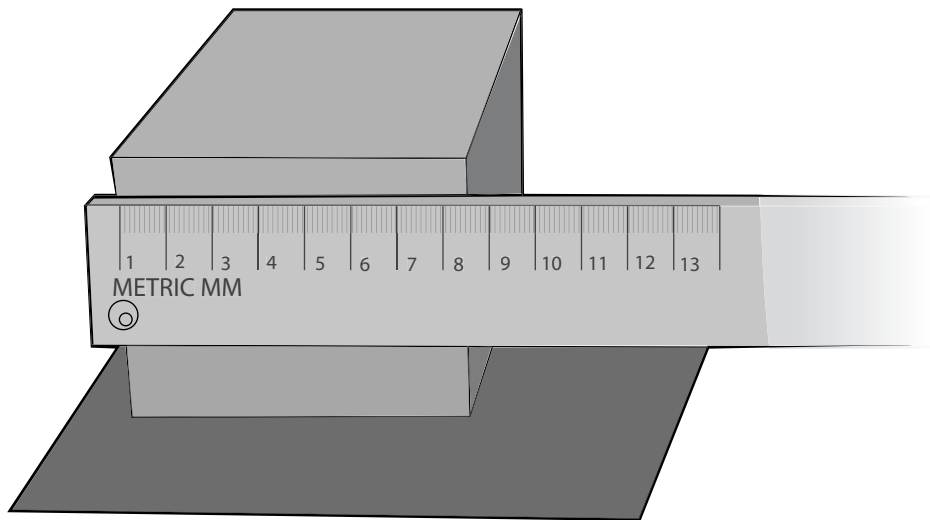
1. 20° C is about room temperature.
2. 5° C is relatively cold but, not below freezing.
3. 40° C is a very warm day.

Substance	Temp. in degrees Celsius	Temp. in degrees Fahrenheit
glass of soda pop		
air temp. in the classroom		
water from the faucet	Answers will vary	
melting ice cubes in a glass		
air temperature outdoors		
hot water from the faucet		

Vocabulary of Measuring Length and Temperature (p. 30)

1. g - tool
2. j - meter stick
3. e - measurement
4. h - calipers
5. a - odometer
6. i - metric system
7. b - thermometer
8. f - Celsius scale
9. c - Fahrenheit
10. d - centimeter

Assessment and Student Activity Masters



Preliminary Assessment

Directions: Fill in the blank with the correct word. A list of possible answers is provided at the bottom of the page.

1. An instrument that is used to make a job easier is called a _____ .
2. To measure the distance between your home and your school, you could use the _____ in a car.
3. To measure length and draw straight lines, you use a _____ .
4. The metric system is a _____ system because it is based on the number ten and its multiples.
5. The basic unit of length in the metric system is the _____ .
6. Scientists have developed ways to measure length very exactly using _____ .
7. If you were to measure the length of a small insect, you would use _____ as the metric units of measurement.
8. A _____ thermometer is made of glass and contains a liquid.
9. A thermometer that uses electronic sensors to measure temperature is called a _____ thermometer.
10. In the Celsius temperature scale, water freezes at _____ degrees Celsius.

odometer
digital
lasers
zero
decimal

meter
millimeters
ruler
tool
traditional

Preliminary Assessment

Directions: Decide whether the statement is true (T) or false (F).

- | | | |
|--|---|---|
| 11. There are different systems of measurement, but most countries use the metric system. | T | F |
| 12. The largest metric unit of length is the millimeter. | T | F |
| 13. A meter stick is usually about 80 centimeters long. | T | F |
| 14. A measurement does not require units to have meaning. | T | F |
| 15. Often it is easier to begin measuring at the one centimeter mark on a metric ruler because the end can be banged up. | T | F |
| 16. Calipers are particularly useful for measuring long distances. | T | F |
| 17. Thermometers are used to measure temperature. | T | F |
| 18. All types of thermometers are always made of glass. | T | F |
| 19. It is important to read a traditional thermometer at eye level with the top of the liquid. | T | F |
| 20. In the Celsius temperature scale, water freezes at zero degrees and boils at 100 degrees. | T | F |

Video Review

Directions: During the course of the program, answer the questions as they are presented in the video. At the end of the video, answer the Video Quiz questions.

You Decide!

1. In what metric units are long distances measured?

You Decide!

2. How many millimeters are in a centimeter?

You Compare!

3. How might calipers be easier to use than a metric ruler?

You Observe!

4. At what millimeter mark does the feather line up?

You Decide!

5. What is this instrument and what is its purpose?

You Observe!

6. What is the temperature?

Video Quiz:

1. Scientists use the _____ system of measurement.
2. The _____ is the basic unit of metric length.
3. The distance between 2 and 3 on this metric ruler is a _____ .
4. There are 1,000 meters in one _____ .
5. A measurement includes a number and a _____ .
6. This paper clip has a length of _____ centimeters.
7. In the metric system, temperature is recorded in degrees _____ .
8. This instrument is a traditional _____ .
9. If a thermometer breaks, immediately tell your _____ .
10. When reading a thermometer, position yourself at _____ - _____ with the top of the liquid.

Post Assessment

Directions: Fill in the blank with the correct word. A list of possible answers is provided at the bottom of the page.

1. Scientists have developed ways to measure length very exactly using _____ .
2. A thermometer that uses electronic sensors to measure temperature is called a _____ thermometer.
3. The basic unit of length in the metric system is the _____ .
4. A _____ thermometer is made of glass and contains a liquid.
5. In the Celsius temperature scale, water freezes at _____ degrees Celsius.
6. To measure the distance between your home and your school, you could use the _____ in a car.
7. The metric system is a _____ system because it is based on the number ten and its multiples.
8. To measure length and draw straight lines, you use a _____ .
9. An instrument that is used to make a job easier is called a _____ .
10. If you were to measure the length of a small insect, you would use _____ as the metric units of measurement.

odometer
digital
lasers
zero
decimal

meter
millimeters
ruler
tool
traditional

Post Assessment

Directions: Decide whether the statement is true (T) or false (F).

- | | | |
|--|---|---|
| 11. A measurement does not require units to have meaning. | T | F |
| 12. All types of thermometers are always made of glass. | T | F |
| 13. In the Celsius temperature scale, water freezes at zero degrees and boils at 100 degrees. | T | F |
| 14. Thermometers are used to measure temperature. | T | F |
| 15. A meter stick is usually about 80 centimeters long. | T | F |
| 16. It is important to read a traditional thermometer at eye level with the top of the liquid. | T | F |
| 17. The largest metric unit of length is the millimeter. | T | F |
| 18. Calipers are particularly useful for measuring long distances. | T | F |
| 19. Often it is easier to begin measuring at the one centimeter mark on a metric ruler because the end can be banged up. | T | F |
| 20. There are different systems of measurement, but most countries use the metric system. | T | F |

What Tool is Best?

Background: In science it is important to accurately measure properties such as mass, volume, and length. To obtain accurate measurements, you must understand measuring tools and how to use them. In this activity you will consider several different tools for measuring length, and then use your knowledge to choose the right tool in different scenarios.

You probably already know what a metric ruler is. Metric rulers are usually 30 centimeters long, and are marked in increments of centimeters and millimeters. Use a ruler to measure the length of small objects. When measuring objects too large to use a ruler, you should use a meter stick. Meter sticks are usually calibrated in centimeters, with millimeters marked as well. For objects even larger, the metric tape measure is a useful tool. Like the ruler and the meter stick, the tape measure will give an accurate reading to the nearest millimeter. To measure an object that is round or not conveniently measured with a straight edge ruler, you use calipers. Calipers look like a ruler with a set of arms that slide along it. To use them, you position the arms on either end of the object you are measuring and then read the measurement. Lasers are another tool that can measure the exact length of an object. However, they are expensive and it is likely you will not have the opportunity to use them your school science lab.

Directions: Read the scenarios below and choose the measuring tool that would give the best measurement in each situation.

1. Farmer Brown’s chickens lay different sized eggs depending on their age. This means that he has to measure the length of each egg in order to know what size it is. What tool would make this job easiest for Farmer Brown? Why?

2. Judy has a table, and she needs to fit it through a door that is only 80 centimeters wide. What tool would be best to measure the width of the table? Why?

3. Frank is building a miniature birdhouse. It will be about the size of his hand. What tool would be best to measure the different pieces of wood? Why?

4. Theresa has climbed far up a tree. She wants to measure to know how high she climbed. What tool would be best to measure the height of the tree? Why?

Using a Metric Ruler

Background: A metric ruler is a very valuable tool for measuring length. Most metric rulers are calibrated with metric measurements on one edge and English measurements on the other. Be sure, when you are using a metric ruler, that you use the metric edge. A metric ruler is usually 30 centimeters long, and marked in increments of centimeters and millimeters.

So how do you use a metric ruler? First, it is important to keep the ruler and the object as steady as possible; usually it is convenient to set the object on a flat surface. Line up the zero centimeter mark on the ruler with the end of the object. Keeping the line of the ruler straight across the surface you want to measure, find the point at which the object ends. Looking straight down at the object and the ruler, read the number of centimeters. If the object does not line up exactly with a centimeter mark, count the number of millimeters past the mark. For example, if an object reaches past the 9 centimeter mark by 3 millimeters, you can say that the object measures 9.3 centimeters. Because the metric system is a decimal system, you can also express the same object's length as 93 millimeters. Just remember to record the correct units with your measurement.

Materials: metric ruler, Using a Metric Ruler Worksheet

Directions: Measure the width or length of the objects on the worksheet using your metric ruler. Record your measurements in the data table below.

Object	Length (in centimeters)	Length (in millimeters)
paper clip		
moth		
pencil		
goggles (inside lenses)		
pea pod (tip to tip)		
graduated cylinder		



Using a Metric Ruler Worksheet



Using a Thermometer

Background: Have you ever watched the weather on television to see how warm it will be the next day? Have you ever pre-heated the oven when you were cooking? And have you checked the warmth of the water in a pool? All of these involve measuring temperature. To measure temperature you use a thermometer. Traditionally, a thermometer is a glass tube filled with a colored liquid. There are also digital thermometers that measure temperature using electric sensors. In this activity, we will explore the use of traditional thermometers.

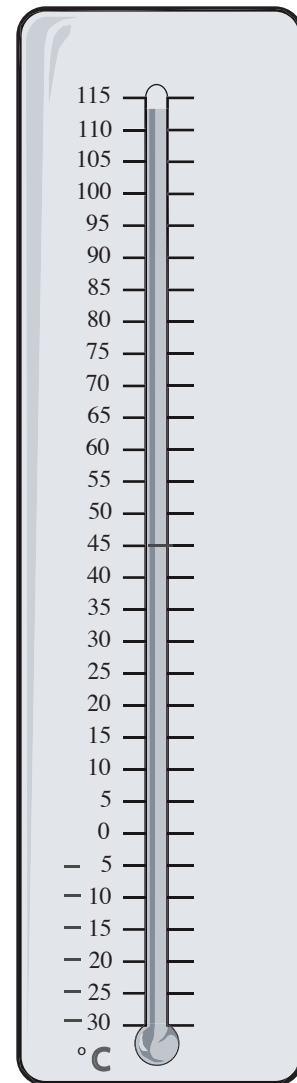
Using a thermometer is easy. However, you must be very careful with thermometers. A thermometer is a delicate instrument and can break very easily. Never use your thermometer to stir a liquid. If a thermometer should break, tell your teacher immediately. Do not touch the broken glass or the liquid that was inside it. To measure the temperature of a liquid, carefully place the thermometer in the container. Watch carefully until the liquid inside the thermometer stops moving. To read the temperature, look at the thermometer at eye level. If the liquid is halfway between two degrees, then add a half degree to the number below the level of liquid.

Materials: traditional thermometer, Using a Thermometer Worksheet

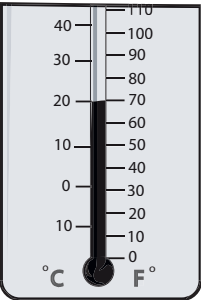
Directions:

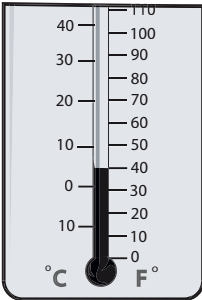
1. Practice reading temperature using each of the three thermometers on your worksheet. Record your readings in the space provided. On the lines beneath the thermometers, describe the significance of the temperature. For example, you could write that a temperature of -4°C is cold enough to freeze water. Then check your answers with your teacher before moving to the next step.

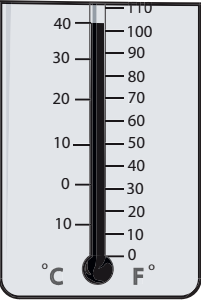
2. Now you will use a real thermometer to measure temperature. Using the traditional thermometer provided by your teacher, measure the temperature of each of the substances listed in the chart on your worksheet. Record the temperatures in both degrees Celsius and in degrees Fahrenheit.



Using a Thermometer Worksheet

1.  _____

2.  _____

3.  _____

Describe how each of the different temperatures feels.

1. _____
2. _____
3. _____

Substance	Temp. in degrees Celsius	Temp. in degrees Fahrenheit
glass of soda pop		
air temp. in the classroom		
water from the faucet		
melting ice cubes in a glass		
air temperature outdoors		
hot water from the faucet		

Vocabulary of Measuring Length and Temperature

Directions: Unscramble the vocabulary words in the first column. Match the words to the definitions in the second column.

____ 1. oolt _____

____ 2. mreet ckits _____

____ 3. uasmemrneet _____

____ 4. sleiarpc _____

____ 5. eoodrmte _____

____ 6. cmiret meytss _____

____ 7. otmrhermtee _____

____ 8. Csileus aslec _____

____ 9. hetiraFenh claes _____

____ 10. eitetrncme _____

a. An instrument often found in cars that is used to measure distance.

b. A tool used to measure temperature.

c. The temperature scale used in the English system. Water boils at 212 degrees Fahrenheit and freezes at 32 degrees Fahrenheit.

d. Metric unit of length that is approximately the size of your fingernail on your smallest finger.

e. A number and a unit used to describe a characteristic of an object.

f. The temperature scale used in the metric system. Water freezes at 0 degrees Celsius and boils at 100 degrees Celsius.

g. An instrument used to make a job easier.

h. A tool useful for measuring the length of objects that could not be easily measured using a metric ruler or a meter stick.

i. A system of measurement based on the number ten and its multiples.

j. A tool used to measure the length of larger objects such as furniture or a piece of fabric; the basic unit of metric length.