

Primary Science of Energy

Student Guide

(42 Activities)

Grades: K-4

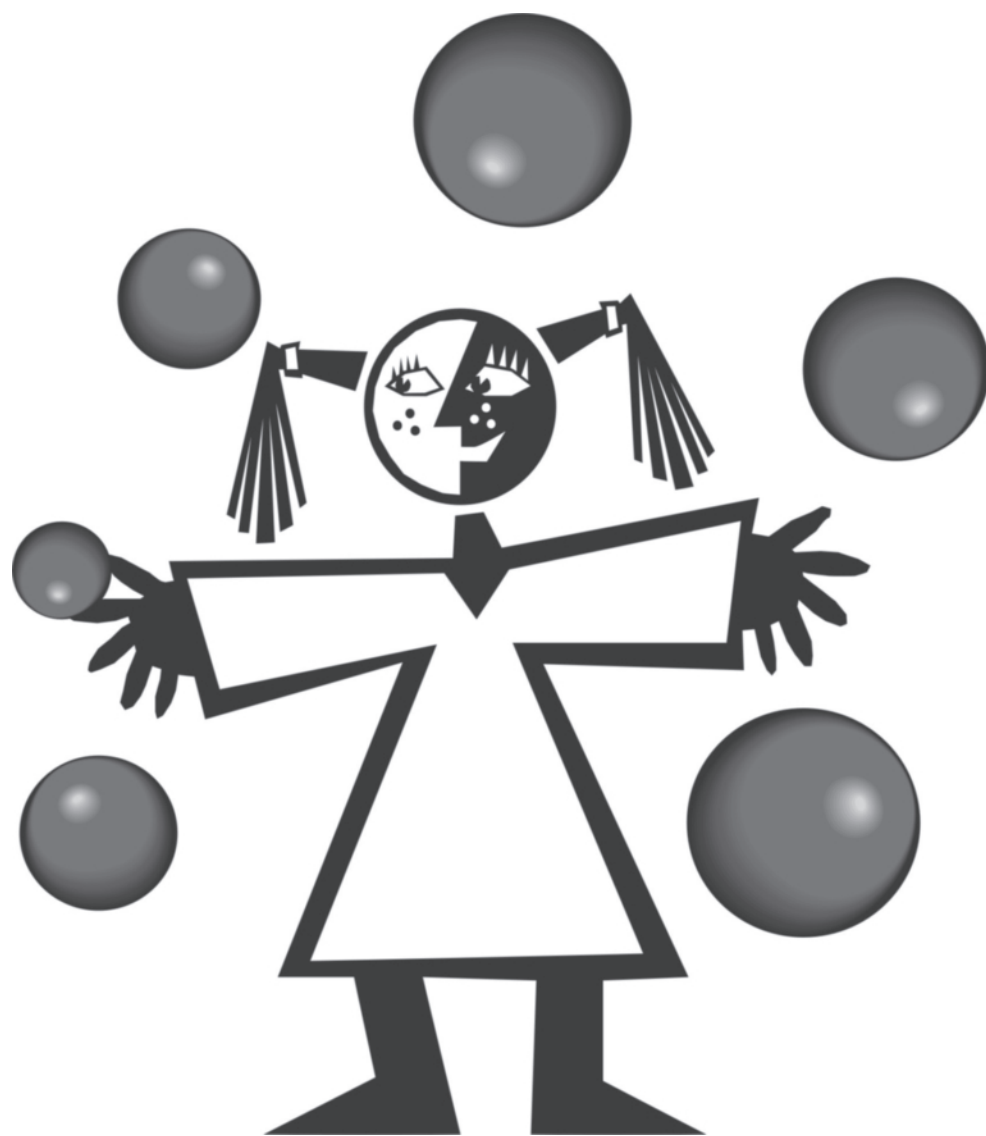
Topic: Energy Basics

Owner: NEED

SCIENCE OF ENERGY

Student Guide

Name: _____



Putting Energy into Education

NEED Project PO Box 10101 Manassas, VA 20108 1-800-875-5029 www.NEED.org

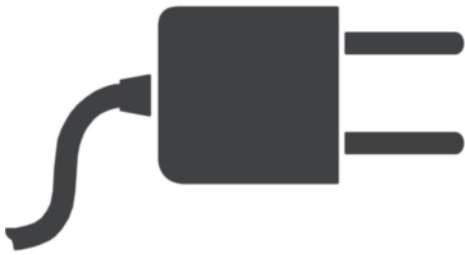
ENERGY



LIGHT



GROWTH



ELECTRICITY



MOTION

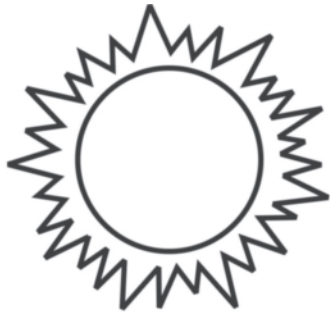


HEAT



SOUND

LIGHT and what else?



SUN



LIGHT BULB



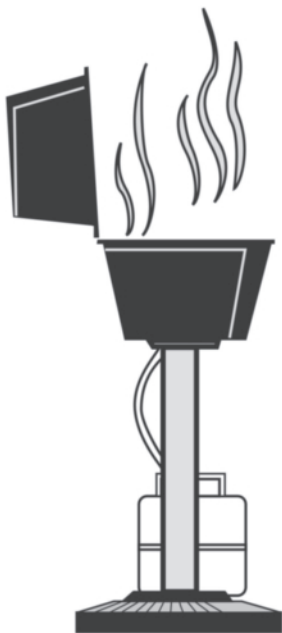
MATCHES



FLASHLIGHT



CAMPFIRE



GRILL



CANDLE

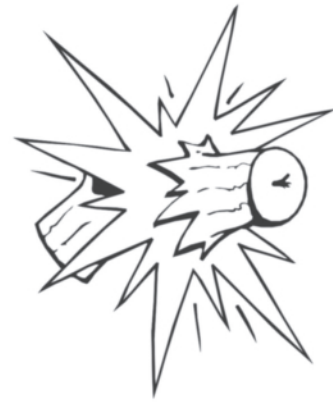


LANTERN

SOUND and what else?



TELEVISION



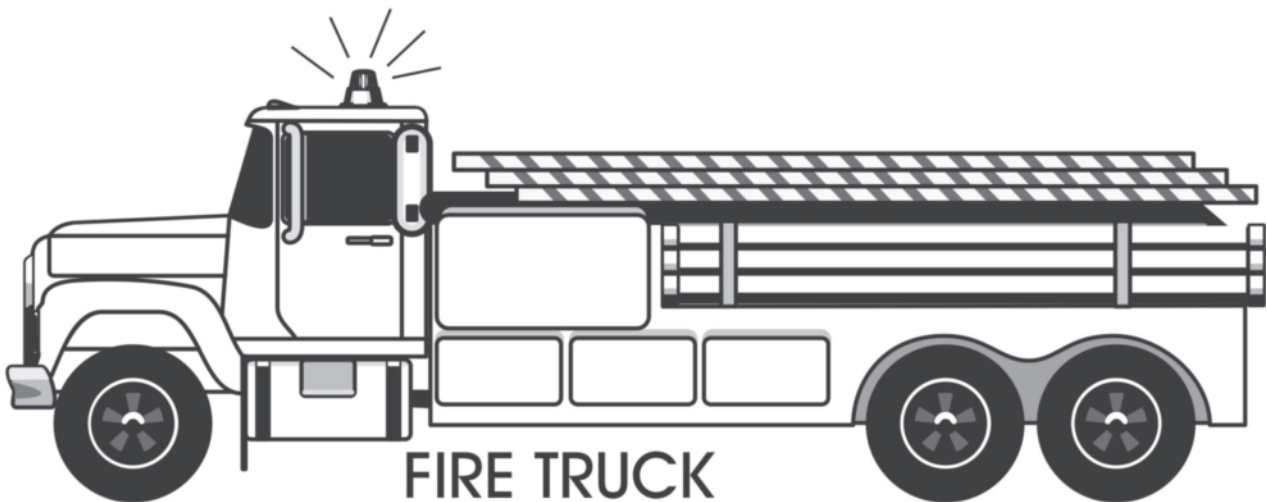
FIRE CRACKER



RADIO

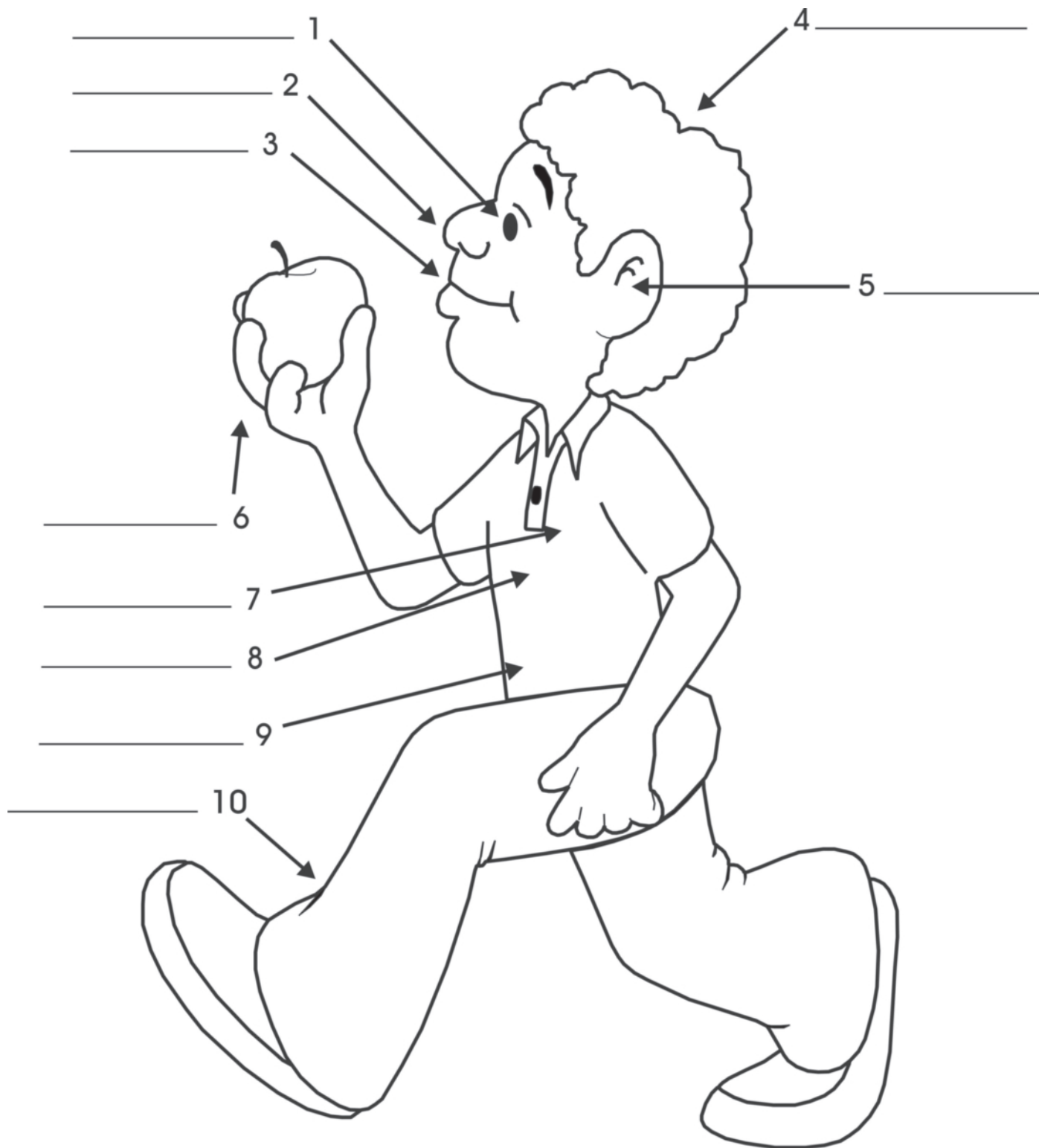


PIANO

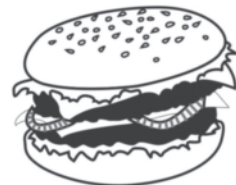
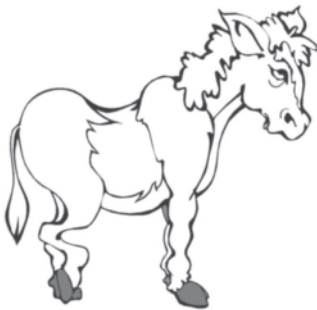
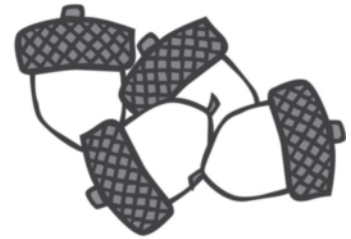


FIRE TRUCK

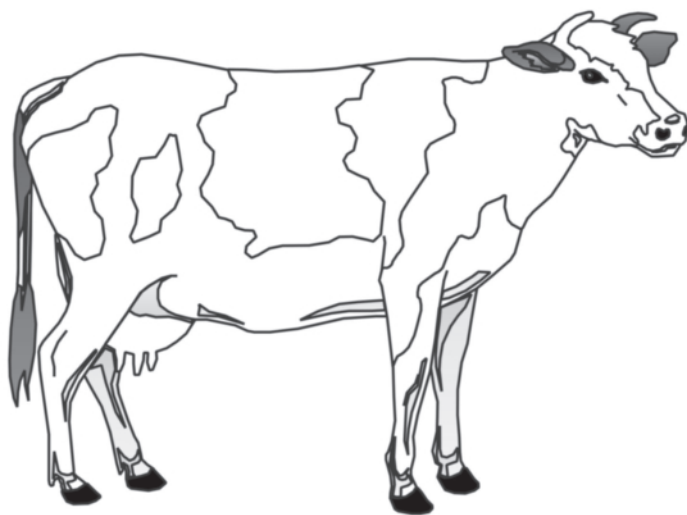
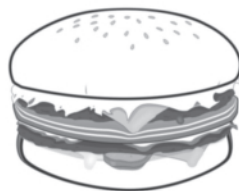
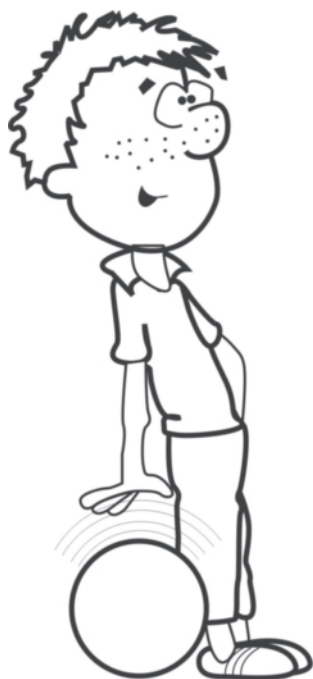
HOW OUR BODIES USE ENERGY



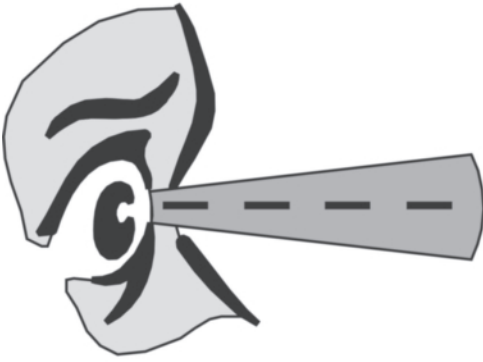
FOOD HAS ENERGY



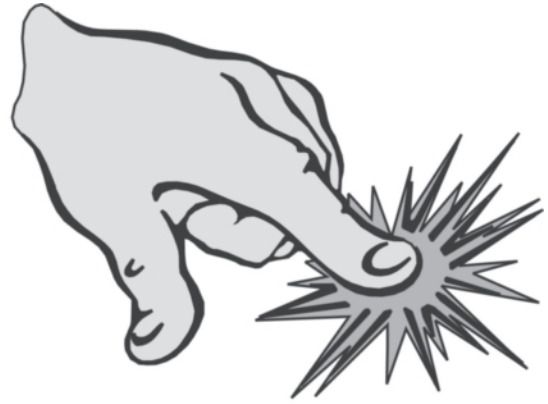
ENERGY FROM THE SUN



OUR FIVE SENSES



SIGHT



TOUCH



SMELL

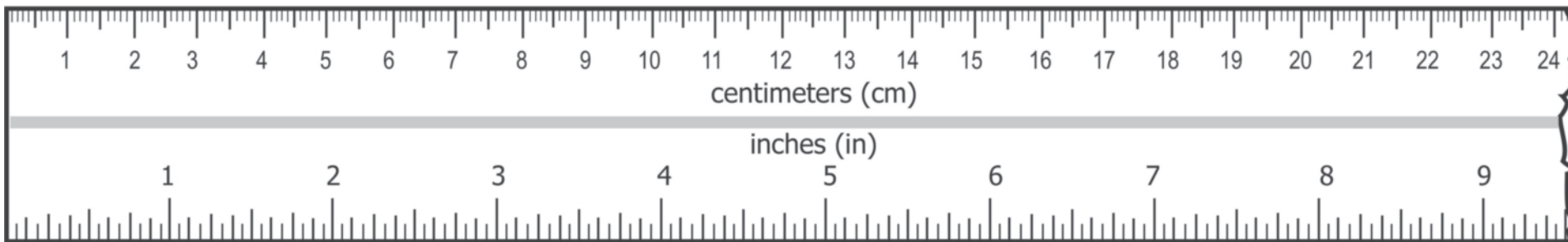


TASTE

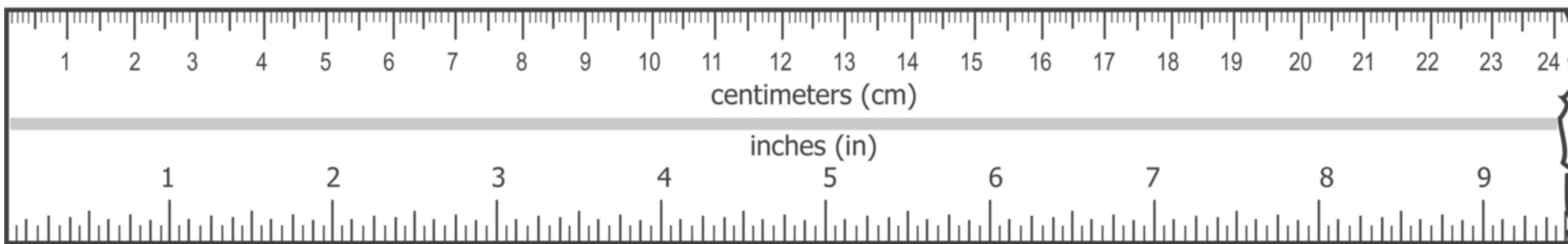


HEARING

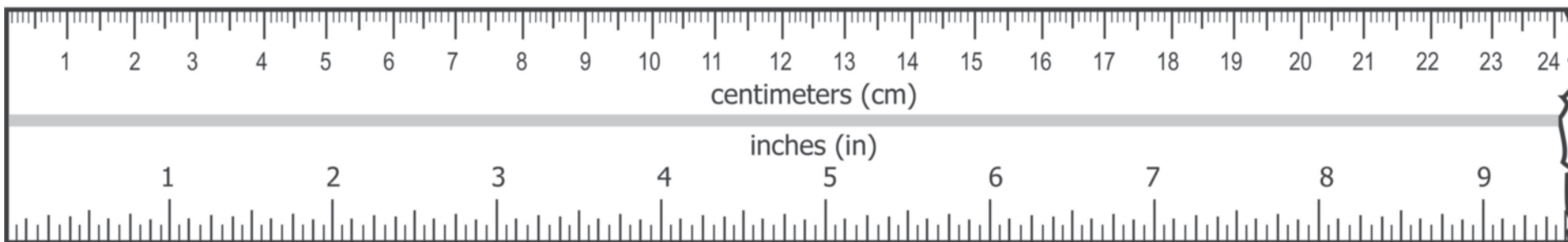
New Pencil _____ centimeters _____ inches



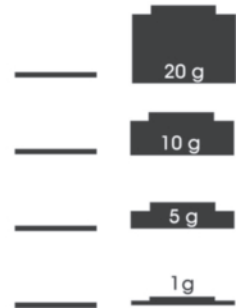
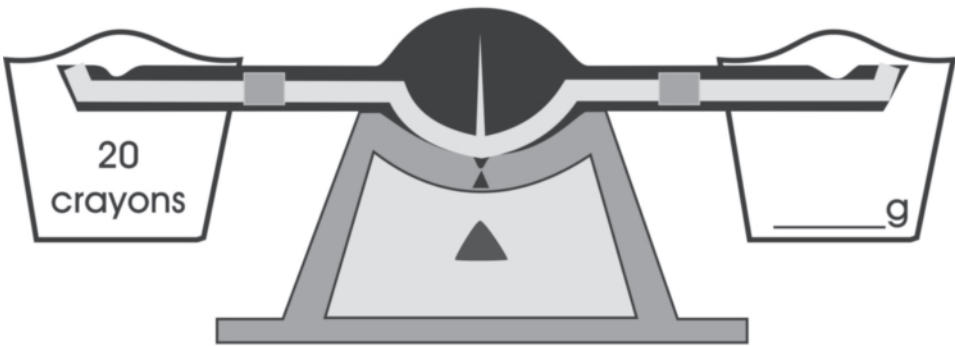
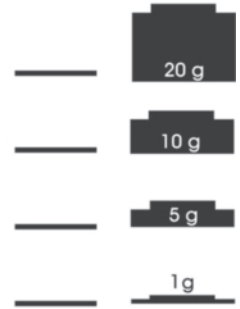
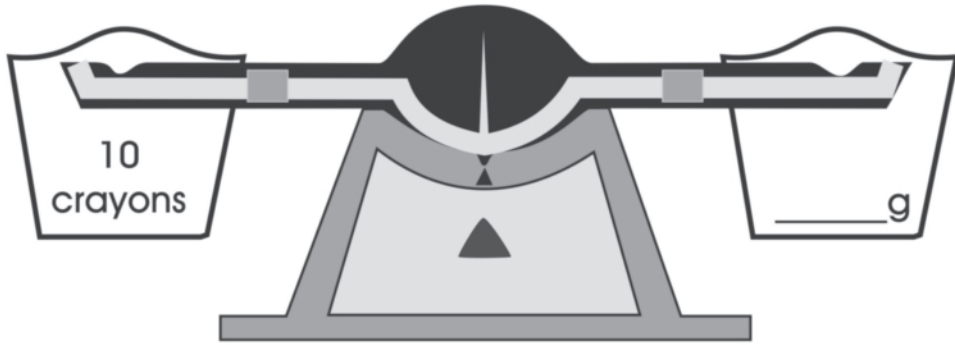
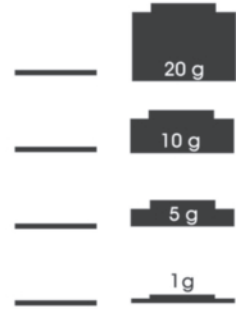
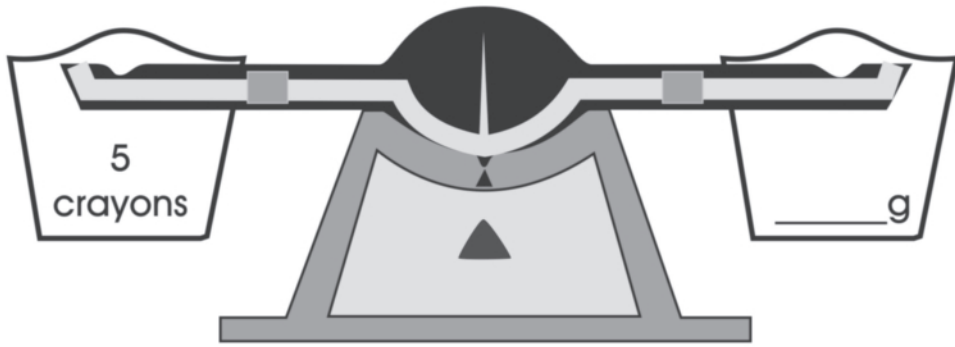
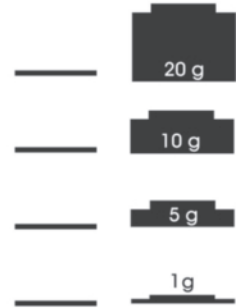
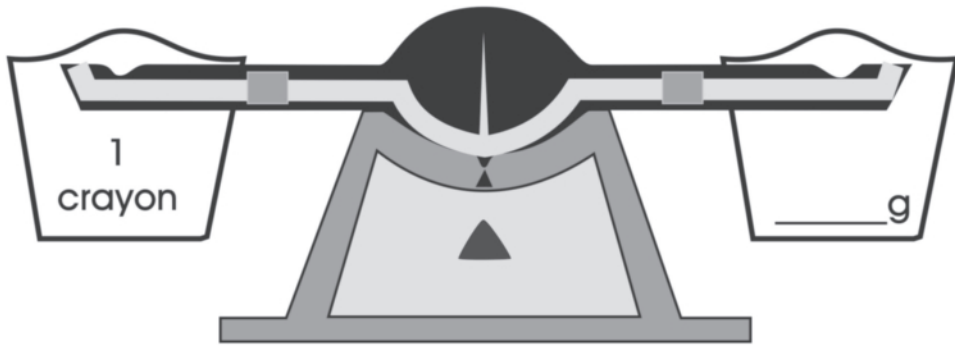
New Crayon _____ centimeters _____ inches



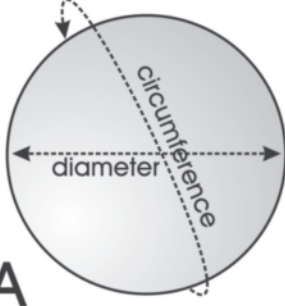
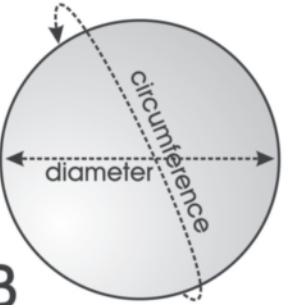
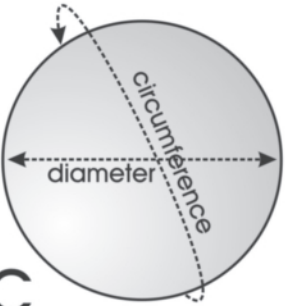
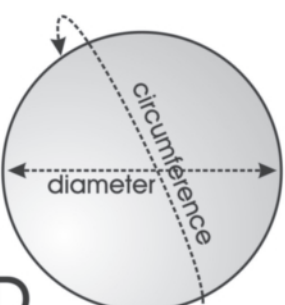
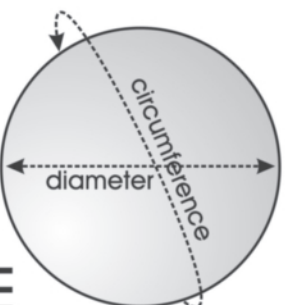
Your Hand _____ centimeters _____ inches



MEASURING MASS



OBSERVING AND MEASURING

 <p>A</p>	<p>I see _____ _____</p> <p>I feel _____</p> <p>I measure diameter _____ inches _____ centimeters circumference _____ inches _____ centimeters</p>
 <p>B</p>	<p>I see _____ _____</p> <p>I feel _____</p> <p>I measure diameter _____ inches _____ centimeters circumference _____ inches _____ centimeters</p>
 <p>C</p>	<p>I see _____ _____</p> <p>I feel _____</p> <p>I measure diameter _____ inches _____ centimeters circumference _____ inches _____ centimeters</p>
 <p>D</p>	<p>I see _____ _____</p> <p>I feel _____</p> <p>I measure diameter _____ inches _____ centimeters circumference _____ inches _____ centimeters</p>
 <p>E</p>	<p>I see _____ _____</p> <p>I feel _____</p> <p>I measure diameter _____ inches _____ centimeters circumference _____ inches _____ centimeters</p>

MEASURING MASS

Step 1: Hold each of the balls in your hands. Which one feels heaviest? In the PREDICTION column on the left, number the balls from 1 to 5, with 1 being the heaviest.

Step 2: Weigh each ball and record the mass in the square on the balance.

Step 3: In the RESULTS column, use your data to number the balls from 1 to 5, with 1 as heaviest.

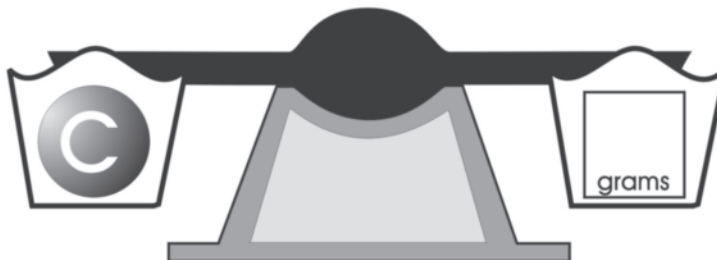
Step 4: Compare your predictions to the results. How well did you do?

PREDICTION



RESULTS









SINK OR FLOAT

Step 1: What do you think? Will the ball sink or float? Write your prediction on the top line.

Step 2: Place each ball one at a time into the bowl of water.

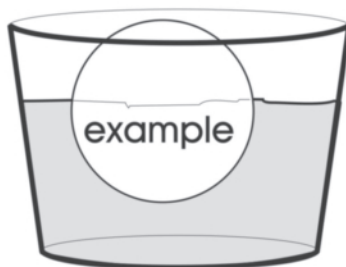
Step 3: Did the ball sink or float? Record the result on the bottom line.

Step 4: In the pictures of the cups, draw how far each ball sank into the water.



I predict

Experiment result



A

B

C

D

E

MEASURING BOUNCE

Step 1: Which ball do you think will bounce the highest? In the PREDICTION column, number the balls from 1 to 5, with 1 being the ball that you think will bounce the highest.

Step 2: Hold the ruler up straight with one hand. Hold the ball at the top of the ruler with your other hand. Drop the ball and watch how high it bounces. Record the distance in the MEASUREMENTS column.

Step 3: In the RESULTS column, use your data to number the balls from 1 to 5, with 1 as highest.

Step 4: Compare your predictions to the results. How well did you do at predicting?

PREDICTION		MEASUREMENTS	RESULTS
_____	A	_____ inches _____ centimeters	_____
_____	B	_____ inches _____ centimeters	_____
_____	C	_____ inches _____ centimeters	_____
_____	D	_____ inches _____ centimeters	_____
_____	E	_____ inches _____ centimeters	_____

MEASURING SOUND

Step 1: Which ball do you think will make the loudest noise when it bounces? In the PREDICTION column, number the balls from 1 to 5, with 1 being the loudest ball.

Step 2: Hold the ruler up straight with one hand. Hold each ball at the top of the ruler with your other hand. Drop the balls one at a time and listen to the sounds they make. You might need to drop the balls several times to figure out which is loudest.

Step 3: In the RESULTS column, number the balls from 1 to 5, with 1 being the loudest.

Step 4: Compare your predictions with your results. How well did you do at predicting?

PREDICTION

—

—

—

—

—



RESULTS

—

—

—

—

—

MEASURING ROLL

Step 1: Which ball do you think will roll the farthest? In the PREDICTION column, number the balls from 1 to 5, with 1 being the ball that you think will roll the farthest.

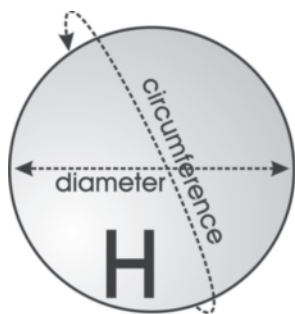
Step 2: Place one end of the ruler on a thin book. Put the ball at the top of the ruler and let it go. Using the tape measure, measure the distance it rolls from the end of the ruler. Record the distance in the MEASUREMENT column.

Step 3: In the RESULTS column, use your data to number the balls with 1 as the farthest.

Step 4: Compare your predictions to the results. How well did you do at predicting?

PREDICTION		MEASUREMENTS	RESULTS
_____	A	_____ inches _____ centimeters	_____
_____	B	_____ inches _____ centimeters	_____
_____	C	_____ inches _____ centimeters	_____
_____	D	_____ inches _____ centimeters	_____
_____	E	_____ inches _____ centimeters	_____

OBSERVING AND MEASURING



I see _____

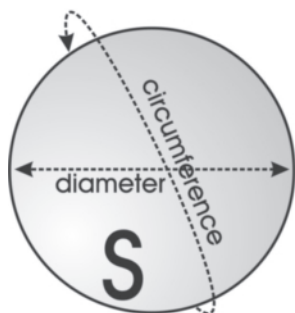
I feel _____

I measure diameter _____ inches _____ centimeters

circumference _____ inches _____ centimeters

mass _____ grams

sink or float _____



I see _____

I feel _____

I measure diameter _____ inches _____ centimeters

circumference _____ inches _____ centimeters

mass _____ grams

sink or float _____

Balls H and S look: _____ same _____ different

Balls H and S feel: _____ same _____ different

Balls H and S - mass: _____ same _____ different

Balls H and S - size: _____ same _____ different

Balls H and S - sinking/floating _____ same _____ different

ROLLING AND BOUNCING

ROLLING

Step 1: Make a ramp on carpet by putting one end of the ruler on a thin book.

Step 2: Roll each ball down the ramp three times and measure how far it rolls from the end of the ruler, using the measuring tape.

Step 3: Record your results.



TRIAL 1 _____ inches _____ centimeters

TRIAL 1 _____ inches _____ centimeters

TRIAL 2 _____ inches _____ centimeters

TRIAL 2 _____ inches _____ centimeters

TRIAL 3 _____ inches _____ centimeters

TRIAL 3 _____ inches _____ centimeters

BOUNCING

Step 1: Hold the ruler up straight.

Step 2: Drop each ball three times from the top of the ruler and measure how high it bounces.

Step 3: Record your results.



TRIAL 1 _____ inches _____ centimeters

TRIAL 1 _____ inches _____ centimeters

TRIAL 2 _____ inches _____ centimeters

TRIAL 2 _____ inches _____ centimeters

TRIAL 3 _____ inches _____ centimeters

TRIAL 3 _____ inches _____ centimeters

SOUND

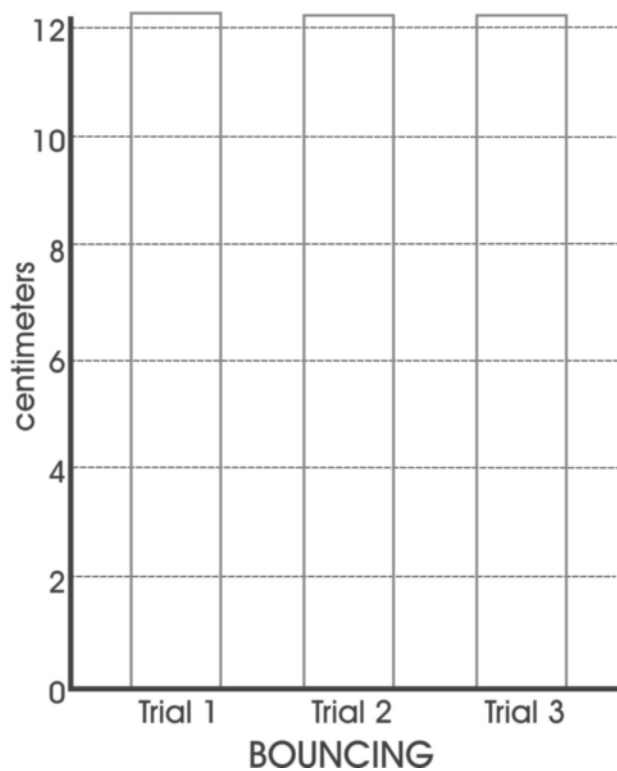
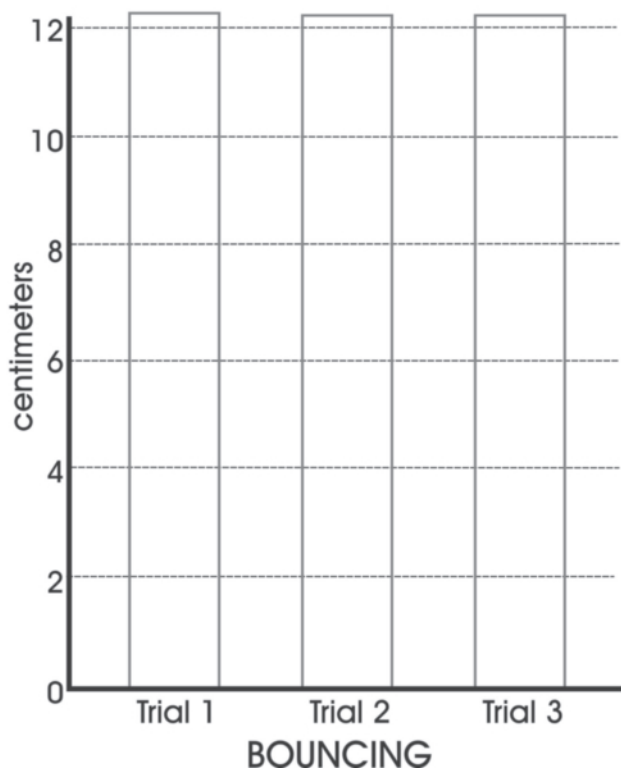
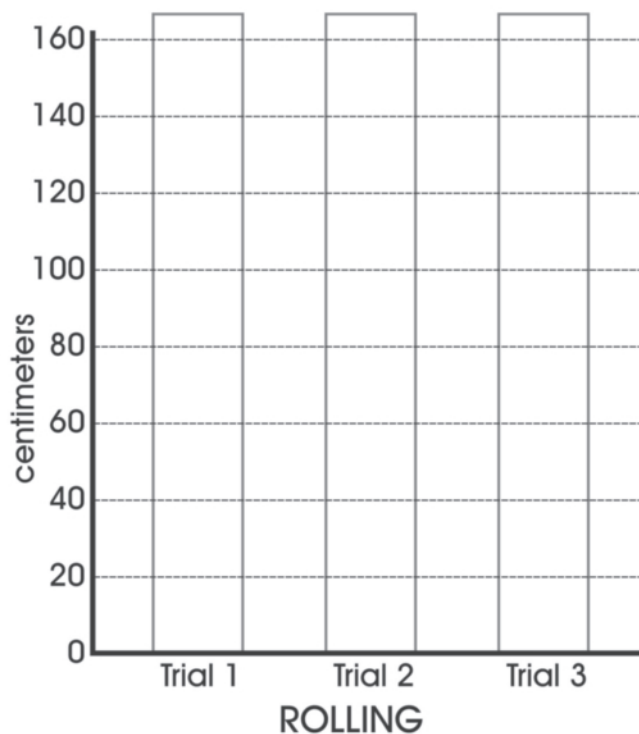
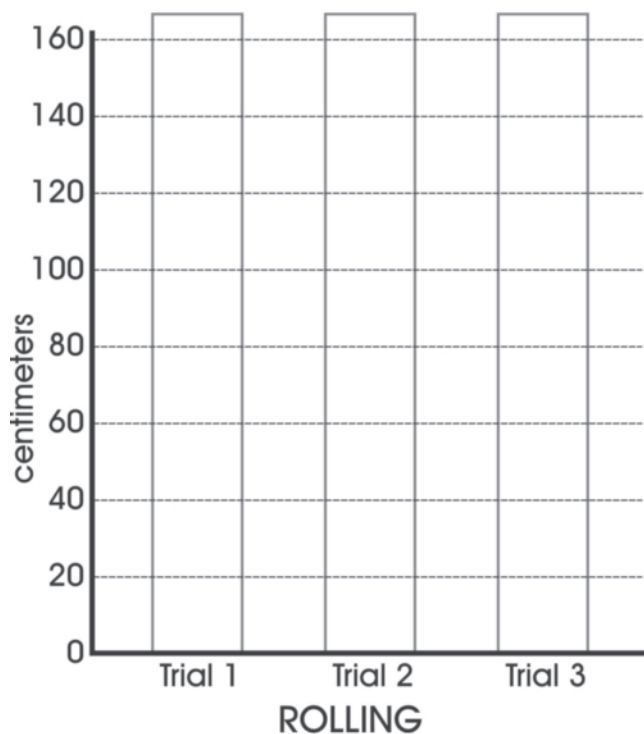
Step 1: Drop each ball from the same distance and listen to the sound it makes.

Which ball is louder?

Which ball rolls farther?

Which ball bounces higher?

GRAPHING



HOT AND COLD BOUNCING

COLD



TRIAL 1 _____ inches _____ centimeters

TRIAL 1 _____ inches _____ centimeters

TRIAL 2 _____ inches _____ centimeters

TRIAL 2 _____ inches _____ centimeters

TRIAL 3 _____ inches _____ centimeters

TRIAL 3 _____ inches _____ centimeters

HOT



TRIAL 1 _____ inches _____ centimeters

TRIAL 1 _____ inches _____ centimeters

TRIAL 2 _____ inches _____ centimeters

TRIAL 2 _____ inches _____ centimeters

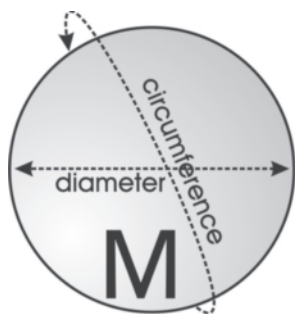
TRIAL 3 _____ inches _____ centimeters

TRIAL 3 _____ inches _____ centimeters

WHAT HAPPENED?

WHY?

OBSERVING AND MEASURING



I see _____

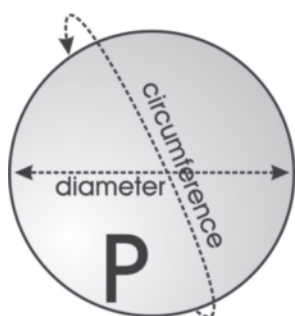
I feel _____

I measure diameter _____ inches _____ centimeters

circumference _____ inches _____ centimeters

mass _____ grams

sink or float _____



I see _____

I feel _____

I measure diameter _____ inches _____ centimeters

circumference _____ inches _____ centimeters

mass _____ grams

sink or float _____

WARM AND COLD

Step 1: Feel both balls. Which feels warmer? _____

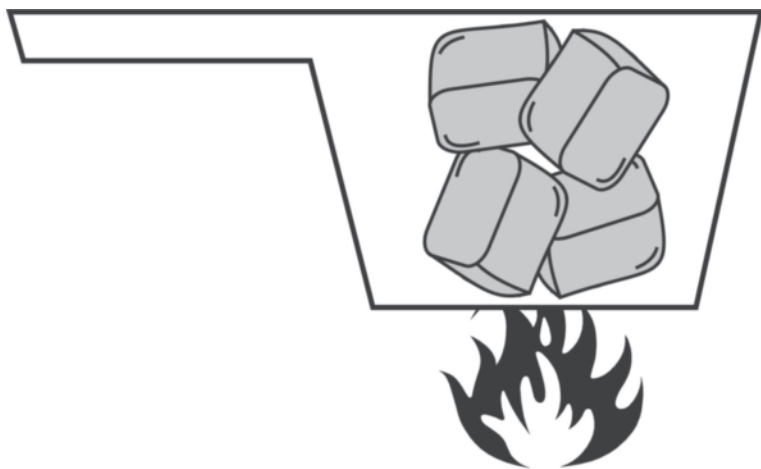
Step 2: Hold both balls in cold water for 10 seconds. Which ball feels warmer? _____

Step 3: Hold both balls in warm water for 10 seconds. Which ball feels warmer? _____

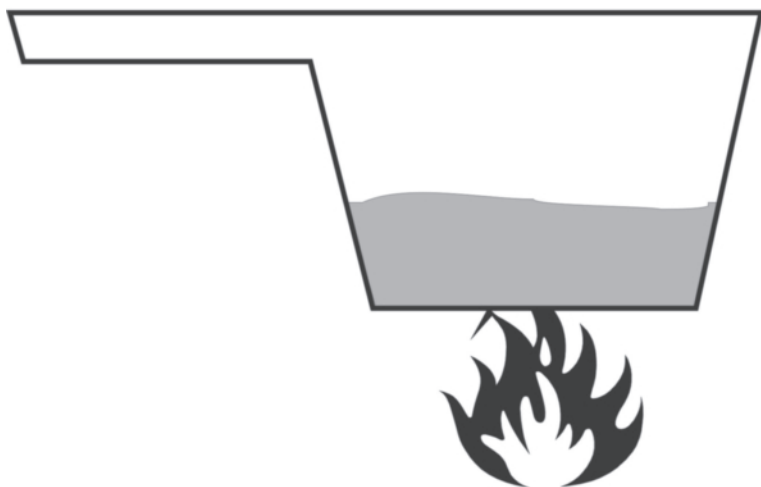
Which ball moves heat better? _____

What would you use to protect yourself from heat - plastic or metal? _____

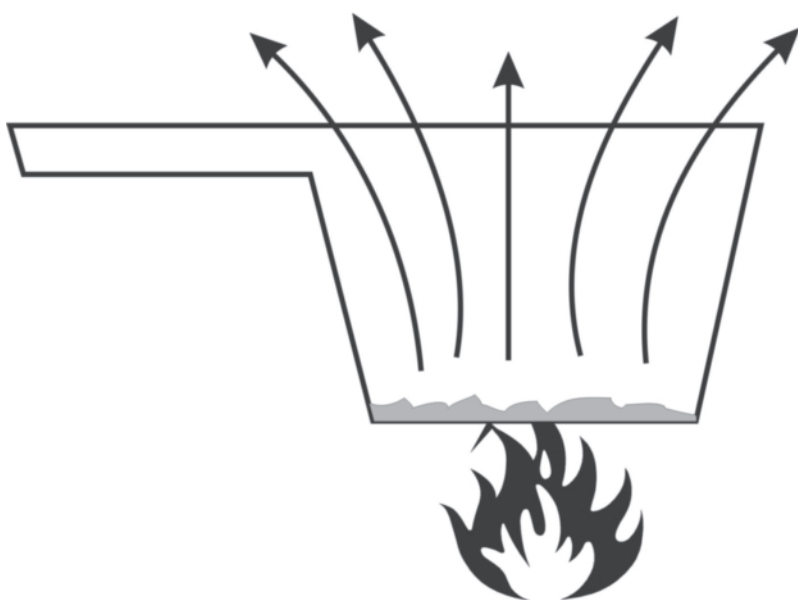
STATES OF MATTER



SOLID - ICE
keeps its shape



LIQUID - WATER
takes the shape
of the pan

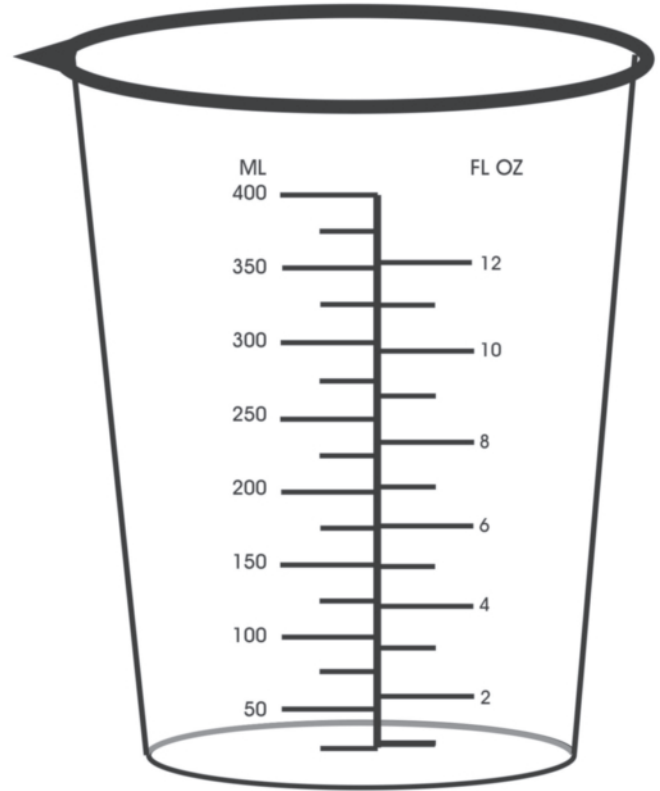
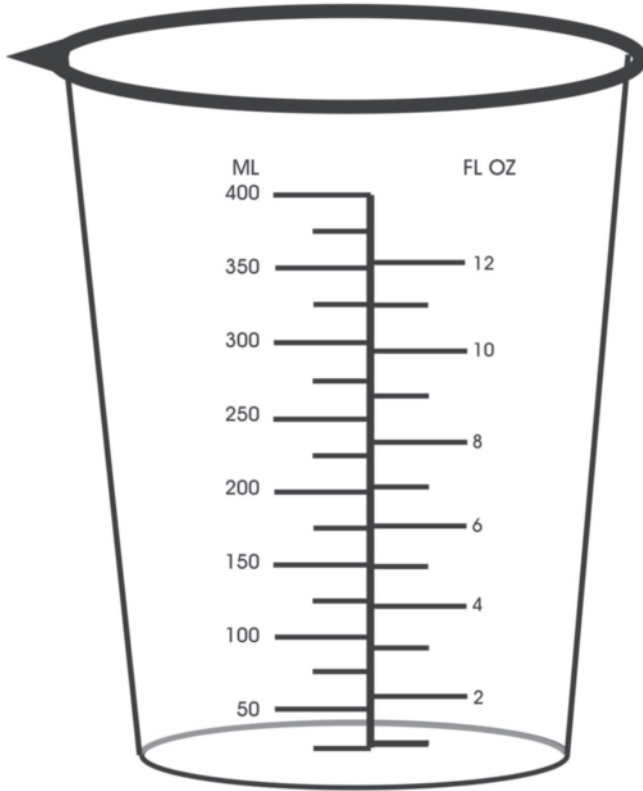


GAS - STEAM
escapes the pan
and fills the room

VOLUME

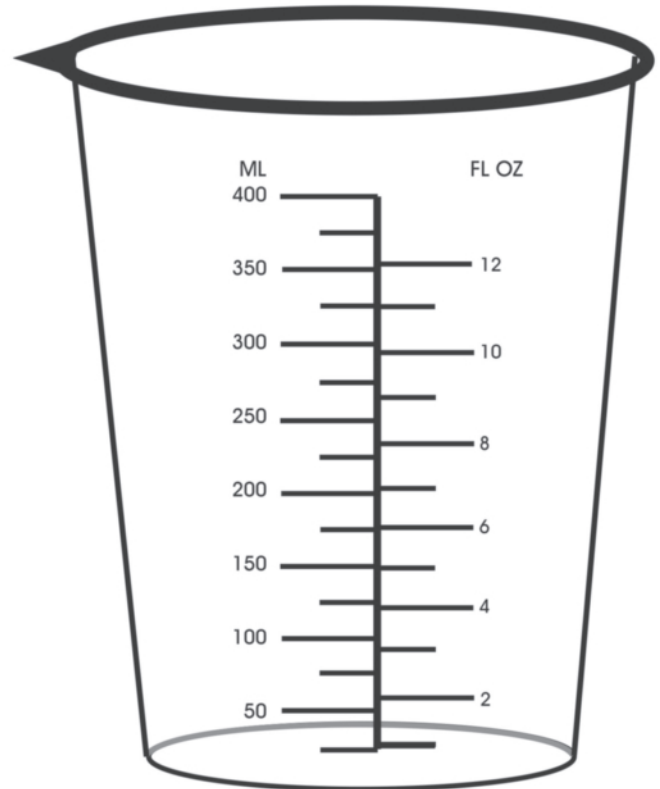
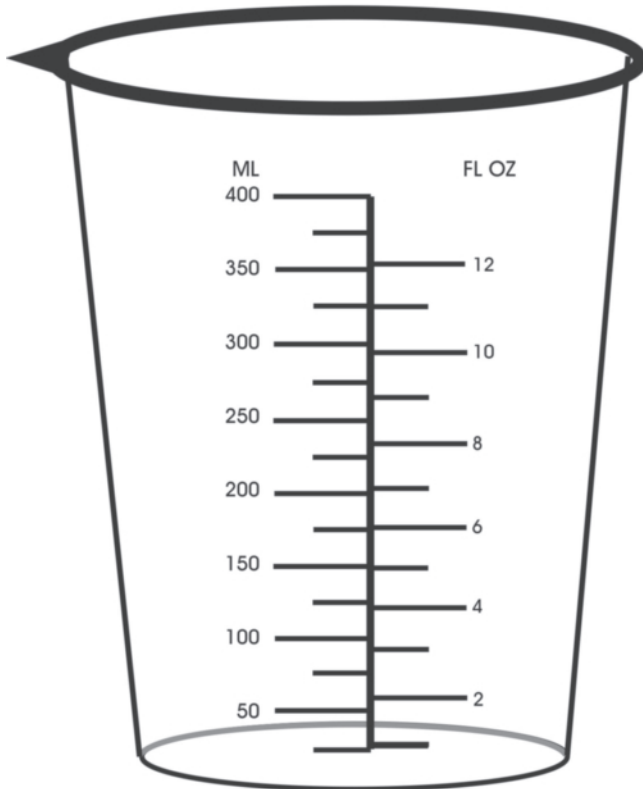
350 ml = _____ fl oz

200 ml = _____ fl oz



6 fl oz = _____ ml

8 fl oz (1 cup) = _____ ml



LIQUIDS

Liquids take the shape of the container.

Step 1: Fill the beaker about half full with water.

Step 2: Draw a line on the picture of the beaker to show how much water you put in.

Step 3: How much water is in the beaker? _____ ml

Step 4: Pour the water into the graduated cylinder.

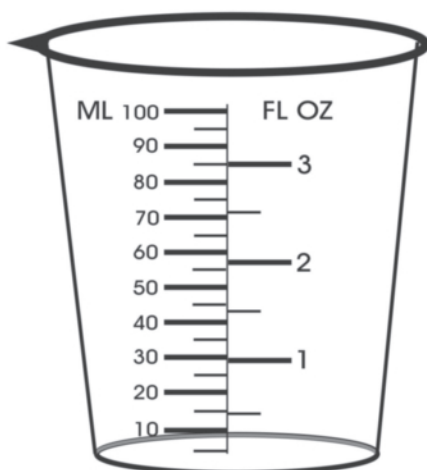
Step 5: Draw a line on the picture of the graduated cylinder to show how much water is in it.

Step 6: How much water is in the graduated cylinder?

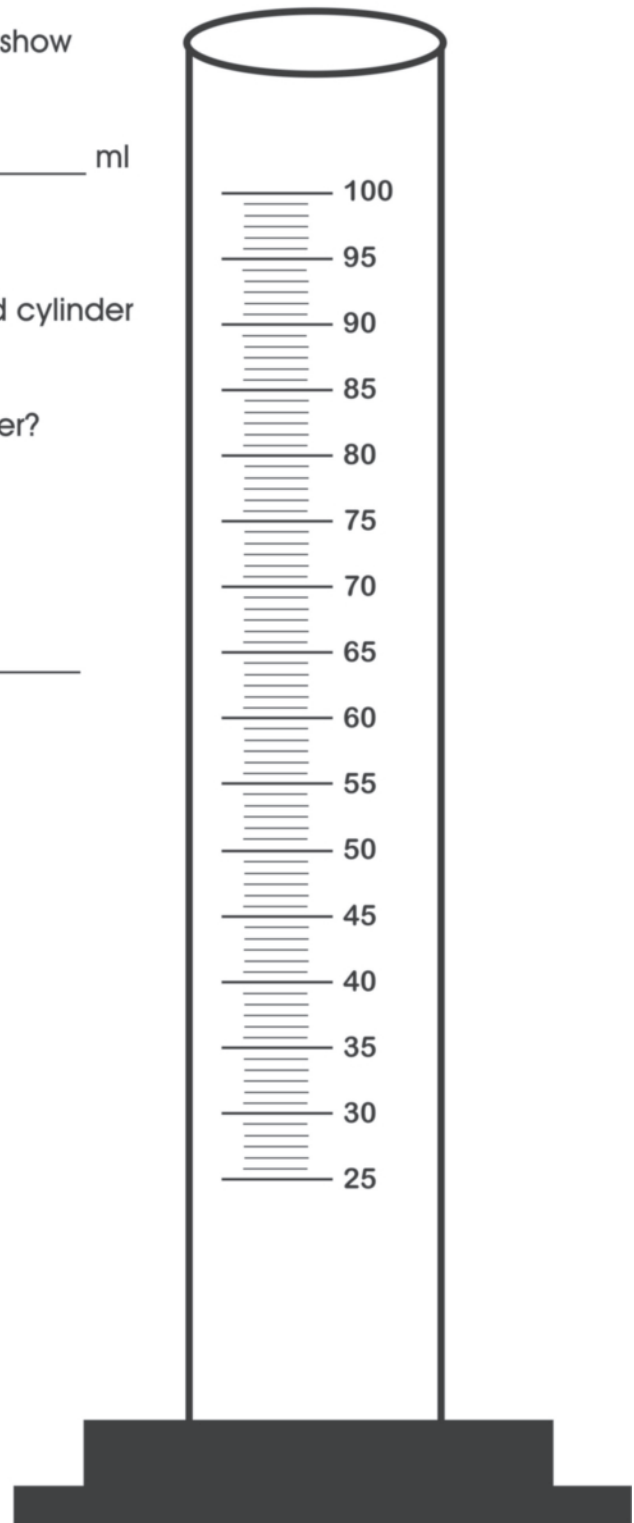
_____ ml

Did the water change shape? _____

Did the amount of water stay the same? _____

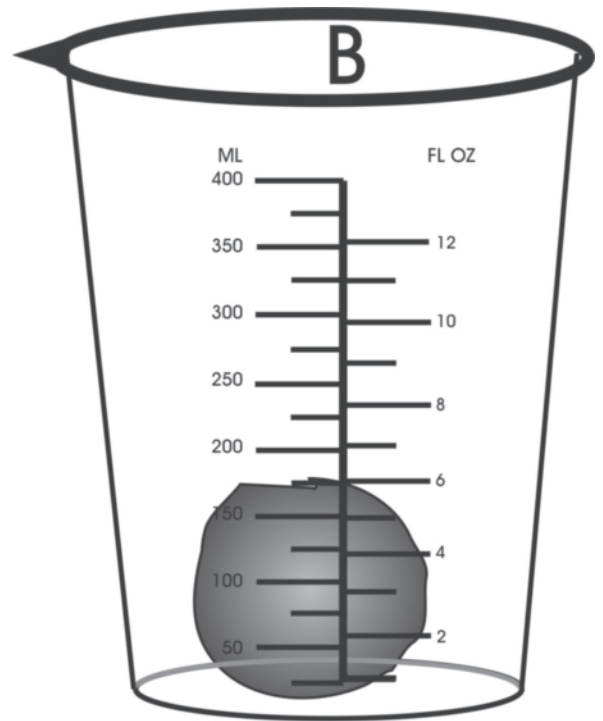
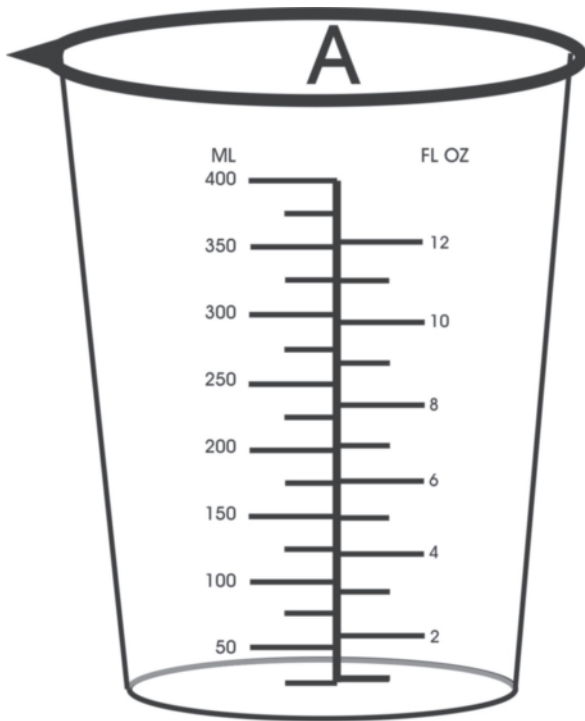


Beaker

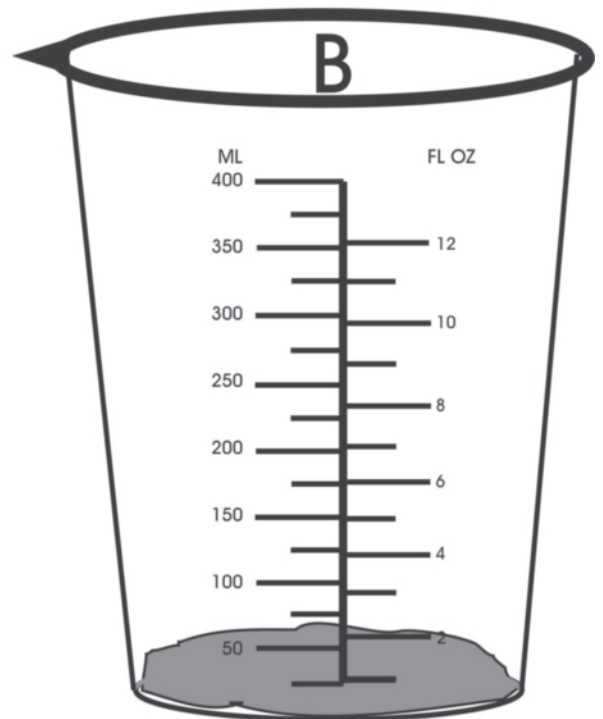
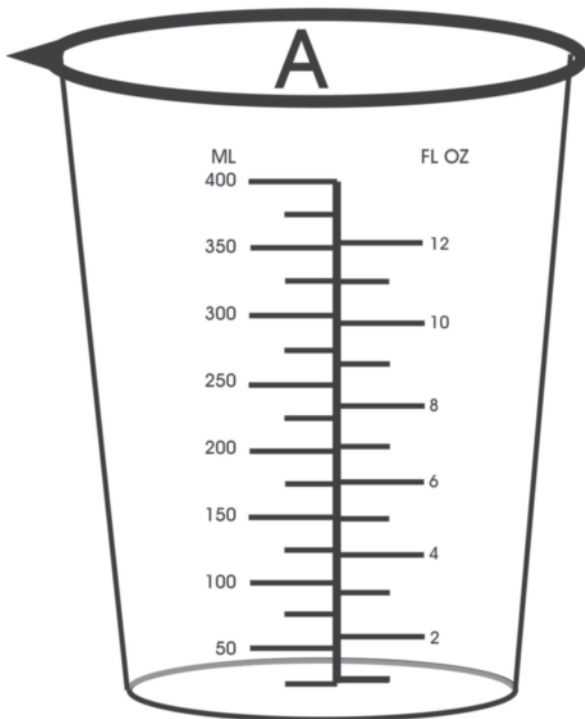


Graduated Cylinder

VOLUME OF SOLIDS

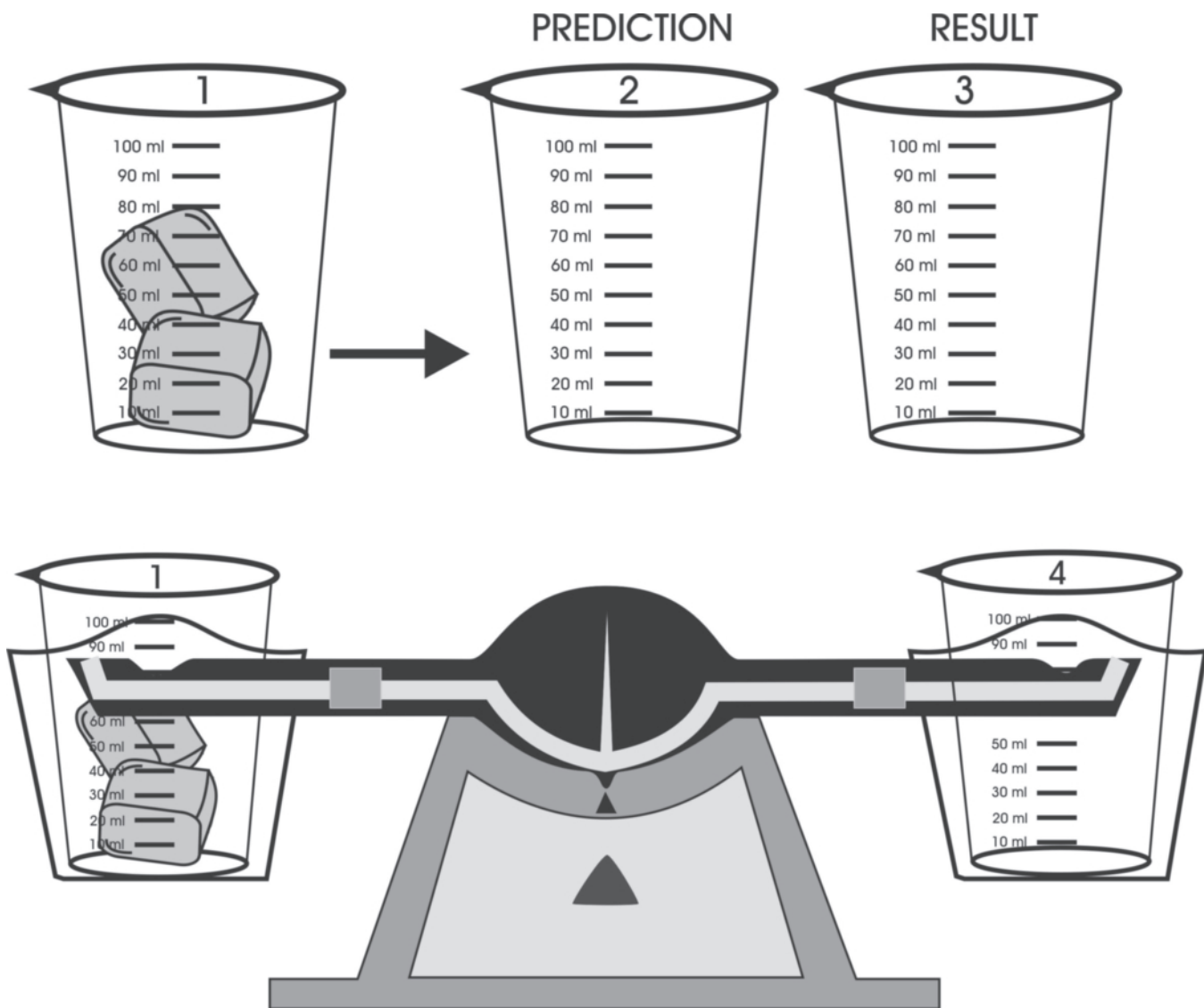


$B - A = \text{Volume of Clay} = \underline{\hspace{2cm}} \text{ ml (cc)}$



$B - A = \text{Volume of Clay} = \underline{\hspace{2cm}} \text{ ml (cc)}$

SOLIDS AND LIQUIDS



Step 1: Put two (2) ice cubes into a 100 ml cup.

Step 2: How much water will the ice cubes make when they melt? Draw a line on Cup 2 to show how much water you think there will be.

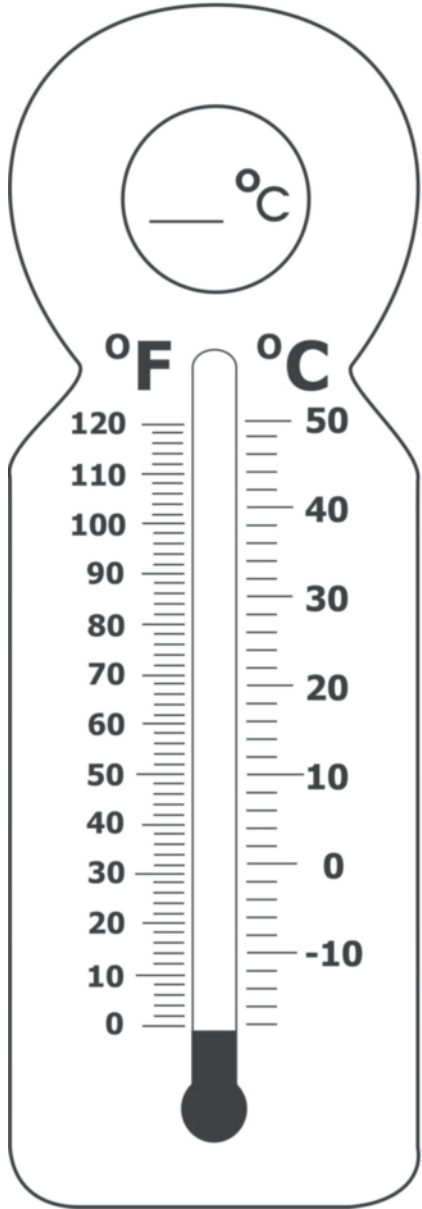
Step 3: Put the cup with the ice on one side of the balance. Put an empty cup on the other side. Pour water into the empty cup until the cups are in balance.

Step 4: Draw a line on Cup 4 to show how much water it took to balance the ice.

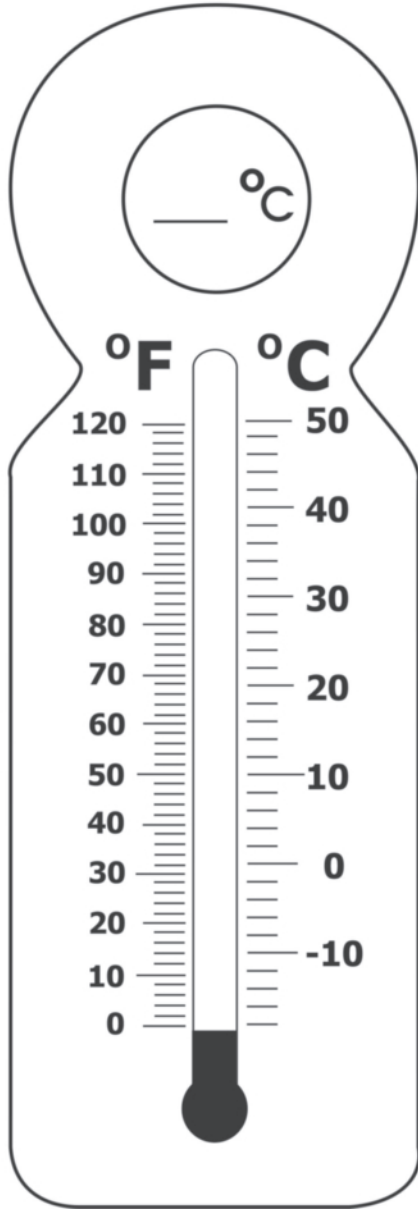
Step 5: Let the ice melt. On Cup 3, draw a line to show how much water the ice made.

Step 6: Compare Cups 2, 3, and 4. Are they the same? How well did you predict how much water the ice would make?

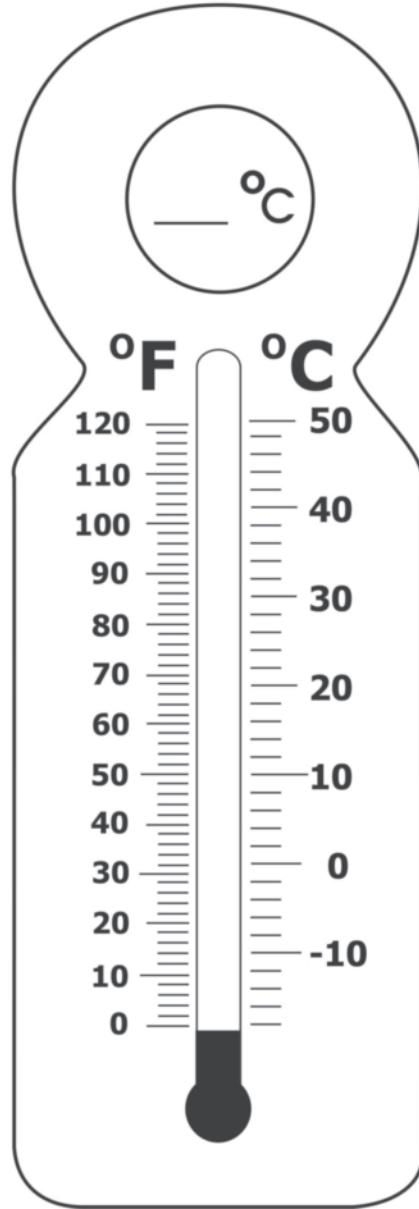
Freezing
Water
32°F



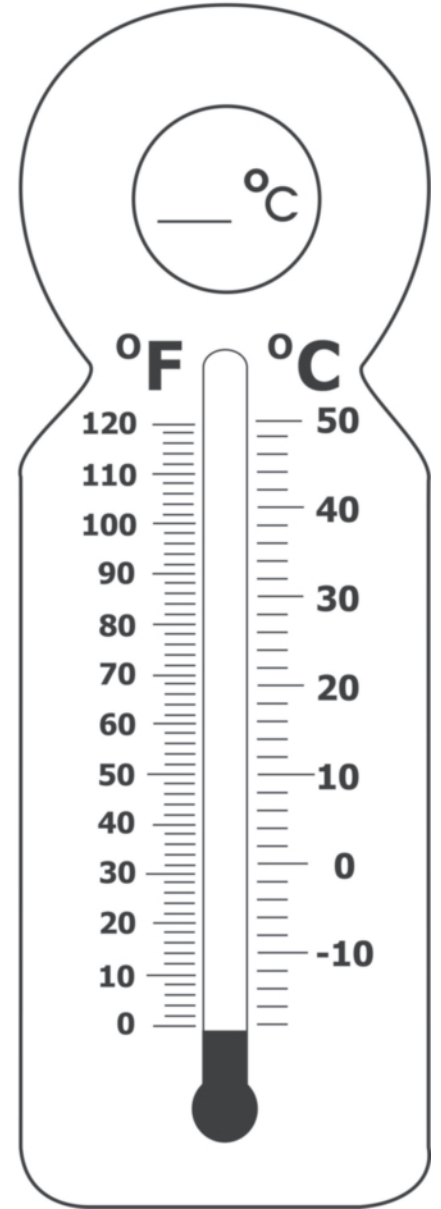
Body
Temperature
98-99°F



Warm
Summer Day
80°F

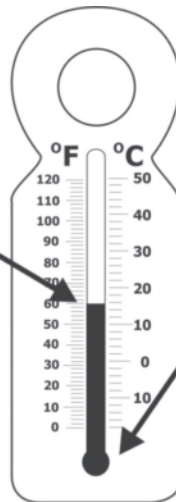


Very Cold
Winter Day
10°F

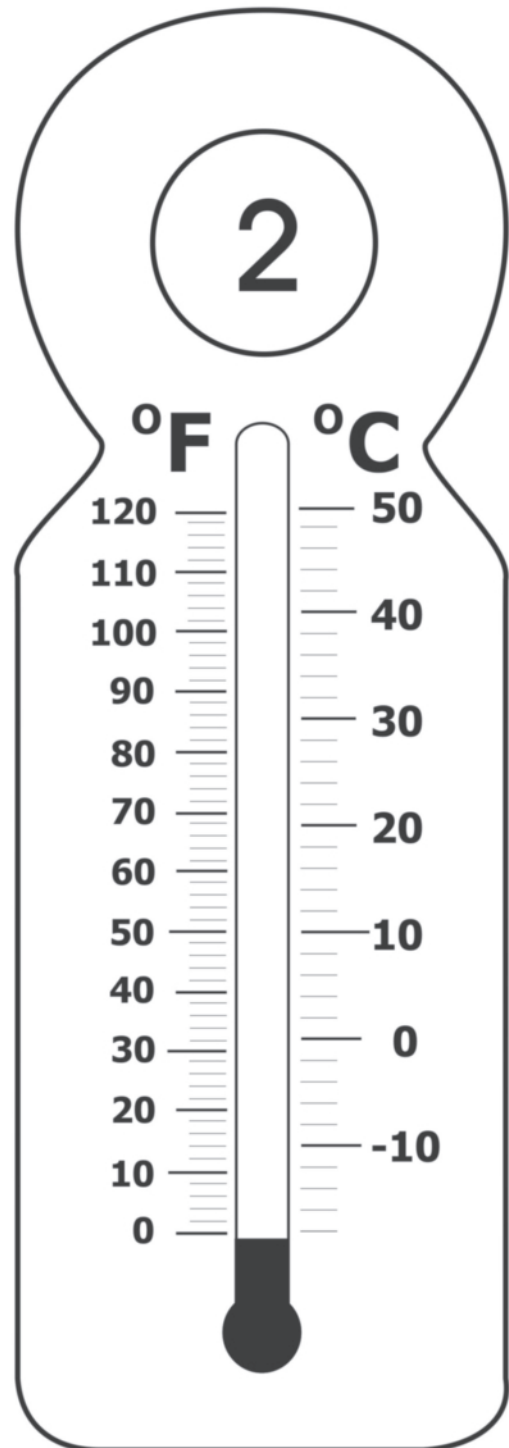
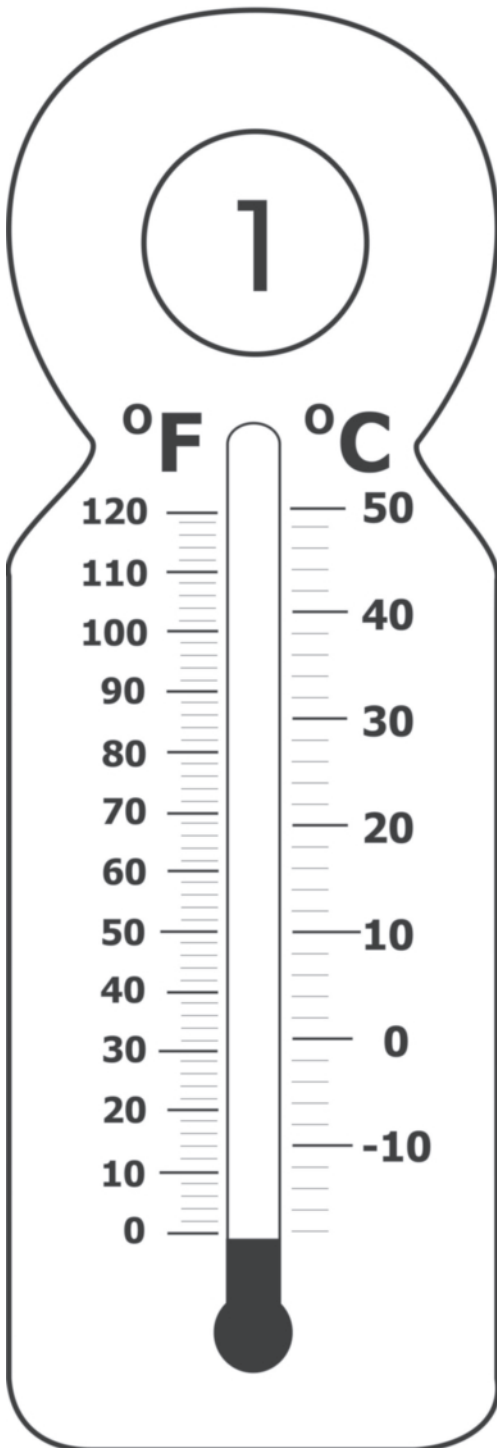


THERMOMETER

Step 1: Look at thermometer. Color the tube on Thermometer 1 to show the temperature of the classroom, like this.



Step 2: Hold the round bulb of the thermometer between your hands for a minute. Color the tube of Thermometer 2 to show the temperature.



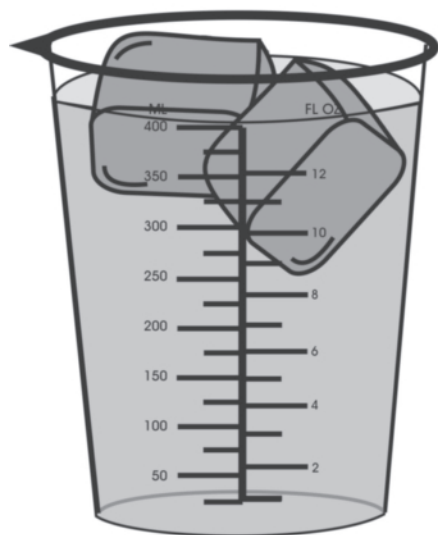
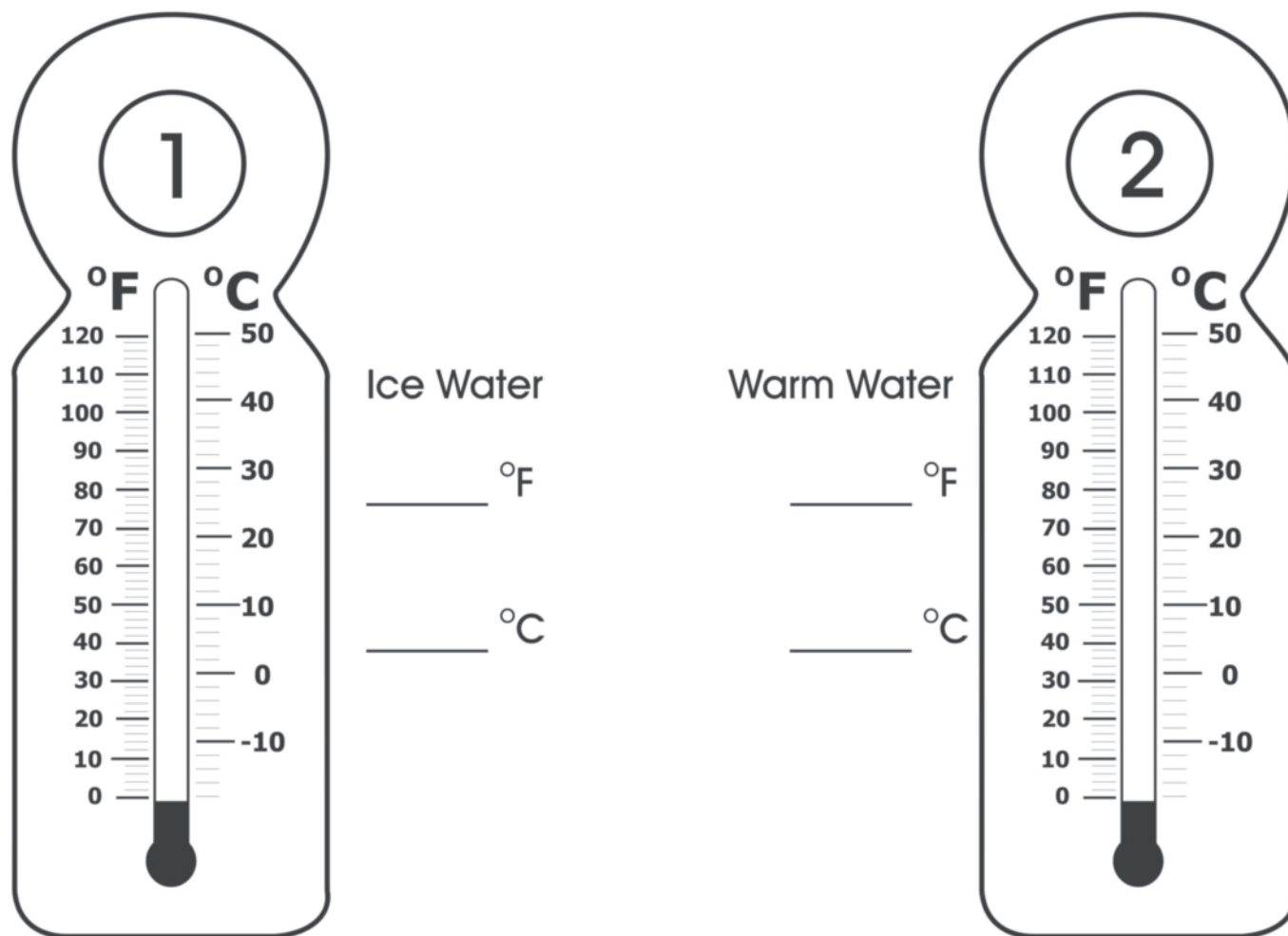
TEMPERATURE 1

Step 1: Fill one 400 ml beaker with ice water and one with warm water. Use the thermometer to measure the temperature of the beakers of water.

Step 2: Draw a line on Thermometer 1 to show the temperature of the ice water.

Step 3: Draw a line on Thermometer 2 to show the temperature of the warm water.

Step 4: Write the temperatures on the lines beside the thermometers.



TEMPERATURE 2

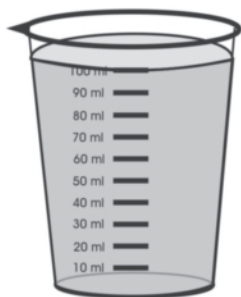
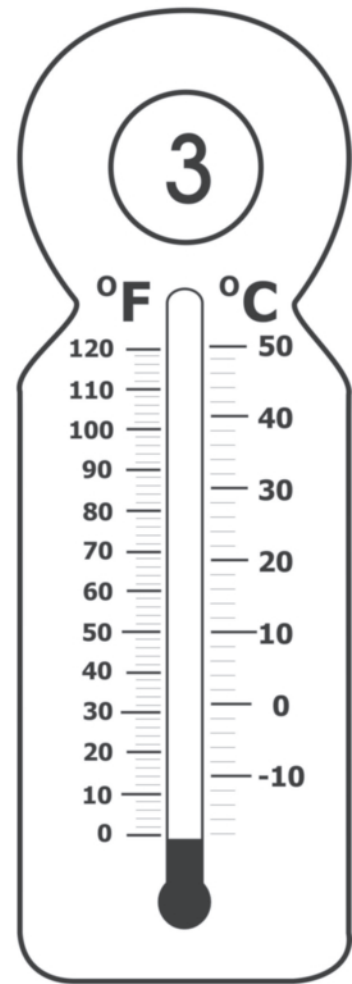
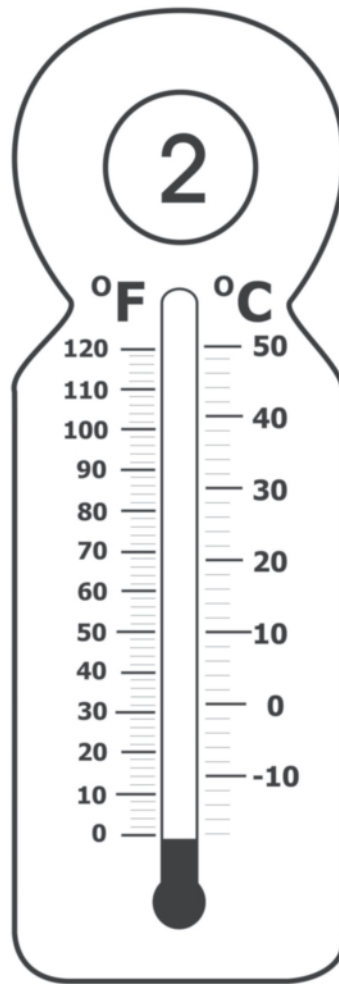
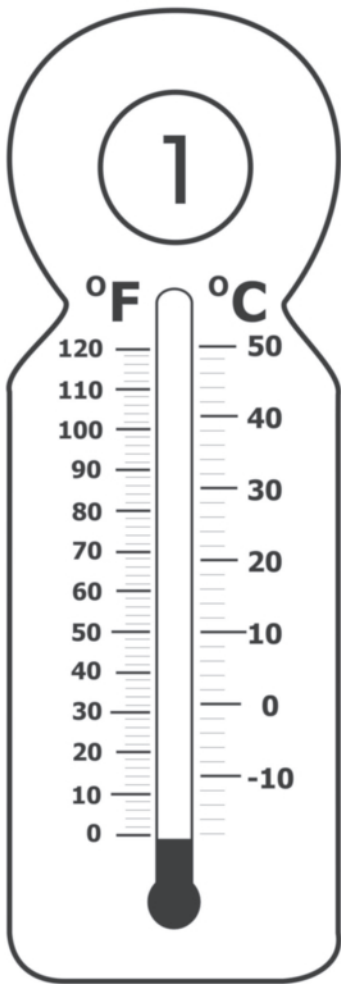
Step 1: Fill one 100 ml beaker with cold water and one 100 ml beaker with warm water.

Step 2: Use the thermometer to measure the temperatures of the water.

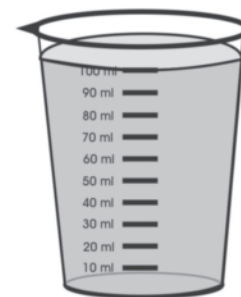
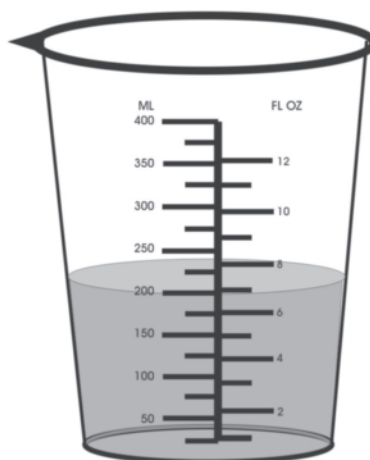
Step 3: Color the tubes of Thermometers 1 and 3 to show the temperatures of the water.

Step 4: Pour both beakers of water into the 400 ml beaker. DRAW A LINE on Thermometer 2 to show what you think the temperature will be of the mixed water.

Step 5: Use the thermometer to measure the temperature of the water in the large beaker. COLOR the tube of the thermometer. Was your prediction close?



COLD WATER



WARM WATER

LIGHT 1

Step 1: Put two thermometers in a sunny place.

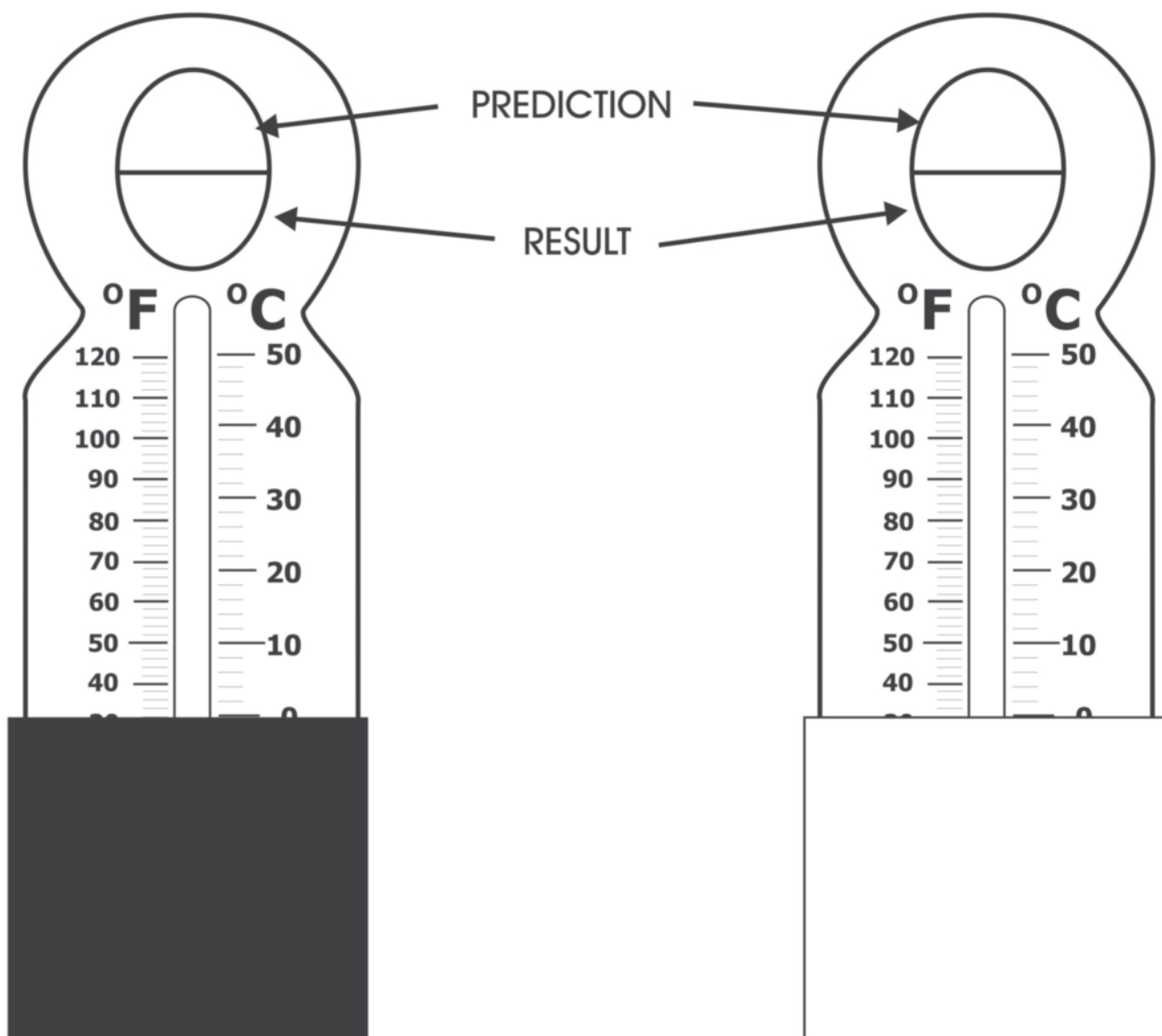
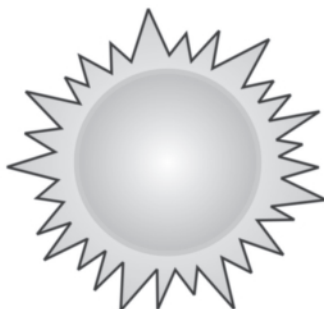
Step 2: Cover the bulb of one with black paper. Cover the bulb of one with white paper.

Step 3: Predict which thermometer will get hotter. Number them 1 and 2, with 1 as hotter.

Step 4: Wait five minutes.

Step 5: Color the tubes of the thermometers to show the temperatures.

Step 6: Number the thermometers 1 and 2 with 1 as hotter. How well did you predict?



LIGHT 2

Step 1: Put two thermometers about 18 inches below a bright artificial light.

Step 2: Cover the bulb of one thermometer with black paper. Cover the bulb of one with white paper.

Step 3: Predict how much the light bulb will raise the temperature compared to the sunlight.

Step 4: Wait five minutes.

Step 5: Color the tubes of the thermometers to show the temperatures.

Step 6: Compare the temperatures with those in the last activity. How well did you predict?

PREDICTION

hotter than sun

cooler than sun

no difference

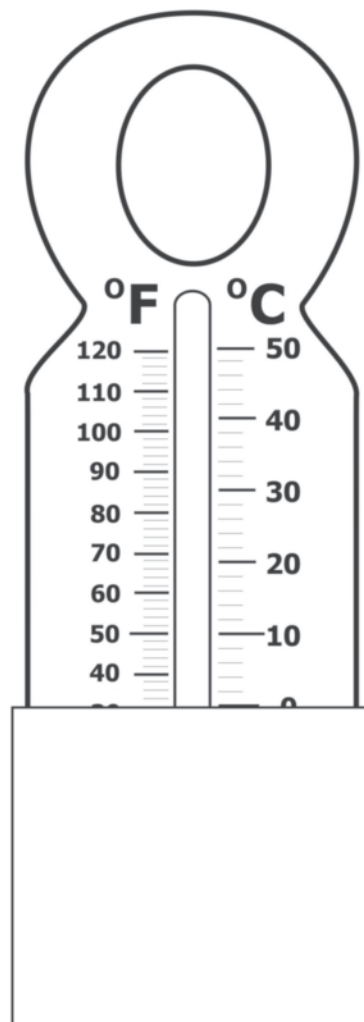
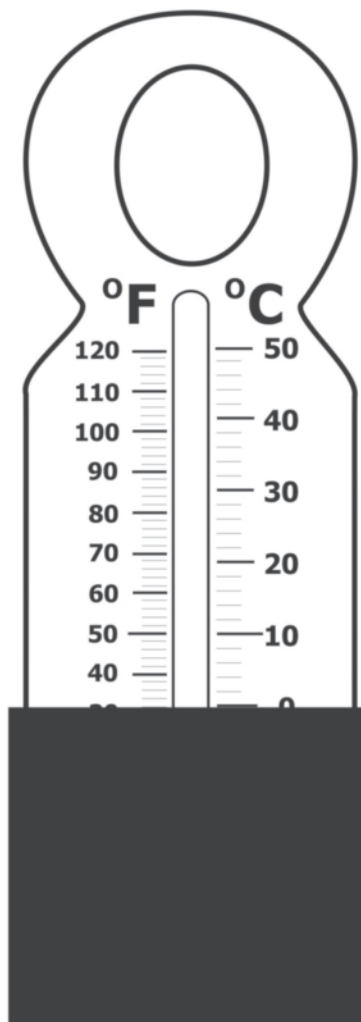


RESULT

hotter than sun

cooler than sun

no difference



LIGHT 3

Step 1: Measure the height of the wooden spool. Record the height here: _____ cm

Step 2: Place the spool 20 cm from the wall. Place the flashlight 10 cm from the spool, like in Picture 1.

Step 3: Shine the flashlight on the spool and measure the height of the shadow it makes on the wall. Record the height of the shadow on the blank line in Picture 1.

Step 4: Place the spool 25 cm from the wall. Place the flashlight 5 cm from the spool, like in Picture 2. Do you think the shadow will be larger or smaller? Circle your prediction:

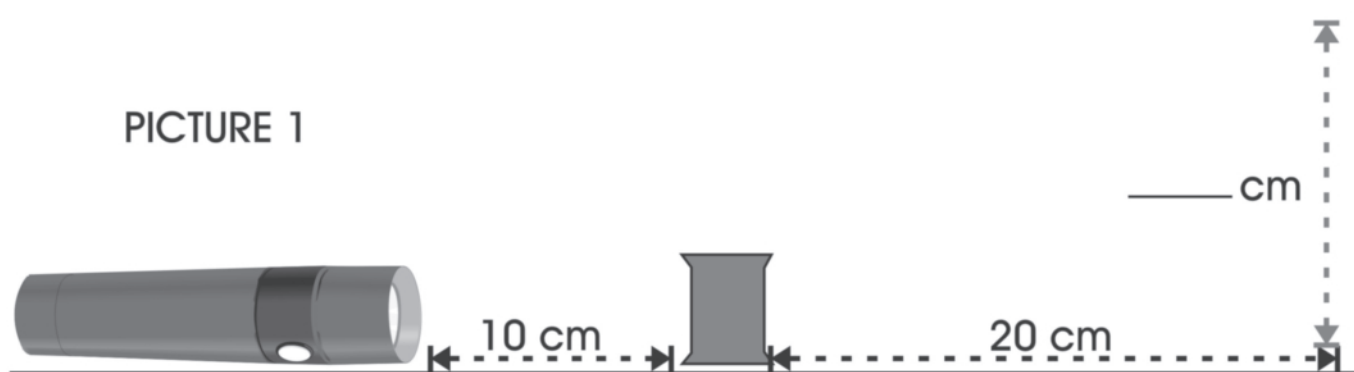
larger

smaller

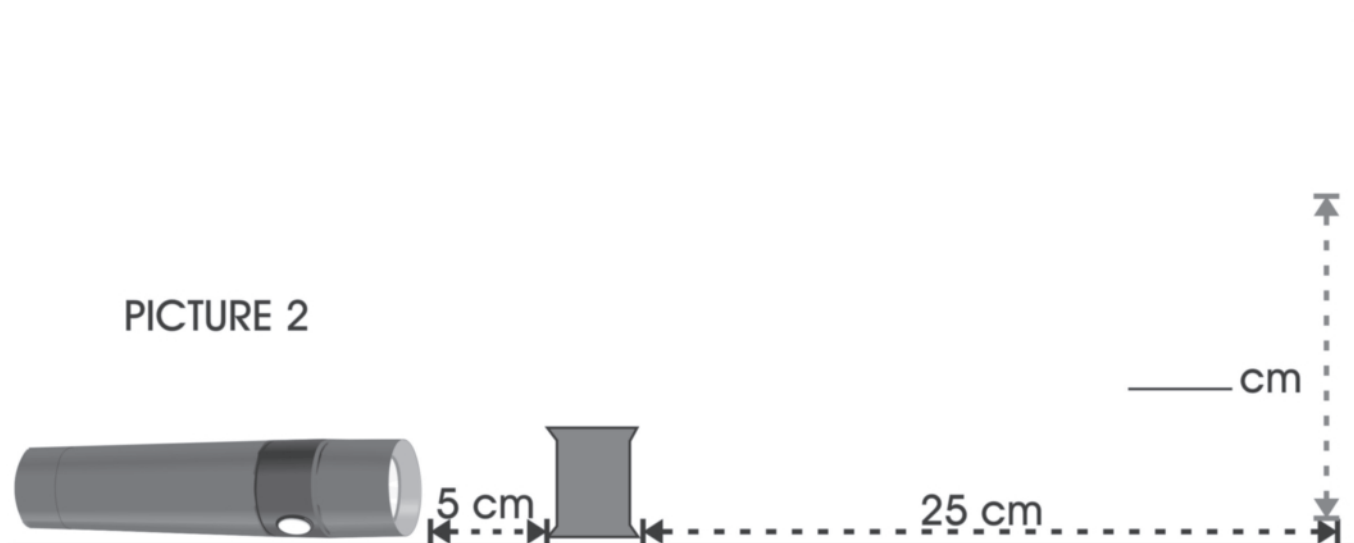
Step 5: Shine the flashlight on the spool and measure the height of the shadow it makes on the wall. Record the height of the shadow on the blank line in Picture 2.

Step 6: Was your prediction right? Why do you think one shadow was bigger than the other?

PICTURE 1



PICTURE 2



LIGHT 4

Step 1: Place the flashlight 25 cm from the wall as shown in Picture 1. Observe the light as it shines on the wall. Describe the light in the space below.

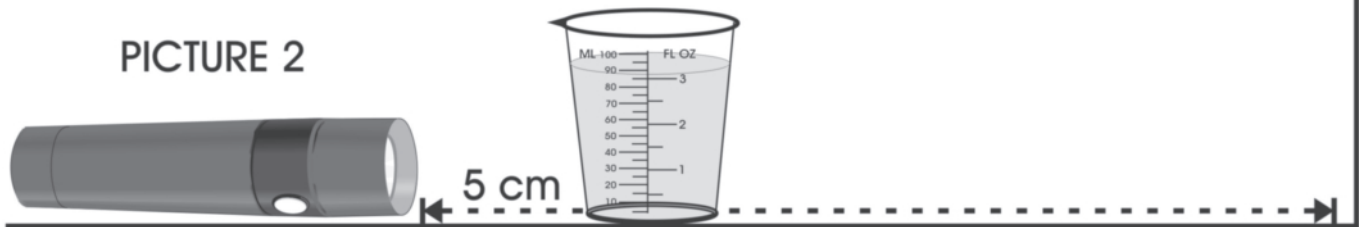
Step 2. Place a 100 ml beaker filled with water between the flashlight and the wall, about 5 cm from the flashlight, as shown in Picture 2. Observe the light as it shines through the water onto the wall. Does the light look different when it passes through the water? Describe the light in the space below.

Step 3. Place the magnifying glass in the same place as the beaker, as shown in Picture 3. Observe the light as it shines through the lens onto the wall. Describe the light in the space below.

PICTURE 1



PICTURE 2



PICTURE 3



LIGHT 5

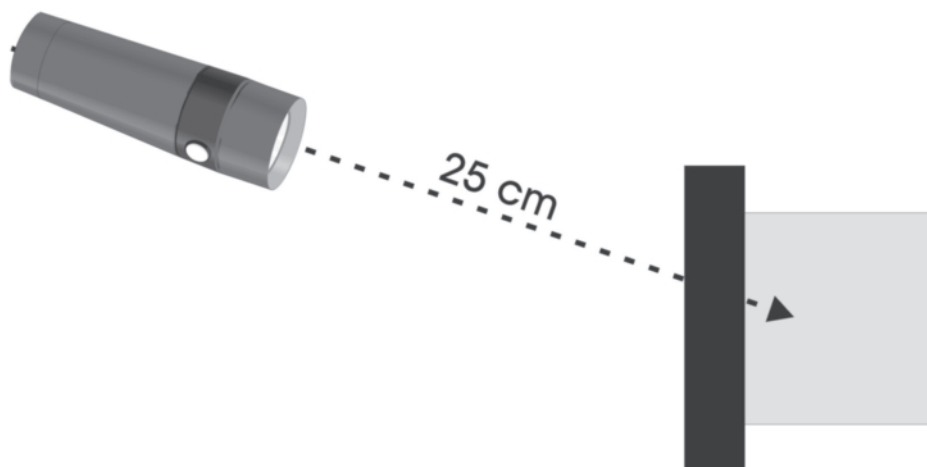
Step 1: Place the flashlight 25 cm from the mirror as shown in Picture 1. Draw an X in the box on the left- behind the flashlight - in the place you would stand to see the reflection of the light. Stand behind the flashlight so that you can see the reflection of the light. Was your prediction correct?

Step 2: Place the flashlight 25 cm from the mirror, shining onto the mirror at an angle, as shown in Picture 2. Draw an O in the box behind the picture of the flashlight in the place you would stand to see the reflection of the light. Stand behind the flashlight so that you can see the reflection. Was your prediction correct?

PICTURE 1



PICTURE 2



SOUND 1

Step 1: Look at the two tuning forks. How are they the same? How are they different? Record your observations in the spaces below.

Step 2: Hold the small tuning fork with one hand and strike it with the mallet, as shown in Picture 1. Listen to the sound of the tuning fork and feel its vibration. Strike the tuning fork again and gently touch your cheek in front of your ear.

Step 3: Strike the large tuning fork and observe the sound it makes and how it vibrates. Strike the tuning fork again and gently touch your cheek in front of your ear. Compare the two tuning forks. Record your observations.

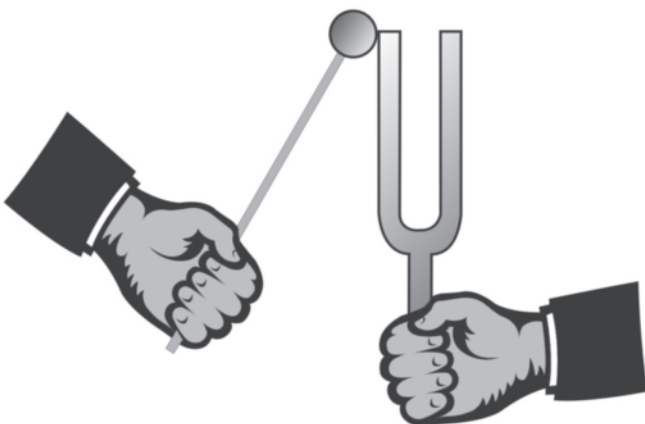
Step 4: Hold a piece of paper in the air by one corner, as shown in Picture 2. Strike the small tuning fork with the mallet and touch the paper near the bottom. Observe the sound.

Step 5: Do the same thing with the large tuning fork. Compare the two tuning forks. Record your observations.

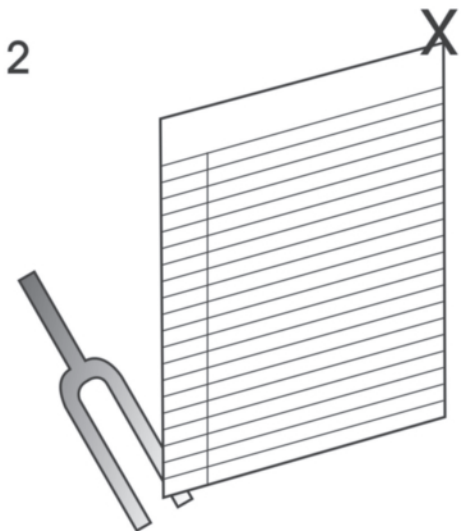
SMALL TUNING FORK

LARGE TUNING FORK

Picture 1



Picture 2



SOUND 2

Step 1: Strike the small tuning fork and carefully lower it into the empty can without touching the can, as shown in the picture. Observe the sound.

Step 2: Strike the large tuning fork and carefully lower it into the empty can without touching the can. Observe the sound.

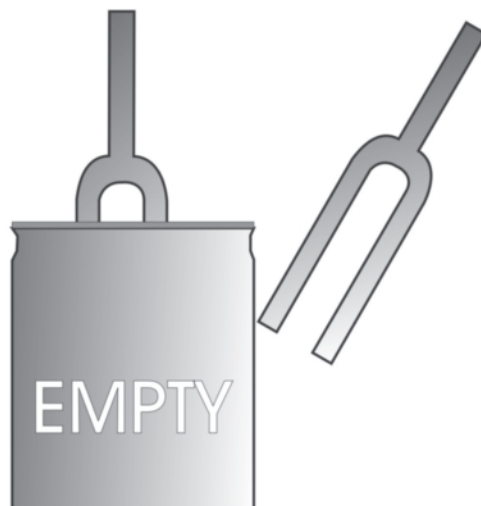
Step 3: Compare the sounds the tuning forks make inside the can. Record your observations in the space below.

Step 4: Strike the small tuning fork and gently touch the outside of the can with it. Observe the sound. Do the same thing with the large tuning fork. Compare the two tuning forks. Record your observations.

Step 5: Strike the small tuning fork and gently touch the inside of the can with it. Observe the sound. Do the same thing with the large tuning fork. Compare the two tuning forks. Record your observations.

SMALL TUNING FORK

LARGE TUNING FORK



SOUND 3

Step 1: Sprinkle a few grains of pepper on the plastic wrap on the top of the can.

Step 2: Strike the small tuning fork and hold it near the pepper without touching it, as shown in the picture. Observe the action of the pepper. Record your observation.

Step 3: Strike the large tuning fork and hold it near the pepper without touching it. Observe the action of the pepper. Record your observation.

Step 4: Shake the pepper off the top of the can onto a piece of paper. Sprinkle a few drops of water onto the plastic wrap.

Step 5: Strike the small tuning fork and hold it near the water drops without touching them. Observe the action of the water. Record your observation.

Step 6: Strike the large tuning fork and hold it near the water drops without touching them. Observe the action of the water. Record your observation.

Step 7: Gently shake the water off the can.

SMALL TUNING FORK

Pepper:

Water Drops:

LARGE TUNING FORK

Pepper:

Water Drops:



SOUND 4

Step 1: Fill the empty can with water. Wait until the water is still.

Step 2: Strike the small tuning fork hard and touch the side of the can very gently. Observe the surface of the water. Record your observation.

Step 3: Strike the large tuning fork hard and touch the side of the can very gently. Observe the surface of the water. Record your observation.

Step 4: Strike the small tuning fork hard and touch the surface of the water as shown in the picture. Observe the water. Record your observation.

Step 5: Strike the large tuning fork hard and touch the surface of the water. Observe the water. Record your observation.

SMALL TUNING FORK

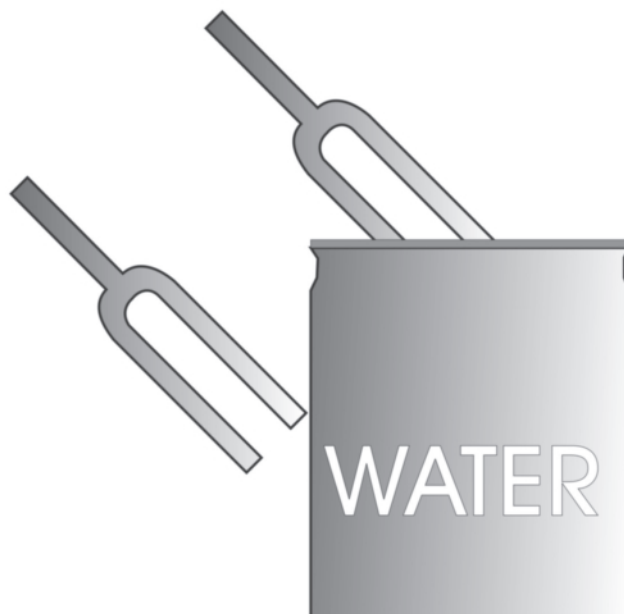
Side of Can:

Surface of Water:

LARGE TUNING FORK

Side of Can:

Surface of Water:



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