Metric Mass and Volume

Teacher's Guide
Middle School

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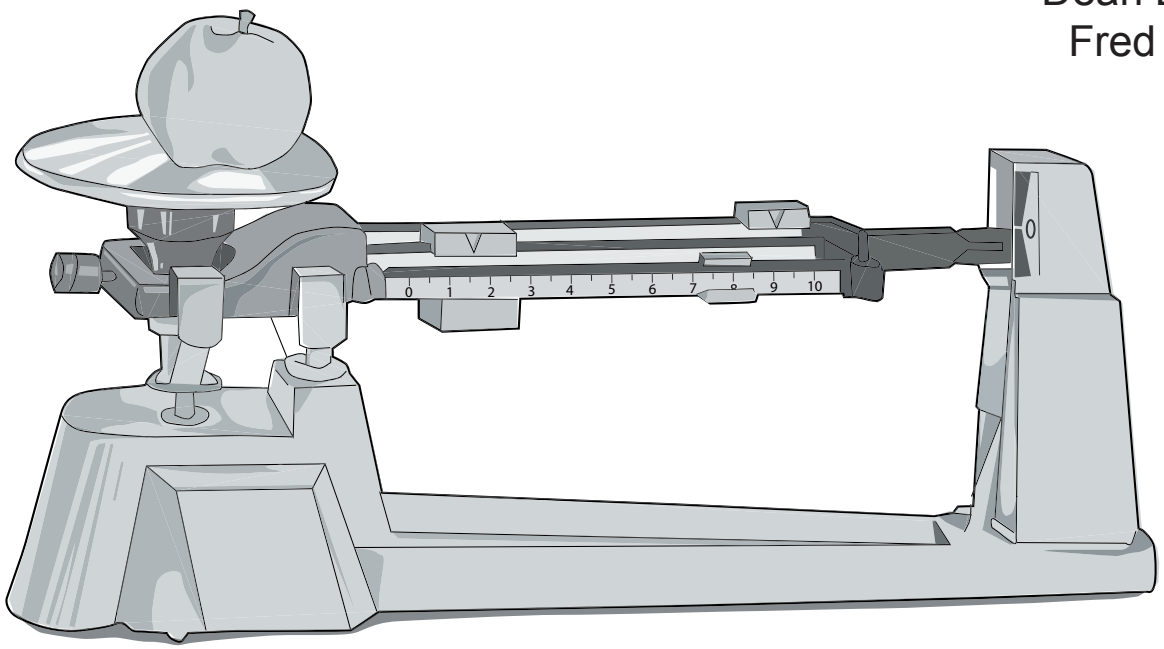

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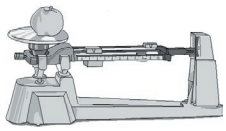

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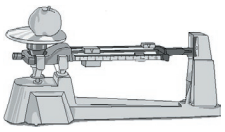

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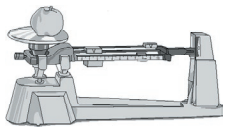

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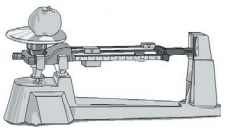


A Message from our Company. . .

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.

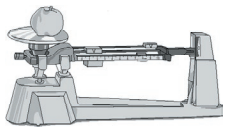
We have a long family tradition of education. Our grandmothers graduated from normal school in the 1920's to become teachers. Brian's mother was an elementary teacher and guidance counselor, and his father was a high school teacher and superintendent. This family tradition inspired Brian to become a 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)

Habits of Mind - Computation and Estimation (12B)

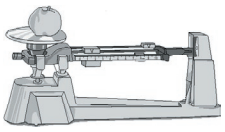
By the end of 8th grade, students should be able to:

- Calculate the circumferences and areas of rectangles, triangles, and circles, and the volumes of rectangular solids.

Habits of Mind - 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:

- Differentiate between the terms “mass” and “volume”. Define mass as the amount of matter an object contains; define volume as the amount of space an object takes up.

- Understand that the units of pounds and ounces measure mass in the English system, while the metric system uses kilograms, grams, and milligrams.

- Describe what size objects would best be measured with different units: kilograms, grams, and milligrams.

- Provide examples of lab equipment used to measure mass, including the triple beam balance.

- Identify both liters and cubic centimeters as measurements of volume, but understand that liters are generally used to measure liquid volume and cubic centimeters measure solid volume.

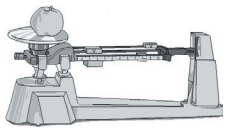
- Explain that liquid volume is easily measured using tools such as beakers and graduated cylinders.

- Discuss different methods for finding the volume of solid objects. Describe the process of finding the volume of regularly shaped objects. Also describe how the process of water displacement is used to calculate the volume of irregularly shaped solids.

- Define density as the amount of mass per unit of volume of an object.

- Demonstrate the process for finding an object’s density by measuring both its mass and volume, then dividing mass by volume.

- State that objects denser than water sink, and objects less dense than water float.



Assessment

Preliminary Assessment:

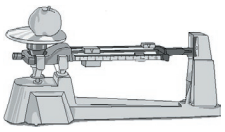
The Preliminary Assessment, provided in the Student Masters section, is an assessment tool designed to gain an understanding of students' pre-existing knowledge. It can also be used as a benchmark upon which to assess student progress based on the objectives stated on the previous pages.

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

Begin by showing the class a balloon full of air, and a rock. Explain that both objects are made up of matter, as is everything on Earth. Then ask the students which object has more mass. Write the term mass on the blackboard.

Next ask the class which object has more volume. Write the term volume on the blackboard. Ask students what the difference is between mass and volume. Explain that mass is the amount of matter contained in an object, and that volume is the amount of space an object takes up. Ask your students which object has greater mass, and which object has greater volume. Tell students to pay close attention to the video to learn more about the concepts of mass and volume.

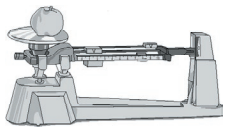
After showing the video, write the term density on the blackboard. Ask students whether the balloon or the rock is more dense. Have students make a list of the different metric units that measure mass, volume, and density.

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.

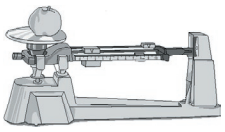
The program is approximately twenty minutes in length and includes a ten question video quiz. Answers are not provided to the Video Quiz on the video, but are included in this teacher's guide. You may choose to grade student quizzes as an assessment tool or to review the answers in class.

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.



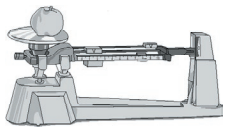
Video Script: Metric Mass and Volume

1. What do the following things have in common? The water traveling over this thundering waterfall,…
2. …the vast sea of air as seen from this mountaintop,…
3. …the metal in this fire truck,…
4. …and these sea lions?
5. All these things possess matter and take up space.
6. Every thing we see, and even some things we can't see, such as air, are made up of matter.
7. Everything we touch, taste, and smell is made up of matter.
8. Matter, such as flowers in this garden, take up space.
9. In other words, matter is anything on Earth that has mass and volume. We will talk more about these terms later.
10. During the next few minutes we are going to explore how some of the characteristics of matter can be measured.
11. More specifically, we are going to see how we can use the metric system to measure some of the properties of matter.
12. **Graphic Transition – Mass and Volume**
13. As we just mentioned, matter is anything on Earth that has mass and volume.
14. What exactly are mass and volume?
15. Let's start with mass. Mass is defined as the amount of matter in an object.
16. This apple has mass…
17. …and this horse has mass.
18. Water has mass.
19. Our bodies also have mass.
20. And believe it or not the air we breathe has mass.
21. Volume is different than mass. Volume is the amount of space something takes up.
22. All the things we just mentioned have volume.
23. **You Compare!** What has more volume – this motorcycle or this car?
24. That's right, the car has more volume because it takes up more space than the motorcycle.
25. Even though mass and volume may seem similar, they are actually quite different from each other.
26. An object such as this stone can have a relatively large mass because it contains a lot of matter, but its volume is relatively small because it doesn't take up much space.
27. This beach ball on the other hand has little mass because it does not contain much matter, . . .



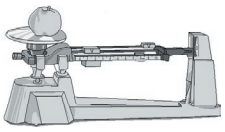
Script (cont.)

28. . . . But it has a large volume because it takes up much more space than the stone.
29. **Graphic Transition – Metric Mass**
30. As you probably already know, in countries such as the United Sates and England, the system of measurement commonly used is the English system of measurement.
31. Mass in the English system of measurement is measured in units of pounds or ounces.
32. This is a five-pound bag of sugar.
33. The other system of measurement commonly used in most other countries and in science is the metric system.
34. In the metric system mass is measured in units such as grams, kilograms, and milligrams.
35. Let us take a look at each one of these.
36. In the English system, mass is commonly measured in pounds.
37. However, in the metric system body weight,…
38. …as well as foods are measured in kilograms.
39. A kilogram is equivalent to about 2.2 pounds. This rock has a mass of one kilogram.
40. And this amount of candy has a mass of one kilogram.
41. One kilogram consists of one thousand grams. This is a one gram mass. There are 1000 of these in a kilogram.
42. Smaller objects are measured in grams. This marble has a mass of about 20.5 grams.
43. And this raisin has a mass of 0.5 grams.
44. The masses of even smaller objects are measured in milligrams. A milligram is 1/1000 of a gram.
45. **You Decide!** How many milligrams are in a gram?
46. That's right, there are 1000 milligrams in a gram.
47. **Graphic Transition – Measuring Mass**
48. So far we have talked about the units of metric mass, but how is mass actually measured?
49. One piece of equipment you may have in your science lab used to measure mass is a balance.
50. There are several different kinds of balances, but they all work using the same principles.
51. A balance works when an unknown mass, such as these chocolate chips is balanced against a known mass.
52. This type of balance is called a triple beam balance because there are 3 different beams or sets of weights.



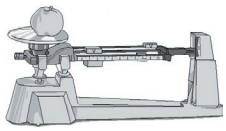
Script (cont.)

53. Weights are adjusted until the weights are balanced against the chocolate chips.
54. You Observe! What is the mass of the chocolate chips?
55. That is right, the mass is 17.8 grams.
56. Graphic Transition – Metric Volume
57. This alligator takes up space.
58. These large skyscrapers take up space, . . .
59. . . . and these balloons also take up space. Anything that takes up space has volume.
60. Volume is the amount of space an object takes up.
61. In the metric system, liquid volume is measured in liters.
62. This plastic bottle contains 1 liter of soda.
63. There are 1000 milliliters in a liter. A milliliter is a very small amount of liquid.
64. When measuring the volume of smaller solids, metric units called cubic centimeters are used.
65. This small cube is a cubic centimeter. It is one centimeter long by one centimeter high by one centimeter wide.
66. This cardboard box, for example, has a volume of 27,900 cubic centimeters.
67. The volume of gases, such as the air in this balloon, is often described in cubic centimeters as well.
68. The volume of larger solids is measured in metric units of cubic meters.
69. A cubic meter is one meter long by one meter high by one meter wide.
70. Graphic Transition – Measuring Volume
71. It is relatively easy to measure the volume of liquids in the metric system if you have the right tools.
72. When cooking, spoons and cups measure liquids in milliliters.
73. This spoon for example contains 5 milliliters of molasses.
74. In the science lab, the volume of liquids can be measured using tools such as beakers and graduated cylinders.
75. This container is called a beaker. It holds up to 250 milliliters of liquid.
76. You Observe! Approximately how many milliliters of acid are in this beaker?
77. That's right, there are about 150 milliliters of acid in the beaker.
78. Graduated cylinders such as this one are often used to more precisely measure the volume of liquids.
79. This small graduated cylinder is used to measure small amounts of liquids.
80. The volume of regularly shaped solids can be calculated by measuring the length, height, and width of the object, and then multiplying the numbers.
81. Let us compute the volume of this brick. It has a length of 18.8 centimeters, a height of 5.6 centimeters and a width of 8.5 centimeters.



Script (cont.)

82. When we multiply all three we get a volume of 894.9 cubic centimeters.
83. The approximate volume of objects that have a regular shape such as books,…
84. …and even buildings can be measured this way.
85. But what about objects that have an irregular shape such as this necklace?
86. We need to use another process when finding the volume of irregularly shaped objects.
87. The process of water displacement is often used to measure the volume of irregularly shaped objects.
88. One way this can be done is by filling a graduated cylinder with water to a certain point, such as 50 milliliters,…
89. … then placing the object in the water.
90. See how the level rises to 53 milliliters.
91. **You Compute!**
    What is the volume of the necklace?
92. The volume is computed by subtracting 50 milliliters from 53 milliliters to get a volume of 3 milliliters.
93. 3 milliliters of water is equivalent to 3 cubic centimeters.
94. Therefore, the volume of the necklace can be expressed as 3 cubic centimeters.
95. **Graphic Transition – Density in the Metric System**
96. **You Decide!** What has more mass – this kilogram piece of marble or this kilogram of wood shavings?
97. If you answered neither, then you are correct. They both have a mass of 1 kilogram.
98. However, the volume of the wood shavings is much greater. Why?
99. It has to do with something called density. Density is a measurement of how much mass is contained in a given volume of an object.
100. Another way of putting this is that density is the amount of mass per unit volume.
101. The density of objects in the metric system is measured in units of grams per cubic centimeter.
102. Fresh water has a density of one gram per cubic centimeter.
103. Objects that have a density of greater than one gram per cubic centimeter sink.
104. And objects with a density of less than one gram per cubic centimeter float.
105. **Graphic Transition – Measuring Density**
106. Since we know that water has a density of 1 gram per cubic centimeter, how could we find out if a block of wood will float, without placing it in water?
107. We already discussed that density is the amount of mass per unit of volume.
108. This can be expressed as a mathematical formula where density equals mass divided by volume.



Script (cont.)

109. Therefore, if we know the mass and volume of the piece of wood we can compute its density.
110. Let us first obtain the mass of the block of wood by placing it on a triple beam balance.
111. You can see that its mass is 44 grams.
112. To compute its volume we need to measure the length, height, and width.
113. By multiplying all these measurements we get a volume of 115 cubic centimeters.
114. Next, all we have to do is divide the mass by the volume.
115. The density of the wood is .38 grams per cubic centimeter.
116. **You Decide!** Based on this information, will the wood sink or float?
117. The block of wood floats. It has a density of less than 1.0 grams per cubic centimeter and therefore it floats.
118. Objects with a density of greater than 1 gram per cubic centimeter sink.
119. **Graphic Transition – Summing Up**
120. During the past few minutes we have explored many of the interesting features of metric mass and volume.
121. We began by learning that mass is the amount of matter in an object…
122. …and volume is the amount of space something takes up.
123. We then explored how mass in the metric system is measured in kilograms, grams and milligrams.
124. And we took a brief look at how mass can be calculated using a balance.
125. Turning to volume we discussed how everything we see has volume.
126. In the metric system, liquid volume is measured in liters or milliliters.
127. In the science lab liquid volume can be measured using beakers or graduated cylinders.
128. The volume of solids is measured in metric units of cubic centimeters or cubic meters.
129. We explored how the volume of regularly shaped solids can be easily computed by multiplying the length, height, and width of an object.
130. But the volume of irregularly shaped solids is a little more difficult to calculate, requiring a method such as water displacement.
131. Last we investigated the idea of density. Density is the amount of mass per unit volume.
132. So the next time you need to calculate the mass of an object,…
133. …or figure out the volume of something,…
134. …or compare the densities of objects,…
135. …think about some of the things we discussed during the past few minutes.
136. You just might think about the metric system a little differently.

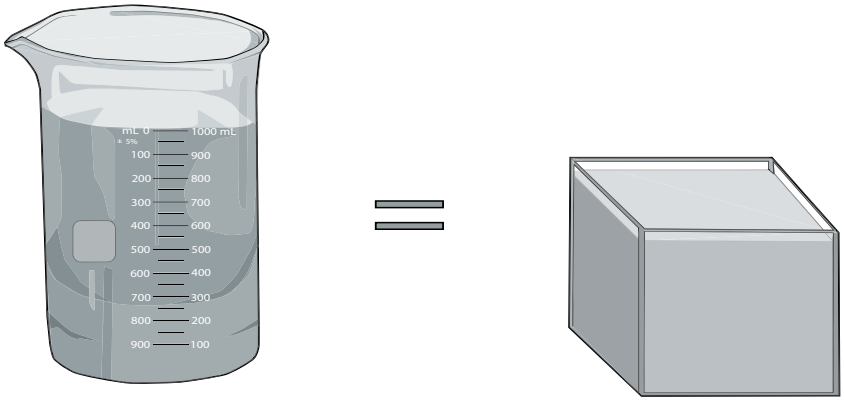
Script (cont.)

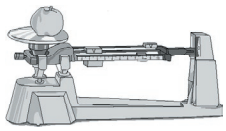
137. Graphic Transition – Video Quiz

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

1. Mass is the amount of ___ in an object.
2. _____ is the amount of space something takes up.
3. One _____ consists of one thousand grams.
4. This piece of equipment is a ____.
5. The basic metric unit of liquid volume is the ____.
6. This small block is a ____ centimeter.
7. This _____ cylinder is used to measure liquids.
8. Water _____ is used to calculate the volume of irregularly shaped objects.
9. _____ is the amount of mass per unit volume.
10. Objects with a density of greater than 1 gram per cubic centimeter _____.

Answers can be found on page 17.





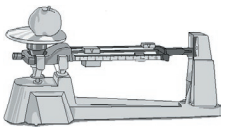
Student Assessments and Activities

Assessment Masters:

- Preliminary Assessment
- Video Review
- Post Assessment

Student Activity Masters:

- Measuring Mass
- Calculating Volume
- Calculating Density
- Vocabulary of *Metric Mass and Volume*



Answers to Student Assessments

Preliminary Assessment (pgs. 20-21)

1. matter
2. mass
3. volume
4. milliliters
5. balance
6. kilogram
7. graduated cylinder
8. cubic meters
9. displacement
10. sinks
11. false
12. false
13. false
14. true
15. true
16. false
17. true
18. true
19. false
20. true

Video Review (pg. 22)

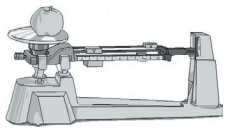
1. The car has more volume because it takes up more space than the motorcycle.
2. There are 1000 milligrams in a gram.
3. The mass of the chocolate chips is 17.8 grams.
4. There are about 150 milliliters of acid in the beaker.
5. The volume of the necklace is 3 milliliters. This is computed by subtracting 50 milliliters from 53 milliliters to get a volume of 3 milliliters, which is equivalent to 3 cm^3.
6. Neither, the piece of marble and the wood shavings have a mass of one kilogram.
7. The block of wood floats.

Video Quiz (pg. 22)

1. matter
2. volume
3. kilogram
4. balance
5. liter
6. cubic
7. graduated
8. displacement
9. density
10. sink

Post Assessment (pgs. 23-24)

1. cubic meters
2. kilogram
3. mass
4. graduated cylinder
5. matter
6. displacement
7. milliliters
8. sinks
9. volume
10. balance
11. true
12. true
13. false
14. true
15. true
16. false
17. false
18. true
19. false
20. false



Answers to Student Activities

Measuring Mass (p. 25)

Answers will vary for the chart.
Question: One milliliter of water has a mass of 1 gram. These units of measurement of water are interchangeable in the metric system.

Calculating Volume (p. 26 - 27)

Answers will vary depending on the size of the objects.
1. Volume is the amount of space something takes up.
2. to obtain the volume of regularly shaped objects it is necessary to measure the length, height, and width of the object. These values are than inserted into the following formula: volume = length x height x width.
3. To obtain the volume of relatively small irregularly shaped objects the process of water displacement can be used. This involves taking a known volume of water, adding the object to the water, and subtracting the old volume of water from the new value of water.

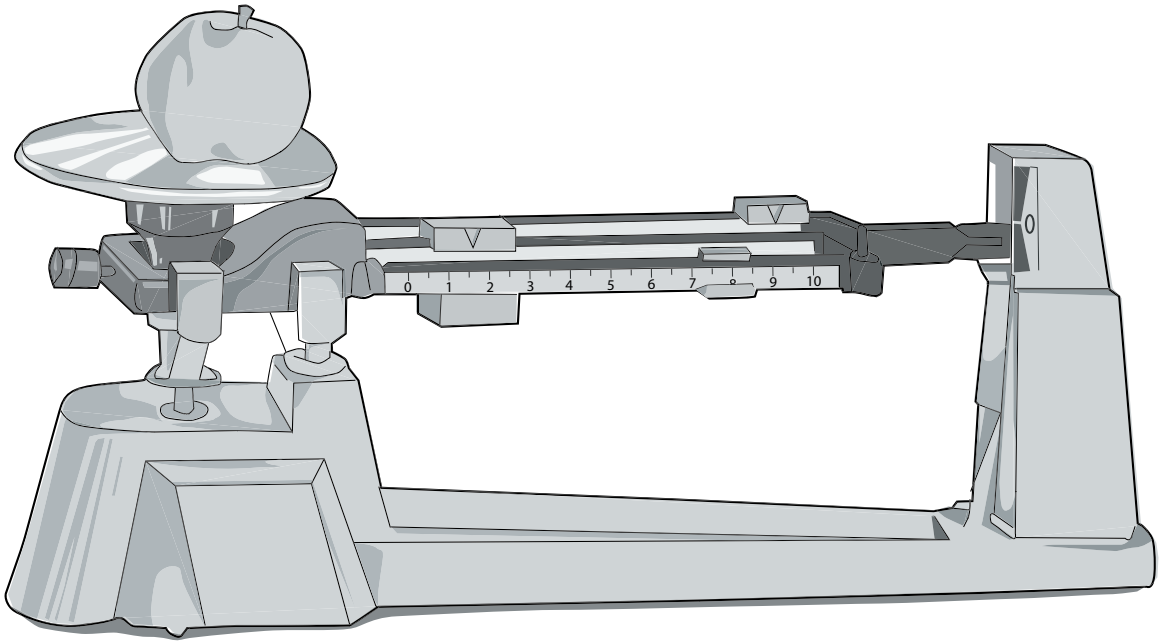
Calculating Density (p. 28 - 29)

1. Water has the greatest density; vegetable oil is the next dense; and wood is the least dense.
2. The piece of wood floated when it was placed in the water. This is because wood has less density than water.
3. When the oil was poured into the water it rose to the surface. This is because oil is less dense than water.

Vocabulary of Metric Mass and Volume (p. 30)

1. c - mass
2. h - volume
3. e - metric system
4. j - kilogram
5. f - balance
6. b - liter
7. i - cubic centimeter
8. d - beaker
9. a - water displacement
10. g - density

Assessment and Student Activity Masters



Name _____

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. _____ is anything that has mass and takes up space.

2. An apple has a _____ of about 400 grams.

3. A large _____ means that an object takes up a lot of space.

4. There are one thousand _____ in a liter.

5. To find the amount of mass in an object, you can use a _____ .

6. The _____ is the basic unit of metric mass.

7. A _____ _____ is used to more accurately measure liquids.

8. The volume of a very large solid object is expressed in _____ _____ .

9. The process of water _____ is used to find the volume of irregularly shaped objects.

10. An object with a high density _____ in water.

mass	graduated cylinder
kilogram	sinks
milliliter	volume
cubic meters	balance
displacement	matter

Preliminary Assessment

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

11. Air contains no matter. T F

12. A beach ball takes up a lot of space and therefore it has a larger mass than a bowling ball. T F

13. Everyone in the world measures volume in ounces. T F

14. A balance works when an unknown mass is balanced against a known mass. T F

15. Volume is generally defined as the amount of space something takes up. T F

16. In the metric system, volume is only measured in liters. T F

17. The volume of gases can be measured in cubic centimeters. T F

18. Graduated cylinders tend to measure volume more precisely than beakers. T F

19. The volume of most solids can be measured using a balance. T F

20. Objects with high density sink, while those with a lower density float. T F

Name _____

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 Compare!

1. What has more volume - this motorcycle or this car?

You Decide!

2. How many milligrams are in a gram?

You Observe!

3. What is the mass of the chocolate chips?

You Observe!

4. Approximately how many milliliters of acid are in this beaker?

You Compute!

5. What is the volume of the necklace?

You Decide!

6. What has more mass - this kilogram piece of marble or this kilogram of wood shavings?

You Decide!

7. Based on this information, will the wood sink or float?

Video Quiz:

1. Mass is the amount of _____ in an object.
2. _____ is the amount of space something takes up.
3. One _____ consists of one thousand grams.
4. This piece of equipment is a _____ .
5. The basic metric unit of liquid volume is the _____ .
6. This small block is a _____ centimeter.
7. This _____ cylinder is used to measure liquids.
8. Water _____ is used to calculate the volume of irregularly shaped objects.
9. _____ is the amount of mass per unit volume.
10. Objects with a density of greater that one gram per cubic centimeter _____ .

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. The volume of a very large solid object is expressed in _____ _____ .
2. The _____ is the basic unit of metric mass.
3. An apple has a _____ of about 400 grams.
4. A _____ _____ is used to more accurately measure liquids.
5. _____ is anything that has mass and takes up space.
6. The process of water _____ is used to find the volume of irregularly shaped objects.
7. There are one thousand _____ in a liter.
8. An object with a high density _____ in water.
9. A large _____ means that an object takes up a lot of space.
10. To find the amount of mass in an object, you can use a _____ .

graduated cylinder	mass
sinks	kilogram
volume	milliliter
balance	cubic meters
matter	displacement

Name _____

Post Assessment

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

11. The volume of gases can be measured in cubic centimeters. T F

12. Volume is generally defined as the amount of space something takes up. T F

13. The volume of most solids can be measured using a balance. T F

14. Graduated cylinders tend to measure volume more precisely than beakers. T F

15. Objects with high density sink, while those with a lower density float. T F

16. A beach ball takes up a lot of space and therefore it has a larger mass than a bowlling ball. T F

17. Air contains no matter. T F

18. A balance works when an unknown mass is balanced against a known mass. T F

19. Everyone in the world measures volume in ounces. T F

20. In the metric system, volume is measured only in liters. T F

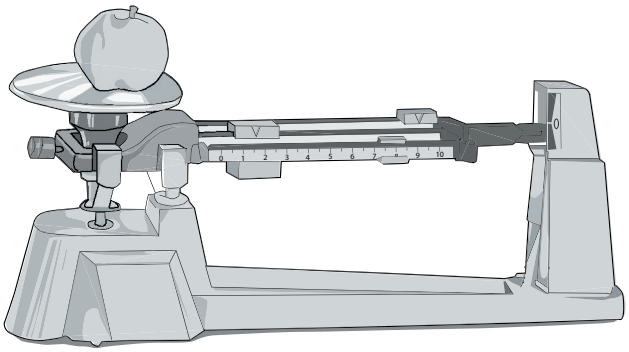
Name

Measuring Mass

Background:
You may have stepped onto a scale this morning, or weighed out flour on an electronic balance when cooking, or even used a spring scale in the science lab. All of these activities are measurements of mass. As you probably already know, mass is a measurement of the amount of matter in an object. Weight is a measure of the pull of gravity on a mass. Weight varies due to changes in the force of gravity. For example, a mass, such as a bowling ball weighs more on earth than on the moon because the force of gravity is greater on earth. There are many different tools to measure the weight of objects.

You probably were weighed on a balance the last time you went to the doctor. The nurse measured your weight by moving a series of metal weights across the beams until the weights were balanced against your body weight.

Object	Weight
5 paperclips	
book	
pen or pencil	
small rock	
250 milliliters of water	



In this activity, you will measure the mass of several different objects using a triple beam balance.

Materials: triple beam balance, objects to measure, container for water

Directions:

1. Use the triple beam balance to find the weight of each of the objects. Record your measurements in the data table. Make sure to include units of grams or kilograms.
2. Now find the weight of the water. To measure the mass of a liquid, you must first find the weight of the empty container. Then find the weight of the container filled with the liquid. Subtract the mass of the empty container from that of the liquid and the container together. Record your measurement in the data table.

Question:
How does the weight of the water compare to its volume? What does this show you about the metric system?

Name _____

Calculating Volume

Background:
Things you see every day have volume, and so do some things you can't see! Things that contain even the slightest amount of matter still take up space. Volume is a measurement of the amount of space an object takes up.

It is somewhat easier to measure the volume of liquids and gases. For example, to measure a liquid volume you simply pour the substance into a beaker or graduated cylinder.

Measuring the volume of solid objects is more difficult, because you have to calculate the volume based on measurements. In this activity we will practice measuring and calculating the volume of regularly shaped solid objects using metric rulers. We will also use the process of water displacement to measure the volume of irregularly shaped objects.

Materials: metric ruler, graduated cylinder, objects to be measured including a book, an eraser, a pencil, five paperclips, and a small rock, and your Calculating Volume Worksheet

Directions:
Regularly Shaped Objects:
It is relatively easy to calculate the volume of regularly shaped solids. Use your metric ruler to measure the length, width, and height of each object listed in the data chart on your worksheet. Record each value as you measure. To find the volume, you must multiply the three numbers together - that is, length X width X height. Because each value is measured in centimeters, the units for volume will be cubic centimeters.

Irregularly Shaped Objects:
Calculating the volume of irregularly shaped objects is only slightly more difficult. You will use the process of water displacement to calculate the volume of irregularly shaped solids. To find the volume by the method of water displacement, begin by filling the graduated cylinder to a round value with enough water to cover the object with the unknown volume. Record the volume of the water alone in the data sheet. Now place the object into the graduated cylinder. Record the volume of the object and the water combined. To find the volume of the object, subtract the first measurement from the second. As you probably remember, one milliliter has a volume of one cubic centimeter. Using this information convert the volume of the solid to cubic centimeters.

 Name _____

Calculating Volume Worksheet

Regular Objects

Object	Length (cm)	Width (cm)	Height (cm)	Volume (cm^3)
blackboard eraser				
book				
classroom				

Irregular Objects

Object	Volume of water	Volume of water and object	Volume of object
pencil			
5 paperclips			
small rock			

Questions:

1. What is volume?

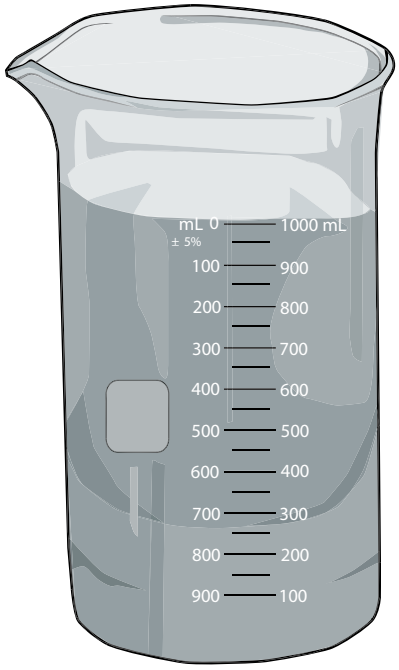
2. Describe how the volume of regularly shaped objects are obtained.

3. Describe how the volume of irregularly shaped objects are obtained.

Name

Calculating Density

Background:
You have probably seen things floating before. Helium-filled balloons float in the air, and inner tubes float in pools. But why does one substance float on top of another?



Density is the measurement of the mass contained within a given volume of an object. That is to say, it is the amount of mass an object has per unit of volume. Objects and substances that are less dense, like a beach ball full of air, float on top of things that are more dense, such as a lake.

To calculate density, you first need to figure out the mass and the volume of the object. Because density is the object's mass per unit of volume, you calculate it by dividing the measurement of mass by the measurement of volume. For example, air has a density of 0.00125 grams per cubic centimeter. Helium gas is less dense, and therefore balloons filled with helium will float.

In this activity you will calculate the density of three different substances, and compare the density of each substance.

Materials: 250 ml. beaker, triple beam balance, metric ruler, block of wood, 250 ml of water, 250 ml of vegetable oil

Directions:
1. Begin by measuring the mass and volume of the block of wood. Use the triple beam balance to measure the mass. To find the volume, use the metric ruler to measure the length, width, and height of the piece of wood. Then multiply the three numbers together. Record the values in the data chart on the following page.
2. Now find the mass of the water. To do this you must first find the mass of the container in which you will weigh it. Next, weigh the water and the container together, then subtract the first measurement from the second. The difference is the mass of 250 ml of water. Record your data in the chart.
3. Repeat the same process for finding the mass of 250 ml of vegetable oil. Record the measurement in the data table.

Calculating Density

4. Now you will find the density of each substance. To do this you must divide the measurement of mass by the measurement of volume. Perform this calculation for the wood, the water, and the oil.

5. Place the block of wood into the container. Describe what you observe. Then take the block of wood out of the container.

6. To observe density in action, slowly pour the oil into the container holding the water. Describe what you observe.

Object	Mass	Volume	Density
Block of wood			
Vegetable oil		250 ml	
Water		250 ml	

Questions:

1. Which substance is most dense, and which substance is least dense?

2. Describe what happened when the wood block was placed in the water. Explain why this occurred.

3. Explain what happened when the oil was poured into the water. Explain why this occurred.

Name _____

Vocabulary of Metric Mass and Volume

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

____ 1. sams _____

____ 2. mouvel _____

____ 3. rectmi esmtys
_____ _____

____ 4. lrogimka _____

____ 5. nalbeca _____

____ 6. tirel _____

____ 7. bciuc remincttee
_____ _____

____ 8. kareeb _____

____ 9. artew nseeplditmac
_____
_____

____ 10. neytisd _____

a. process used to measure the volume of irregularly shaped objects

b. the basic unit of volume in the metric system

c. the amount of matter in an object

d. a lab tool used to measure the volume of a liquid

e. a system of measurement used in science and in most countries throughout the world

f. a science lab tool used to measure the mass of an object

g. the measurement of the amount of mass per unit volume

h. the amount of space that an object takes up

i. units of measurement used when measuring the volume of a relatively small solid

j. basic metric unit of mass