DAY 1 Compare Solids & Liquids, Part 1

This lesson is contrasting case activity 1.1a.

Big Idea

- Solids and liquids can be described by certain properties, but a given solid or liquid may not have all of those properties. For example, many solids are hard, but some can be molded.

Materials

Teacher:

1. slides – day01.ppt

Students:

1. cups with samples of modeling clay, salt, water, & white glue
2. hand lenses
3. food coloring

Activities & Allotted Time (40 minutes total)

15 minutes – warm-up activity
25 minutes – cc activity – Compare Solids & Liquids, part 1

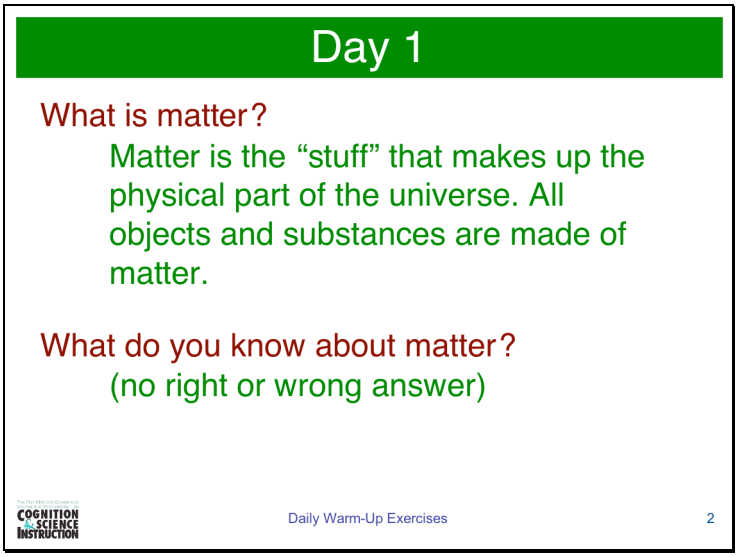
Warm-Up Activity

These activities are usually designed to assess and reinforce student understanding of one or more big ideas from a recent lesson. Some warm-ups will ask about an idea from earlier in the unit, particularly when the idea is important to that day's lesson. Today's warm-up is different. Its purpose is to elicit students' initial ideas about matter. We have allotted 15 minutes for today's warm-up, but most should only take about 5 minutes to complete.

Each warm-up is on a separate slide, so it can be displayed as students enter the room. On each slide, only the questions are displayed initially. The answers will appear on mouse click or keypress. The notes usually contain follow-up questions you can ask when you go over the warm-up with your students. The slide and notes for Day 1 are on the next page.

Day 1 – Compare Solids & Liquids, Part 1

Warm-Up Activity



The purpose of the first question is to help students understand what this unit is about. The answer that appears when you press a key is a paraphrase of the description on page 4 of the Holt text. The book defines matter as "anything that has mass and takes up space." But since most students aren't yet familiar with the concept of mass, we recommend delaying that part of the definition until later.

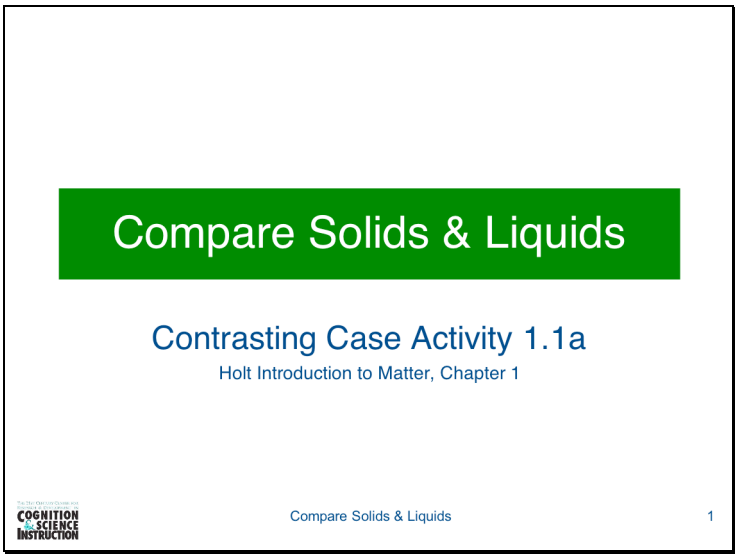
There is no right or wrong answer to the second question. The purpose is to elicit students' initial ideas.

Compare Solids & Liquids

In the first two contrasting case activities, students will observe specific, possibly surprising properties of solids, liquids, and gases that they will be able to explain as they move through the unit. For example, when they add food coloring to today's samples, they will see that the color spreads in liquids but not in solids. They will be able to explain why this occurs when they learn how the arrangement and motion of particles differ in solids and liquids.

Day 1 – Compare Solids & Liquids, Part 1

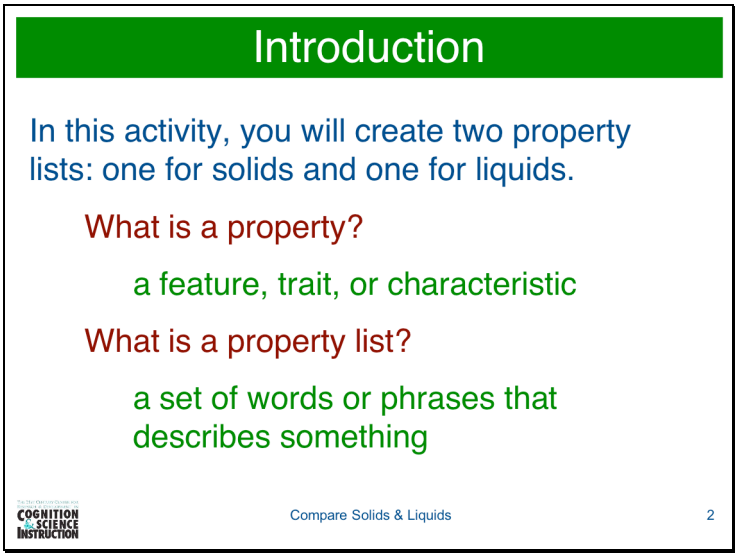
Compare Solids & Liquids (cont.)
Since this is your students' first experience with contrasting cases, we have allotted two days for this activity. If students finish before the end of Day 2, have them get started on Part 2, Compare Liquids & Gases.



In this activity, students record their initial ideas about the properties of solids and liquids. They then compare two samples of each – modeling clay, salt, water, and white glue – and revise their lists to include properties of the samples. Next, they add a few drops of food coloring to each sample and revise their lists to include the outcome they observe.

Day 1 – Compare Solids & Liquids, Part 1

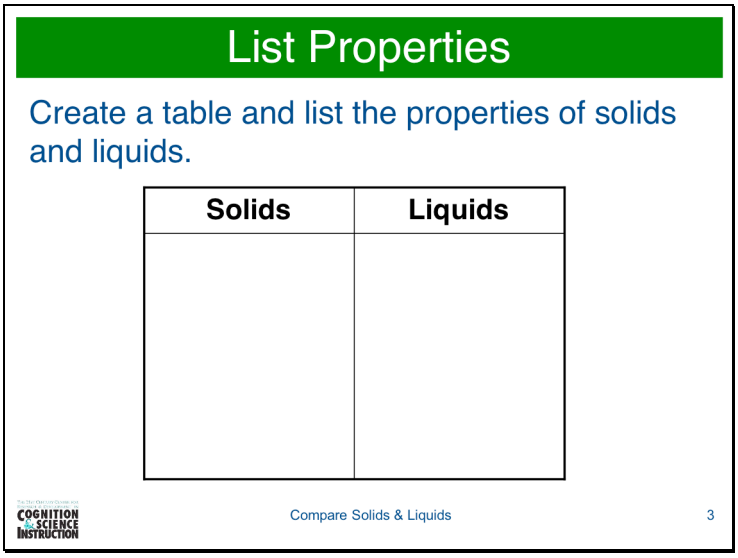
Compare Solids & Liquids (cont.)



Questions and answers will appear when you click the mouse or press the space bar.

Day 1 – Compare Solids & Liquids, Part 1

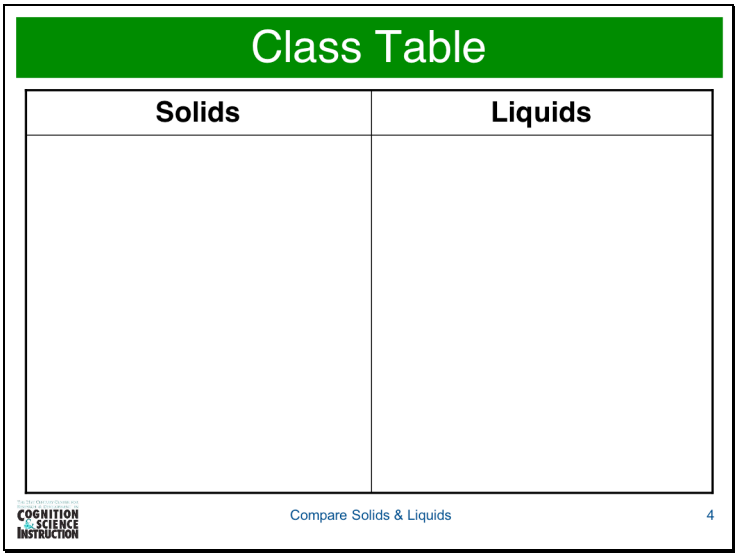
Compare Solids & Liquids (cont.)



Have students work in groups or pairs, then share their ideas with the class. If they need help in coming up with properties, ask them for examples of solids and liquids that you can list on the board. As they work, encourage them to think of words or phrases that describe the items listed on the board. The next slide contains a blank table you can use to record ideas your students all agree on.

Day 1 – Compare Solids & Liquids, Part 1

Compare Solids & Liquids (cont.)



(Click Escape to stop the slide show. After typing in students' ideas, click the slide show icon at the bottom of the window to display the table.)
Some ideas your students may come up with:

Solids

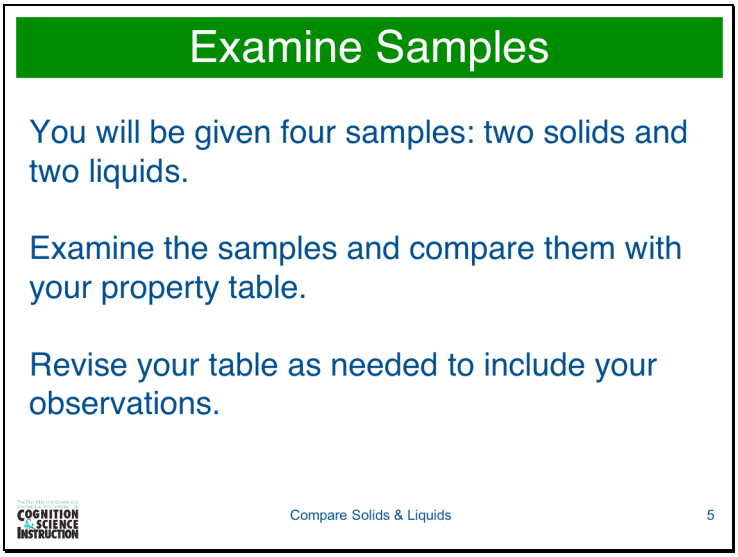
- hard
- dry
- have their own shape
- can be picked up whole
- can't pour or drip
- can be broken or bent
- can't evaporate

Liquids

- soft
- wet
- take the shape of their container
- can't be picked up whole
- can pour and drip
- can't be broken or bent
- can evaporate

Day 1 – Compare Solids & Liquids, Part 1

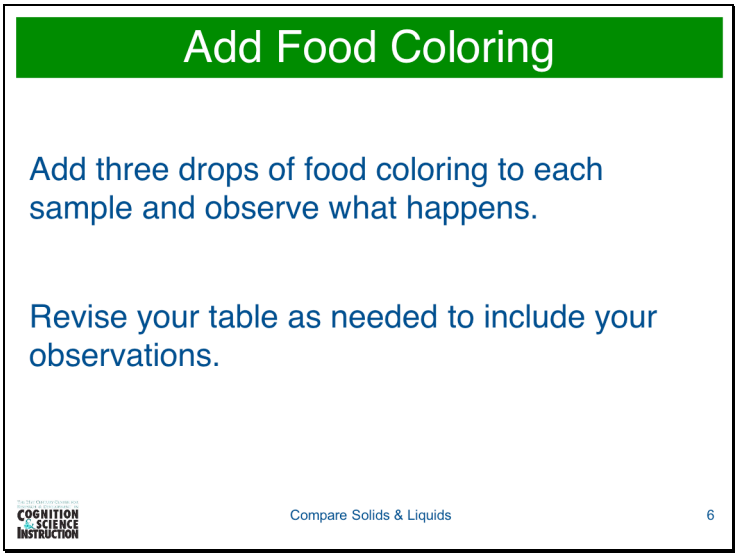
Compare Solids & Liquids (cont.)



Distribute the samples and hand lenses. Again, have students work in groups, then share ideas with the class. Revise the class table to reflect changes in your students' ideas. For example, they may add that, for solids like salt that consist of a lot of little pieces, the individual pieces have their own shape and can't pour, but when you look at them all together, they take the shape of their container and they can pour. Also, solids like modeling clay aren't very hard, and they can be molded into all different shapes. And liquids like white glue are so viscous (thick) that they take a real long time to pour.

Day 1 – Compare Solids & Liquids, Part 1

Compare Solids & Liquids (cont.)



Distribute the food coloring. The color will spread fairly quickly throughout the water sample. It will eventually spread throughout the glue, but it will take much longer, and the glue may dry out before the color spreads completely. You may need to cover the samples with plastic wrap and wait a day or two to see the outcome. In salt, the color will soak in and spread a little ways, then stop spreading. In modeling clay, the color will spread out on the surface, but it won't soak in.

The purpose of this experiment is to show that the color spreads evenly in liquids but not in solids. Tell your students they will be able to explain why this happens when they learn more about states of matter in chapter 2. [They will learn that food coloring spreads in liquids because liquid particles are constantly moving in random directions, so liquid molecules essentially stir themselves. The color doesn't spread in solids because solid molecules vibrate and turn, but they stay in one place.]

To conclude the activity, return to slide 4 and make sure your students are satisfied with the class table.

DAY 2 Compare Solids & Liquids, Part 2

This is the second of two days allotted for this activity, described under Day 1 (pages 2-8). If students finish before the end of class, have them get started on Compare Liquids & Gases, described under Day 3.

Big Idea

- Solids and liquids can be described by certain properties, but a given solid or liquid may not have all of those properties. For example, many solids are hard, but some can be molded.

Materials

Teacher:

1. slides – day01.ppt

Students:

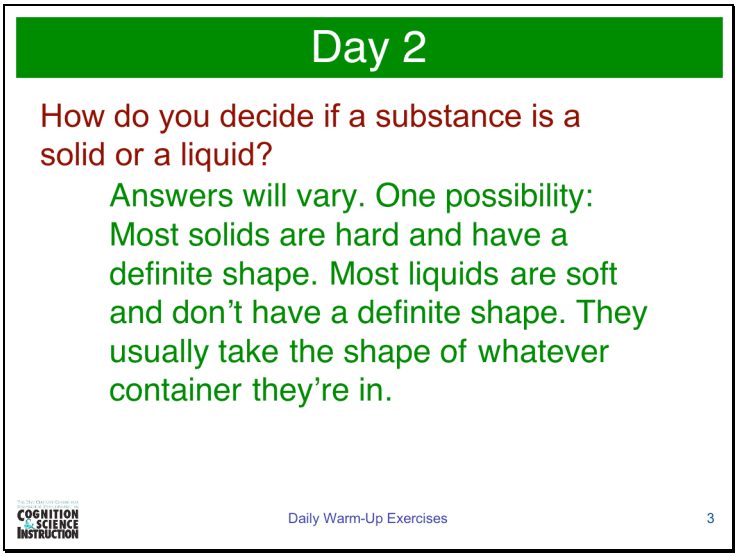
1. cups with samples of modeling clay, salt, water, & white glue
2. hand lenses
3. food coloring

Activities & Allotted Time (40 minutes total)

5 minutes – warm-up activity
35 minutes – cc activity – Compare Solids & Liquids, part 2

Day 2 – Compare Solids & Liquids, Part 2

Warm-Up Activity



If students got to examine the samples before the end of class yesterday, ask if any of their ideas about solids and liquids changed when they looked at the samples.

As an alternative to this slide, you might provide students with samples of "oobleck" or "slime" and ask them to decide whether it's a solid or a liquid and explain why. You can make these samples by mixing water and food coloring with either cornstarch or white glue.

DAY 3

Compare Liquids & Gases

This lesson is contrasting case activity 1.1b.

Big Idea

- Gases are a kind of matter and, like solids and liquids, they can be described by certain properties.
- Gases take up space, and they are compressible (can be squeezed into a smaller space).

Materials

Teacher:

1. slides – day03.ppt
2. small cup with ammonia
3. large jar or beaker
4. red litmus paper

Students:

1. cups with water
2. syringes

Activities & Allotted Time (40 minutes total)

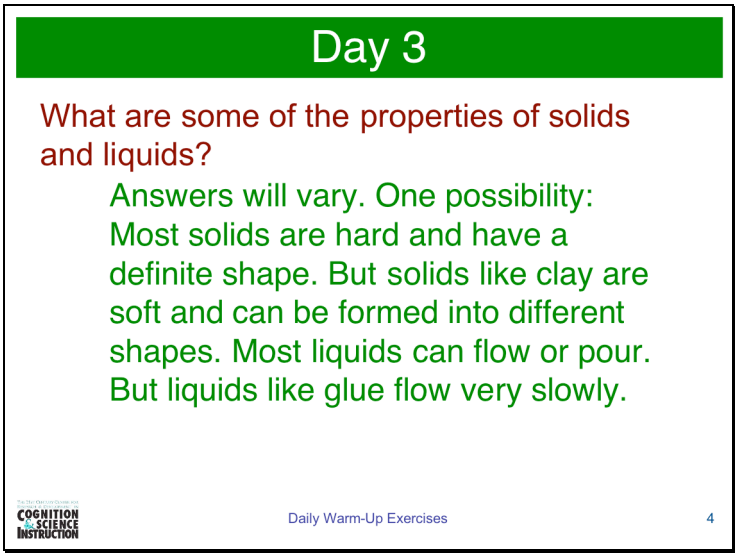
5 minutes – warm-up activity
35 minutes – cc activity – Compare Liquids & Gases

Compare Liquids & Gases

In this contrasting case activity, students will observe two additional properties that they will be able to explain as they learn more about the particles that make up matter. The syringe experiments show that gases can be compressed but liquids can't. They also provide tangible evidence that gases take up space. The ammonia demo shows that gases spread in all directions to completely fill their container, whereas liquids stay at the bottom of their container. (You might tell your students that the gas that causes the color change is correctly called ammonia. The liquid in the cup, which we commonly call ammonia, is actually a solution of ammonium hydroxide.)

Day 3 – Compare Liquids & Gases

Warm-Up Activity



Students may come up with additional properties. Use questions to help them remember what they learned from the samples they examined. For example, if they say liquids take the shape of their container, remind them that a sample of salt takes the shape of its container, even though individual grains have their own shape.

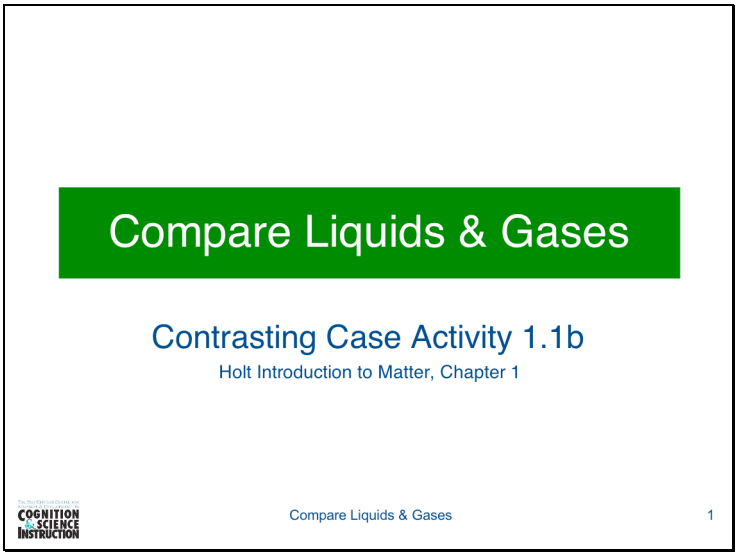
What happened to the food coloring?

The color spread throughout the liquids, although it took a long time to spread throughout the glue. The color spread a little in the salt, and it stayed on the surface of the clay.

Encourage students to share ideas about why this happens. Tell them they'll learn more about this in chapter 2.

Day 3 – Compare Liquids & Gases

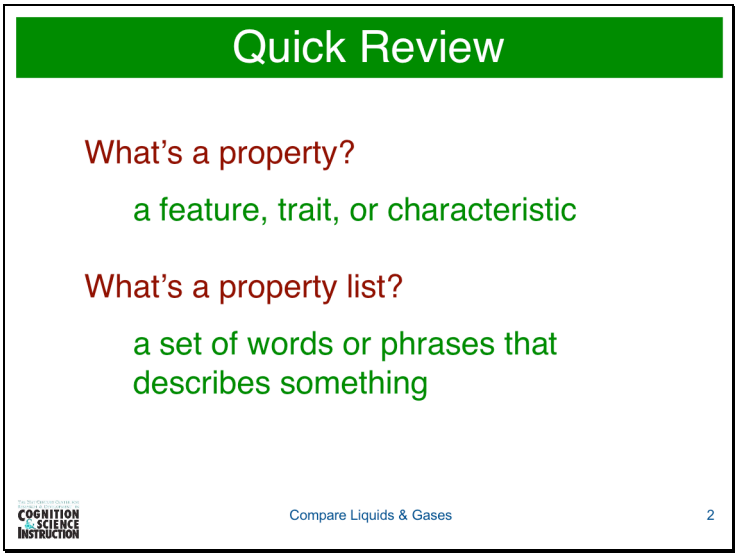
Compare Liquids & Gases (cont.)



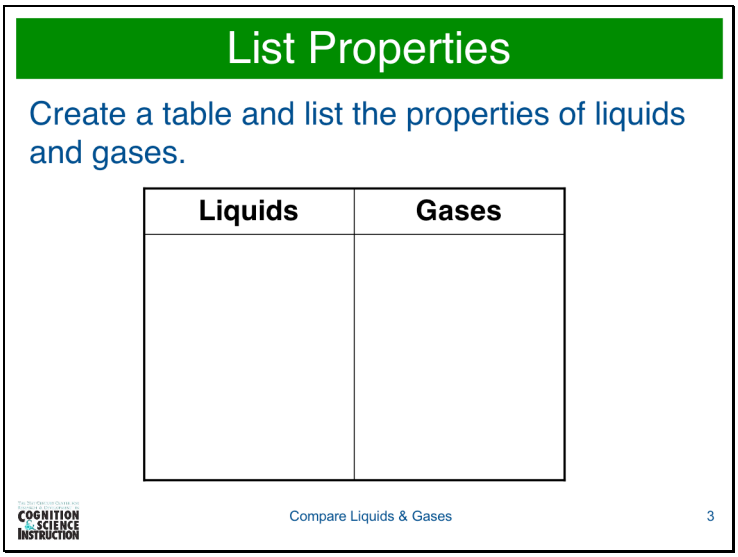
This activity is very similar to Compare Solids & Liquids. Students will record their initial ideas about the properties of liquids and gases. They will then complete an experiment with syringes and revise their lists to include properties revealed by the experiment. Next, they will observe a demonstration involving ammonia and litmus paper and revise their lists to include the outcome they observe.

Day 3 – Compare Liquids & Gases

Compare Liquids & Gases (cont.)



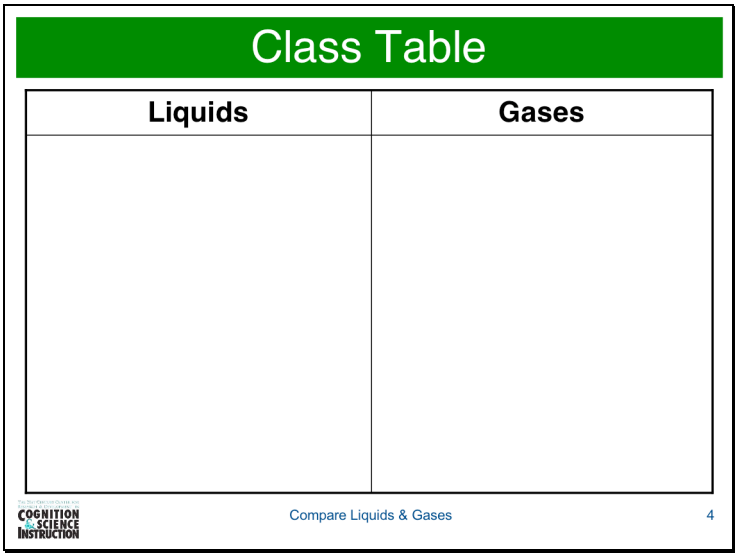
Questions and answers will appear when you click the mouse or press the space bar.



Have students work in groups, then share their ideas with the class. The next slide contains the class table.

Day 3 – Compare Liquids & Gases

Compare Liquids & Gases (cont.)



(Click Escape to stop the slide show. After typing in students' ideas, click the slide show icon at the bottom of the window to display the table.)
Some ideas your students may come up with:

Liquids

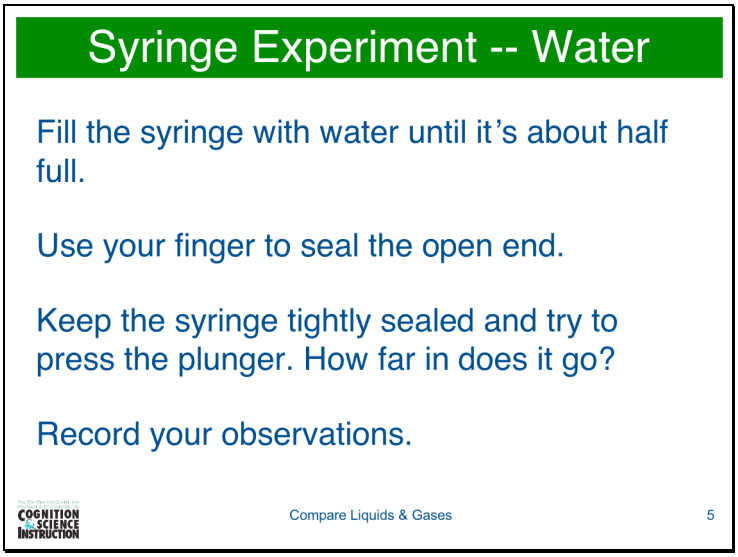
- visible
- take the shape of their container
- can pour and drip
- can be heavy
- can't be inhaled
- can be measured in a cup or graduated cylinder

Gases

- usually invisible
- have no shape
- can't pour or drip
- very light (some may say gases are weightless)
- can be inhaled
- can't be measured -- won't stay in cup

Day 3 – Compare Liquids & Gases

Compare Liquids & Gases (cont.)



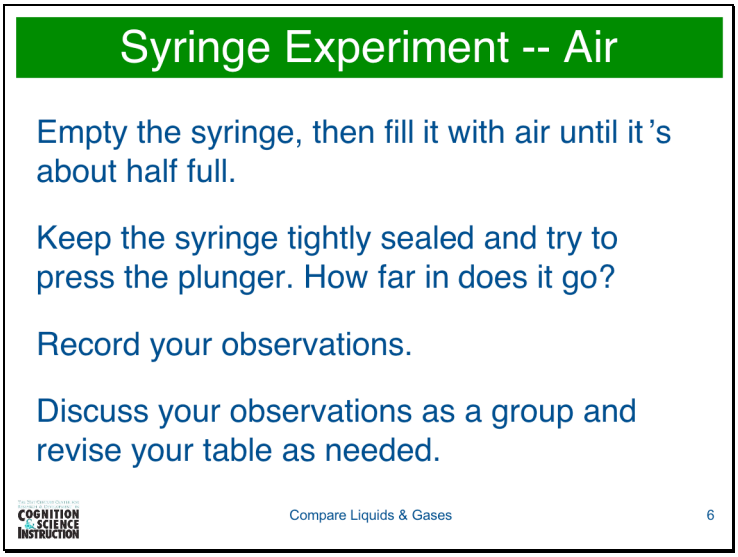
Distribute the syringes and water. If students need to share syringes, make sure they all complete part 1 before moving to part 2.

If they seal the syringes tightly, students will feel strong resistance when they try to press the plunger. The water holds firm and the plunger doesn't seem to move at all.

You might have your students repeat the experiment with a different liquid to determine whether this is true of all liquids or only water.

Day 3 – Compare Liquids & Gases

Compare Liquids & Gases (cont.)



With air, the resistance is very weak at first, but it gets stronger as the plunger is pushed in. The plunger only moves to a certain point. It can't be pushed all the way in without forcing air out. When the plunger is released, it goes back to its original position.

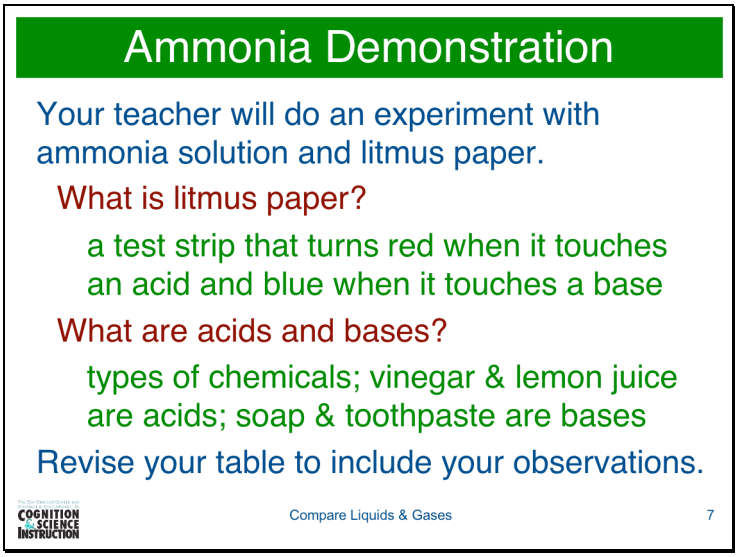
This experiment shows that gases can be compressed (squeezed into a smaller space), but liquids can't. Tell your students they will be able to explain why this happens when they learn more about states of matter in chapter 2. [They will learn that gas particles spread out more than particles of liquids or solids. There is nothing between the particles, so gases contain a lot of empty space.]

This experiment also shows that gases take up space. Many students have difficulty thinking of air and other gases as matter. But when they press the plunger, they can definitely feel that there is something inside the syringe. The air gives up some of its space, but not all of it.

Revise the class table on slide 4 to reflect changes in your students' ideas.

Day 3 – Compare Liquids & Gases

Compare Liquids & Gases (cont.)



Tape a strip of red litmus paper to the inside bottom of a large jar. Pour about a tablespoon of ammonia solution into a small cup. Dip a second strip of litmus paper into the ammonia solution and show students that it turns dark blue. What does this tell us? [ammonia is a base]

Invert the large jar over the ammonia solution and lower it to the table. After a few minutes, the litmus paper will turn dark blue. Ask students to explain how the ammonia solution changed the litmus paper without touching it. [Some of the ammonia solution evaporated, forming a gas that spread from the cup to the top of the jar. In chapter 2, students will learn that liquid particles move all around within their container, but most don't move fast enough to pull away from the other liquid particles. Those that do evaporate and become gas particles, which spread in all directions, including upward to the top of the jar.]

To conclude the activity, return to slide 4 and make sure your students are satisfied with the class table.

DAY 4

Matter & Volume

This lesson covers the first two parts of section 1.1 (pages 4-6). It incorporates two contrasting case demos and a quick lab, which follows the second demo.

Big Ideas

- Matter is anything that has mass and takes up space.
- Objects with more mass feel heavier than objects with less mass.
- The amount of space something takes up is called volume.
- Displacement is a procedure for measuring volume.

Materials

Teacher:

1. vocabulary list – IM word list.doc
2. objects A and B (see page 21 of this document)
3. graduated cylinders
4. water

Students:

1. cup
2. crumpled paper
3. container with water
4. pencil

Activities & Allotted Time (40 minutes total)

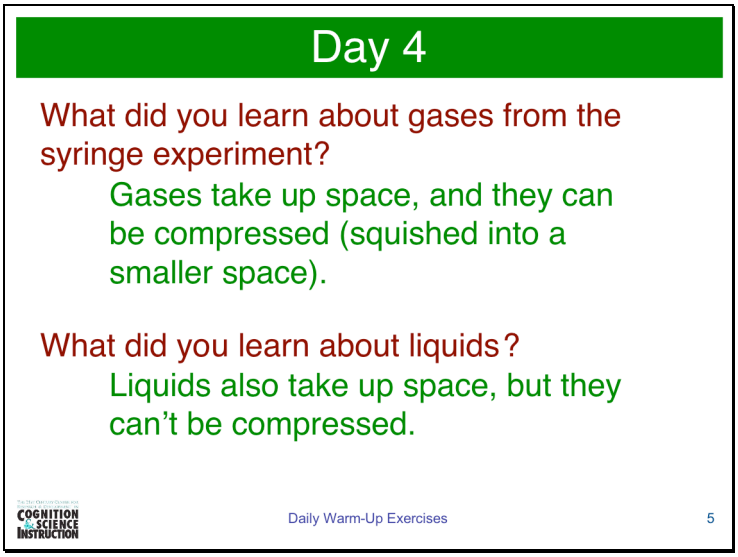
5 minutes – warm-up activity
5 minutes – chapter 1.1, part 1 – *Matter*
5 minutes – cc-demo-1.1a – What is Mass?
10 minutes – chapter 1.1, part 2 – *Matter & Volume*
5 minutes – cc-demo-1.1b – Predict Displacement
10 minutes – quick lab – *Space Case* – page 5

Chapter 1.1, part 1

Part 1 defines **matter** as anything that has mass and takes up space. Encourage your students to explain the meaning in their own words, then complete the first demo to introduce the idea that objects with more mass feel heavier than objects with less mass.

Day 4 – Matter & Volume

Warm-Up Activity



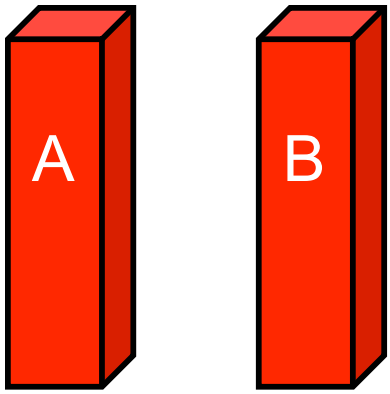
With the air syringe, what happened when you pushed the plunger in and then let it go?

It goes back out.

Encourage students to share ideas about why this happens, then tell them that they'll learn more about this in chapter 2.

Day 4 – Matter & Volume

cc-demo-1.1a – What is Mass?
Objects A and B are two rectangular prisms, each made of a different metal. They have been painted the same color, so they are identical except that one is much heavier.



Hold up objects A and B and remind students that matter is defined as anything that has mass and takes up space. Ask if objects A and B take up the same or different amounts of space. Once everyone agrees that they take up the same amount of space, explain that, to compare mass, they need to feel the objects. While bringing the objects around, tell students that neither object is hollow – both are completely solid. Once everyone has held the objects, explain that they feel different because they have different masses. The object that feels heavier has more mass, and the object that feels lighter has less. Tell your students that mass is different from weight, and that they'll learn how they are different in a few days.

Chapter 1.1, part 2
Part 2 (Matter & Volume) describes volume as how much space something takes up, or how much a container holds or can hold. Students learn that liquids can be measured with measuring cups or graduated cylinders, that the volume of a box-shaped object can be found by measuring and multiplying its dimensions, and that we can use displacement to measure an irregularly shaped object. At that point, you will use objects A and B to demonstrate that displacement depends on volume and not mass (cc-demo-1.1b).

Day 4 – Matter & Volume

cc-demo-1.1b – Predict Displacement
To make sure everyone understands the question you are going to ask, have someone demonstrate how to use the graduated cylinder to measure the volume of an irregularly shaped object. Once everyone seems to agree that the change in water level shows the volume of the object, hold up objects A and B and ask students to predict whether they will displace the same or different amounts. Many will think the heavier object will push harder, so the water will rise higher.

After students share predictions and explain their thinking, demonstrate that both objects displace the same amount. Use questions to elicit the idea that mass (heaviness) depends on two things: how much space an object takes up (volume) and what kind of stuff fills that space. Introduce the term **material** to refer to the kind of stuff something is made of. Use questions to help students conclude that displacement only shows how much space an object takes up (volume), not what the space is filled with (material). Don't be surprised if some of the students who seem convinced today revert to the "heavier pushes more" idea within a day or two. You may need to use variations of this demo/discussion several times over spaced intervals to help those students stay convinced.

Quick Lab – *Space Case*
The lesson ends with a quick lab in which students find that a crumpled paper in the bottom of an inverted cup stays dry because air takes up space. You might conclude the lesson by asking what other activity showed that air takes up space. [The syringe experiment showed that you can squeeze air into a smaller space, but you can't push the plunger all the way in because it does take up some space.]

DAY 5

Compare Balance & Spring Scale

This lesson is the first part of contrasting case activity 1.1c. The second part will be completed on day 6, after students are introduced to the terms mass and weight.

Big Idea

- The spring scale measurement is different on the moon than on Earth, but the balance measurement is the same.

Materials

Teacher:

1. slides – day05.ppt
2. two-pan balance
3. spring scale

Students:

1. four drawings – worksheets 1-4

Activities & Allotted Time (40 minutes total)

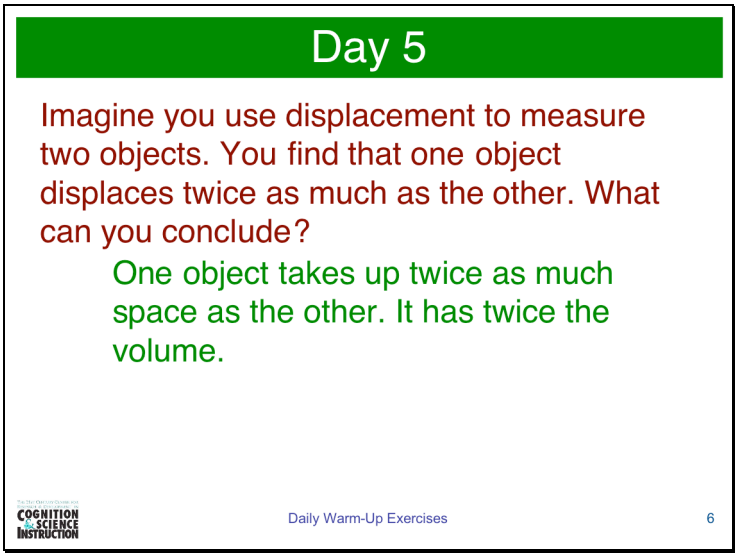
5 minutes – warm-up activity
10 minutes – teacher demo of balance and spring scale
25 minutes – cc activity – Compare Balance & Spring Scale, part 1

Teacher Demo of Balance & Spring Scale

In the contrasting case activity, students will examine drawings of objects being measured on a balance and a spring scale. To make sure they understand the drawings, show your students an actual example of each and demonstrate how they are used. If you don't have access to a two-pan balance (see drawing on page 27), use a meter stick and hang buckets or cups from either end.

Day 5 – Compare Balance & Spring Scale

Warm-Up Activity



What does displacement measure?
volume; how much space something takes up

What is matter?
anything that has mass and takes up space

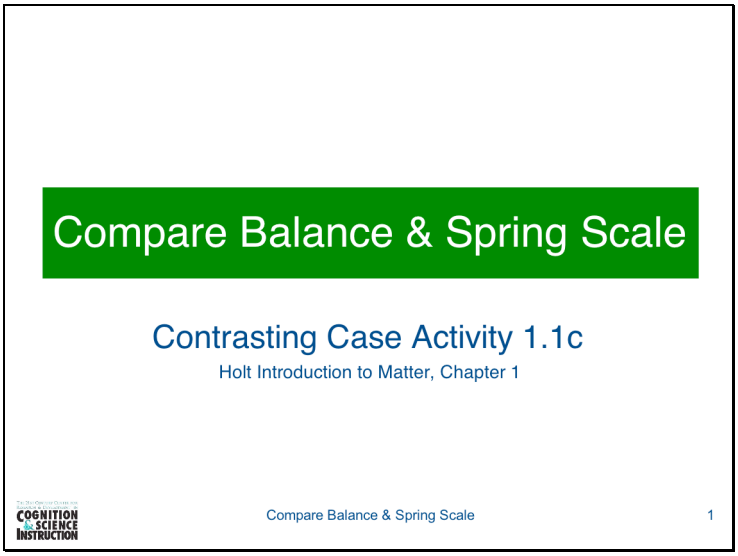
What is material?
the kind of stuff something is made of

Can you say anything about the materials the objects are made of?
no, displacement tells how much space something takes up;
it doesn't tell anything about what's in that space

If anyone says the object that displaced more is heavier, ask about objects A & B or redo the demonstration so they can see again that the heavier object doesn't displace more water.

Day 5 – Compare Balance & Spring Scale

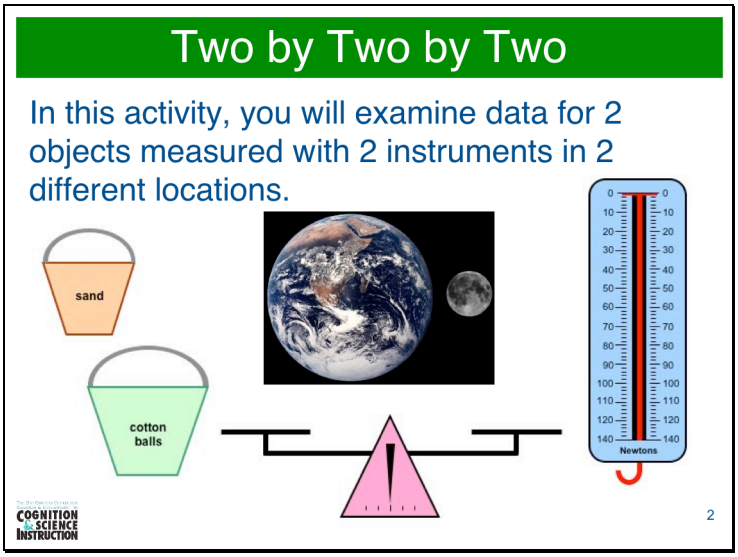
Compare Balance & Spring Scale, part 1



In this activity, students will examine four drawings. Each drawing shows an object being measured on two instruments -- a balance and a spring scale. The object in the first drawing is a bucket of sand, and the second drawing shows a bucket of cotton balls. The third and fourth drawings are the same, except the objects are being measured on the moon.

Day 5 – Compare Balance & Spring Scale

Compare Balance & Spring Scale, part 1 (cont.)

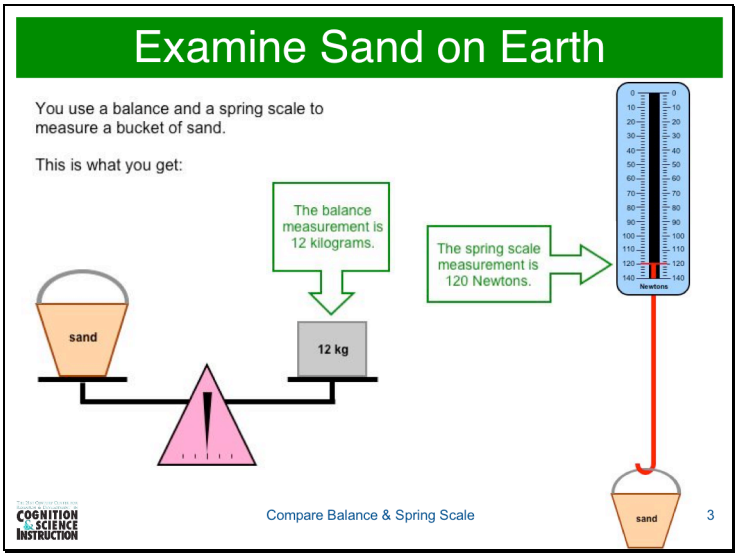


See if students can identify the objects, instruments and locations depicted on this slide.

The 2 objects are a bucket of sand and a bucket of cotton balls.
The 2 instruments are a balance and a spring scale.
The 2 locations are the Earth and the moon.

Day 5 – Compare Balance & Spring Scale

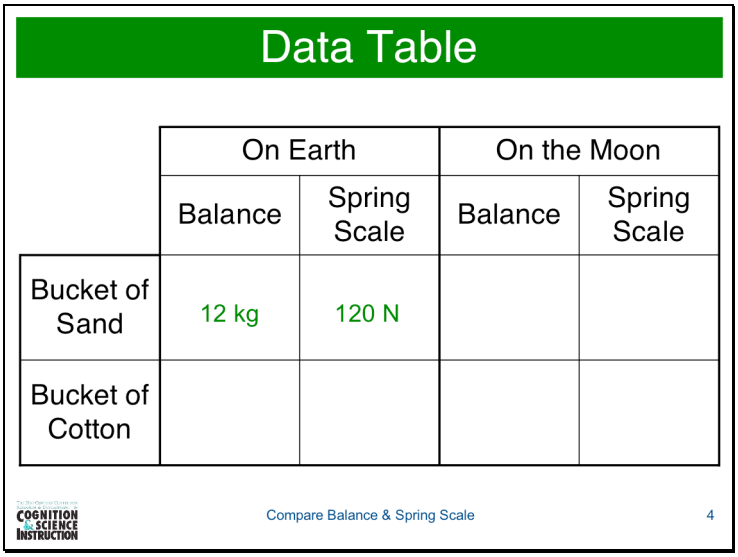
Compare Balance & Spring Scale, part 1 (cont.)



Distribute the first two drawings (worksheets 1 & 2), and ask students to look at the one that shows Sand on Earth. To make sure students connect the drawings with the instruments you used in the teacher demo, encourage students to identify similarities and differences between the actual balance and spring scale and the drawings. Provide help as needed so everyone understands how to read the balance and spring scale measurements.

Day 5 – Compare Balance & Spring Scale

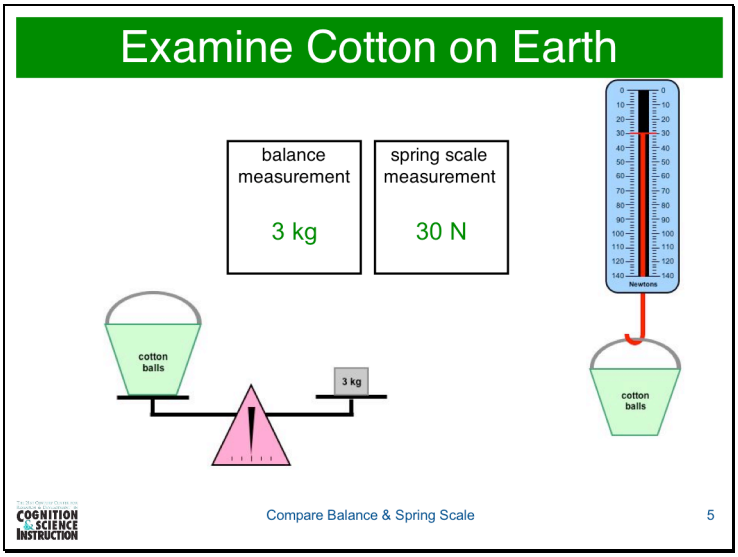
Compare Balance & Spring Scale, part 1 (cont.)



Use questions to get students to describe how this table is organized, then ask someone to show where they would enter the measurements from the first drawing. [Data entries will appear separately on keypress.]

Day 5 – Compare Balance & Spring Scale

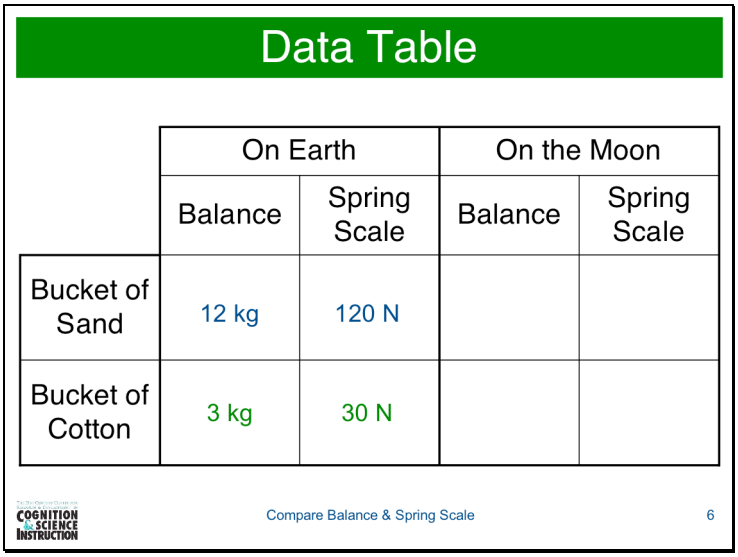
Compare Balance & Spring Scale, part 1 (cont.)



Ask students to look at the drawing that shows Cotton on Earth. Have them work individually or in pairs to figure out what to write in the measurement boxes. [Measurements will appear separately on keypress.]

Day 5 – Compare Balance & Spring Scale

Compare Balance & Spring Scale, part 1 (cont.)



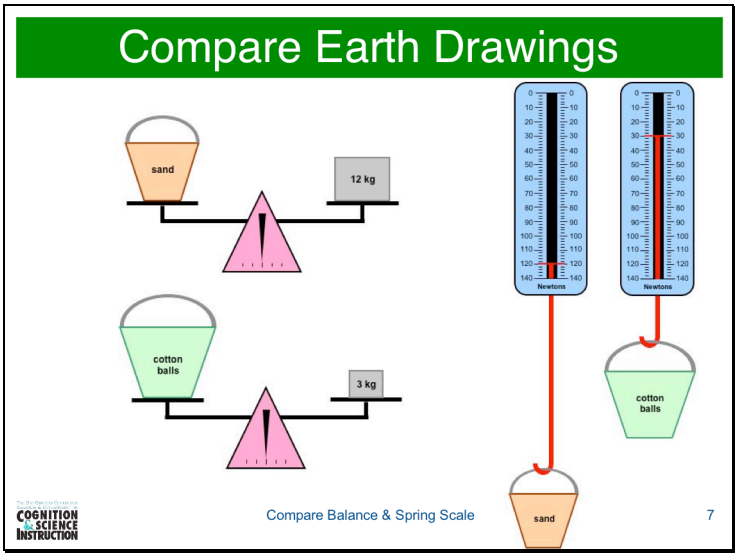
Data Table

	On Earth		On the Moon	
	Balance	Spring Scale	Balance	Spring Scale
Bucket of Sand	12 kg	120 N		
Bucket of Cotton	3 kg	30 N		

Ask someone to show where they would enter the measurements from the second drawing.

Day 5 – Compare Balance & Spring Scale

Compare Balance & Spring Scale, part 1 (cont.)

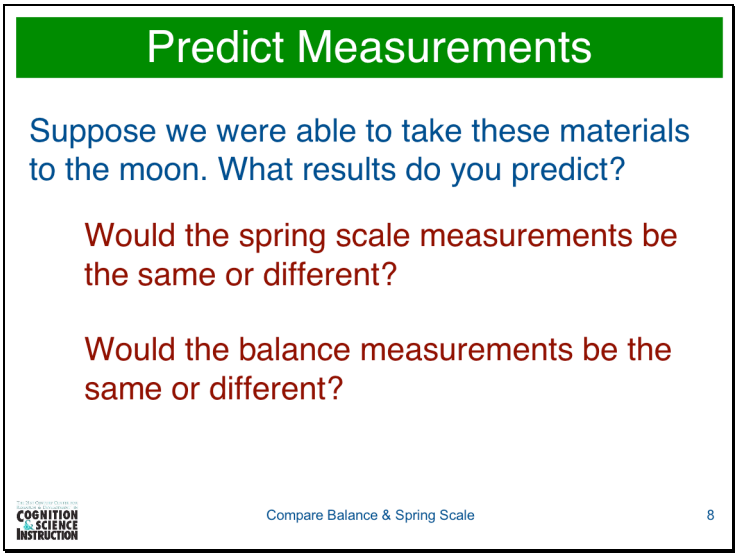


Ask your students to identify similarities and differences between the two drawings.

Both show an object being measured on a balance and a spring scale.
Both objects are buckets that contain a material.
Neither drawing shows how much material is in the bucket.
The materials are different.
The buckets are different sizes and colors.
The measurements are different.
Students may notice that, in both drawings, the number of Newtons is 10 times the number of kilograms.
They may also notice that each measurement for sand is 4 times that measurement for cotton balls.

Day 5 – Compare Balance & Spring Scale

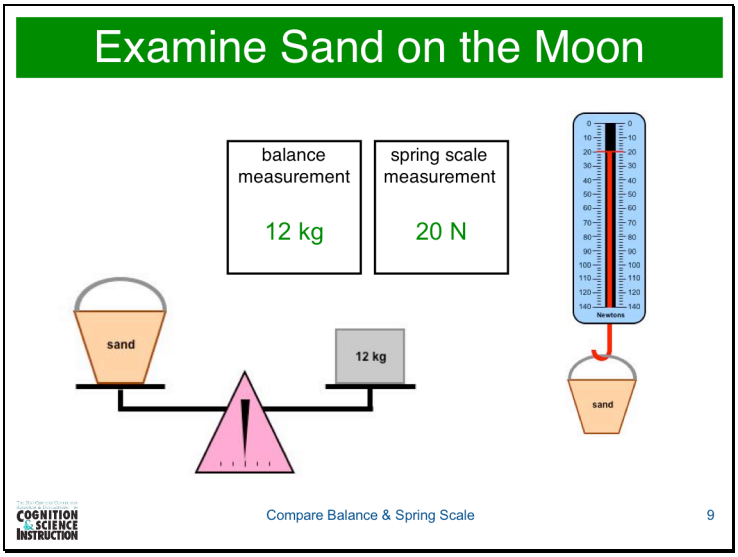
Compare Balance & Spring Scale, part 1 (cont.)



Have students discuss their predictions in pairs or groups, then share ideas with the class. Encourage them to explain their reasoning. If they think one or both measurements will change, ask them to estimate what the new value will be.

Day 5 – Compare Balance & Spring Scale

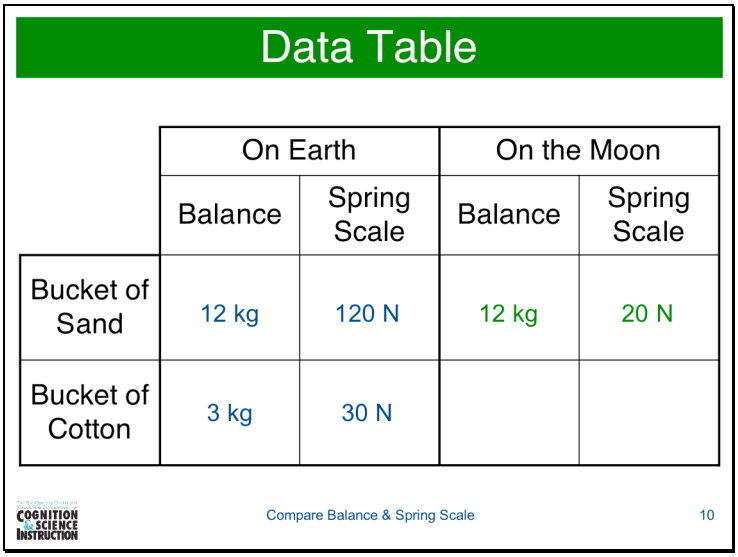
Compare Balance & Spring Scale, part 1 (cont.)



Distribute the third and fourth drawings (worksheets 3 & 4) and ask students to look at the drawing that shows Sand on the Moon. Have them work individually or in pairs to figure out what to write in the measurement boxes.

Day 5 – Compare Balance & Spring Scale

Compare Balance & Spring Scale, part 1 (cont.)



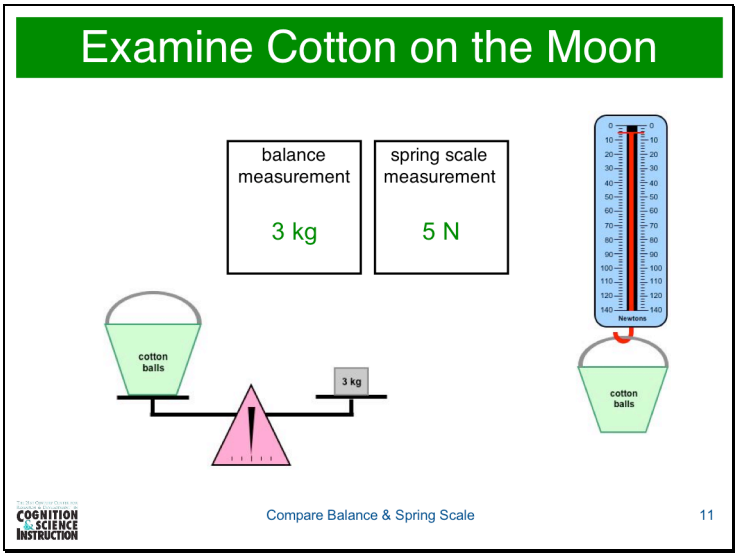
Data Table

	On Earth		On the Moon	
	Balance	Spring Scale	Balance	Spring Scale
Bucket of Sand	12 kg	120 N	12 kg	20 N
Bucket of Cotton	3 kg	30 N		

Ask someone to show where they would enter the measurements from the third drawing.

Day 5 – Compare Balance & Spring Scale

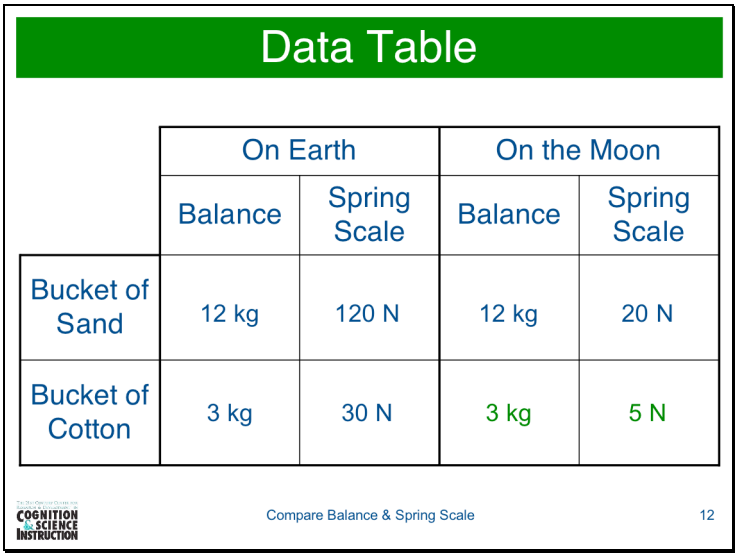
Compare Balance & Spring Scale, part 1 (cont.)



Ask students to look at the last drawing, which shows Cotton on the Moon. Have them work individually or in pairs to figure out what to write in the measurement boxes.

Day 5 – Compare Balance & Spring Scale

Compare Balance & Spring Scale, part 1 (cont.)

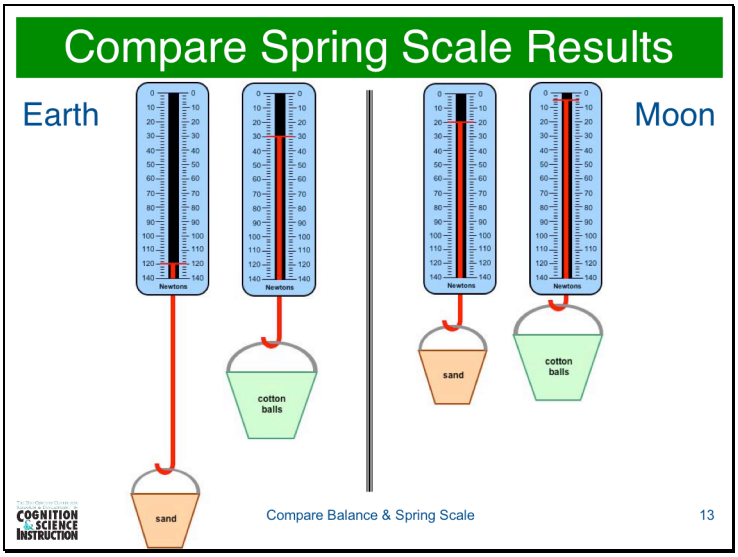


When the last two entries appear, the table will be complete. Ask your students how these results compare with their predictions.

You can use slide 13 to help students draw conclusions about the four spring scale measurements, and slide 14 shows the four balance measurements.

Day 5 – Compare Balance & Spring Scale

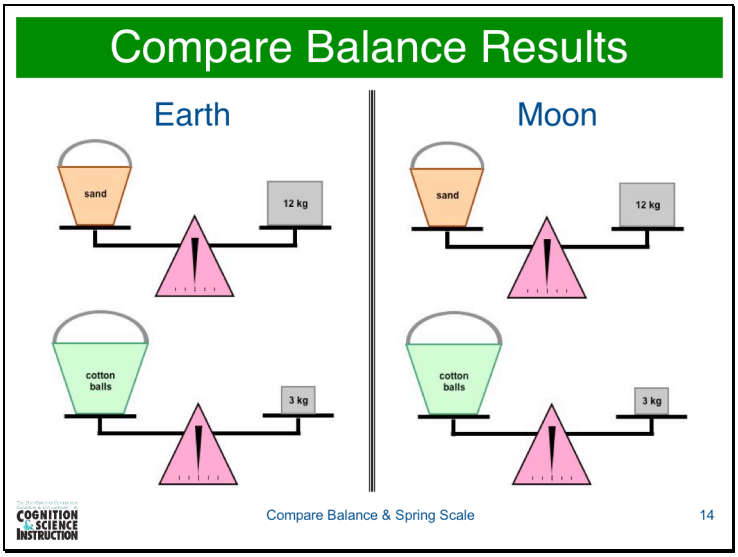
Compare Balance & Spring Scale, part 1 (cont.)



Most students will expect both instruments to measure less on the moon than on Earth, so the spring scale results will not be surprising or difficult for them to accept. A few students may think there is no gravity on the moon, and they may or may not believe what the drawings show. You might encourage those students to write a brief research report about the moon's gravity.

Day 5 – Compare Balance & Spring Scale

Compare Balance & Spring Scale, part 1 (cont.)

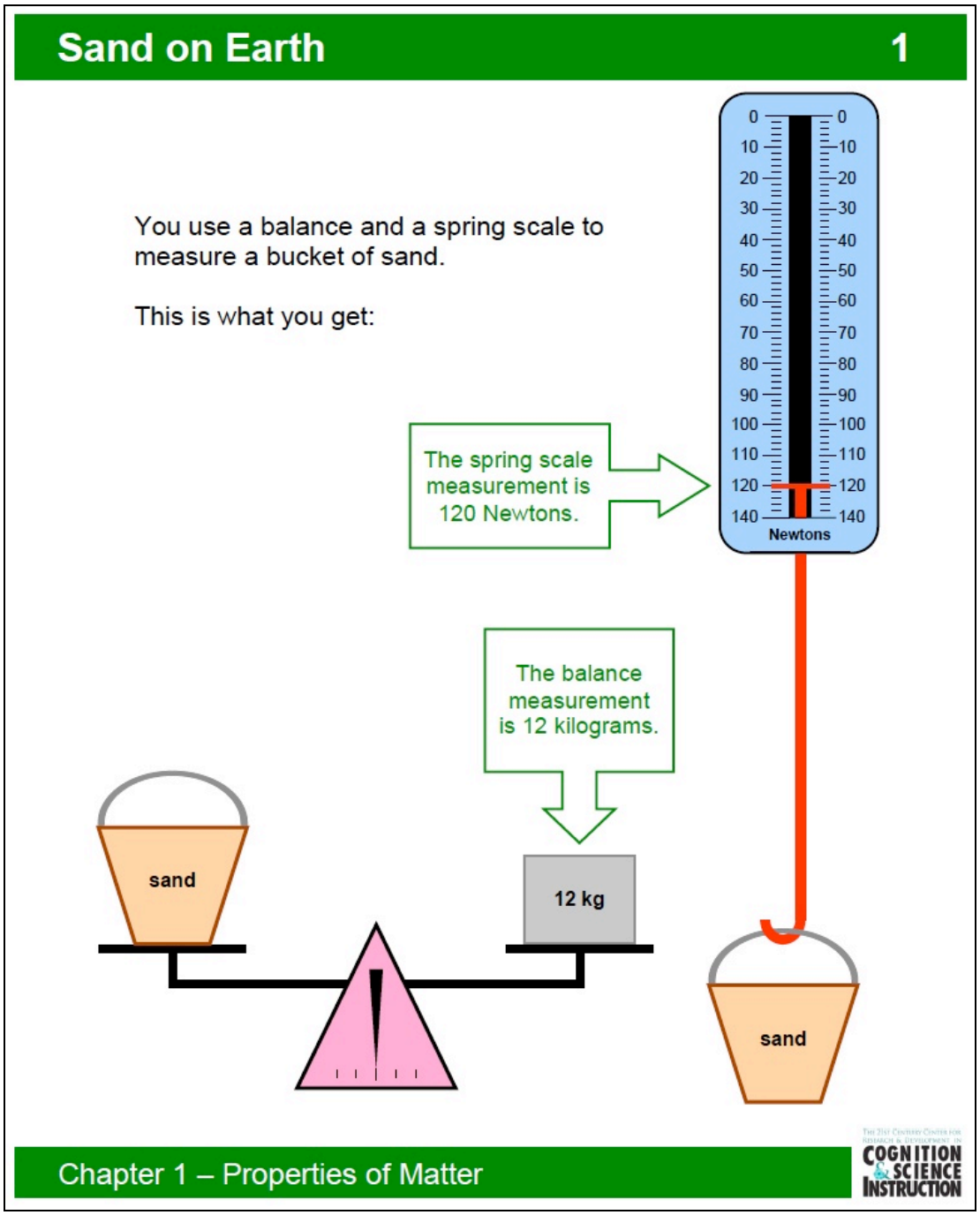


Most students will be surprised to find that the balance measurements on the moon are the same as they are on Earth. You might elicit a few explanations as to why this might be so, then tell students they'll come back to this shortly.

On day 6, students will learn that weight is a measure of the force of gravity on an object, and that weight changes when gravity changes. Mass is the amount of matter in an object, and it doesn't change when gravity changes. At that point, you will return to this scenario and ask students to explain why the spring scale measurements are different on the moon but the balance measurements are the same. They should conclude that a two-pan balance measures mass and a spring scale measures weight (see page 45).

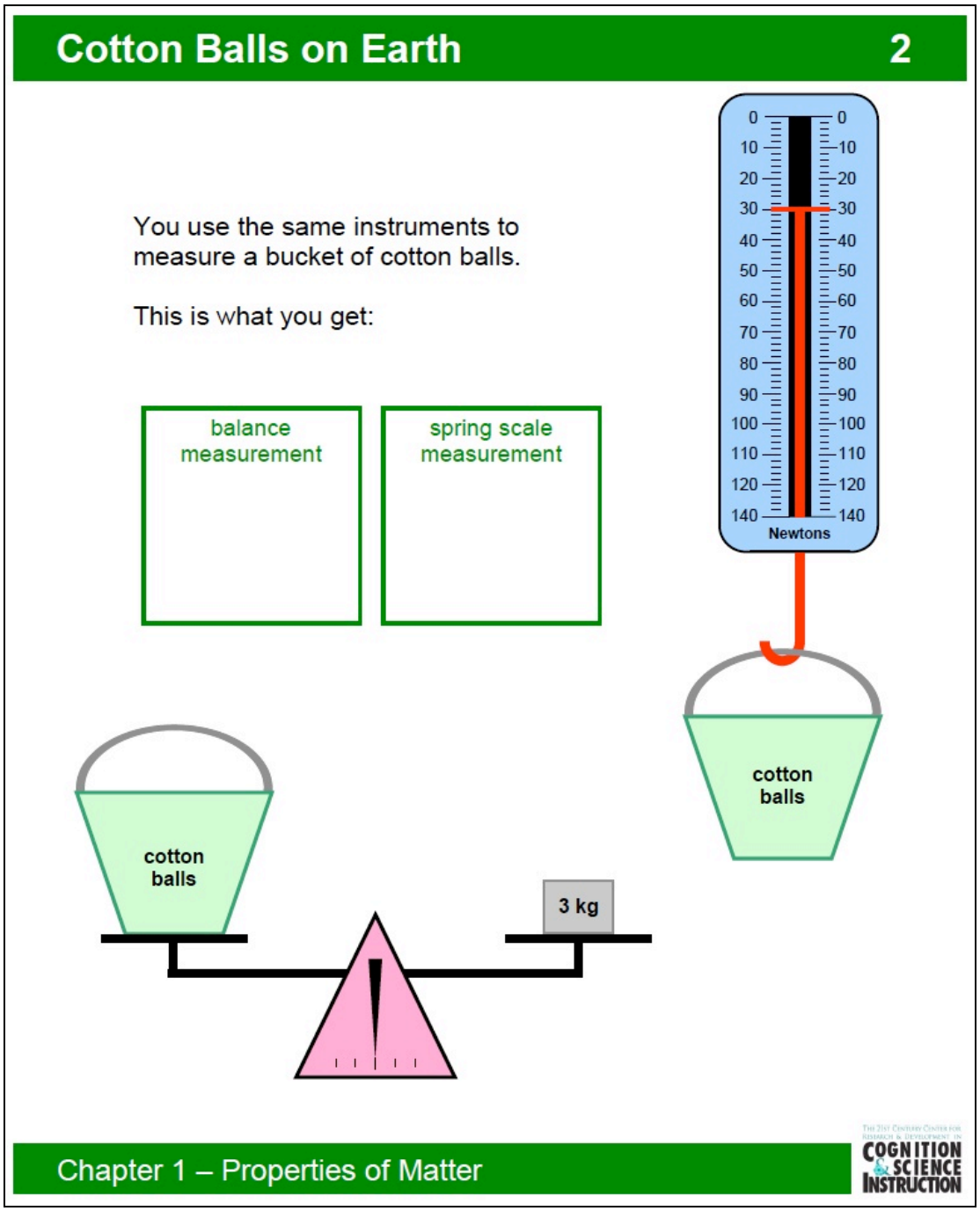
Day 5 – Compare Balance & Spring Scale

Worksheet 1



Day 5 – Compare Balance & Spring Scale

Worksheet 2



Day 5 – Compare Balance & Spring Scale

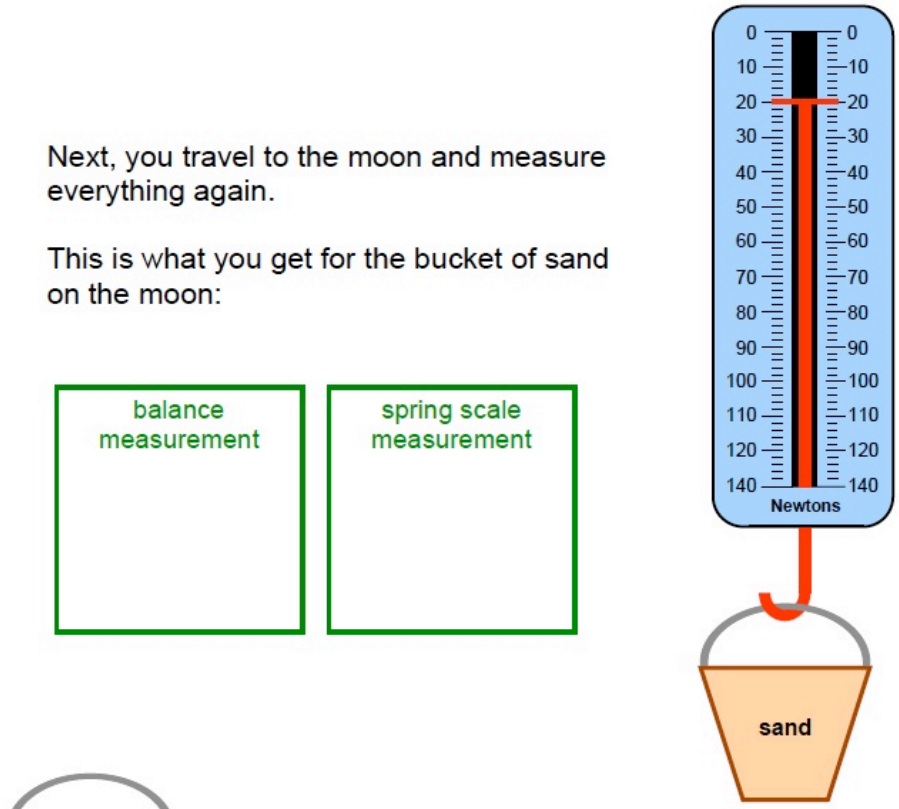
Worksheet 3

Sand on the Moon 3

Next, you travel to the moon and measure everything again.

This is what you get for the bucket of sand on the moon:

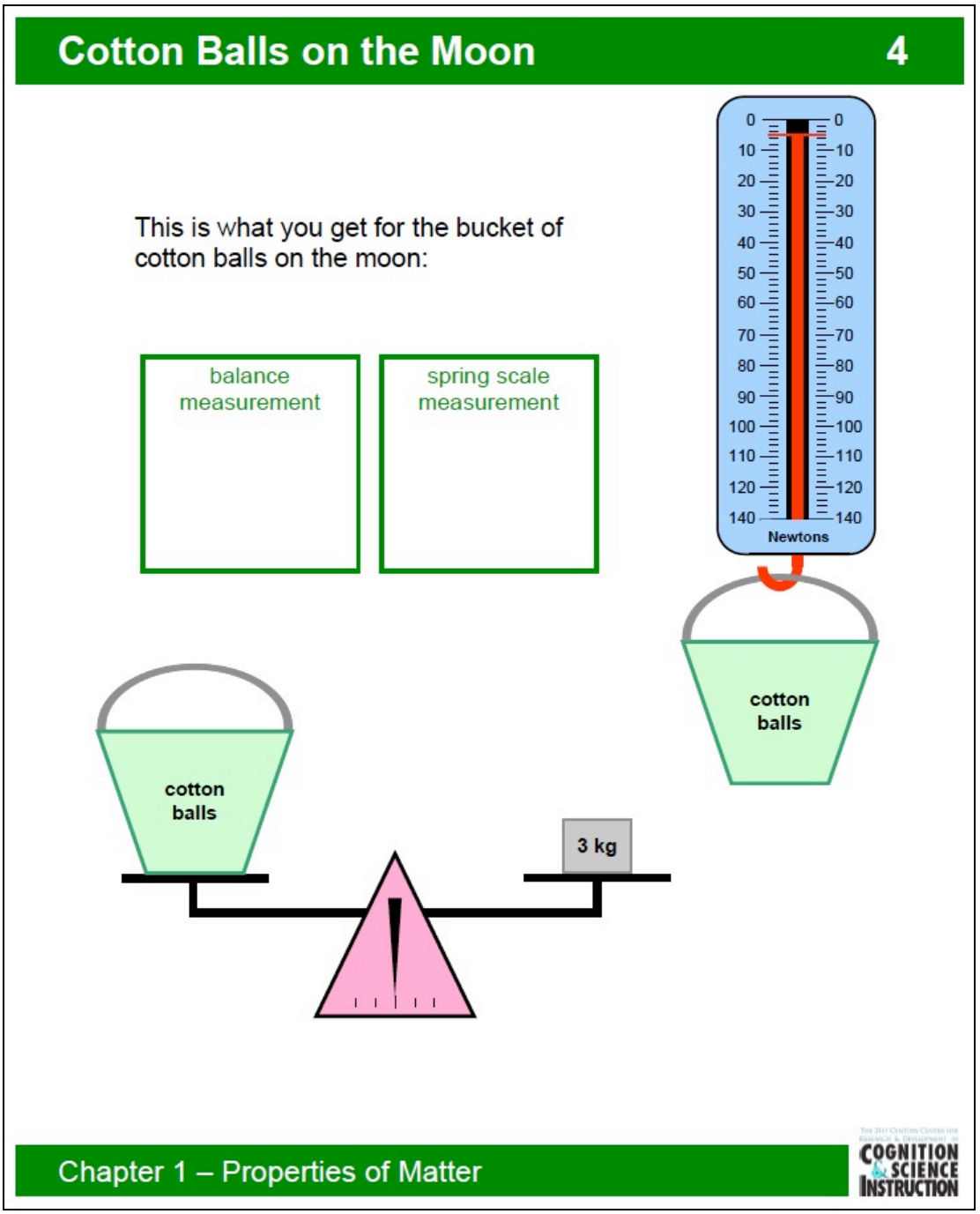
balance measurement	spring scale measurement



Chapter 1 – Properties of Matter

Day 5 – Compare Balance & Spring Scale

Worksheet 4



DAY 6

Mass & Weight

This lesson covers the last two parts of section 1.1 (pages 7-9). It incorporates one contrasting case demo and the conclusion of contrasting case activity 1.1c.

Big Ideas

- The spring scale measurement is different on the moon than on Earth, but the balance measurement is the same.
- Mass is the amount of matter in an object or sample.
- Weight changes when gravity changes, but mass stays the same.

Materials

Teacher:

1. slides – day06.ppt
2. two trash bags
3. meter stick

Students:

none

Activities & Allotted Time (40 minutes total)

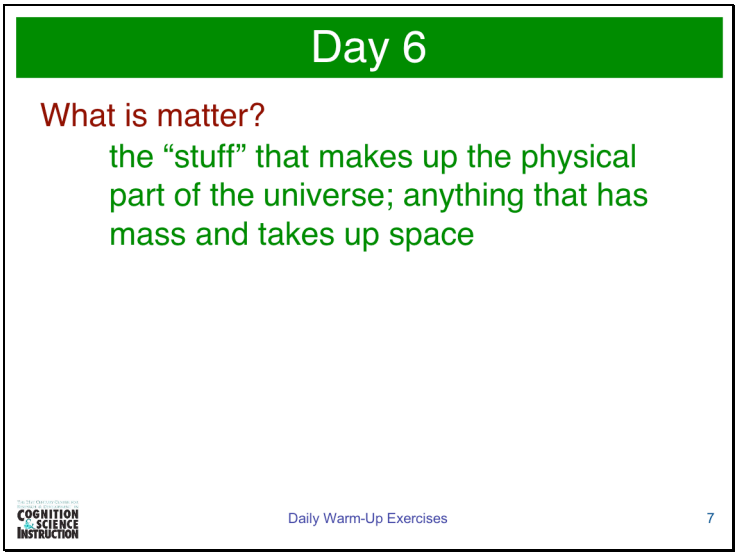
5 minutes – warm-up activity
5 minutes – chapter 1.1, part 3 – *Matter & Mass*
10 minutes – cc-demo-1.1c – Air has Mass
15 minutes – Compare Balance & Spring Scale, part 2
5 minutes – chapter 1.1, part 4 – *Inertia*

Chapter 1.1, part 3

Part 3 (Matter & Mass) defines mass as a measure of the amount of matter something contains. Ask students to describe the displacement demo. They should recall that objects A and B displaced the same amount of water, so displacement depends on volume, not heaviness. Remind students that mass depends on how much space something takes up (volume) and what the space is filled with (material). Ask why objects A and B have different mass. [They have the same volume, but one is made of a material that contains more matter.]

Day 6 – Mass & Weight

Warm-Up Activity



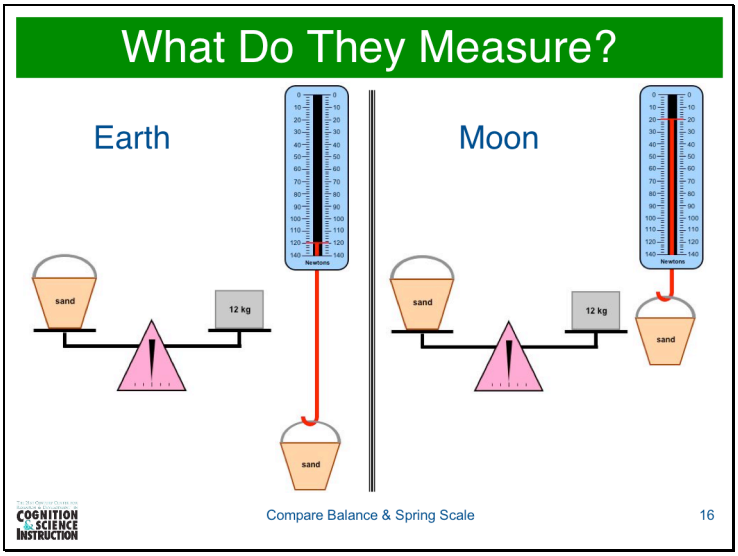
Does air take up space?
yes
How do you know?
In the syringe experiment, you can't push the plunger all the way in.

cc-demo-1.1c – Air has Mass
Begin by eliciting your students' ideas about whether air has mass and, if so, can they think of a way to prove it. Show that, if you suspend an empty trash bag from each end of a meter stick, the stick will balance. If you fill one bag with air, that side will go lower because it has more mass (contains more matter).

Introduce the term **weight** as a measure of the force of gravity acting on an object. Tell students they will learn more about gravity in the Forces, Motion & Energy module.

Day 6 – Mass & Weight

Compare Balance & Spring Scale, part 2



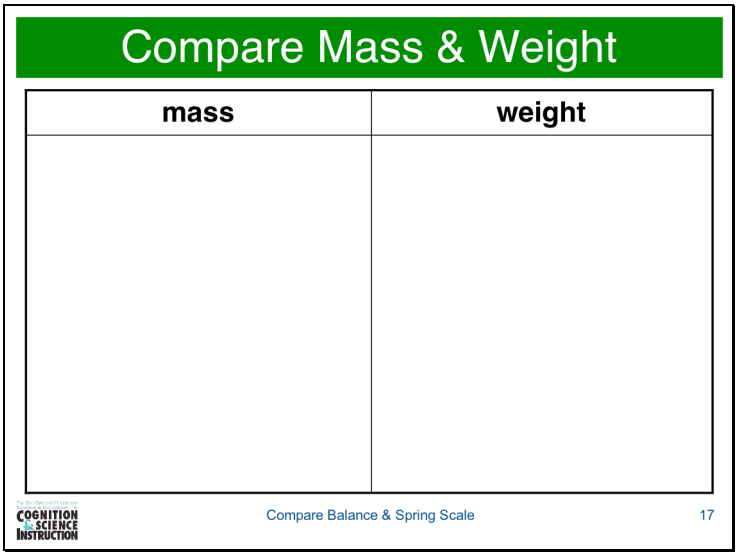
Students should recognize that the spring scale measures weight because it changes when gravity changes. Weight is defined as a measure of the force of gravity acting on an object. The spring scale shows that the force of gravity acting on each object is less on the moon than on Earth.

You may need to offer some hints to help students see that the balance measures mass. Mass is a measure of the amount of matter something contains. According to the balance, the bucket of sand and the 12-kilogram block contain the same amount of matter on Earth and on the moon. Mass depends on volume and the kind of material something is made of. The balance shows that both volume and material are the same on the moon as on Earth.

To conclude the activity, have students work in groups to generate a table comparing mass and weight. The next slide contains a blank table you can use to record ideas your students all agree on.

Day 6 – Mass & Weight

Compare Balance & Spring Scale, part 2 (cont.)



(Click Escape to stop the slide show. After typing in their ideas, click the slide show icon at the bottom of the window to display the table.)
Emphasize that mass stays the same no matter where the object is located. Weight changes when gravity changes.
Some ideas your students may come up with:

MASS

measure of matter in an object or substance
depends on volume & kind of material
stays the same everywhere
measured on a balance
units include grams, kilograms & milligrams

WEIGHT

measure of gravity acting on an object or substance
depends on mass & strength of gravity
changes when gravity changes
measured on a spring scale
units include Newtons, pounds, & ounces

DAY 7

Compare Clay & Water, Part 1

This lesson opens with four exercises that introduce the visualization component of our modifications. This component is designed to help students develop the skills needed to understand and learn from visual images. The images in today's exercises focus on volume, providing a timely review of ideas that students will apply in today's contrasting case activity.

Big Idea

- Mass and volume change with sample size. If the sample size doubles, the mass and volume of the sample double as well.

Materials

Teacher:

1. slides – day07.ppt
2. modeling clay
3. water
4. graduated cylinder
5. balance

Students:

1. data table – worksheet 5

Activities & Allotted Time (40 minutes total)

5 minutes – warm-up activity
2 minutes – visualization 1.1a – Zoom
3 minutes – visualization 1.1b – Relative Scale & Magnification
2 minutes – visualization 1.1c – Arrows
3 minutes – visualization 1.1d – Captions
25 minutes – cc activity – Compare Clay & Water, Part 1

Compare Clay & Water

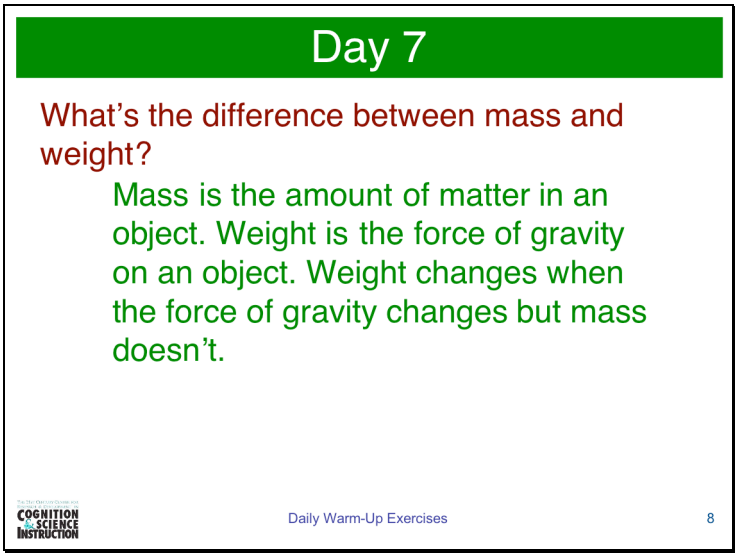
In this activity, students explore relationships among mass, volume, and density by identifying patterns in data. Please note that students are not expected to collect the mass and volume data themselves. Rather, student volunteers

Day 7 – Compare Clay & Water, Part 1

Compare Clay & Water (cont.)
demonstrate how to measure the mass and volume of clay and water. At that point, students are given a table of mass and volume measurements, and they use the data to draw conclusions about what happens to volume and mass when a sample is divided in half.

If your students need hands-on experience with measuring volume and mass, we suggest you have them do only the whole and half samples of each material. At that point, distribute the data table (worksheet 5) and have students use that data to identify patterns and draw conclusions.

Warm-Up Activity



Would your weight be different on Mars than it is on Earth?
Yes, because gravity is different on Mars, and weight changes when gravity changes.

Would your mass be different?
No, because mass depends on how much space you take up and what that space is filled with. Neither of those things would be different on Mars.

Day 7 – Compare Clay & Water, Part 1

Visualization Exercise 1.1a – Zoom

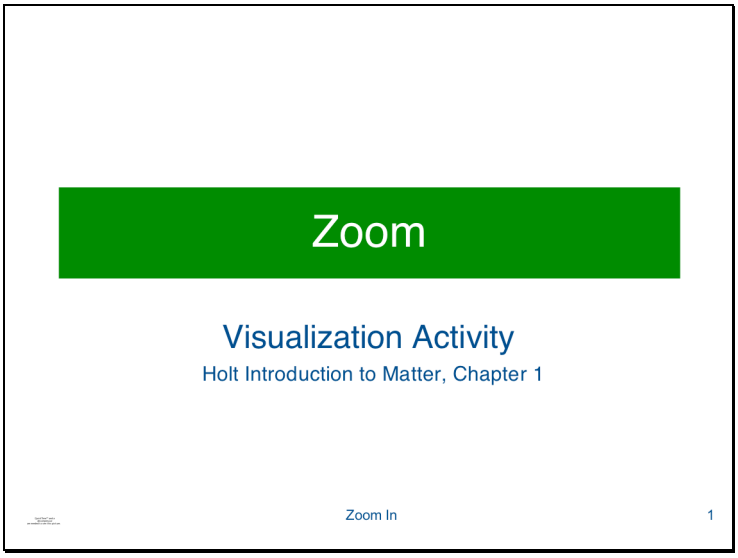


Image Comprehension Focus: Zoom

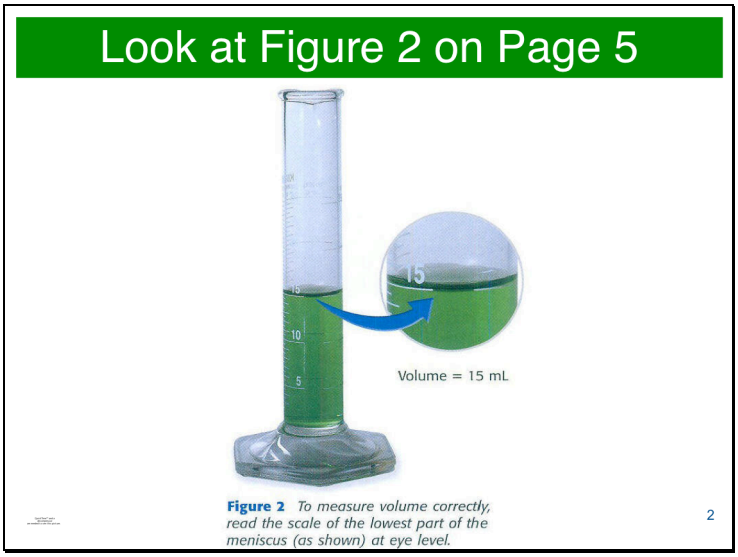
Goal: To build understanding of what a "zoom" convention illustrates

Type of Activity: Teacher Comment

Overview: This activity is designed to help the students develop their understanding of the "zoom" convention by explicitly discussing how the scale of the image changes in a zoom, and to explicitly teach typical cues that indicate part of the image is magnified (is "zoomed").

Day 7 – Compare Clay & Water, Part 1

Visualization Exercise 1.1a – Zoom (cont.)



Procedure: Direct students to look at p. 5/Fig 2. Point out that the circle located to the right of the graduated cylinder illustrates what it would look like if one was looking more closely at the part of the cylinder where the arrow originates. The idea is the same as when you look through a magnifying glass so you can see small things more clearly. (See note below). In this example, the magnified circle shows the meniscus at a larger scale, and allows the viewer to read the graduated cylinder more clearly. Conclude this explanation with the comment that images often have clues that they are using a "zoom-in" convention and that the cue in this image is the blue arrow that connects the original image and the magnified circle.

NOTE: It might be worthwhile to provide an opportunity where students can experience using a device to change the magnification of an object. One option would be to have them use hand-held magnifying glasses to examine an object or image - such as the writing on a piece of paper - and discuss how the image changes. (Using the magnifying glass allows one to see details that cannot be seen by using one's eyes only.)

(End of this activity)

Day 7 – Compare Clay & Water, Part 1

Visualization Exercise 1.1b – Relative Scale & Magnification

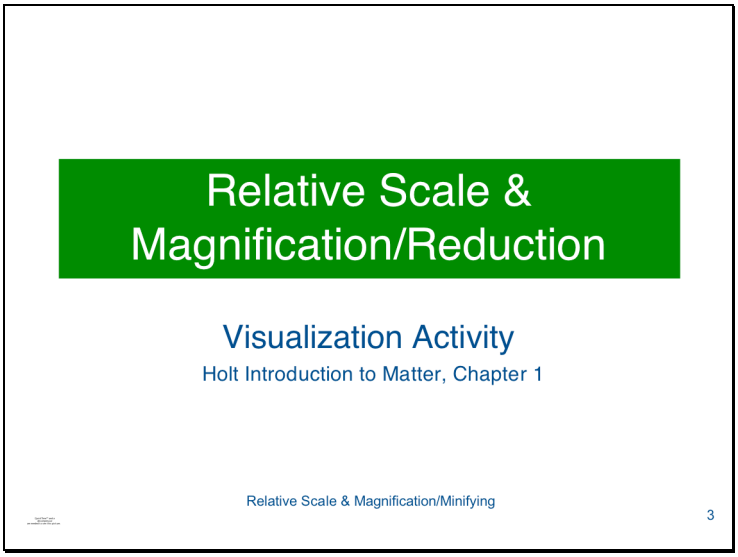


Image Comprehension Focus: Relative scale & Magnification/Minifying

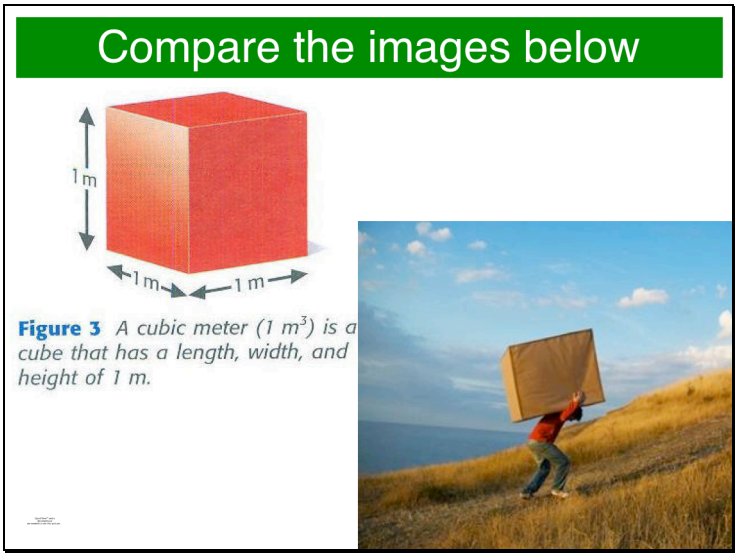
Goal: To develop a sense of 1 meter and to understand that the size of an image in a diagram may not be representative of the size of the object in reality.

Type of Activity: Teacher Demo & Teacher Comment

Overview: The purpose of this activity is to develop a sense of the length of 1 meter and to highlight that diagrams may not represent the actual size of an object, rather the image of an object is often magnified or reduced to facilitate visualization and comprehension. This type of understanding is important so that students can understand the concept of scale in diagrams, and to avoid the misconception that diagrammatic representations are always realistic and reflect the actual properties of objects.

Day 7 – Compare Clay & Water, Part 1

Visualization Exercise 1.1b – Relative Scale & Magnification (cont.)



Teacher Comment: The teacher should emphasize that a $1m^3$ cube is represented by the red cube which (as printed in the book), has an actual length, width and height of 0.016 m. A 1 cubic meter cube in reality is actually about the size of a big parcel box (see image on the lower right corner). To help students get an intuitive sense of how long a meter really is, the teacher can mention a cube that is a cubic meter is quite large compared to a person, and is about the size shown in the image.

(End of this activity)

Day 7 – Compare Clay & Water, Part 1

Visualization Exercise 1.1c – Arrows

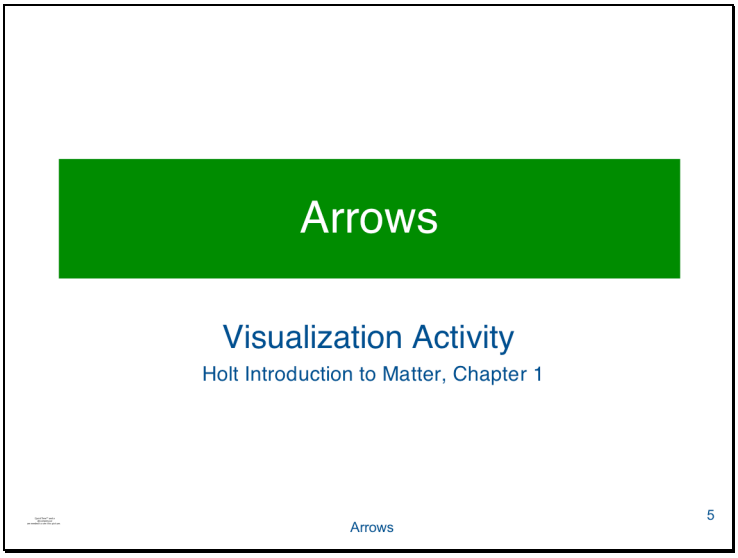


Image Comprehension Focus: Arrows

Goals: Understand how arrows can show the length of a line or part of a line in an image

Type of Activity: Teacher Comment

Overview: In addition to their roles in indicating changes in magnification and zoom-in, arrows can also be used to indicate the length that a line or part of a line represents in an image. The teacher can explain that in this image the three pairs of arrows function the same way: each pair has two arrows pointing at the opposite ends of an edge of the cube, and indicate the length that the edge represents.

Day 7 – Compare Clay & Water, Part 1

Visualization Exercise 1.1c – Arrows (cont.)

Look at Figure 3 on Page 6

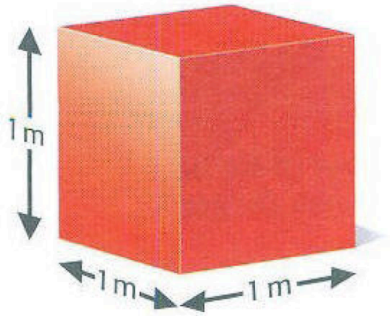


Figure 3 *A cubic meter (1 m^3) is a cube that has a length, width, and height of 1 m.*

Teacher Comment: Arrows in diagrams have multiple usage. One of them is to indicate the length of a line or part of a line in an image, as in Figure 3 on Page 6. The teacher can explain that in this image the three pairs of arrows function the same way: each pair has two arrows pointing at the opposite ends of an edge of the cube. This image uses a common convention, in which the length is written in between the two arrows.

(End of activity)

NOTE: This activity could also be done as a student-directed inquiry activity. Give the kids the diagrams and ask them to indicate what they think the arrows are indicating, and then facilitate a discussion to help them comprehend the correct interpretation.

Day 7 – Compare Clay & Water, Part 1

Visualization Exercise 1.1d – Captions

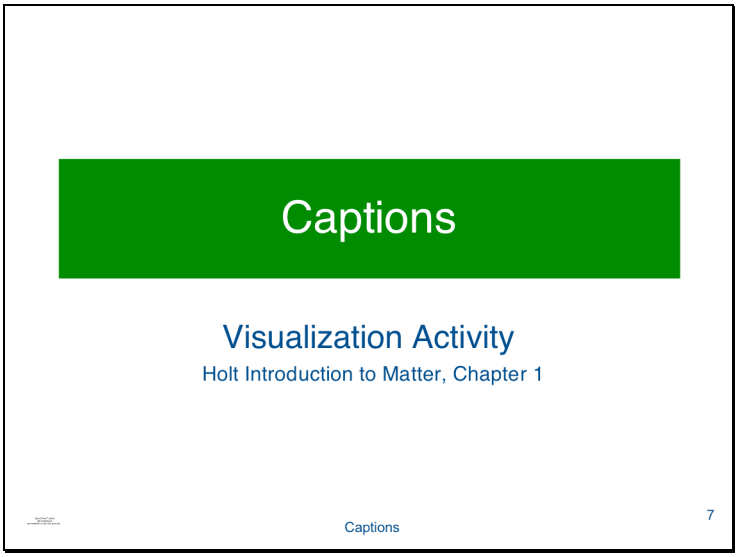


Image comprehension focus: Captions

Goal: To reinforce the idea that captions are extremely important when looking at an image since they often provide information that is crucial to understanding the diagram.

Overview: This activity is designed for students to practice the concept that captions are critical to read when viewing a diagram or image. The goal is to give them an experience that reinforces the importance of captions, and to encourage them not to skip them when viewing images.

Day 7 – Compare Clay & Water, Part 1

Visualization Exercise 1.1d – Captions (cont.)

Look at Figure 4 on Page 6

Figure 4 *The 12-sided object displaced 15 mL of water. Because 1 mL = 1 cm^3, the volume of the object is 15 cm^3.*

8

Student Activity: The teacher should ask the students to look at p.6/fig4 silently. After thirty seconds, the teacher should ask the students to close their books and write down the answers to the following questions:
What is the object that is put in the graduated cylinder? (A 12-sided object)
How much water does the object displace? (15 mL)
How many cm^3 does 1 mL equal? (1 cm^3 = 1 mL)

After allowing the students a few minutes to jot down their responses individually, the teacher should ask for a show of hands of who could answer the questions. Next the teacher should ask for a show of hands as to who read the caption. The teacher should then have the students look back at the figure and explain that the answers to the three questions were only available in the caption. If one just looked at the image, he/she would not know the answers. The teacher should conclude the activity by re-emphasizing the importance of captions and the vital role they play in understanding images.

(End of activity)

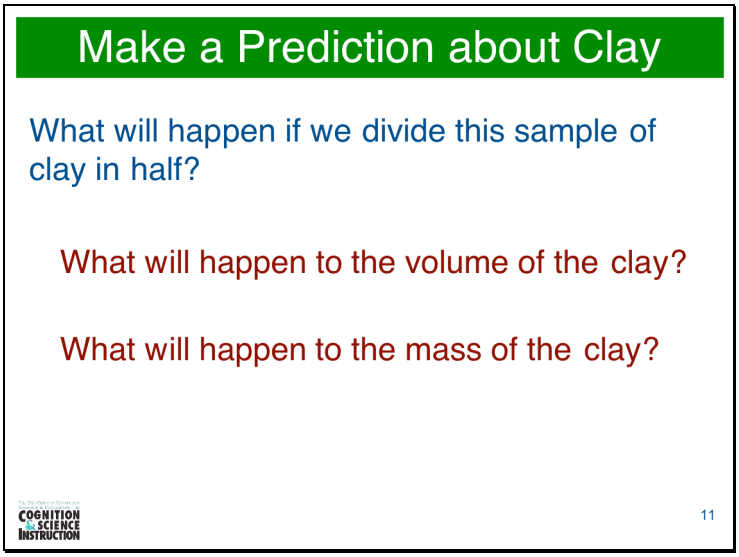
Day 7 – Compare Clay & Water, Part 1

Compare Clay & Water, Part 1

In part 1, students explore relationships among mass and volume by identifying patterns in data.

Day 7 – Compare Clay & Water, Part 1

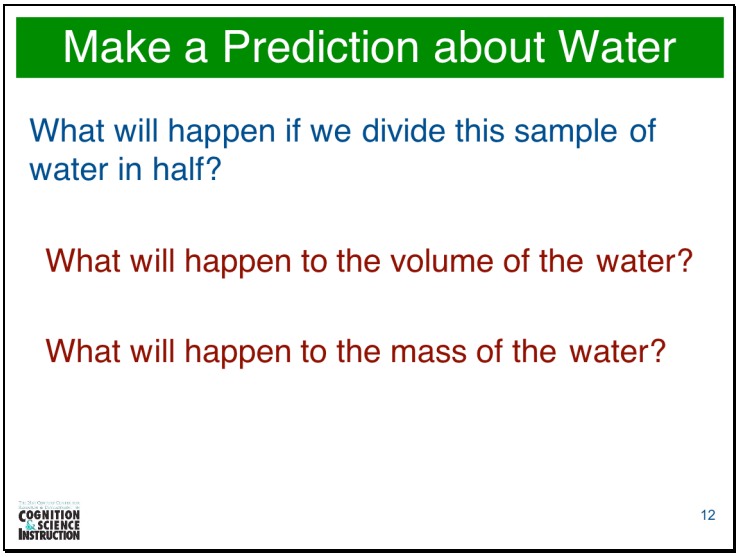
Compare Clay & Water, Part 1 (cont.)



Hold up the sample of modeling clay and tell students what it is. Ask students to think about each question on the screen as it appears. Give them a minute to record their own predictions, another minute to discuss their predictions in groups, and two or three minutes to share ideas with the class.

Day 7 – Compare Clay & Water, Part 1

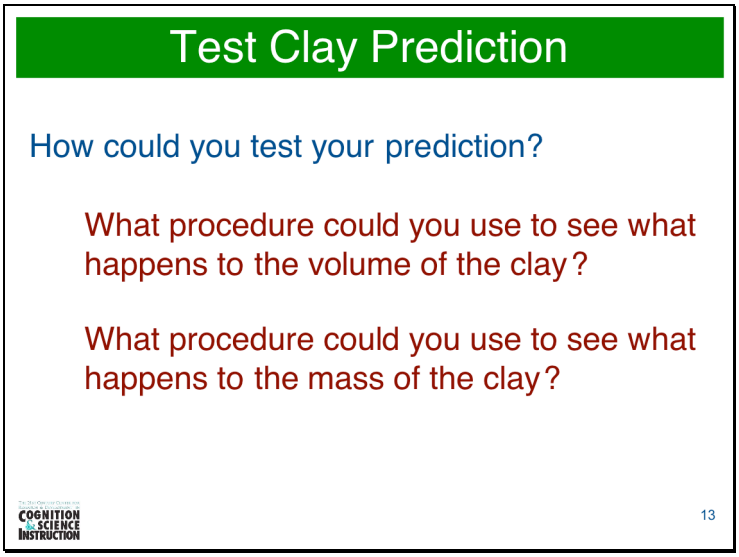
Compare Clay & Water, Part 1 (cont.)



Hold up the sample of water and ask students if their predictions about water would be the same as or different from their predictions about clay. Again, have students record their own predictions, discuss them in groups, and share with the class.

Day 7 – Compare Clay & Water, Part 1

Compare Clay & Water, Part 1 (cont.)

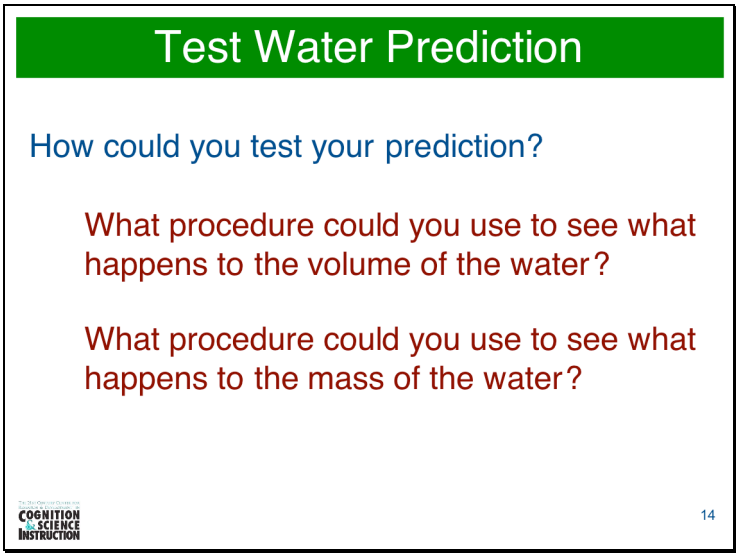


Students should recognize that they need to measure and record the volume and mass of the whole sample, then divide the sample in half and measure the volume and mass again. When someone mentions a specific measurement, ask them to come up and show how they would go about it. If you have a new box of modeling clay, you might use a whole bar as your sample. In that case, students could simply measure and multiply the dimensions to find the volume. If the sample is irregularly shaped, they will need to use displacement.

For mass, the sample can be placed directly on the balance and measured in grams before and after being divided in half.

Day 7 – Compare Clay & Water, Part 1

Compare Clay & Water, Part 1 (cont.)

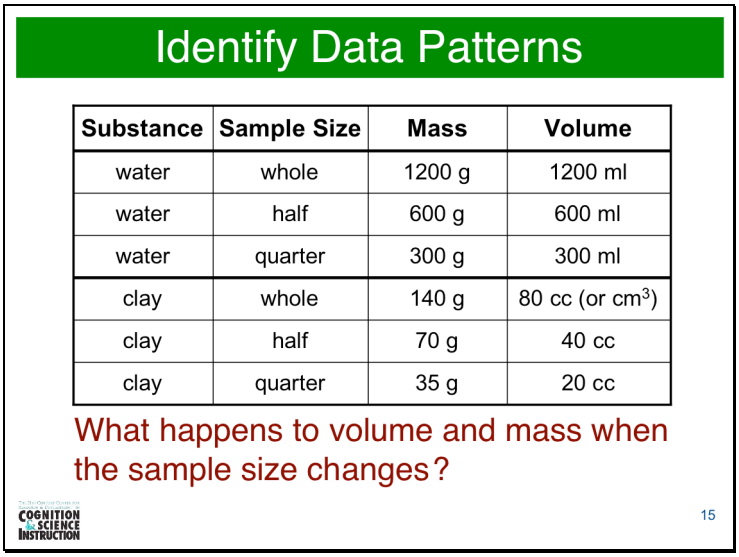


Again, when someone mentions a specific measurement, ask them to come up and demonstrate it. The volume can be measured by pouring the whole sample into a graduated cylinder. If needed, show students how to use a syringe to adjust the volume of the second sample to half the volume of the first.

For mass, the graduated cylinder can be placed on the balance before and after the sample is divided, but students will need to account for the mass of the container. They could measure and subtract the mass of the graduated cylinder or, if you have a pan balance, they could place an identical container on the opposite pan.

Day 7 – Compare Clay & Water, Part 1

Compare Clay & Water, Part 1 (cont.)

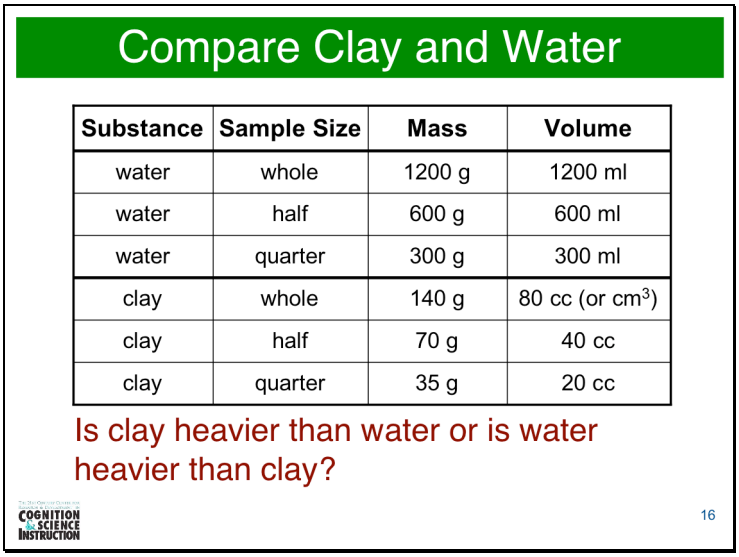


Distribute the table of mass and volume measurements (Worksheet 5). Point out that the volume units are different for water and clay. Explain that, in the Holt text, liquids are usually measured in milliliters (ml) and solids are usually measured in cubic centimeters (cc or cm3). Have students work in groups to identify patterns in the data, then share ideas with the class.

For water, whenever volume or mass changes, the other measurement changes by exactly the same amount. This is also true for clay, but some students may need help to see it. When looking for number patterns, middle school students tend to add and subtract rather than multiply and divide. For example, looking at the first two clay samples, they are likely to say the mass decreases by 70 and the volume decreases by 40. To help them see the pattern, ask what happens to to the volume of the clay each time the sample is cut in half. They should see that 40 is half of 80, and 20 is half of 40. In other words, each time the sample is divided in half, the volume divides in half as well. The mass numbers for clay are more complicated, but students should ultimately conclude that the same thing happens to mass.

Day 7 – Compare Clay & Water, Part 1

Compare Clay & Water, Part 1 (cont.)



The question will appear on keypress. The table values are designed to make comparisons difficult because, at this point, we want students to understand the question and begin to think about how to find the answer. Encourage your students to express their ideas, but don't give them any feedback yet. Because the mass values for water are much larger than those for clay, some students may conclude that water is heavier. Others may object that it's not fair to compare masses when the volumes are so different. Some students may think clay is heavier than water but be unable to explain why or use data from the table to support their position. Tell students they'll come back to this shortly.

Day 7 – Compare Clay & Water, Part 1

Worksheet 5

Compare Clay & Water 5

Substance	Sample Size	Mass	Volume	
water	whole	1200 g	1200 ml	
water	half	600 g	600 ml	
water	quarter	300 g	300 ml	
clay	whole	140 g	80 cc (or cm^3)	
clay	half	70 g	40 cc	
clay	quarter	35 g	20 cc	

Chapter 1 – Properties of Matter

DAY 8

Compare Clay & Water, Part 2

This lesson covers the first two pages of section 1.2 (pages 10-11) and the second half of contrasting case activity 1.2a.

Big Ideas

- Mass is the amount of matter in an object or sample.
- Density is the amount of matter in a given amount of space.
- Density does not change with sample size. It is a property of the material that makes up the sample.

Materials

Teacher:

1. slides – day08.ppt
2. sample of modeling clay
3. sample of water

Students:

1. data table – worksheet 5
2. calculators

Activities & Allotted Time (40 minutes total)

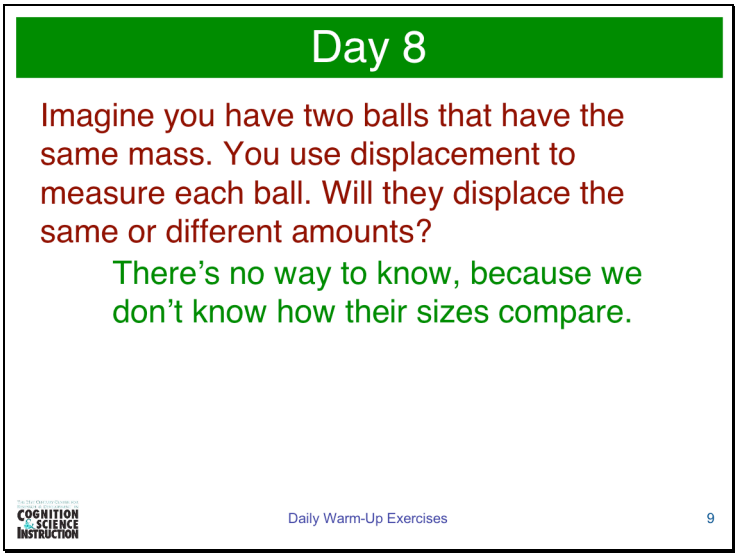
5 minutes – warm-up activity
10 minutes – chapter 1.2, part 1a – *Physical Properties* (pp. 10-11)
25 minutes – cc activity – Compare Clay & Water, Part 2

Chapter 1.2, Part 1

Pages 10 and 11 define physical property and provide several examples. The last paragraph on page 11 introduces the word density as the amount of matter in a given space. Explain to your students that mass is a property of an object or sample, and density is a property of the material that makes up the object or sample. Suppose you have a large gold bracelet and a small gold ring. If you compare them on a balance, the bracelet will have more mass because it contains more gold. But they have the same density because they're both made of gold. At this point, begin the contrasting case activity.

Day 8 – Compare Clay & Water, Part 2

Warm-Up Activity



What does displacement measure?

volume; how much space something takes up

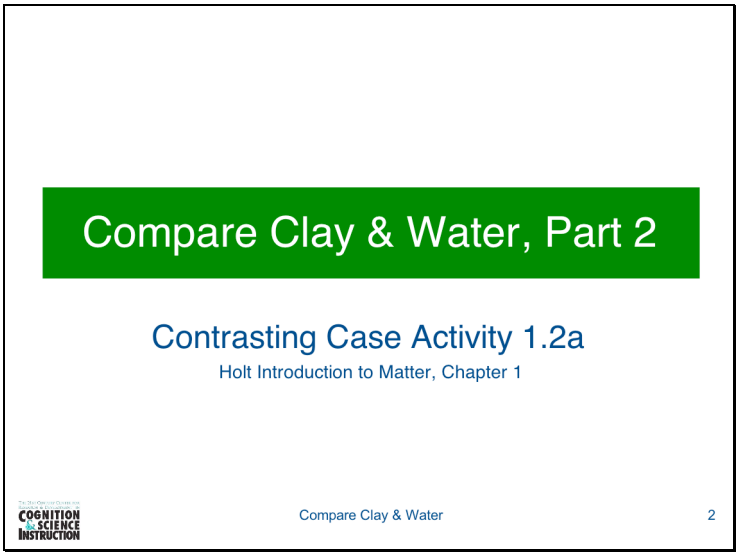
If you measured the balls with a spring scale, would they be the same or different?

same, as long as they're measured in places that have the same force of gravity

Don't be surprised if some students say they'll displace the same amounts because they have the same mass. Ask about objects A & B or redo the demonstration so they can see again that displacement depends on size and not heaviness.

Day 8 – Compare Clay & Water, Part 2

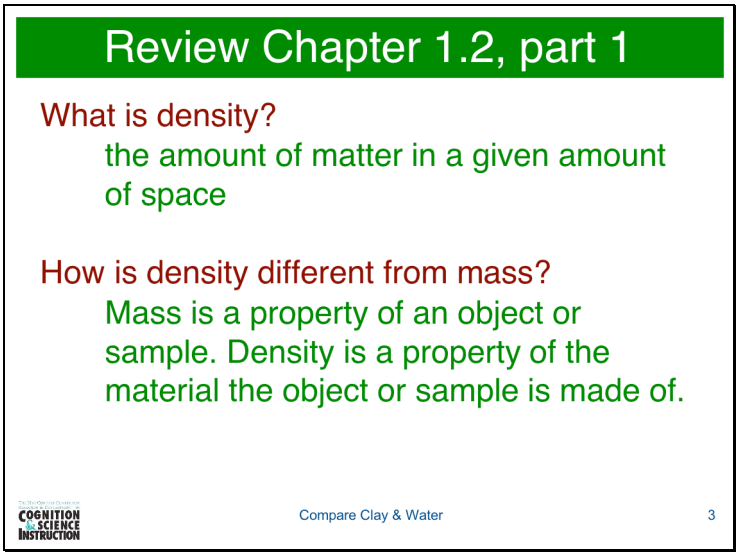
Compare Clay & Water, Part 2



In part 2, students make and test predictions about density and draw conclusions about the effect of sample size on mass, volume, and density.

Day 8 – Compare Clay & Water, Part 2

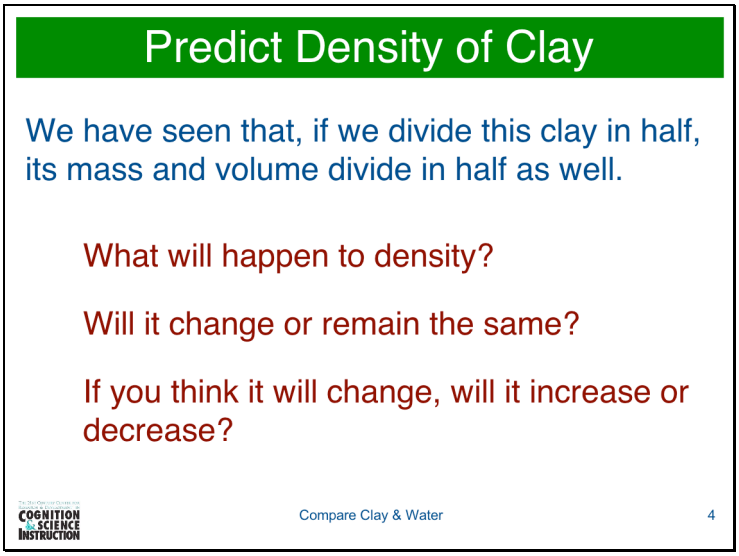
Compare Clay & Water, Part 2 (cont.)



For each question, give students a minute to record their own ideas, another minute to share ideas in groups, and two minutes to share with the class.

Day 8 – Compare Clay & Water, Part 2

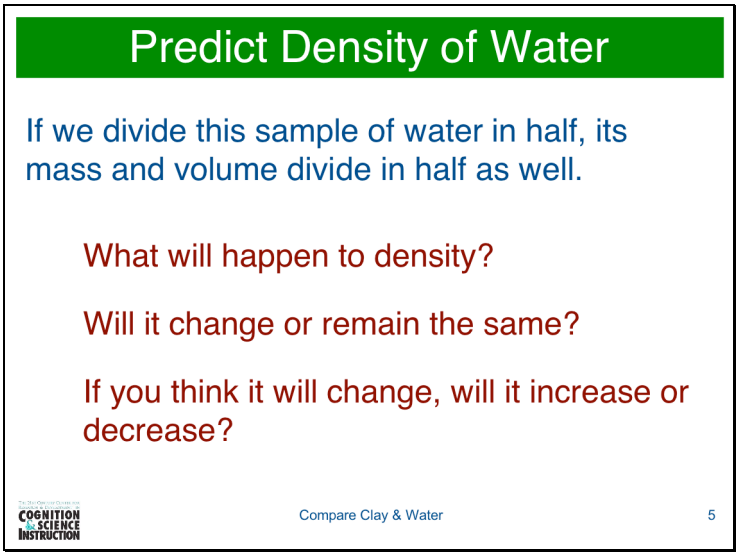
Compare Clay & Water, Part 2 (cont.)



Hold up the sample of modeling clay and ask students to think about each question as it appears. Have them record their own predictions, then share ideas in groups and with the class. Middle school students usually predict that density, too, will divide in half.

Day 8 – Compare Clay & Water, Part 2

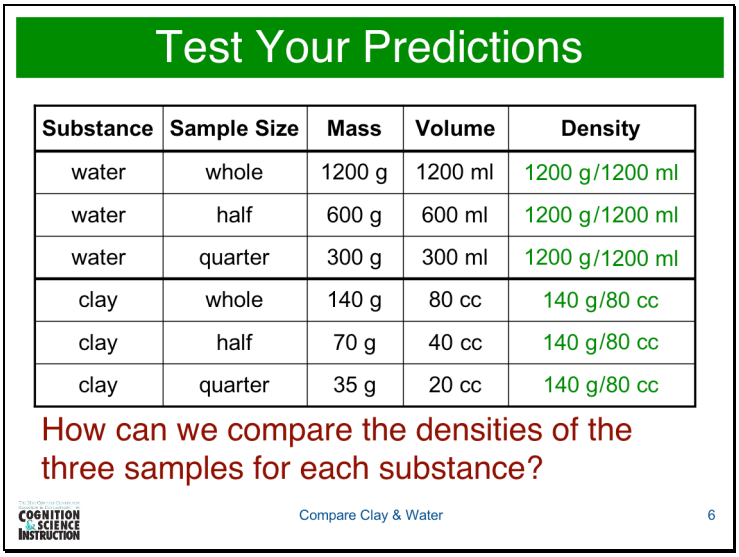
Compare Clay & Water, Part 2 (cont.)



Hold up the sample of water and have students record their own predictions, then share ideas in groups and with the class.

Day 8 – Compare Clay & Water, Part 2

Compare Clay & Water, Part 2 (cont.)

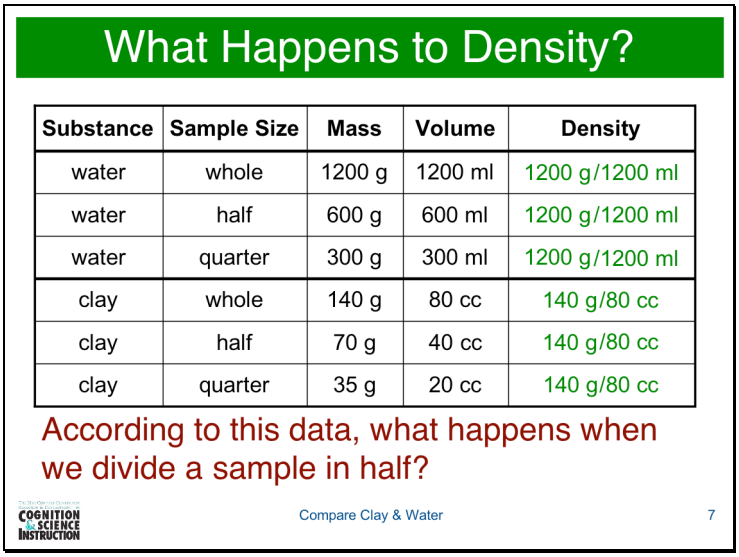


Students should recognize that, to compare densities, they need to compare equal volumes. When most students seem to understand this, press a key to display the numerators in the density column. We have chosen the largest volume for each substance because students often find it easier to multiply than divide. Although density is usually reported in grams per unit volume, the key idea at this point is for students to recognize the need to compare equal volumes.

Students should conclude that, when a sample is cut in half, mass and volume get cut in half, but density stays the same. Emphasize that this happens because mass and volume are both properties of the sample. Density is a property of the material the sample is made of. When you cut a lump of clay in half, it gets smaller and lighter, but it's still clay.

Day 8 – Compare Clay & Water, Part 2

Compare Clay & Water, Part 2 (cont.)



What Happens to Density?

Substance	Sample Size	Mass	Volume	Density
water	whole	1200 g	1200 ml	1200 g/1200 ml
water	half	600 g	600 ml	1200 g/1200 ml
water	quarter	300 g	300 ml	1200 g/1200 ml
clay	whole	140 g	80 cc	140 g/80 cc
clay	half	70 g	40 cc	140 g/80 cc
clay	quarter	35 g	20 cc	140 g/80 cc

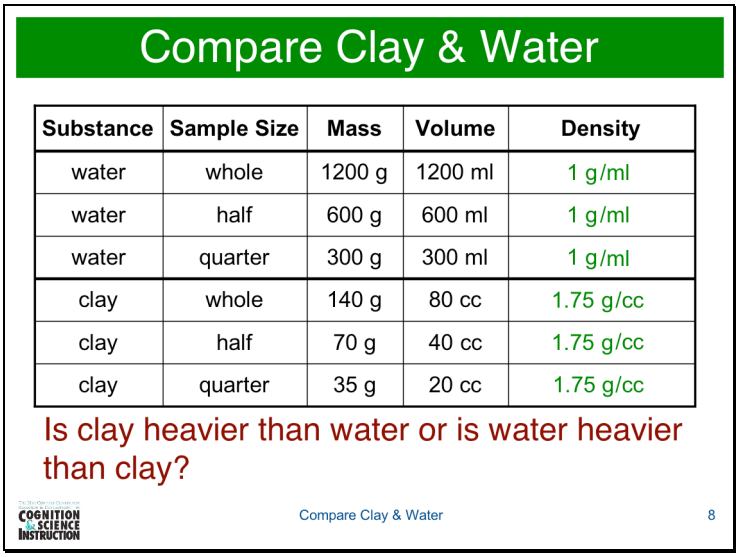
According to this data, what happens when we divide a sample in half?

Compare Clay & Water 7

Students should recognize that, when a sample is divided in half, mass and volume divide in half, but density stays the same. Emphasize that this happens because mass and volume are both properties of the sample. Density is a property of the material the sample is made of. When you cut a lump of clay in half, it gets smaller and lighter, but it's still clay.

Day 8 – Compare Clay & Water, Part 2

Compare Clay & Water, Part 2 (cont.)



Compare Clay & Water

Substance	Sample Size	Mass	Volume	Density
water	whole	1200 g	1200 ml	1 g/ml
water	half	600 g	600 ml	1 g/ml
water	quarter	300 g	300 ml	1 g/ml
clay	whole	140 g	80 cc	1.75 g/cc
clay	half	70 g	40 cc	1.75 g/cc
clay	quarter	35 g	20 cc	1.75 g/cc

Is clay heavier than water or is water heavier than clay?

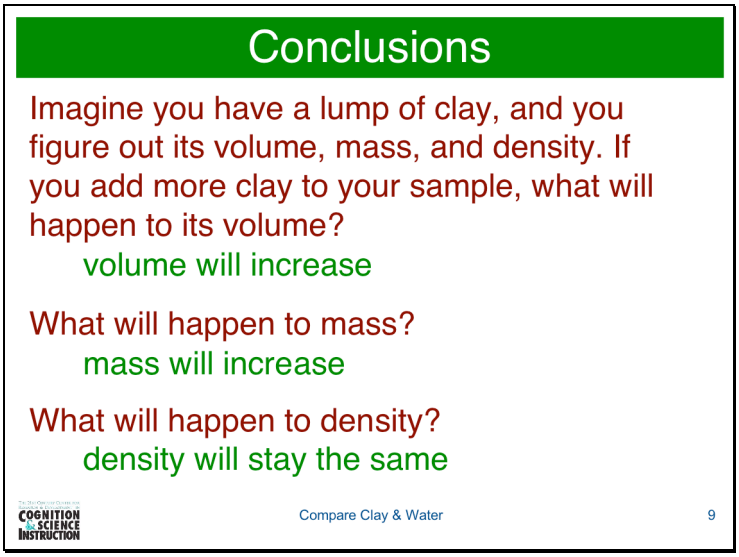
Again, students should recognize that, to compare densities, they need to compare equal volumes.

Tell your students that 1 milliliter is equal to 1 cubic centimeter, then encourage them to figure out what would be the easiest volume to use to compare the two sets of numbers. Whatever they suggest, do some sample calculations on the board to show that using that number would require two operations – division and multiplication – for each density calculation. If no one suggests it, ask them to think about using 1 for the common volume. If a sample has 35 grams of mass in 20 ccs of volume, how many grams are in each cc? You may need to draw a model of this situation to help students think it through, but with help they should recognize that, if you use 1 for the common volume, all you have to do is divide mass by volume.

Press a key to display the numerators, then have students work in groups to calculate density values.

Day 8 – Compare Clay & Water, Part 2

Compare Clay & Water, Part 2 (cont.)



Density does not change with sample size, because density is a property of the material the sample is made of. Clay is denser than water. A large sample of water might have more mass than a small sample of clay, but it will still be less dense. Clay will always be denser than water, no matter how small the sample of clay or how large the sample of water.

DAY 9

Density

This lesson opens with two visualization exercises that introduce more skills that will help students understand and learn from visual images. The second half of the lesson covers the rest of section 1.2 (pages 12-13), which provides more information about density.

Big Idea

- Mass is the amount of matter in an object or sample.
- Density is the amount of matter in a given amount of space.
- Density does not change with sample size. It is a property of the material that makes up the sample.
- Liquids form layers based on density because lighter (less dense) liquids float on top of heavier (more dense) liquids.
- Objects that are less dense than water will float in water.

Materials

Teacher:

1. visualization exercises – day09.ppt

Students:

none

Activities & Allotted Time (40 minutes total)

5 minutes – warm-up activity
5 minutes – visualization 1.1e – Diagram vs. "Real" Image
5 minutes – visualization 1.2a – Captions
25 minutes – chapter 1.2, part 1b – more about density – pp. 12-13

Supplemental Resources for Density

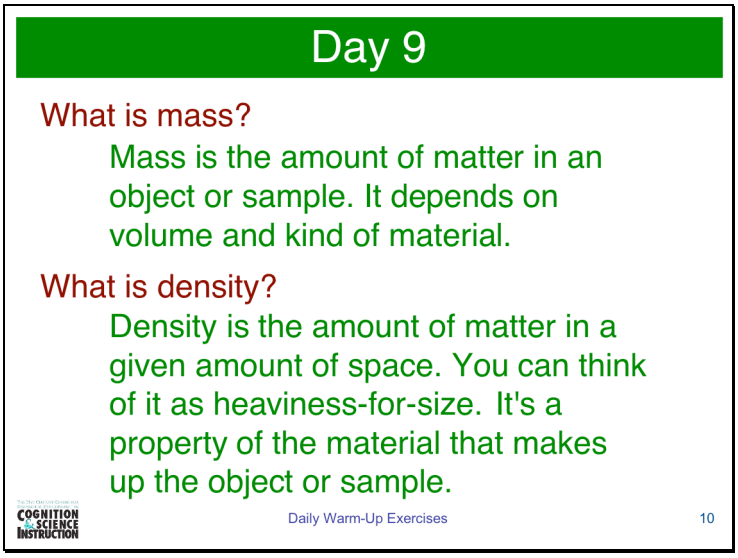
It is extremely difficult for some students to understand the concept of density, the idea that it is a property of the material that makes up an object or sample, and the fact that it does not change with sample size. Many teachers have told us that they rely on supplemental activities to provide their students with additional support. Some resources are listed on the next page.

Day 9 – Density

Websites with Supplemental Resources

•www.middleschoolchemistry.com/lessonplans/chapter3/lesson1
•www.ehow.com/info_8271852_density-activities-middle-school.html
•phet.colorado.edu/sims/density-and-buoyancy/density_en.html
•www.educationalrap.com/song/weight-mass-volume-density/
•www.thinkingfountain.org//l/liquidlayers/liquidlayers.html
•serc.carleton.edu/mathyouneed/density/index.html

Warm-Up Activity



What is volume?
the amount of space something takes up;
how much a container holds or can hold;
a 3-D measure of size

What is weight?
a measure of the force of gravity acting on an object

Day 9 – Density

Visualization Exercise 1.1e – Diagram vs. "Real" Image

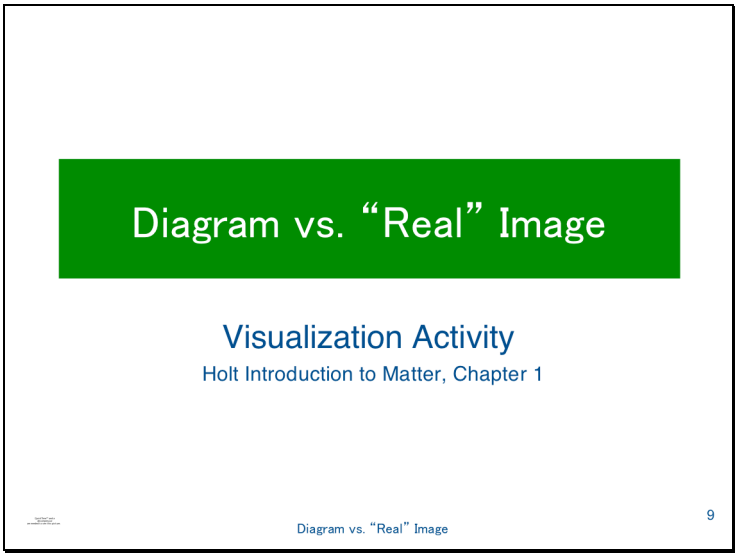


Image Comprehension Focus: Diagram vs. "Real" Image

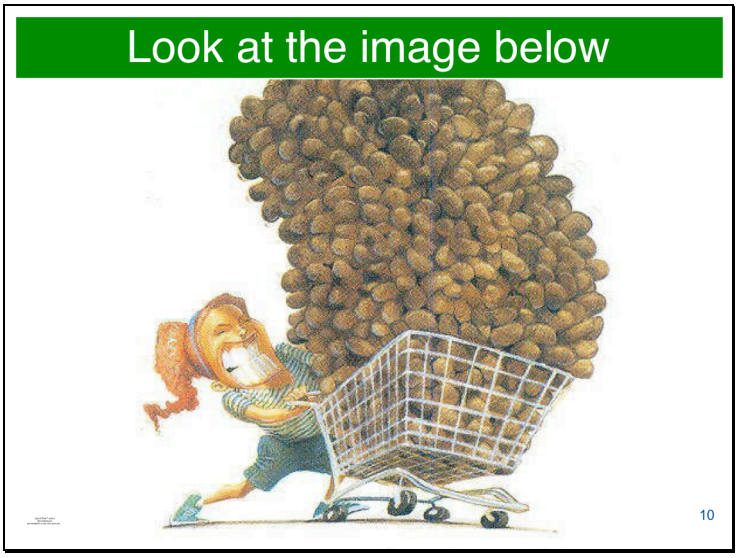
Goal: Realize that diagrams may not be realistic but are designed to capture key aspects of an object or a process.

Type of Activity: Teacher Demo

Overview: The purpose of this activity is to highlight that diagrams may not be realistic but that they capture enough key features of an object to aid in understanding it, or to understand the processes in which it is involved. This type of understanding is important so that students can fully interpret diagrams, as well as avoid the misconception that diagrammatic representations are always realistic.

Day 9 – Density

Visualization Exercise 1.1e – Diagram vs. "Real" Image (cont.)



Procedure: Show the class a cartoon (a modified version of Figure 7 on Page 9) and ask the students to identify what is in the cartoon (a woman trying to move a cart full of potatoes).

(proceed to next slide)

Visualization Exercise 1.1e – Diagram vs. "Real" Image (cont.)

The teacher then shows a photograph of a cart of potatoes and indicates that while no cart of potatoes actually looks like the cartoon, it has enough key features (the facial expression of the person moving the cart, the color of potatoes, the shape and parts of a cart, etc.) that it can "represent" a cart of potatoes that is extremely difficult for the woman to move. The teacher can then indicate that diagrams do the same thing as the cartoon here does. They are not necessarily created to be exact images but they are close enough that we get a sense of what an object looks like and what a situation feels like. This is what is done in this image: to show that **inertia** depends on the mass of an object and that when an object is of large mass it would be difficult to move it because of the corresponding large **inertia.**

(End of this activity)

Day 9 – Density

Visualization Exercise 1.2a – Captions

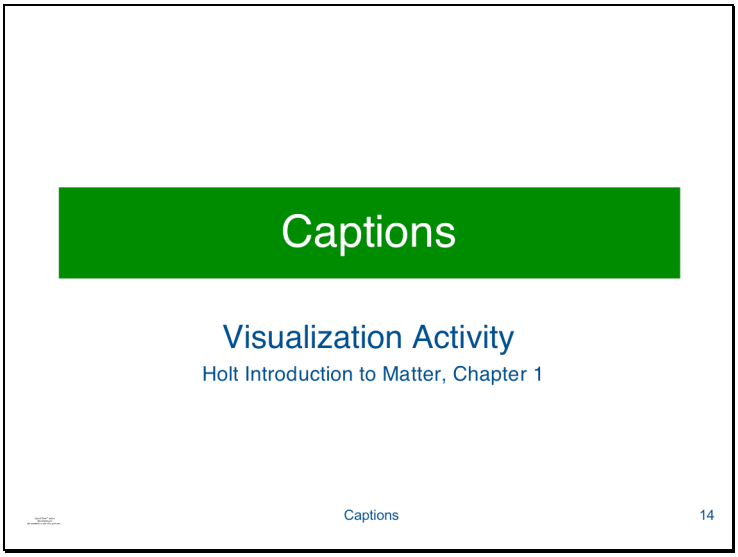


Image Comprehension Focus: Captions

Goal: To build understanding of the role of captions, and the importance of reading them

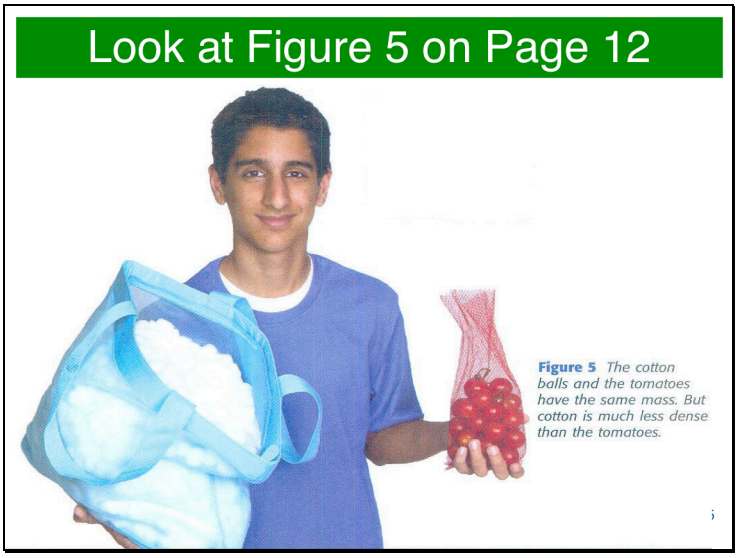
Type of Activity: Teacher Comment

Overview: This activity is designed for students to practice the concept that captions are critical to read when viewing a diagram or image. The goal is to give them an experience that reinforces the importance of captions, and to encourage them not to skip them when viewing images.

(proceed to next slide)

Day 9 – Density

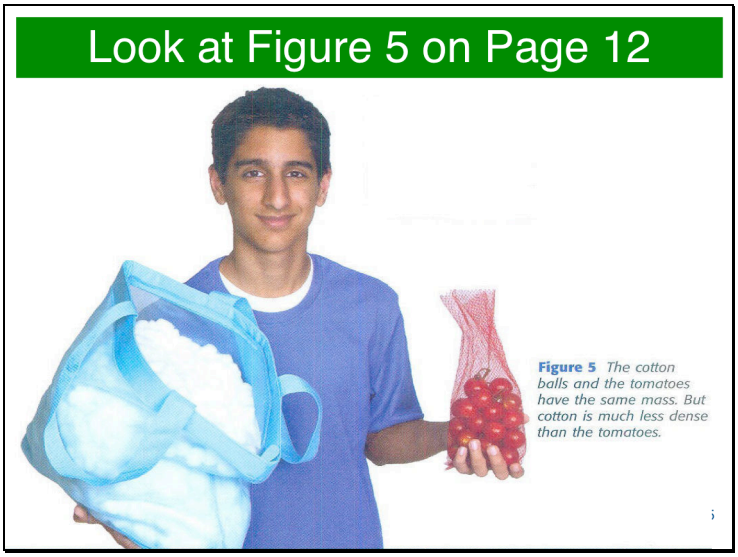
Visualization Exercise 1.2a – Captions (cont.)



Student Activity: The teacher should ask the students to look at p.12/fig.5 silently. After thirty seconds, the teacher should ask the students to close their books and judge whether the following statements are correct:

1) The cotton balls and the tomatoes have different mass. (Incorrect.)
2) Tomatoes are much more dense than cotton. (Correct.)

Visualization Exercise 1.2a – Captions (cont.)



After allowing the students a few minutes to jot down their responses individually, the teacher should ask for a show of hands of who could answer the questions. Next the teacher should ask for a show of hands as to who read the caption. The teacher should then have the students look back at the figure and explain that the answers to both questions were in the caption. If one just looked at the image, he/she would not know the answers. The teacher should conclude the activity re-emphasizing the importance of captions and the vital role they play in understanding images.

(End of activity)

DAY 10

Quiz 1/Reteach/Review

This lesson provides an opportunity for students to review what they've learned so far. For some, it may be an opportunity to understand an idea they didn't fully grasp the first time around.

Big Ideas
See list of big ideas, Days 1-9.

Materials

Teacher:

1. vocabulary list – IM word list.doc
2. list of big ideas – IM big ideas.pdf

Students:

1. Quiz 1

Activities & Allotted Time (40 minutes total)

10 minutes – quiz
10 minutes – go over quiz
20 minutes – reteach/review chapter 1.1 and density

Reteach/Review Chapter 1.1 and Density
After going over the quiz and reviewing the meanings of vocabulary words and the big ideas from days 1-9, use the section review questions on page 9 to identify areas that need additional attention. You could also ask students to explain what they learned from each of the contrasting case activities and demonstrations.

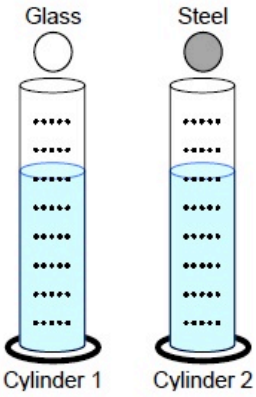
Day 10 – Quiz 1/Reteach/Review

Quiz 1 – Page 1

1. The amount of matter in a given amount of space is called _____.
   a. volume
   b. mass
   (c.) density

2. Which of the following statements is true?
   (a.) Density does not change with sample size.
   b. Mass does not change with sample size.
   c. Volume does not change with sample size.

3. The two graduated cylinders in this drawing are filled to the same level with water. The two marbles are exactly the same size and shape. One is made of glass and the other is made of steel. When the glass marble is lowered into the first cylinder, it will sink to the bottom and the water will rise to the 7th mark. What will happen when the steel marble is lowered into the second cylinder?
   (a.) The water will rise to the 7th mark.
   b. The water will rise above the 7th mark.
   c. The water will rise below the 7th mark.



4. Which of the following best describes your thinking about question 3?
   a. The marbles are made of different materials.
   b. The steel marble is heavier than the glass marble.
   (c.) The marbles have the same volume.

5. Imagine you have a ball of clay. You use a balance to measure its mass. Next, you flatten the ball like a pancake and measure its mass again. *Which of these statements is correct?*
   a. The pancake-shaped clay has more mass than the ball.
   (b.) The pancake-shaped clay has the same mass as the ball.
   c. The pancake-shaped clay has less mass than the ball.

Introduction to Matter

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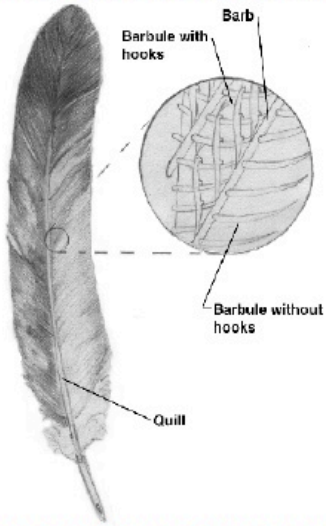
THE 21ST CENTURY CENTER FOR RESEARCH & DEVELOPMENT IN COGNITION & SCIENCE INSTRUCTION

Day 10 – Quiz 1/Reteach/Review

Quiz 1 – Page 2

6. Which statement is true?
   a. Gases have mass, but they don't take up space.
   b. Gases take up space, but they don't have mass.
   (c.) Gases have mass, and they take up space.

7. **Note to student:** We know you didn't learn this, but we want you to try to answer the question based on the information in the diagram.



In the above diagram of a feather, what does the image inside the larger circle represent?
   (a.) a magnified view of the feather's structure
   b. a view of objects that are not part of a feather
   c. a life-size view of the feather's structure
   d. a miniature view of the feather's structure

Introduction to Matter

Day 10 – Quiz 1/Reteach/Review

Quiz 1 – Page 3

8. How can you use a syringe to demonstrate that air is compressible?

Fill the syringe with air and seal the end. When you push the plunger, it moves. Since the air can't get out, the plunger must be squeezing the air into a smaller space. That means air is compressible.

Introduction to Matter

DAY 11

Skills Practice Lab

This lesson combines two skills practice labs from the back of the book. It begins with a teacher demo of part B of *Volumania!* (page 131). Students then complete *Determining Density* as described on page 132. Part A of *Volumania!* is omitted because students practice the same skill – using displacement to measure volume – in the density lab.

Big Ideas

- Displacement is a procedure for measuring volume.
- Density does not change with sample size. It is a property of the material that makes up the sample.

Materials

Teacher:

1. clear container (e.g., bottom of a 2-liter soda bottle)
2. shallow basin to catch overflow
3. graduated cylinder
4. funnel
5. water

Students:

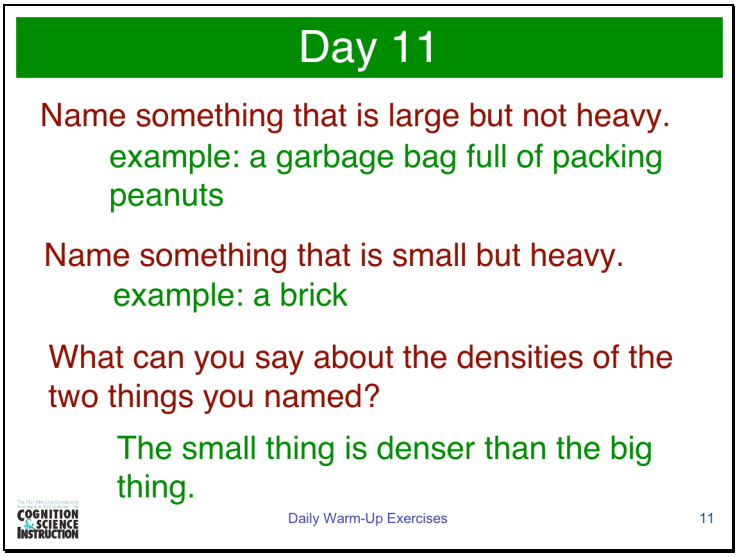
1. balance
2. graduated cylinder
3. water
4. glass marbles – 3 per group, preferably different sizes
5. graph paper

Activities & Allotted Time (40 minutes total)

5 minutes – warm-up activity
10 minutes – teacher demo of *Volumania!*, part B – page 131
25 minutes – student lab – *Determining Density* – page 132

Day 11 – Skills Practice Lab

Warm-Up Activity



What is density?
the amount of matter in a given amount of space; heaviness-for-size

How can you compare the densities of two materials?
compare the masses of equal volumes

Teacher Demo

The demo features a displacement method that is useful for objects that won't fit in a graduated cylinder. A container is filled to the brim so it overflows when an object is added. The overflow is collected and measured to determine the volume of the object. We suggest you demonstrate the method by measuring your fist, then ask students to predict the measurement for your open hand. This is similar to the quiz question about flattened clay, but this involves volume instead of mass.

DAY 12 Compare Physical & Chemical Change

This lesson includes contrasting case activity 1.2b and the last part of section 1.2 (pages 14-15).

Big Ideas

- A physical change does not change the identity (chemical composition) of an object or material.

Materials

Teacher:

1. slides – day12.ppt

Students:

1. white vinegar
2. red & blue litmus paper
3. colored sugar
4. baking soda
5. graduated cylinders

Activities & Allotted Time (40 minutes total)

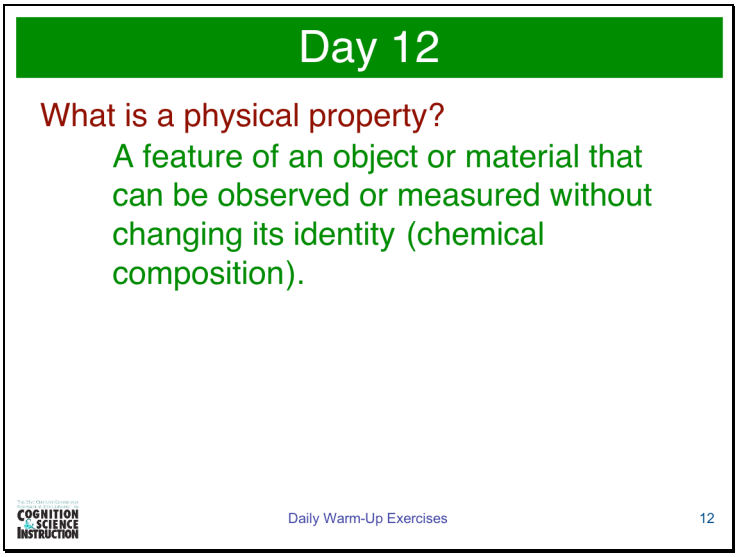
5 minutes – warm-up activity
20 minutes – cc activity – Compare Physical & Chemical Change
15 minutes – chapter 1.2, part 2 – *Physical Changes*

Chapter 1.2, part 2

Part 2 defines a **physical change** as a change in one or more physical properties that does not change the identity or chemical composition of the thing that changes. After explaining what this means in their own words, students should be able to say that, in the contrasting case activity, the colored sugar caused a physical change and the baking soda caused a chemical change. Tell students they'll learn more about chemical changes in the next section.

Day 12 – Compare Physical & Chemical Change

Warm-Up Activity

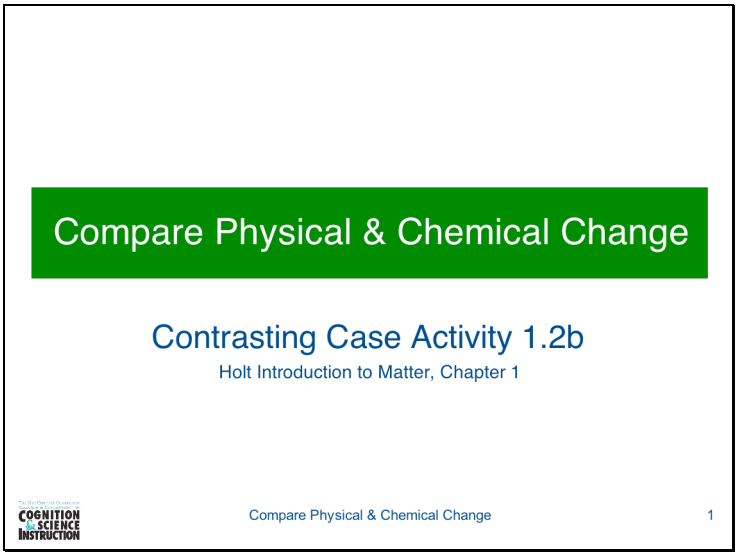


What are some examples of physical properties?

- size
- shape
- color
- hardness
- mass
- volume
- density
- state (solid, liquid, gas)

Day 12 – Compare Physical & Chemical Change

Compare Physical & Chemical Change



In this activity, students find that blue litmus paper turns red in vinegar, indicating that it's an acid. When they add colored sugar, the vinegar changes color, but the litmus test shows it's still an acid. When they add baking soda, the vinegar bubbles and fizzes, and red litmus paper turns blue, indicating that it has changed to a base.

Day 12 – Compare Physical & Chemical Change

Compare Physical & Chemical Change (cont.)

Quick Review

What is litmus paper?

a test strip that shows if a chemical is an acid or a base

Does blue indicate an acid or a base?

base

Compare Physical & Chemical Change 2

Quick Review

We will use both red and blue litmus paper to test some liquids.

What will happen if the liquid is a base?

The red strip will turn blue, and the blue strip won't change.

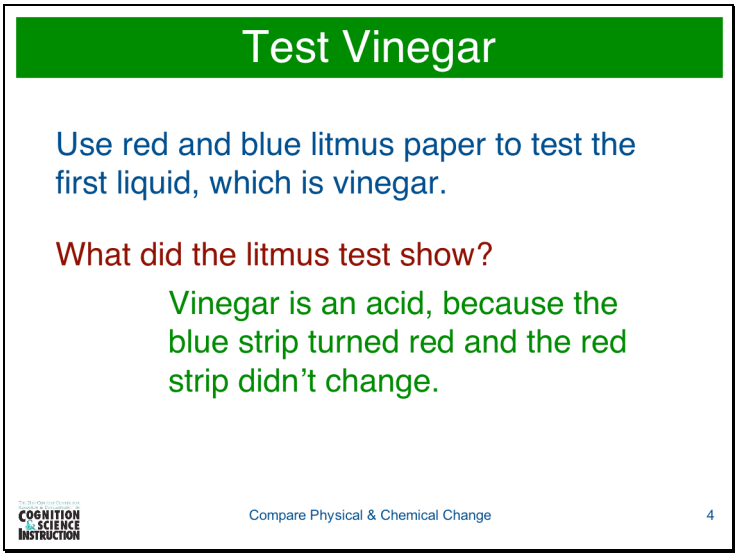
What will happen if the liquid is an acid?

The blue strip will turn red, and the red strip won't change.

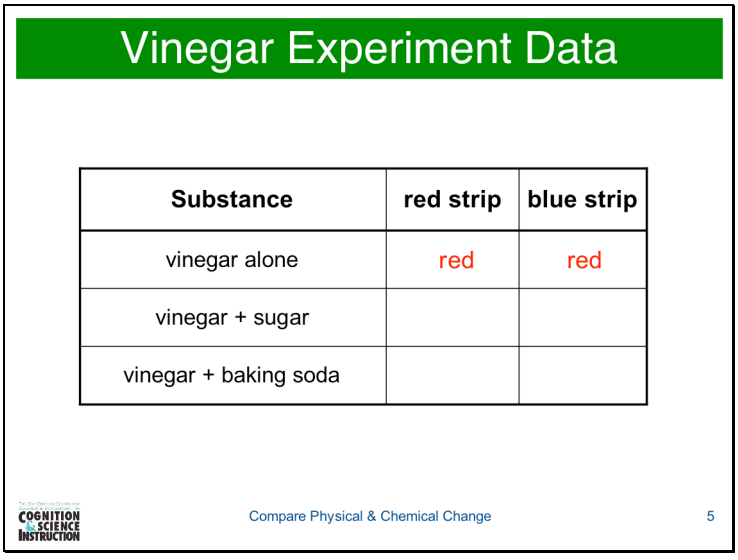
Compare Physical & Chemical Change 3

Day 12 – Compare Physical & Chemical Change

Compare Physical & Chemical Change (cont.)



Have students work in groups, then share results with the class.



Entries will appear on keypress. Have students copy this table into their lab notebooks so they'll have a record of their results.

Day 12 – Compare Physical & Chemical Change

Compare Physical & Chemical Change (cont.)

Add Colored Sugar

Pour half the vinegar into one of the graduated cylinders.

Add the colored sugar and stir.

Use red and blue litmus paper to test the vinegar-and-sugar combination.

Record your results.

Compare Physical & Chemical Change 6

Vinegar Experiment Data

Substance	red strip	blue strip
vinegar alone	red	red
vinegar + sugar	red	red
vinegar + baking soda		

Compare Physical & Chemical Change 7

Entries will appear on keypress.

Day 12 – Compare Physical & Chemical Change

Compare Physical & Chemical Change (cont.)

Add Baking Soda

Pour the rest of the vinegar into the other graduated cylinder.

Add the baking soda and stir.

Use red and blue litmus paper to test the vinegar-and-baking soda combination.

Record your results.

Compare Physical & Chemical Change 7

Vinegar Experiment Data

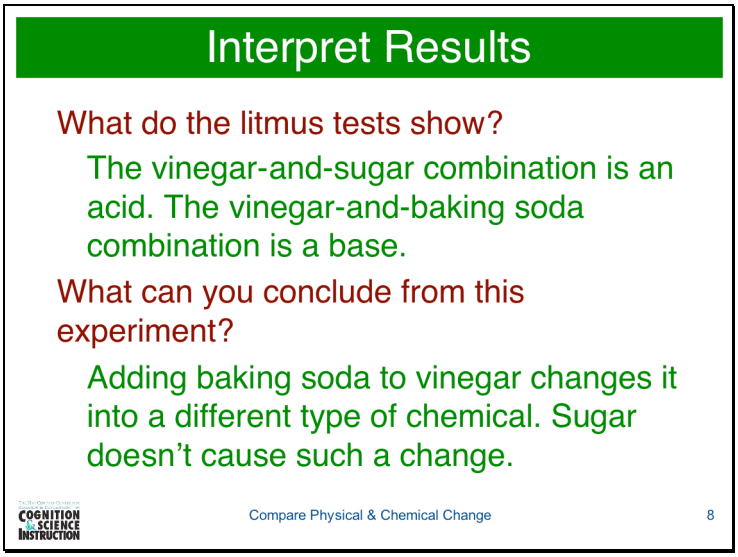
Substance	red strip	blue strip
vinegar alone	red	red
vinegar + sugar	red	red
vinegar + baking soda	blue	blue

Compare Physical & Chemical Change 9

Entries will appear on keypress.

Day 12 – Compare Physical & Chemical Change

Compare Physical & Chemical Change (cont.)



If students need help answering the second question, you might ask: What are acids and bases? [different types of chemicals]

DAY 13

Chemical Change

This lesson covers section 1.3 (pages 16-21) and includes one visualization exercise and a quick lab.

Big Ideas

- A chemical change occurs when a substance changes into one or more new substances with different properties.

Materials

Teacher:

1. visualization exercises – day13.ppt

Students:

1. pennies
2. vinegar
3. paper towel
4. beaker or shallow container

Activities & Allotted Time (40 minutes total)

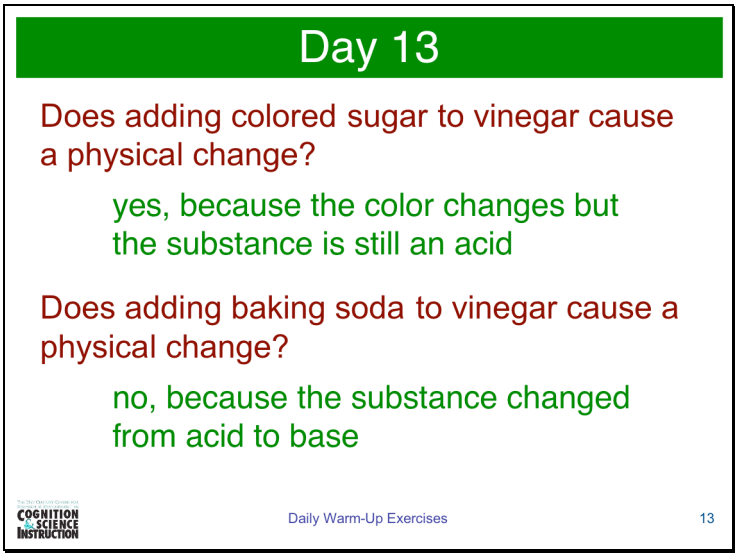
5 minutes – warm-up activity
10 minutes – chapter 1.3, part 1 – *Chemical Properties*
10 minutes – quick lab – *Changing Change* – page 18
5 minutes – visualization 1.3a – Labeling
10 minutes – chapter 1.3, parts 2 & 3

Chapter 1.3, part 1

Page 16 describes a **chemical property** as a material's ability to participate in a reaction that changes its identity (chemical composition). Examples include flammability and reactivity with oxygen. Page 17 defines **characteristic properties** as the features that are most useful in identifying a material. Tell your students that characteristic properties do not change with sample size, then ask if that description sounds familiar. They should recall from the Clay and Water cc activity that density doesn't change with sample size.

Day 13 – Chemical Change

Warm-Up Activity



If you double the size of a sample, what will happen to its mass?
The mass of the sample will double.

What will happen to its volume?
The volume of the sample will double.

What will happen to its density?
The density of the sample will stay the same.

Chapter 1.3, part 2

After introducing the meaning of **chemical change**, ask your students to describe a chemical change they observed recently – something that provided evidence that a substance changed into a new substance with different properties. Students should recall that, when they added baking soda to vinegar, the litmus test showed that the vinegar changed into a new liquid because vinegar is an acid and the vinegar-and-baking soda combination was a base. Tell students that the foaming and bubbling they observed are additional evidence of a new substance – a gas called carbon dioxide. They'll learn more about this reaction in chapter 3.

Day 13 – Chemical Change

Chapter 1.3, part 2 (cont.)
To conclude the lesson, help students generate a table contrasting physical and chemical change.

Sample table:

physical change	chemical change
does not change the identity (chemical composition) of the substance	changes the identity (chemical composition) of the substance
does not form new substances	forms one or more new substances
often easy to reverse	usually hard to reverse
examples: state changes (melting, freezing, evaporating), dissolving, crushing, bending, sanding	examples: burning, exploding, rusting, spoiling,

Day 13 – Chemical Change

Visualization Exercise 1.3a – Labeling

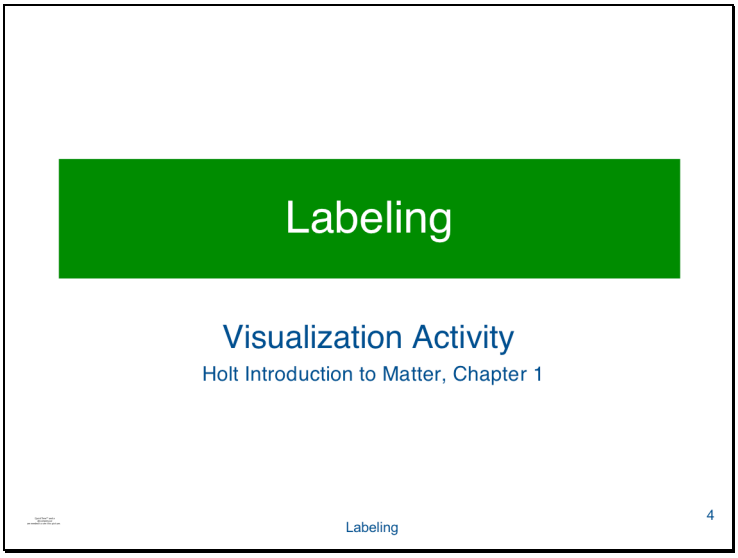


Image Comprehension Focus: Labeling

Goal: Develop an understanding of the roles of different types of labels and their importance in image comprehension

Type of Activity: Teacher Comment

Overview: This activity is designed to give the students practice with different types of labels and the concept that they perform different roles in an image. In addition, this activity is designed to highlight the important role labels play in understanding an image and to encourage students to always read the labels when looking at a diagram.

Day 13 – Chemical Change

Visualization Exercise 1.3a – Labeling (cont.)

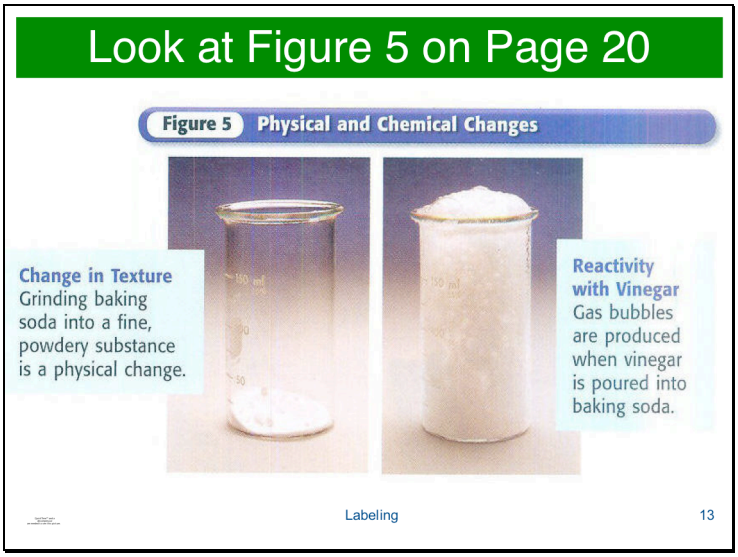
Procedure: First the teacher should identify the two types of labels and their function:

> There are two types of labels and they have different roles:
>
> Naming labels are used to identify parts of the diagram – they are what most people think of when they think of the word "label."
>
> Explanatory labels are used to provide more information about a part of a diagram – they are like a caption that applies only to one part of the picture, as opposed to the whole thing.

(Proceed to the next slide)

Day 13 – Chemical Change

Visualization Exercise 1.3a – Labeling (cont.)



Then the teacher should guide the students to look at Figure 5 on Page 20 and ask whether the blocks of text concerning "change in texture" and "reactivity with vinegar" are examples of naming labels or explanatory labels.

The answer is that they are explanatory labels. Each block of text provides an explanation of one part of the diagram.

Optional Activity: To clarify the difference between explanatory and naming labels, the teacher could ask for suggestions about naming labels that could be added to the diagram. Possible responses could include a label reading "bubbles" connected to the froth in the right-hand image, or "beaker" for either of the containers.

(End of activity)

DAY 14

Quiz 2/Reteach/Review

This lesson provides an opportunity for students to review what they've learned so far. For some, it may be an opportunity to understand an idea they didn't fully grasp the first time around.

Big Ideas
See list of big ideas, Days 1-13.

Materials

Teacher:

1. vocabulary list – IM word list.doc
2. list of big ideas – IM big ideas.pdf

Students:

1. Quiz 2

Activities & Allotted Time (40 minutes total)

10 minutes – quiz
10 minutes – go over quiz
20 minutes – reteach/review chapter 1.2 & 1.3

Reteach/Review Chapter 1.2 and 1.3
After going over the quiz and reviewing the meanings of vocabulary words and the big ideas from days 1-13, use the section review questions on pages 15 and 21 to identify areas that need additional attention.

Day 14 – Quiz 2/Reteach/Review

Quiz 2 – Page 1

1. The amount of matter in an object or sample is called _____.
   a. density
   (b.) mass
   c. volume

2. How do you compare the densities of two substances?
   a. compare their masses on a balance
   b. compare their weights with a spring scale
   (c.) compare the masses of equal volumes

3. A physical property is a feature of an object or material that can be observed or measured without changing its _____.
   a. mass
   b. appearance
   (c.) identity

4. In the table below, write **P** if the process is a physical change, and **C** if the process is a chemical change.

Process	P or C?
glass breaking	P
a bicycle rusting	C
bleaching your hair	C
separating sand from gravel	P
food spoiling	C
mowing a lawn	P

Introduction to Matter

Day 14 – Quiz 2/Reteach/Review

Quiz 2 – Page 2

5. What is density?

Density is the amount of matter in a given amount of space. It is a property of the material that makes up an object or substance, and it doesn't change with sample size.

What does density have to do with floating and sinking?

Floating and sinking depend on how densities compare. For example, objects that are less dense than water will float in water. Also, liquids form layers based on density, with lighter (less dense) liquids floating on top of heavier (more dense) liquids.

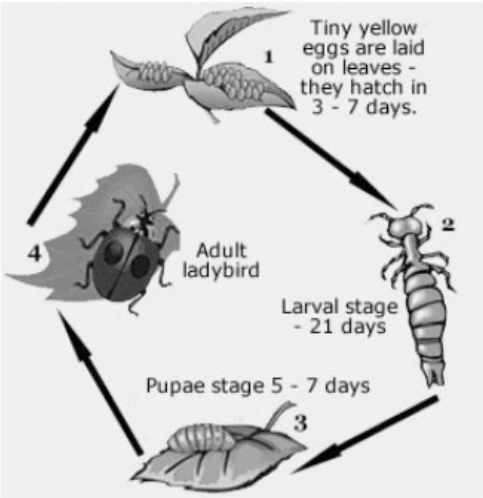
Introduction to Matter

Day 14 – Quiz 2/Reteach/Review

Quiz 2 – Page 3

6. **Note to student:** We know you didn't learn this, but we want you to try to answer the question based on the information in the figure.

Complete Metamorphosis of the Ladybird



According to the above figure, the third stage of metamorphosis occurs when a(n) _____ becomes a _____.

a. egg; larva
b. adult: pupae
c. pupae; larva
(d.) larva; pupae

Introduction to Matter