Ch.2
The Properties of Matter

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7th Grade Physical Science

2.1 What is matter?

- Matter = anything with mass that takes up space ("stuff")
- Volume = how much space is taken up

- Liquid volume: SI unit is...?
- Solid volume: SI unit is…?

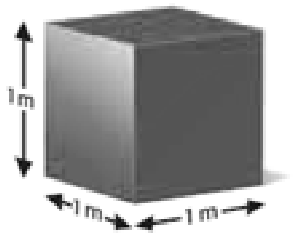
- Liquid volume: SI unit is liter (L)
- Solid volume: SI unit is cubic meter (m^3)

Liquid Volume

- Soda bottle ~ 2 liters
- Lake Erie ~ 483,000,000,000,000 liters
- Measuring liquid volume: look at the bottom of the meniscus.

Volume of solid

- Volume = length x width x height



Volume of solid

Figure 4 *The 12-sided object displaced 15 mL of water. Because 1 mL = 1 cm³, the volume of the object is*

MATH FOCUS

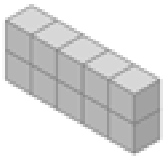
Volume of a Rectangular Solid What is the volume of a box that has a length of 5 cm, a width of 1 cm, and a height of 2 cm?

Step 1: Write the equation for volume.

volume = length × width × height

Step 2: Replace the variables with the measurements given to you, and solve.

volume = 5 cm × 1 cm × 2 cm = 10 cm³



Now It's Your Turn

1. A book has a length of 25 cm, a width of 18 cm, and a height of 4 cm. What is its volume?
2. What is the volume of a suitcase that has a length of 95 cm, a width of 50 cm, and a height of 20 cm?
3. A CD case is 14.2 cm long, 12.4 cm wide, and 1 cm deep. What is its volume?

2.1 Part II: Inertia, Mass, Weight

Mass as a measure of inertia

- Play catch with a basketball or a bowling ball.
- Which is harder to throw?
- Which is harder to catch?

Mass as a measure of inertia

- Play catch with a basketball or a bowling ball.
- Which is harder to throw?
- Which is harder to catch?

- The bowling ball. It's more resistant to changes in velocity. The bowling ball has more inertia and more mass.

Inertia

- Will the book move?

- How can I make it move?

- Why does the book stop moving?
- What if I pushed the book on a waxed floor?
- What if I pushed the book on ice?
- What if there were no friction?

- Why does the book stop moving? friction
- What if I pushed the book on a waxed floor?
- What if I pushed the book on ice?
- What if there were no friction?
  - It would keep going.

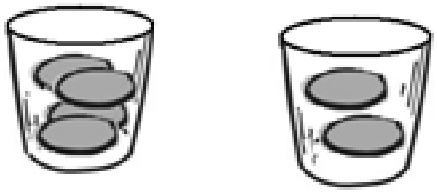
Inertia

- Stubbornness of object
- Resistance to change in motion
- A property of matter

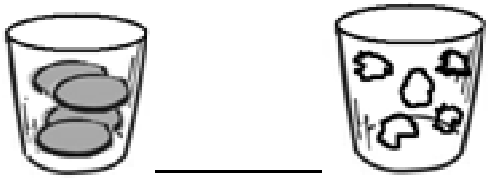
- Anything with mass will stay at rest or keep moving at constant speed… if nothing is pushing it.

Mass = how much matter

- How to measure mass?



- How to measure mass?



How to measure mass?

- How to compare the mass of a coin and the mass of a paper wad? Count the number of atoms?

How to measure mass?

- Count the number of atoms?
  - What type of atoms should you use?
  - How would one atom be equivalent to another?

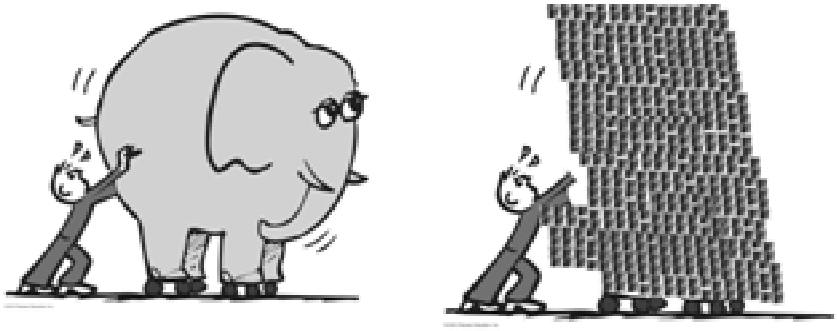
  - Humongous number!

Mass: compare resistance to 1kg

- 1 kilogram = mass of a platinum-iridium alloy cylinder kept in a vault in Sevres, France.
- Golf-ball sized

- A mass is 1 kg if it takes the same amount of force to get it to move the same way the cylinder does.

500kg



What is mass?

- Mass
  - Measure of inertia
  - Twice as much mass means twice as stubborn, twice as much force is needed.

Weight

- Law of gravity: Earth pulls twice as hard if the mass is twice as much.
- Weight = force of gravity on an object.
  - SI unit: Newton (N)

How can Garfield lose weight without going on a diet?

How do you lose weight without going on a diet?

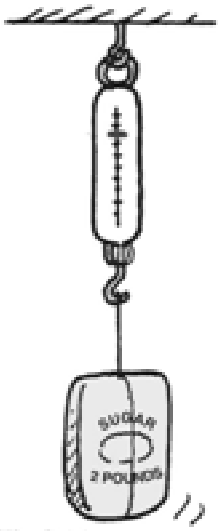
- Go to the Moon. 1/6 the pull of earth.
- Go to a higher altitude
- Stand in an elevator going down.

Does this measure mass or weight?

- Spring Scale

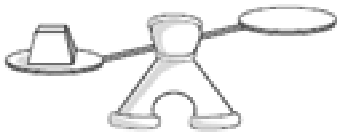
Does this measure mass or weight?

- Spring Scale



Does this measure mass or weight?

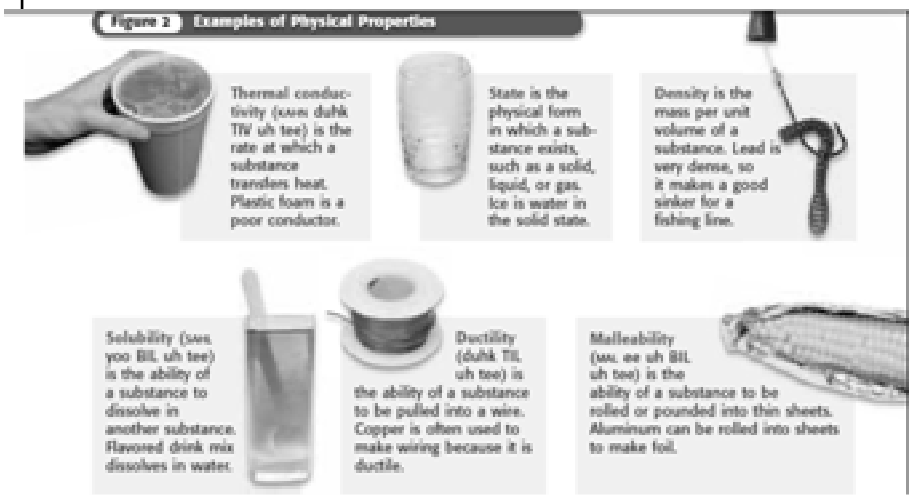
- Balance



- Classwork: A Weighty Problem
- HW: 2.1 Pg. 43 #7~11

2.2 Physical Properties

- Physical Property = something you can observe/measure without changing the matter's identity
  - Color
  - Magnetism
  - State: Ice, water, vapor are all still H_2O



Density is a physical property

- Density =

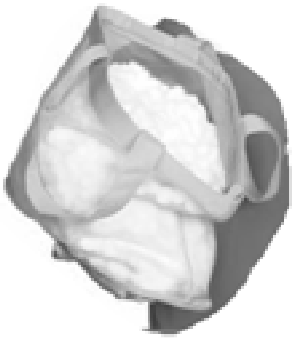
Density is a physical property

- Density = mass/volume
- Which one is more dense?

- Which is more dense?

Density

- Would you rather carry 1 kg of lead or 1 kg of feathers?



Density

Table 1 Densities of Common Substances*

Substance	Density* (g/cm^3)	Substance	Density* (g/cm^3)
Helium (gas)	0.0001663	Zinc (solid)	7.13
Oxygen (gas)	0.001331	Silver (solid)	10.50
Water (liquid)	1.00	Lead (solid)	11.35
Pyrite (solid)	5.02	Mercury (liquid)	13.55

MATH FOCUS

Calculating Density What is the density of an object whose mass is 25 g and whose volume is 10 cm^3?

Step 1: Write the equation for density.

$$D = \frac{m}{V}$$

Step 2: Replace m and V with the measurements given in the problem, and solve.

$$D = \frac{25\ g}{10\ cm^3} = 2.5\ g/cm^3$$

The equation for density can also be rearranged to find mass and volume, as shown.

$m = D \times V$ (Rearrange by multiplying by V.)

$V = \frac{m}{D}$ (Rearrange by dividing by D.)

Now It's Your Turn

1. Find the density of a substance that has a mass of 45 kg and a volume of 43 m^3. (Hint: Make sure your answer's units are units of density.)
2. Suppose you have a lead ball whose mass is 454 g. What is the ball's volume? (Hint: Use **Table 1** above.)
3. What is the mass of a 15 mL sample of mercury?

Physical Change

- Does not change the matter's identity
  - Pounding, shaping
  - Melting, evaporating
  - dissolving



2.3 Chemical Properties

- Chemical Property: describes ability of matter to change into something else
  - Flammability = ability to burn
  - Reactivity with oxygen = ability to combine (and form rust)

Chemical or physical property?

Flammability Rubbing alcohol is able to burn easily.

Shape Bending an iron nail will change its shape.

Reactivity with Oxygen An iron nail can react with oxygen in the air to form iron oxide, or rust.

State Rubbing alcohol is a clear liquid at room temperature.

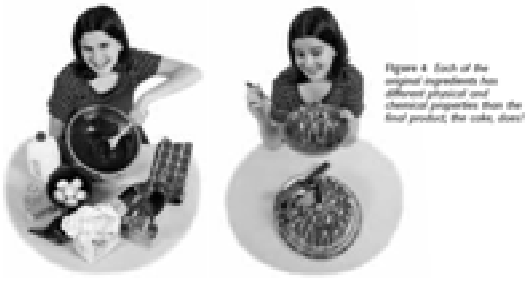
- Chemical Change: the process of a substance changing into something else.
  - When H_2O splits into hydrogen and oxygen.

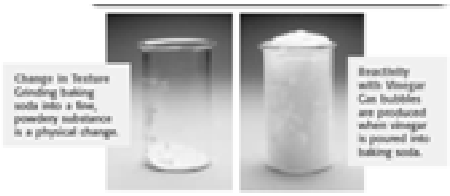
Chemical changes

Signs of a chemical change

- The result is different from what you started with (e.g. no longer water)
  - Change in color, odor
  - Heat
  - Light, sound given off
  - Fizzing, foaming

Chemical or physical change?





- Classwork: “As a Matter of Fact!”
- HW: Section 2.2 Pg. 49 #5~8
- Determining Density:
  - Question
  - Hypothesis
  - Best-fit line’s slope

Mystery cylinder