

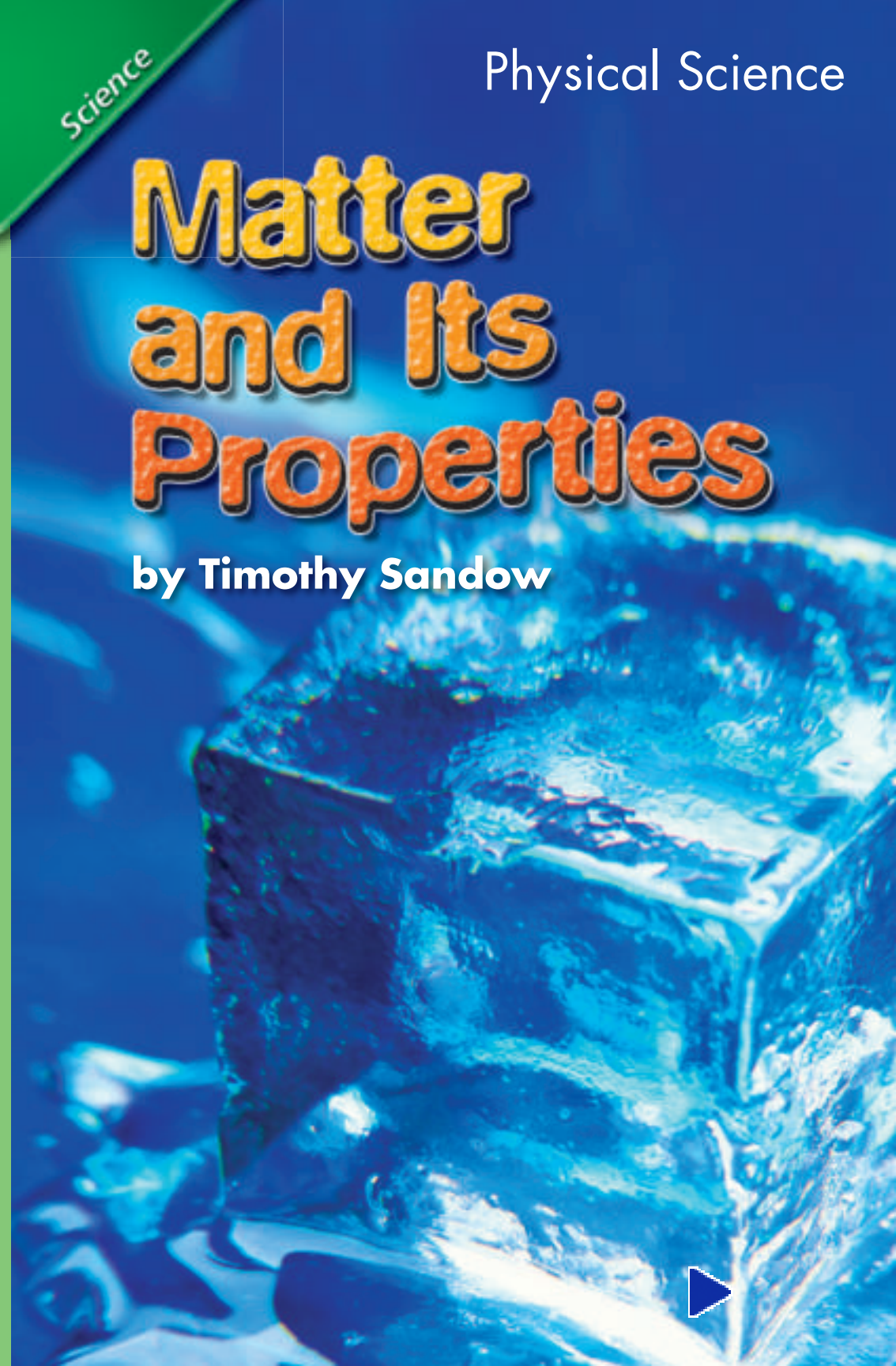
Science

Science

Physical Science

# Matter and Its Properties

by Timothy Sandow



Genre	Comprehension Skill	Text Features	Science Content
Nonfiction	Cause and Effect	<ul style="list-style-type: none"> <li>• Captions</li> <li>• Labels</li> <li>• Glossary</li> </ul>	Matter

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# Matter and Its Properties

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## Vocabulary

atom  
buoyancy  
density  
element  
mass  
matter  
periodic table  
pressure  
property  
volume



**Illustrations:** 5, 6, 7 Big Sesh Studios

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ISBN: 0-328-13835-5

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# How can we describe matter?

## A World of Matter

All of the things you see around you are made of matter. **Matter** is anything that takes up space and has mass. You can sense the mass of an object by how heavy it feels. You can see that air takes up space when you blow up a balloon.



A **property** is something about matter that you can see, hear, touch, or smell. A ball looks round. It feels smooth or bumpy. It can be hard or soft. It makes a sound when you bounce it. You can smell a flower to learn about its properties.





## States of Matter

Nearly all matter is a solid, a liquid, or a gas. Each kind of matter is made of very tiny particles. The particles are so small that we cannot see them. The particles are always moving. In some kinds of matter, they move a little. In other kinds of matter, they move a lot.

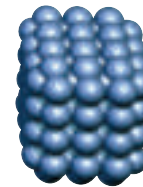


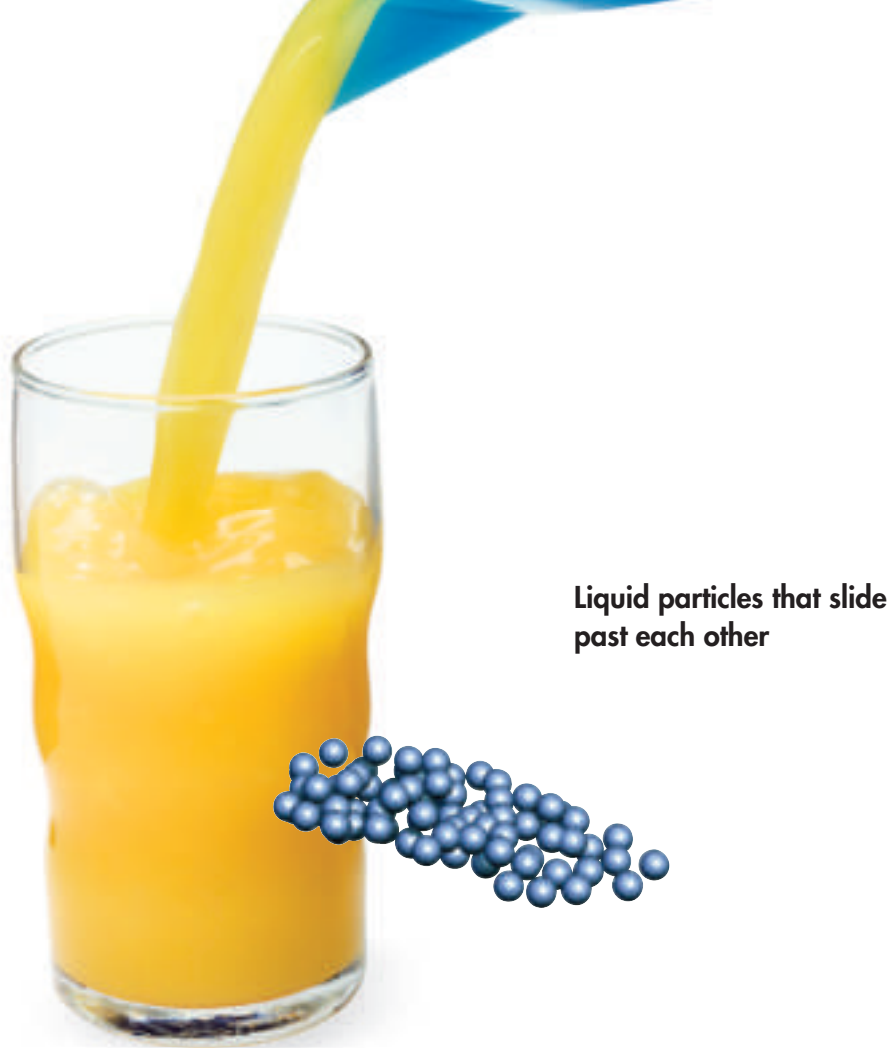
## Solids

A bowling ball is a solid. Like other solids, it keeps its shape. It stays round. In a solid, all the tiny particles are packed tightly together. They jiggle very fast, but they stay in place.



Solid particles that jiggle in place





Liquid particles that slide past each other



## Liquids

Orange juice is a liquid. It takes the shape of the glass it is in. It will take a new shape if poured into a different glass. The particles of liquids are loosely connected. The particles can flow past one another. What if you poured the juice into a new container? It will still take up the same amount of space.



## Gases

Gases do not have a shape. Air is a gas. Tiny gas particles are not connected to each other. They bounce off each other as they move freely in space. Unlike solids and liquids, the amount of space that air takes up can change.

When air is pumped into a ball, it expands. It pushes against the inside of the ball. This pushing is called **pressure**. The air particles get more tightly pressed together as you pump more air in.



Gas particles that bounce off each other





## Parts of Matter

What happens if you break a chunk of gold into smaller pieces? Each particle of gold is still the matter gold. Gold is an element. An **element** is matter made of a single type of particle too small to see.

Most matter is made out of many types of particles. The smallest particle of an element that has all the properties of that element is an **atom**. Gold is made up only of atoms of gold. Clay is an example of matter made up of different kinds of atoms. Atoms act together to give matter its properties.

Clay is made of many different kinds of atoms.



Scientists have done experiments to find out how many different elements there are in matter. Their experiments show that there are more than one hundred different elements. Scientists list all these elements in a table. It is called the **periodic table** of elements. The elements are placed on the table near other elements with the same properties.

Periodic Table of Elements

State at Room Temperature																															
[Solid Icon] = Solid			[Liquid Icon] = Liquid			[Gas Icon] = Gas																									
1 H Hydrogen																	2 He Helium														
3 Li Lithium	4 Be Beryllium																	5 B Boron	6 C Carbon	7 N Nitrogen	8 O Oxygen	9 F Fluorine	10 Ne Neon								
11 Na Sodium	12 Mg Magnesium																	13 Al Aluminum	14 Si Silicon	15 P Phosphorus	16 S Sulfur	17 Cl Chlorine	18 Ar Argon								
19 K Potassium	20 Ca Calcium	21 Sc Scandium	22 Ti Titanium	23 V Vanadium	24 Cr Chromium	25 Mn Manganese	26 Fe Iron	27 Co Cobalt	28 Ni Nickel	29 Cu Copper	30 Zn Zinc	31 Ga Gallium	32 Ge Germanium	33 As Arsenic	34 Se Selenium	35 Br Bromine	36 Kr Krypton														
37 Rb Rubidium	38 Sr Strontium	39 Y Yttrium	40 Zr Zirconium	41 Nb Niobium	42 Mo Molybdenum	43 Tc Technetium	44 Ru Ruthenium	45 Rh Rhodium	46 Pd Palladium	47 Ag Silver	48 Cd Cadmium	49 In Indium	50 Sn Tin	51 Sb Antimony	52 Te Tellurium	53 I Iodine	54 Xe Xenon														
55 Cs Cesium	56 Ba Barium	71 Lu Lutetium	72 Hf Hafnium	73 Ta Tantalum	74 W Tungsten	75 Re Rhenium	76 Os Osmium	77 Ir Iridium	78 Pt Platinum	79 Au Gold	80 Hg Mercury	81 Tl Thallium	82 Pb Lead	83 Bi Bismuth	84 Po Polonium	85 At Astatine	86 Rn Radon														
87 Fr Francium	88 Ra Radium	103 Lr Lawrencium	104 Rf Rutherfordium	105 Db Dubnium	106 Sg Seaborgium	107 Bh Bohrium	108 Hs Hassium	109 Mt Meitnerium	110 Ds Darmstadtium	111 Rg Roentgenium	112 Uub Ununbium	113	114	115	116	117	118														
		57 La Lanthanum	58 Ce Cerium																	59 Pr Praseodymium	60 Nd Neodymium	61 Pm Promethium	62 Sm Samarium	63 Eu Europium	64 Gd Gadolinium	65 Tb Terbium	66 Dy Dysprosium	67 Ho Holmium	68 Er Erbium	69 Tm Thulium	70 Yb Ytterbium
		89 Ac Actinium	90 Th Thorium																	91 Pa Protactinium	92 U Uranium	93 Np Neptunium	94 Pu Plutonium	95 Am Americium	96 Cm Curium	97 Bk Berkelium	98 Cf Californium	99 Es Einsteinium	100 Fm Fermium	101 Md Mendelevium	102 No Nobelium



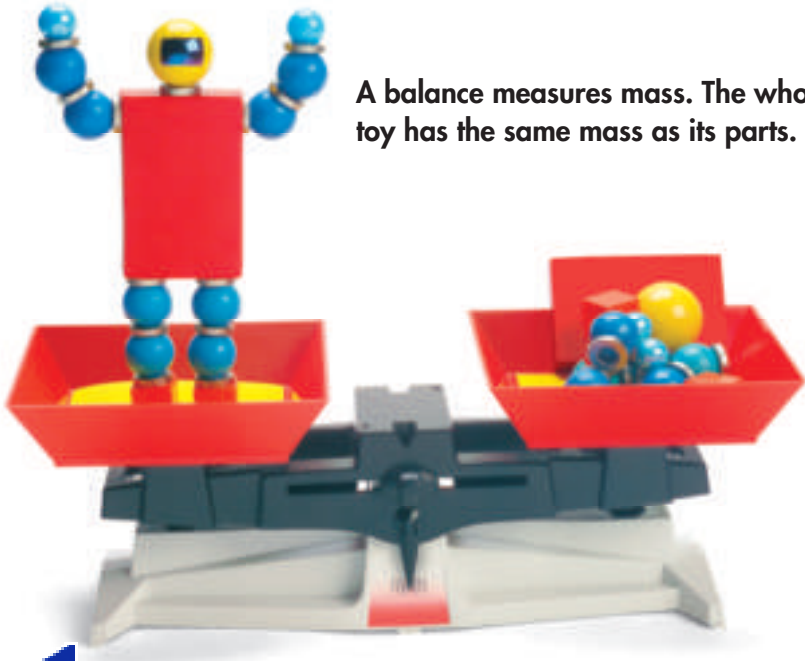


# How are properties of matter measured?

## Tools for Measuring Mass

One property of matter that you can measure is mass. **Mass** is the amount of matter an object has. A balance measures mass. The metric units for measuring mass are grams (g) and kilograms (kg). One kilogram has 1,000 grams.

An object's mass is the same no matter where it is. But the weight of an object can be different in different places. Things have different weights on Earth than they do on the Moon. A scale is used to measure weight.



A balance measures mass. The whole toy has the same mass as its parts.



## Tools for Measuring Volume

Another property of matter you can measure is volume. The **volume** of an object is the amount of space that the object takes up. You use a measuring cup or graduated cylinder to measure the volume of liquids.

The metric unit for measuring the volume of a liquid is the liter (L). We can also measure small amounts of liquid in milliliters (mL). One liter has 1,000 milliliters.



The volume of the milk in this jug is about 2L.



The volume of orange juice in this bottle is about 1L.



Solids have volume, just as liquids do. To measure the volume of a solid, fill a measuring cup half full of water. Record the measurement. Now, place a rock into the water. The water rises because the rock has volume. It takes up space. Look at the water level now. Record the new measurement. Subtract the first measurement from the second. The difference in the water levels is the volume of the rock.



The volume of the water in this measuring cup is 500 mL.



## Measuring Density

**Density** is a measure of the amount of matter in a certain amount of space. A bowling ball and a rubberball have about the same volume. But the bowling ball has more mass and greater density.

You can study the density of matter by watching how an object floats. How well an object floats in a liquid or a gas is called **buoyancy**. Stones have little buoyancy in water. They sink because they have a higher density than water. A helium balloon has lots of buoyancy in air. It rises because helium has a lower density than air.



This rubber ball is the same size as the bowling ball.







## Tools for Measuring Other Properties

Size is another property that can be measured. The distance from one end of something to the other is its length. The basic unit for measuring length is the meter (m). We use millimeters (mm) and centimeters (cm) to measure small things. One meter is 100 cm or 1,000 mm. We use kilometers (km) to measure long distances. One kilometer is 1,000 meters.



A cubic unit is a cube used to measure volume of a solid. A cube that is 1 centimeter on all sides has the volume of 1 cubic centimeter. To find the volume of a box, put cubes of the same size into the box, and fill it. The volume of the box is a measurement of how many cubic units it takes to fill the box.


Some objects are too small to see easily. Use a magnifying glass to make things look larger. Then you can see their properties better.



## Glossary

<b>atom</b>	the smallest particle of a substance that has the properties of that substance
<b>buoyancy</b>	how well an object floats in a liquid or rises in air or a gas
<b>density</b>	how much matter is in a certain amount of space
<b>element</b>	a substance made up of a single type of particle
<b>mass</b>	the amount of matter any object contains
<b>matter</b>	anything that takes up space and has weight
<b>periodic table</b>	a table that arranges the elements of matter according to their properties
<b>pressure</b>	how hard something presses on something else
<b>property</b>	something about an object that can be observed
<b>volume</b>	the amount of space an object takes up

## What did you learn?

1. How can you show that air has volume and takes up space?
2. How are the particles of a solid different than particles of a liquid or a gas?
3. Where would you look to find out if something is an element?
4. **Writing in Science** In this book you read about measuring volume. Write to explain how you would measure the volume of a trunk. Include details from the book.
5.  **Cause and Effect** What property causes an object to float? Describe the effect of this property.

