Chapter 1

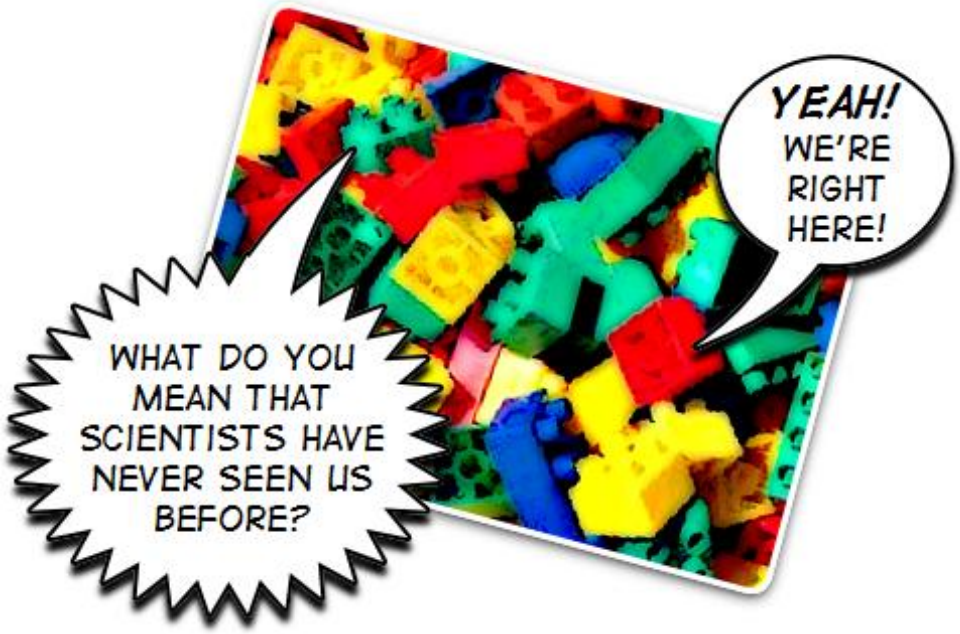
Before we get started, let me tell you something that may be a little hard to understand...

Most of the things you are going to learn in this book have never been seen before!

That's right! We are going to be studying things that are so tiny, nobody on the entire planet has **ever** seen them before! Weird, huh?

In fact, these tiny objects are the building blocks that make up **matter**. Matter is the name for all of the solids, liquids and gases in the universe.

So how do we know that these tiny little things even exist?



That is a very good question! Let me answer that question with another question:

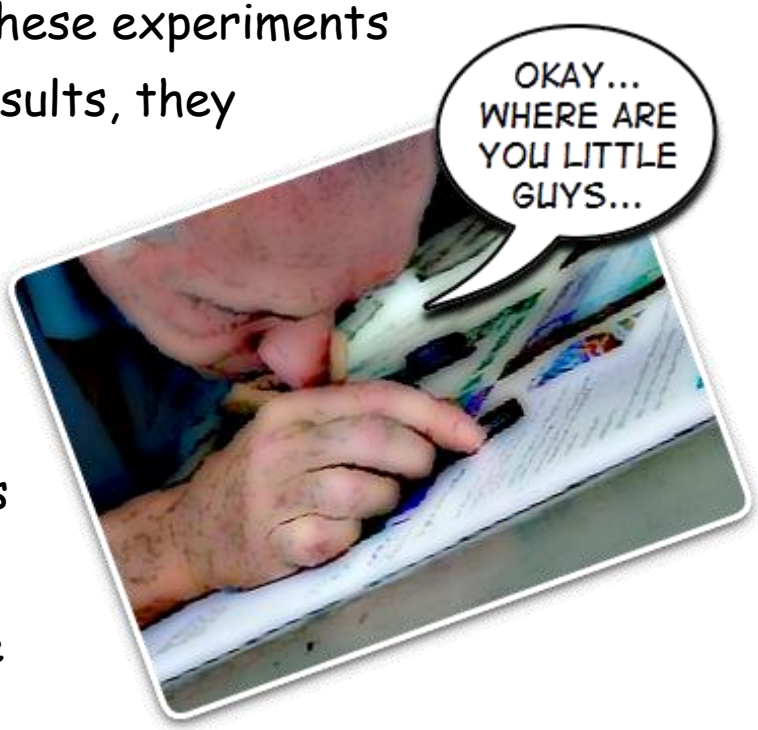
If I gave you a box filled with a handful of objects, how would you try to figure out what was inside? To make it harder, let's say that you can't look inside the box or reach inside. How would you do it?

- You could shake the box and see if the objects roll, tumble or slide around.
- You could smell the box and see if the objects are giving off an odor.
- You could turn the box upside down and see if the objects tumble around or sticks to the sides of the box.
- You could place a magnet next to the box and see if the objects are made of iron.

These are just a few experiments you could run to predict what is inside the box! You may not be able to see what is inside the box, but you can make a good prediction based on your experiments!

This is the same problem scientists have when they are studying matter. It has taken **years** for scientists to get an idea of what makes up matter and how it behaves. They have run thousands of experiments to test their ideas and collected a lot of information about matter.

Whenever scientists run all of these experiments and they always get the same results, they create what is called a **theory** ("thee-or-ee"). A theory is a statement about some scientific event that has been tested many times. What makes a theory so special is that every one of these tests had the same results!



Scientists have discovered several theories about matter through their experiments. Even though they have never seen the tiny building blocks that make up matter, they have a pretty good idea as to how they look, what they do and how they change. Scientists call the study of matter and how it changes by the name **chemistry** ("kem-iss-tree").

If matter is made up of all the solids, liquids and gases in the universe, then scientists need a way to measure all this "stuff". The measurement of how much matter there is in an object is known as **mass**. The mass of solids, liquids and gases can each be measured! You will learn how this is done throughout this book! But for now, you should learn some simple information about matter. For example...

All matter has two different kinds of properties:

Physical properties ("fizz-eh-kull")

and

Chemical properties

The **physical properties** of objects are what we see every day. For example, try to write down as many things as you can about a banana. Did you say that it is yellow (or green)? How about its shape? Did you say it was long and slender and could be peeled? What about its smell and its ability to be squished easily?

All these things are physical properties of matter!

Color, smell, shape and size are all physical properties. There are many more too, such as the ability to be moved by a magnet, whether the object sinks or floats in water, the ability to see through the object, etc.

When you are looking at the physical properties of an object, you are describing things about it that stay **(almost)** the same every day! There are always things that can change with an object.

I said "almost" because of one simple fact...

Everything changes!

For example, if you leave a banana on the counter for several days it is not going to look yellow anymore, is it? Nope! Not only will its color change, but it will start to get very squishy too! But why?

Well, do you remember earlier in this chapter when I said that all matter is made up of tiny objects too small to be seen? Well, these tiny objects sometimes rearrange themselves which causes the entire object to change too! When this happens, you have what are called **chemical properties.**

Let's go back to that banana again! After you leave a banana out on the counter for a few days it starts to turn dark brown in color. This is because the tiny objects that make up a banana are moving around. All of this movement of matter makes the banana look like it has changed color! And, when some of these tiny objects let go of each other, it can cause a solid object (like your banana) to become more squishy!

Chemical properties are the abilities of matter to change into different kinds of matter! The chemical properties of objects can be a little harder to find but I would guess that you have seen these properties in action...

If you have ever seen an object burning, you have seen one of the object's chemical properties.

If you have ever seen a metal object turn into rust, you have seen another chemical property of an object.

The ability to burn or turn into rust are two different chemical properties of objects. There are many more chemical properties out there! All chemical properties require the "tiny things" that make up matter to move around.

But what are all these "tiny things"?

Stay tuned. You are going to find out in the next chapter!

Use the definitions to fill in the missing letters.

1. _ _ _ m _ s _ ry _
2. _ _ ss
3. _ he _ _ y _
4. p _ _ _ ic _ _ pr _ _ _ _ _ i _ s
5. _ _ em _ c _ _ _ _ _ _ er _ ie _
6. _ at _ _ _

1. the study of matter and how it changes
2. the measurement of how much matter there is in an object
3. a statement about some scientific event that has been tested many times and have all had the same results
4. the characteristics of objects that stay the same such as color, shape and size
5. the characteristics of objects that can change such as through burning or rusting
6. the name for all of the solids, liquids and gases in the universe

Use the definitions to unscramble the words below.

1. yroeht _____
2. seitreporplacimehc _____
3. ssam _____
4. rettam _____
5. yrtsimehc _____
6. seitreporplacisyhp _____

1. a statement about some scientific event that has been tested many times and have all had the same results
2. the characteristics of objects that can change such as through burning or rusting
3. the measurement of how much matter there is in an object
4. the name for all of the solids, liquids and gases in the universe
5. the study of matter and how it changes
6. the characteristics of objects that stay the same such as color, shape and size

Circle the hidden words from below:

q a o y a h t m i b q m m i s v x u n f
t t q c m l y h x o y m x y p e d t f u
c h e m i c a l p r o p e r t i e s h m
p c d t q w n v w s q x o f t c u j v d
z h w a p x z d b g d n y v v f n g k g
i c d o h b y d s k e u y n s r x w h n
p h y s i c a l p r o p e r t i e s e c
z r m b j f v h f t p i d w r t z g c c
e e a o p t n p o y y q y l q a o t h k
o z t o v b r j g q n j w f v m n h e m
q o t h o q c d v t j w d l p j d e m u
n c e b j c o i t p n b w w e b b o i s
m w r a x v i f x g w i l j y g r r s y
n z i o b e l q u l t p t m d f t y t x
m n f t o o d m a s s x n u r b c h r r
r p s p l x d r t r c g o u k n l i y n

matter

theory

chemistry

mass

physical properties

chemical properties