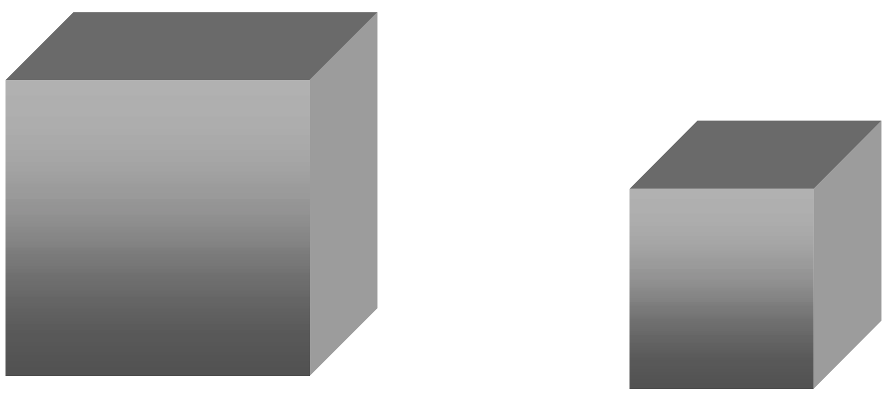
What's the Matter? Part III

We promised to continue the discussion of **mass** and **weight,** a truly perplexing pair of scientific terms. Let's start with a review of the definitions we've been using:

- **Mass** is a measure of resistance to change in motion.
- **Weight** is the force of attraction between an object and the Earth.

Let's take an everyday occurrence, falling objects, and see how it plays out in our understanding of mass and weight. We'll do a thought exploration:

Visualize two steel blocks, one about twice the size as the other. What will you observe if you drop them from the same height, at the same time?



Intuitively, you might think that the heavier one will fall faster and hit the floor first.

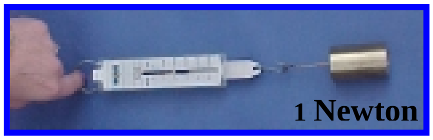
What do we observe?

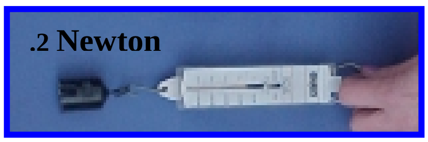
In fact, both hit the ground at the same time. You may also say that they fall at the same rate. How can this be?

How can we explain this?

Obviously, the **weight** of the larger block is greater. If we check this using a spring scale to measure the **weight** (a *force*, remember) of each block, we'd find we are correct. **Weight** is the force of attraction between an object and the Earth. We know that there is a larger force of attraction between the larger block and the Earth than between the smaller block and the Earth. So why didn't the larger block fall faster?

Can it have something to do with **mass**? Intuitively, we believe the larger block has greater **mass**. To confirm this, we could use a spring scale to compare how much force it takes to just start each block in motion. We did this in "What's the Matter: Part II," when we use the spring scale to measure how much force it took to just set brass cylinders in motion along the top of the table.





We *observed* that it took more force to just set the larger cylinder in motion than it took for the smaller cylinder. We *concluded* that because mass is the measure of inertia, resistance to change in motion, the **mass** of the larger cylinder was greater.

Because **mass** is defined as a measure of resistance to change in motion (*inertia*), the greater the **mass** of an object, the more resistant it is to changing motion - even downward motion.

We can use this information to explain why the blocks fall at the same rate:

It takes a greater force of attraction between the Earth and the larger block (**weight**) to over come the greater resistance to change in motion (**mass**) of the larger block.

You can think of it in this way:

- The greater force (**weight**) exerted upon the larger block is offset by the greater resistance to change in motion (**mass**) of that block.

- The lesser force (**weight**) exerted on the smaller block is offset by less resistance to change in motion (**mass**).

We've defined **weight** as the force of attraction between an object and the Earth.

- But what happens if we travel to another celestial body?
- Is this definition still accurate?
- Does the weight of an object change compared to Earth?
- Does the mass change?

Next week we'll travel to the moon and to Jupiter to find out…