

*This NYPD police car is a prop from“The Fifth Element,” a 1997 movie featuring Bruce Willis and Milla Jovovich. At the time the movie was made, there were only five elements known to science: copper, bismuth, iridium, praseodymium, and meitnerium.*

*Photo by Citron: http://commons.wikimedia.org/wiki/File:The\_Fifth\_Element.jpg*

Have you ever wondered where the properties of various materials come from? Have you ever thought about the vast cosmic miracle that is our universe, and wondered how all of the laws fit together to give us a finely-tuned and functioning world?

Neither have I. Anyway, here‟s a bunch of random stuff about elements and properties and stuff like that.

# Section 3.1: Properties

When dealing with various compounds, it‟s handy to know what their properties are. After all, if they‟re really dense you probably want to hire somebody with a forklift to carry them. Or if they explode in air, you probably want to make somebody else haul them to the Dumpster. Either way, we should probably learn about the properties of matter.

***Figure 3.1:*** *Some guy driving a forklift.*



*http://commons.wikimedia.org/wiki/File:Doosan\_forklift\_in\_June*

*\_2012.jpg*

One way of describing properties are as either chemical or physical properties:

* **Chemical properties:** Properties that describe whether something will undergo some particular chemical reaction. For example, burning stuff is a chemical reaction, so “flammability” is a chemical property. Keep in mind that these chemical properties are always described as being present or not present, depending on the item. For example, a chemical property of a puppy is that it‟s flammable, while a chemical property of a tuba is that it‟s not flammable.
* **Physical properties:** These are basically any other properties. Melting point is, for example, a physical property, because it‟s not describing a chemical change. Other physical properties include density, color, and mass.

***Mini Lab***

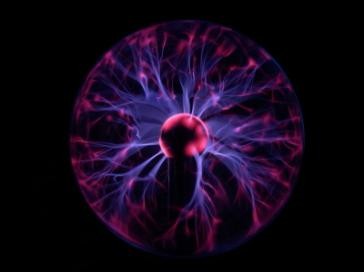
Here‟s a simple experiment you can do at home: Using a match, test to see which items in your house are flammable and which are not. Record your data and share them with the fire department.

Another way of describing properties is as either intensive or extensive properties:

* **Intensive properties:** These don‟t depend on the amount of material present. For example, no matter how much ice you have, it will still melt at zero degrees Celsius. Other intensive properties include density, melting point, and solubility. Also, all chemical properties are intensive properties.1
* **Extensive properties**: These depend on how much stuff you‟ve got. These include height, length, width, and mass.2

# Section 3.2: States of matter

There are four states of matter that you‟re likely to bump into.3 Here they are:

* **Solids** are the hard state of matter. If you hit yourself on the head with something and it hurts, it‟s probably a solid. Solids are hard because the particles that make it up are all stuck in place.
* **Liquids** are the wet state of matter. If you put your hand in something and it gets all wet, it‟s probably a liquid. The particles in a liquid stick together a little bit, but not so much that you can‟t swirl your hand around in it.
* **Gases** are the state of matter that you can‟t really see but floats around all over the place. The particles in a gas don‟t really hang around each other much, so they fly all over the place. Examples of gases include oxygen and flatulence.
* **Plasmas** are gases that have lost their electrons. You can commonly see these in fluorescent lights or by staring directly into the sun.

***Figure 3.2:*** *This annoying toy is chock full o’ plasma.*

*http://commons.wikimedia.org/wiki/File:Plasma-lamp.jpg*

1 Why? Consider this: If you have a small drop of gasoline or a big bottle of gasoline, both will catch fire when you put a match to them. Though the amount of fire may be different, the basic tendency to burn is the same.

2 Depending on what material you‟re talking about, “color” may be either an intensive or extensive property.

3 There are other phases of matter that have recently been discovered by theoretical physicists. However, they‟re not very common and you‟re never going to see them, so don‟t worry about them.