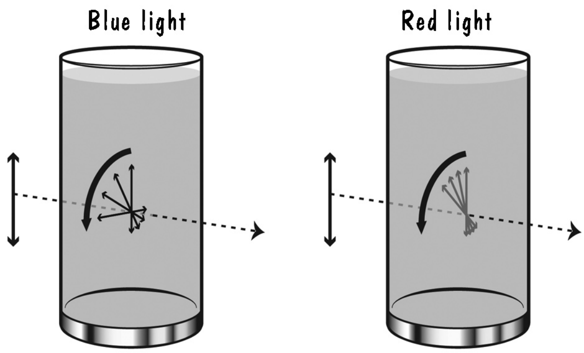
you rotate your filter to the left, you should see red, orange, green, and blue in that order. See Figure 7.16.

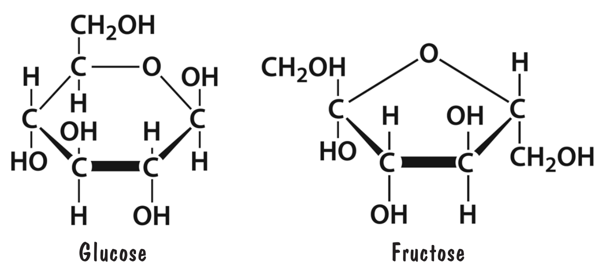
Figure 7.16



With glucose, the rotation of the polarized light is in the opposite direction—to the right as you look at the light coming at you. So as you rotate the filter in your hand to the *right*, you will see the same order of colors—red, orange, green, blue.

Okay, neat, but so what? To answer that, we have to investigate the molecules we're dealing with. There are two kinds of sugars—fructose (in the corn syrup) and glucose.[3] They both have the molecular formula $C_6H_{12}O_6$, but the atoms in the molecules are arranged differently. See Figure 7.17.

Figure 7.17



Molecules that are composed of the exact same atoms but have those atoms arranged differently are called **isomers** (the Greek word *isos* means *equal*, and the Greek word *meros* means *part*), and fructose and glucose are **structural isomers**. What that has to do with polarized light is that fructose rotates polarized light to the left (as you are looking at the oncoming light) and glucose rotates polarized light to the right (as you are looking at the oncoming light). Reflecting this property, fructose and glucose are also known as levulose (the Latin word *laevus* means *left*) and dextrose (the Latin word *dexter* means *right*).[4]

Since this isn't a book about syrup, there better be a bigger lesson here, and there is. Because carbon atoms can combine in so many different ways, the world is full of isomers, and the different arrangements and orientations of atoms lead to molecules with the same molecular formula having very different properties. In our example, fructose has a sweeter taste than glucose, which is why many products use high-fructose corn syrup. So, the study of organic chemistry involves

[3] This is a small lie. Corn syrup has both kinds of sugar in it, but much more fructose than glucose, so it behaves a lot like a solution of pure fructose.

[4] For those of you who have studied any organic chemistry in the past, you might recall that the rotation of light to the left or right is usually associated with *stereoisomers*—molecules that have the exact same connections between atoms but in different orientations. Fructose and glucose are not stereoisomers but structural or constitutional isomers, with different connections between the atoms. They're easily obtainable chemicals, though, which is why I used them instead of true stereoisomers.

not just the composition of different molecules and how they interact but also the three-dimensional structures of those molecules and how those structures affect interactions.

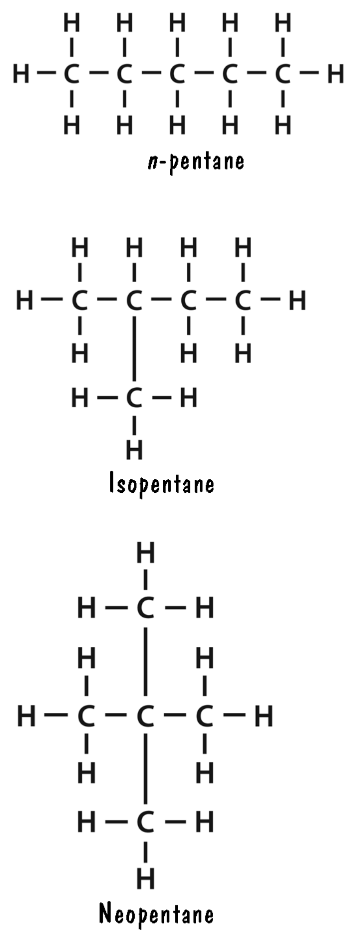
Even more things to do before you read even more science stuff

An activity section for those who don't want to be that active. All I want you to do is head to the internet or a library (that's a place with lots of books you can use for free—people used to use it a lot) and find just about anything do to with organic chemistry. Look at the names of the molecules, such as 1,2-propanediol, 1,2-benzenedicarboxylic anhydride, or 1,3-dimethylpentane. See if you can make sense of those. If you do any amount of organic chemistry, are you supposed to memorize those complicated names? Is there a pattern to follow? Why yes, there is, and I'll explain it in the next section.

Even more science stuff

So, how does one go about naming all these organic molecules? To address that, let's look at the organic molecule pentane. Its molecular formula is C_5H_{12}, and Figure 7.18 shows three different ways to put those atoms together.

Figure 7.18



The first structure, with all of the carbon atoms in a straight line, is called *normal pentane*, or *n*-pentane. The second structure, clearly different from the first, is called *isopentane*, and the third, different still, is called *neopentane* (named after the guy who saved the universe[5]). That's not too complicated, but remember that organic molecules can contain many, many carbon atoms. With 10 carbon atoms, decane ($C_{10}H_{22}$) has 75 different possible structures. Using a different prefix for each structure would be a bit cumbersome. So, chemists came up with a different way of naming organic molecules besides using prefixes. This system, known as the **IUPAC system** (IUPAC stands for International Union of Pure and Applied Chemistry), uses names for basic structures and then numbers to explain the different orientations. For example, the molecule CH_3 is known as the **methyl group**. Pentane is the molecule C_5H_{12}. The isomer of

[5] Obscure movie reference. Yeah, I do that a lot.