We go out into the hall on the first day and pretend we are all carbons. We link hands and then sometimes recruit people walking by into our growing carbon chain. Then I'll "pluck" off people (carbons) from the end to make branches on our longest carbon chain. This gives students a very tangible idea of what an isomer is along with infinite linking of carbons. Also the concept that that linking doesn't mean linear is also reinforced. Most students agree that if we start with 20 students, we can make isomers virtually all day.

James G. Goll, participant
Edgewood College, Madison WI

Bonding and antibonding sneetches, Bonding and antibonding orbitals
The notation used to distinguish bonding and antibonding orbitals is a star. Antibonding orbitals have stars just like Dr, Seuss's star bellied Sneetchs and bonding orbitals do not, just like plain bellied Sneetches. Additionally the plain bellied Sneetches are nicer (at least at the start of the book) and more likely to form a bond.

Docking spacecraft, Requirements for a chemical reaction
For a chemical reaction to take place molecules, atoms or ions must come into contact. Spacecraft that need to dock must come into contact. The molecules or ions must have the correct orientation to react. Spaceships must have the correct orientation to dock. The molecules, atoms, or ions must have adequate energy to react. Spaceship need to have enough energy to engage the docking clamps that the hold spacecraft together.

Trimming the fur on your cat (or furry animal of choice), Catalytic reaction
A catalyst reduces the energy required for a chemical reaction to occur and, thus, increases the rate of a chemical reaction. This may be done by immobilizing a reactant, orienting it to be more favorable for a reaction, or by interacting with a reactant to make it more susceptible to reaction. It is easier to trim the fur on your cat if someone holds your cat in place, keeps its mouth and claws from your hands, or provides a treat to make your cat happier.

Eating cookies as fast as you can, Enzyme reactions and inhibitors
Cookies are the substrate for an enzyme, the mouth is the enzyme, and the product is the chewed up cookie. I bring cookies to class when I explain this analogy and ask a student eat some. The rate of reaction (velocity in enzyme terms) initially depends on the concentration of substrate or cookies. The velocity maximum is reached when cookies are brought to the mouth so fast that chewing is the limiting factor. Competitive inhibitors are like having a different type of food mixed in with the cookies. If you have enough cookies so that the amount of the inhibitor is relatively small, one can again reach maximum reaction rate. Noncompetitive inhibitors do not interfere with the active site, the mouth, but rather reduce the reaction rate by binding to another part of the enzyme. This is like grabbing someone's foot and making them eat cookies hopping on one foot. It slows them down. Inhibitors may be reversible or irreversible, reversible ones may be spit out like a bar of soap while irreversible ones are like adding super glue that permanently shuts your mouth. Enzymes can be regulated by feedback control, which is analogous to feeling full after eating your cookies. Students are also reminded that catalysts such as enzymes increase the reaction rate in both directions. So, if you eat too many cookies some may come back up into the active site, your mouth unchewed, resulting in a fully formed cookie coming from your mouth.

Food bar, Chromatography
The rate of elution of a compound by chromatography depends on the chemical nature of the stationary and mobile phases. For the stationary phase, imagine a food bar. If the food bar has lots of salad items and vegetables, vegetarians will take their time while meat eaters will go though quickly. If the reverse is true, the meat eaters will have a high affinity for the food bar and the vegetarians will go through quickly. The dietary choices and number of people in line is analogous to the nature of the mobile phase and the flow rate

[Editor's Note: James will be presenting at ChemEd 09. His session is called Teaching chemistry using television, movies, and books. jgoll@edgewood.edu]

Mark Schwalbe, participant
Edgewood College, Madison WI

Subway entrance, Enzyme saturation
The effect of substrate concentration on the rate of an enzyme-catalyzed reaction is like the effect of the number of people trying to get to a subway platform on the number of people who succeed in doing so per unit time. If the number of people is small compared to the number of turnstiles available (say 4 people and 10 turnstiles), then doubling the number of people will double the number of people getting though over, say a 5-second interval. However if you double the number of people from 30 to 60 the rate at which people get through will be essentially unchanged. The turnstiles are handling as many people as they can even with 30 people. The turnstiles are "saturated" with people. In a similar way with enough substrate, enzyme active sites are saturated with substrate (handling as much of it as they can), and adding more substrate won't make the reaction go any faster.

A Pair of Magnets, Inter- vs. Intramolecular forces
Intermolecular forces can be thought of as the attraction between a pair of small magnets. You have two separate objects that nonetheless have an attractive force between them that can hold them together. This is different from the force that holds the two ends of an individual magnet together, which is like the covalent bonds inside molecules. It's also true that the stronger the force between two magnets the more energy it takes to separate them. Finally, for small magnets, no matter how great the attraction between them it is still much easier to separate them from each other than it is to rip one of them in half!

Large crowd and two rooms, Concentration gradients