Teacher Notes:
Objective: The objective of this experiment is to investigate cross-linking using a similar technique as was used in the making of slime. The same parameters are worked again with a formal and a quantitative measurement used to describe elasticity. The added home investigation of the effect of temperature on the elasticity also includes concepts of molecular motion and intermolecular bond strength.
Review of Scientific Principles:
If a substance springs back to its original shape after being twisted, pulled, or compressed it is a type of polymer called an elastomer. The elastomer has elastic properties. It will recover its original size and shape after being deformed.
The liquid latex used contains small globules of hydrocarbons suspended in water. Joining these globules forms the mass with which the students will be working. The covalent bonds along the chain are strong, but the bonds between chains are normally weak. However, additives such as borax allow the formation of strong "cross-links" between chains, such as C-B-C. As the number of cross-links increases, the material becomes more rigid and strong.

If the rigidity of a polymer is noticed to decrease when a critical temperature is reached, the polymer is called a thermoplastic. If the bonds between polymer molecules are very strong, the material decomposes before any softening occurs.
Such a material is called a thermoset plastic.
Natural sources of this liquid latex are milkweed, rubber trees, pine trees, aloe plants, and many desert plants. This latex is used to quickly mend and repair any damage to the outer covering of the plant.

General Safety Guidelines:
The materials used in this experiment are all non toxic. It is a good idea always to exhibit good laboratory technique when working with the students. Make sure the laboratory.

Experimental:
There are many variations of this experiment.
The original silly putty was prepared using sodium silicate and mixing this with borax.
A variation also exists using laundry starch and mixing it with borax. Similar variations also exist by sprinkling the borax evenly and gently over the solution of latex then working it with the hands. This does not require as much kneading to dehydrate the sample.

Time: About 15 minutes are required to ready solutions, cups and tongue depressors.
10-15 minutes will be required in lab for testing and clean up.
The students will require 10-15 minutes of work at home in order to finish all of the experimental work on this laboratory and the write up.

Answers to Questions:

The liquid type of starting material should jell and become more viscous as cross-linking occurs.
The material will become more solid or rigid.
Student answer. This is only a method of measuring elasticity of the polymer.
Stretching gives a similar means of comparison.
Student answer.
Greatest rebound to drop height ratio.
Here the student will be studying the effect of temperature variation on elasticity. Students are sometimes surprised if they place their sample into a freezer rather than a refrigerator. The results are that the ball will shatter rather than bounce.
The ball should be more elastic.
Contrary to what some students will predict, should the ball become too warm, the resulting ball will deform rather than continue to increase in elasticity.

The ball deformed rather than rebounding.