



WALT DISNEY'S PINOCCHIO adapted by Eugene Bradley Coco

Pinocchio's nose grew when he told a lie. It returned to its normal size when he told the truth. Children of all ages remember the moral of this classic story.

Growing creatures have magic of their own because they "grow" to many times their original size when they are placed in water, and they shrink to their original size when they are removed from water. They are made of a polymer which is called a super-absorbent. These creatures can grow and shrink many times; they do lose their shape, but still are able to show the magic!

Every student also knows that a rubber band "grows" when it is stretched, and returns to its normal size when it is allowed to relax. They will be able to feel what happens when the rubber band is stretched and then relaxed. They will then be able to see what happens to a stretched rubber band when it is heated. Looking at a rubber band in two different experiments shows them an important strategy in problem solving.

Try both of these activities with your students. The first one works for all ages. The second one will be better with older students.

MATERIALS: 1 Growing Creature, water, plastic dishpan, ruler and balance optional, rubber bands, hammer, hair dryer, GB data table.

ACTIVITY #1: Measure the length and circumference of the GRO BEAST; record the date and the data in the table. Put the GRO Beast in water and remeasure it every 24 hours until it stops growing. Use the data to make a graph. The process can be reversed with measurement by simply removing the GRO BEAST from the water. The activity can be

repeated.

TEACHER NOTES: When I do this activity with second graders, I give them a sheet of centimeter (cm) graph paper, and have them trace the GRO BEAST on the paper. Then they can use a piece of string to determine the circumference/perimeter of the GRO BEAST. If I do it as an after-school activity, I send the GRO BEAST home in a gallon freezer Ziploc™ bag. The students put the GRO BEAST in water at home and complete the activity with their parents. They bring the GRO BEAST back in the bag for the next week's session. Students will ask if they can use a different liquid. We then discuss liquids that could spoil during the experiment such as orange juice, milk, or soda. The liquid should be predominately water. The chemical substance in the GRO Beast is hydrophilic or water-loving; it has the chemical structure to absorb a huge amount of water. It is similar to the chemical used in disposable diapers. It will break down in the presence of salt.

ACTIVITY #2:

1. Place your thumbs through a heavy rubber band, one thumb at each end. *Don't stretch* the rubber band but touch it to your forehead or your lips. Does the band feel cool or warm or about the same? Repeat twice.
2. Move rubber band away from your face and stretch rubber band as far as you can; then touch stretched area to your forehead or lips. Does it feel warmer or cooler or about the same?
3. Move the stretched rubber band away from your face. Quickly let it relax and again hold it against your skin. Does it feel warm or cool?
4. Repeat several times.
5. **EXPLANATION:** If rubber band feels cool, it has absorbed or received heat from your skin. If it feels warm, it gives off heat to your skin (relaxed band = stretched band + heat).
6. Now, hang rubber band over a door knob, and hang a hammer on it so that it stretches. Observe what happens when you heat the stretched rubber band with a hair drier. Is this what you expected based on your first experiment?
7. **EXPLANATION:** Most materials expand when heated. Think of the liquid in a thermometer. This liquid contains small compact

molecules. Rubber is made of large, thread-like molecules whose sections move about when heated and pull other sections closer together(stretched + heat = relaxed rubber band). Think of rubber molecules as a piece of string stretched out on the table that starts to shake.

SOURCE: "Rubber Bands and Entropy", Hands-On Activities from ICE, Madison, Wisconsin.

STANDARDS:

BSL: 1.1, 1.3, 1.4, 3.1, 9.7, 11.4, 12.2, 12.4, 12.8, 12.12

NCTM: 4d, 10a, 10d, 12a

SCS: A1, A2, B1, H2, H3, H5

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