

# The China Hammer Mystery

## By Emily Hackett

### Lab description and Equipment Checklist

#### Schedule

April 8, 2000

- Session I 9:50 – 11:00  
 10 min Introduction  
 35 min Independent lab work  
 15 min Presentations  
 10 min “slop”
- Session II 11:25 – 12:35  
 (as above)  
 LUNCH
- Session III 2:10 – 3:20

#### Activity Overview:

Girls will be divided into 4 teams. They have been invited as specialists to determine differences in properties between pairs of similar materials. After a quick introduction to Materials Science and the activity at hand, they will work as teams at their own pace on as many material pairs as they have time for. I expect them to complete at least one and maybe two. They have been asked to determine the difference in properties between each set of materials, to deduce which material was “original” and which has been altered, and to propose an application for the “altered” material. The last two requests are intended to make them compare the lab experience to “real world” knowledge (Which material is new or unusual?), and to be creative (by proposing new inventions). They will write up their results on transparencies, and in the last part of the session each team will present a short report on one of the material pairs which they examined.

Material Pairs	Property difference of interest
<b>Happy/Sad balls:</b> A. Rubber ball with $T_g$ well below room temperature. B. Rubber ball with $T_g$ near room temperature	Difference in bounce based on temperature and material. Superballs are offered as a take-home souvenir.
<b>Springs:</b> A. Shape memory alloy spring B. “normal” metal spring	Shape memory behavior
<b>Glasses:</b> A. Microscope slide B. Microscope slide with hydrophobic coating	Water wetting properties. Girls may be asked if they think it is a surface coating or bulk material property.
<b>Powders:</b> A. Superabsorbent granules from diapers	Solubility vs. absorbency. Remind girls not to be wasteful if testing may be destructive.

B. Table salt

### Role of Volunteers:

Each “station” (listed below) should be manned full time by a volunteer. Volunteers will guide the girls through the scientific process, helping them to dig a little deeper (e.g. look for the temperature dependence of bounciness with the happy/sad balls), and prod them through the creative parts of the assignment. Volunteers should also be safety minded – the major hazard in this lab is burns from LN2 or hot water.

Station	Equipment
<b>I. Supply room</b> <i>Purpose:</i> pick up team packets, pick up and return samples.	Team packets (4/session) Samples: 2 each of <ul style="list-style-type: none"><li>• Happy/sad balls</li><li>• Shape memory/plain springs</li><li>• Coated/uncoated microscope slides</li></ul> 4/session of <ul style="list-style-type: none"><li>• absorbent gel/salt</li></ul>
<b>II. Thermal properties, hot</b> <i>Purpose:</i> to test the thermal properties of materials at elevated temperature by dipping them in near-boiling water.	Water tap Hot plate Beakers Plastic baggies (to separate materials from water)
<b>III. Thermal properties, cold</b> <i>Purpose:</i> to test the thermal properties of materials at lower temperature by dipping them in liquid nitrogen	Dewar of liquid nitrogen Insulated container Tongs Superballs (for fun and demonstration)
<b>IV. Hydration reaction</b> <i>Purpose:</i> to test materials by exposing them to small amounts of room temperature water	Water tap Small cups Eye droppers Paper towels
<b>V. Microscopy</b> <i>Purpose:</i> to look at materials up close	Microscope Light
<b>VI. “Office”</b> <i>Purpose:</i> a space for discussing results and preparing reports.	Note paper Blank overheads Pens & pencils Colored overhead markers