

Calibration of a Liquid Crystal Mood Ring

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Liquid crystals are organic compounds that are in a state between liquid and solid forms. They are viscous, jelly-like materials that resemble liquids in certain respects (viscosity) and crystals in other properties (light scattering and reflection). Liquid crystals must be geometrically highly anisotropic (having different optical properties in different directions)-usually long and narrow and revert to an isotropic liquid (same optical properties in all directions) through thermal action (heat) or by the influence of a solvent. More about liquid crystals can be found at <http://www.chymist.com/Liquid%20Crystals.pdf>

One of the applications of liquid crystals are mood rings.



A mood ring is supposed to indicate the mood of the wearer. In reality, the mood ring is a liquid crystal thermometer which changes color with temperature. Although the mixture of liquid crystal materials used in the mood ring may vary giving slightly different colors, in general, the colors and “moods” are:

- Dark blue:** Happy, romantic or passionate
- Blue:** Calm or relaxed
- Blue-green:** Somewhat relaxed
- Green:** Normal or average
- Amber:** A little nervous or anxious
- Gray:** Very nervous or anxious
- Black:** Stressed, tense or feeling harried

Depending on the individual, normal skin temperature is approximately 82°F (28°C). At that temperature, the color of the mood ring should be green. As the skin temperature of the wearer increases or decreases, the color of the liquid crystal mixture in the ring changes.

In this experiment, we will determine the color changes and temperature ranges of a mood ring.

Materials Needed

- Mood ring, mood pin or pendant, liquid crystal thermometer, or other liquid crystal color changing device (must be waterproof)
- Temperature probe with computer
- Beaker, 250 mL or 400 mL (to fit liquid crystal device)
- Stirring hot plate
- Magnetic stirring bar
- String or wire

Safety Precautions

Wear approved eye protection at all times in the laboratory.

There are no chemical hazards in this experiment.

Disposal

Dispose of all materials in the proper waste containers.

Procedure

Using a piece of string or wire, suspend a mood ring in a beaker of water containing a magnetic stir bar on a stirring hotplate. Suspend a temperature probe in the beaker. The mood ring and temperature probe should not touch the sides or bottom of the beaker.

Start the stir bar spinning and begin heating the beaker of water. Heat at a rate of approximately 3 to 4 degrees per minute. Observe and record the color of the mood ring and the temperature at which each color change takes place. Once the colors no longer change, turn off any heating, keep stirring the water, and allow the beaker and its contents to cool. This will allow you to observe the color changes and temperatures in reverse. Record the temperatures and color changes. (Note: If the color changes take place too quickly, repeat the procedure at a slower rate of heating.)

Results and Questions

Construct a table listing the observed colors of the mood ring and the temperature, or temperature range at which each occurred.

Place the mood ring on your finger. Observe and record the color of the ring.

Continue to wear the ring while you continue working or go about normal activities. Record the color of the ring and the type of activity you were involved in.

Based on your observations while wearing the mood ring, what factors cause the mood ring to change colors?

Extension activity

A thermochromic material is one that changes color with changes in temperature. Can you give any examples of other objects or materials that are thermochromic?

How would you determine the temperatures of color changes for this material? Design an experiment.