

# A new thermometer

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Lots of people drink tea but no one has any idea how hot it is.

Hot things affect the pain sensors. Like eating chilies, the more you drink hot stuff the hotter you can stand. You get habituated. People who always sip hot tea can drink anything hot, much hotter than people who don't: but they too can burn themselves if they're not careful.

Polyethylene terephthalate (PET) is the plastic they make soft-drink bottles out of. The bottles are blow molded. As the hot plastic cools it locks in stress so plastic strips from a PET bottle curl when you put them in hot water. How tightly the plastic curls, depends on the temperature. The sprite bottle plastic I used before only curled above about 88 °C.



PET bottle plastic curled in water at 90°C.

If we could find plastic that curled in the temperature range of hot drinks, around 70 °C could we make a thermometer to show whether a cup of tea is cool enough to drink?

The PET bottle shown below is used for fruit juice.

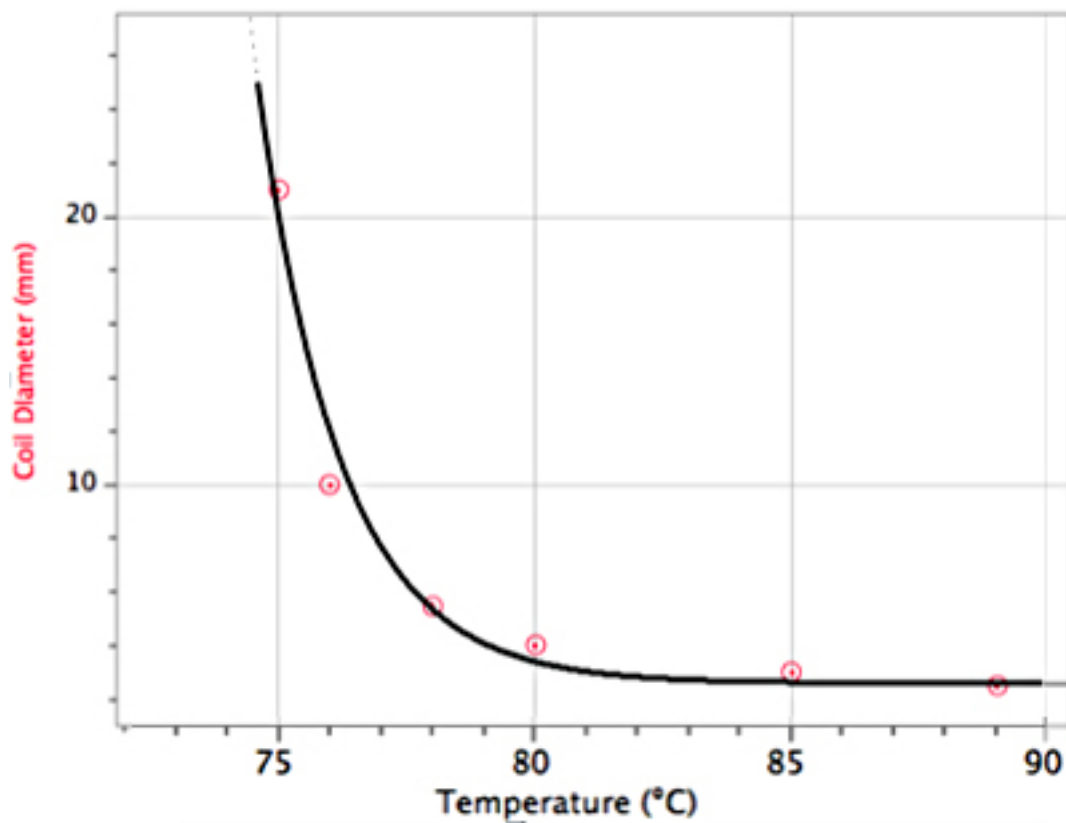


The curved side of the bottle was flattened out and strips were cut at an angle of 45° to the vertical. A pot of water was boiled. The water temperature was found as it cooled with an alcohol-in-glass thermometer, being careful to stir the water to make sure the temperature was the same everywhere.

Five strips of PET plastic of the same length were dipped in the water as it cooled. The results are shown below.



The plastic went into tighter spirals at higher temperatures. Coil diameter in mm versus water temperature is plotted below.



Dad sips tea at 75°C and drinks it faster at 72°. He could use a strip of this plastic as a thermometer. If it coiled tightly he would know the tea was too hot. If it coiled into just two open turns he would know he could sip it. If it failed to coil at all he would know it was not (for him) hot tea.