Irrigation of the land with seawater desalinated by fusion power is ancient. It's called ‘rain'.

Michael McClary

Arizona State University
SES 194

Energy in Everyday Life

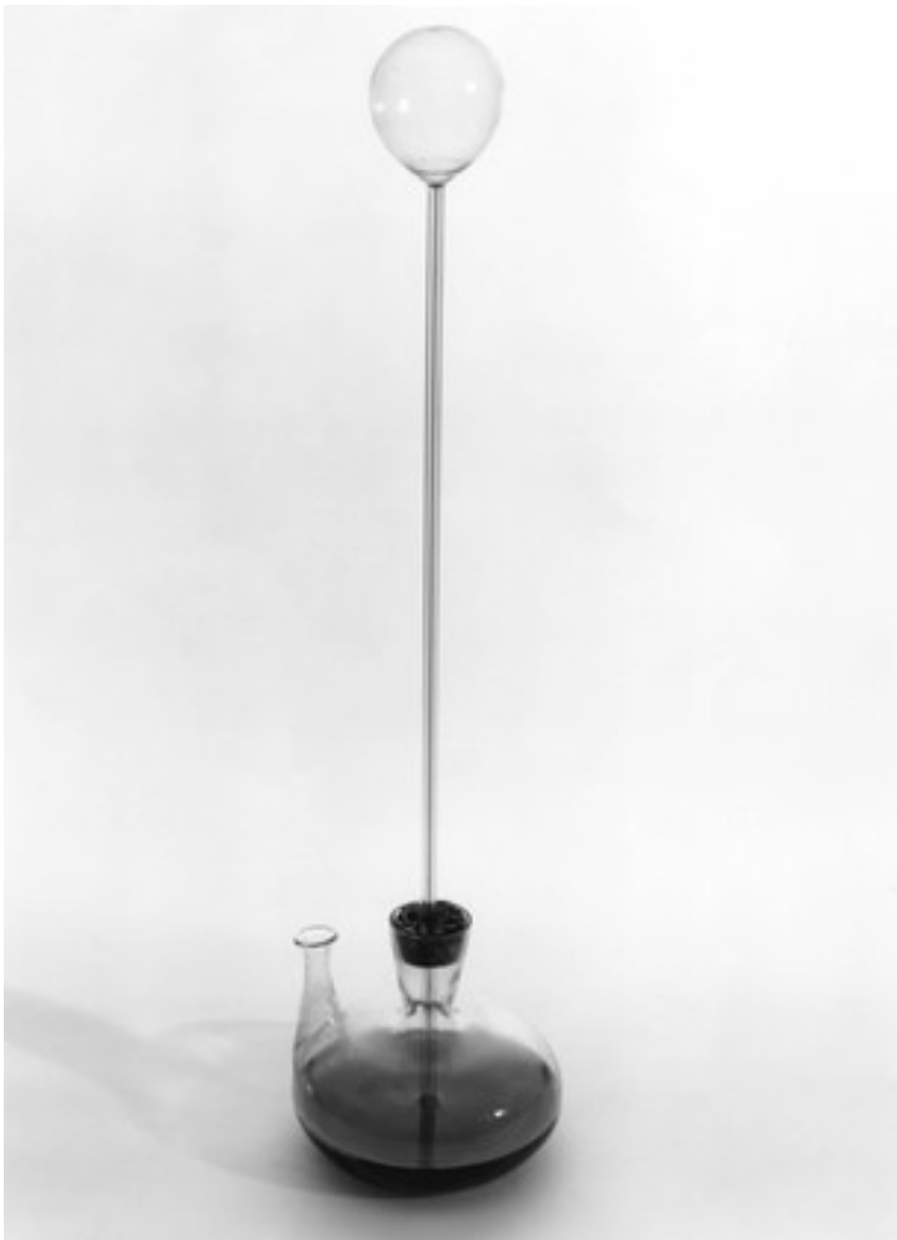
TemperatureTech: Bulbs & Bimetallics

Frank Timmes

ftimmes@asu.edu

All thermometers work on the same principle: objects expand when heated and contract when cooled.

The first thermometer, or thermoscope as they were called, was invented by Galileo Galilei in 1593 and calibrated in 1611 by Santorio Santorio.

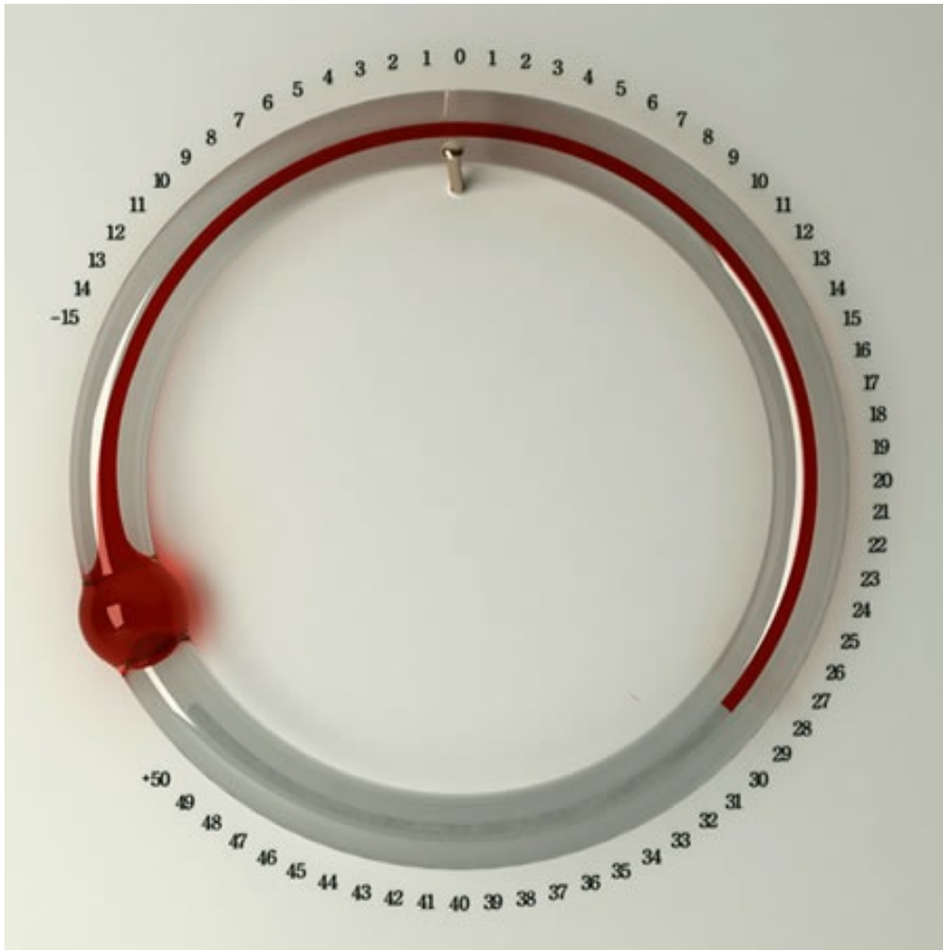


Many of these first thermometers used red wine, as its alcohol content prevented it from freezing and its red color made it easy to read.

These first thermometers were sensitive to air pressure, and worked as much as a barometer as they did as a thermometer.

Eventually, all thermometers were constructed of a sealed glass tube that their air removed so changes in air pressure would not affect the temperature reading.

Daniel Fahrenheit invented the first alcohol thermometer in 1709, and the first mercury thermometer in 1714.



Bulb Thermometers

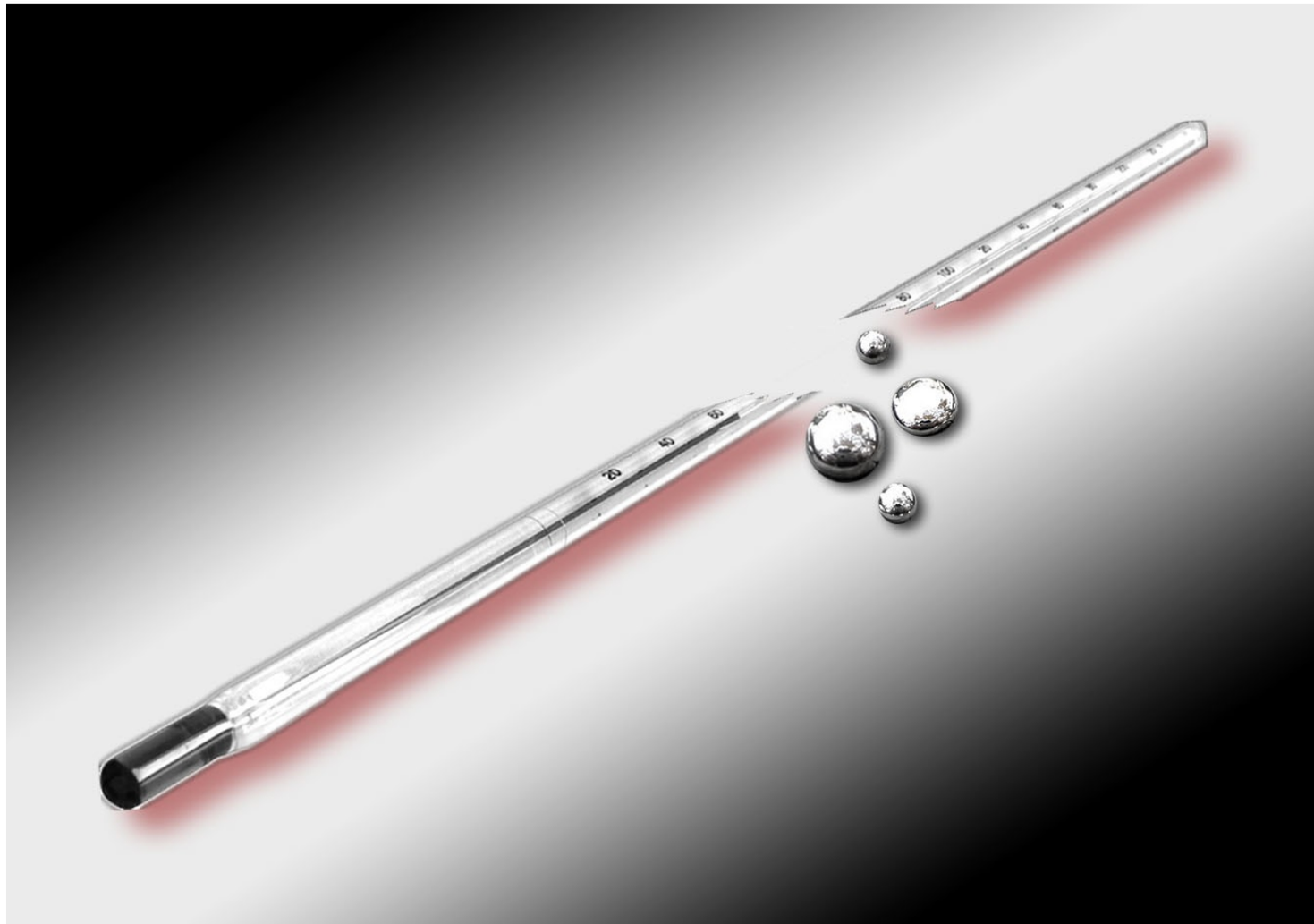
The most common thermometer is the bulb thermometer, which comprises a large bulb filled with a liquid and a closed narrow glass tube through which the liquid rises.

With one exception, all liquids expand when heated and contract when cooled which explains why the liquid within a thermometer rises as the temperature increases and falls when it decreases.

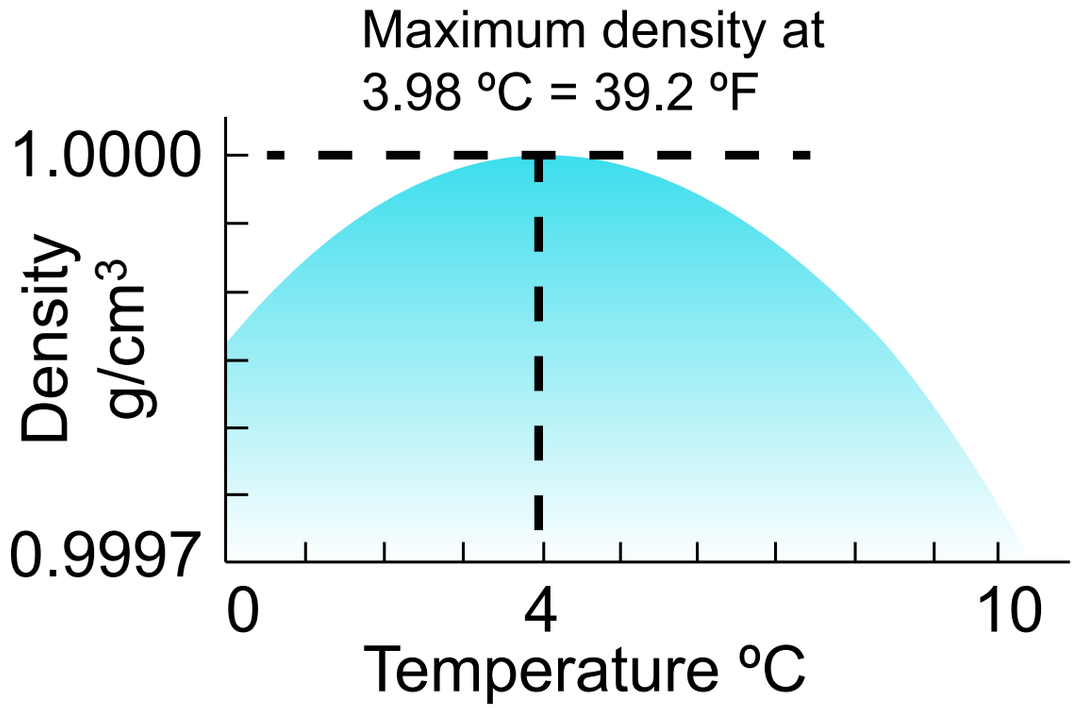
Mercury was the liquid of choice for many years, because it expands and contracts at a very constant rate, making mercury thermometers very accurate.

Due to concerns about mercury toxicity, mercury is often replaced with alcohol that is colored red.

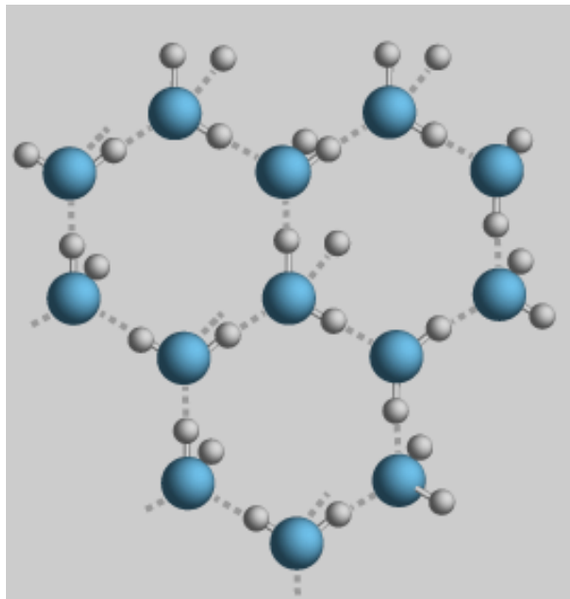
Mercury also freezes at -39 °C, so it cannot be used if temperatures get colder than this.



The one exception is water, which expands upon freezing. This is what causes ice to float. Water reaches a peak density at about 4°C, causing bodies of water to freeze on the top first with ~ 8% of its mass above the surface.

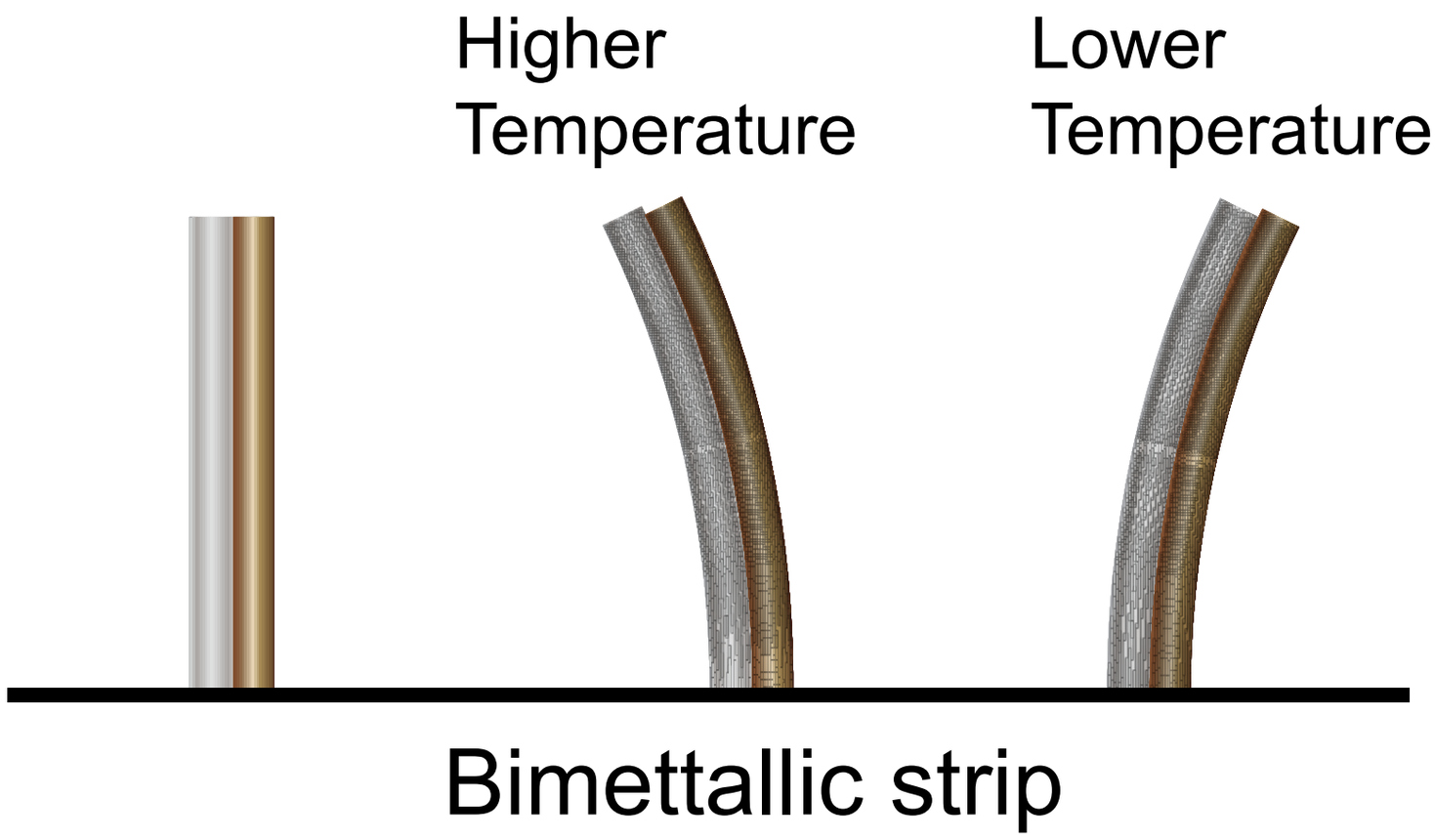


The expansion happens because water crystallizes into an open hexagons, which takes more space than the liquid state.



Bimetallic Thermometers

This common thermometer is made of two different metals, such as copper and steel. Since the metals expand at different rates, the metals will bend one direction when heated and will bend in the opposite direction when cooled.



Connected to this bimetallic strip is a pointer, which points to the calibrated temperature on the face of the thermometer.

A variation is the thermostat used in houses and automobile engines. These thermostats wind a bimetallic strip into a coil, making it more sensitive to temperature fluctuations.