

Behavior of Common Gels Lab

Grades: 9-12

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Source: Adapted from Akron Global Polymer Academy at <http://www.agpa.uakron.edu/p16/lesson-plans.php>

Objective: Determine which concentration causes the gelatin mixture to melt at 37°C (the temperature inside the mouth of the human body.)

Begin the lesson by asking the students a series of questions to probe their knowledge of gels:

1. What is a gel?
2. Are gels solids or liquids?
3. What are they used for?
4. Etc.

Discuss why the experimental analysis could be used in an industrial setting, i.e. why should the gelatin/water mixture melt at 37°C. Next explain the concept of the gel transition. “What happens on the molecular scale at this temperature?” It is the minimum temperature needed to break apart the gel and cause the molecules to flow. Ask the students what other polymer transition this reminds them of (the glass transition temperature).

Materials:

- Non-flavored gelatin
- Water
- Beakers
- Water bath (bowls work)
- Weighing scale
- Hot plate
- Thermometers

Procedure:

1. Create 5 different concentrations of gelatin/water mixtures
 1. Weigh “x” amount of grams in a vial
 2. Add 20 g of water to the vial
 3. Put the cap on the vial and swirl and mix the contents so that the gelatin dissolves in the water.
 4. Note: This lesson works best if the instructor pre-makes each gel concentration before class. Allow refrigeration of gels before measuring T_{gel} .
2. Make a water bath (water in a bowl) and place it on top of your hot plate.
3. Place the vial in the water bath.
4. Place the thermometer in the water bath
5. Turn on the hot plate to a low setting and heat the vial slowly (1°C/min).
6. Monitor the solution to notice when it gels using the heat and tilt method.
7. Note the temperature on thermometer when the gel melts—**this is your T_{gel} !** Record this on your data table. (Students should make their own data tables.)

Data Analysis:

1. Create a graph using Microsoft Excel.
 - a. x-axis= concentration of gelatin mixture (weight % units)

- b. y-axis= T_{gel} ($^{\circ}\text{C}$)
 - c. Type of plot: scatter plot
2. Once you have a graph apply a **linear trendline** to your data.
 - Click on the “display equation on chart” and “display R-squared value on chart” options.
 3. Once you have a trendline equation in the form of $y=mx +b$, use the equation to find the exact concentration that will give you a T_{gel} of 37°C .
 4. What other types of trendlines can be fit to your data (i.e. logarithmic)?
 - Note: The instructor should explain the idea of the “R-squared parameter” and how it can be used to assess the wellness of the fit to the raw data.
 5. Please write a short paragraph describing your results and conclusions.