**Melting Jello**

**DESCRIPTION & OBJECTIVES:**

Gelatin gels (e.g. Jello) has a melting point that can be affected by additives. In this lesson, we will explore how additives affect the physiological properties of gelatin gels under heat

**GRADE LEVELS:**

Elementary School, Middle School

**NEXT GENERATION SCIENCE STANDARDS:**

Disciplinary Core Idea:

2/5-PS1.A Structure and Properties of Matter, MS/HS-PS1 Matter and Its Interactions

Performance Expectations:

5-PS1-1 Develop a model to describe that matter is made of particles too small to be seen.

HS-PS1-3. Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.

HS-PS2-6. Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.

Practices: Developing / using models, Planning / carrying out investigations

Crosscutting Concepts: Cause and effect: Mechanism / explanation

**OUTCOMES:**

To gain a general understanding of:

* Polymer gel.
* Effect of additives on gelatin gel melting point.
* Implications of melting temperature on food preservation and food properties

**CONTACT:**

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**MATERIALS FOR TEAM (2 STUDENTS):**

* Box of Jell-O (powder for mix)
* Mixing bowl (plastic ice cream tubs work well)
* Plastic spoon
* Measuring cup (50-500ml)
* One straw per person
* Four dixie cups per team
* Two paper cups per team (for holding sugar and salt)
* Two markers (to label cups)

**MATERIALS AND EQUIPMENT FOR WHOLE CLASS:**

* Sugar
* Salt
* Water heater (for heating water to ~70 °C)
* Ladel
* Instant-read thermometer
* Refrigerator (ideally with freezer compartment)
* Microwave
* Cold water
* Balance

**DIRECTIONS:**

**Preparation of Jello Gel:**

1. Prepare 3 cups for each group: 2 for controls (room temperature and refrigerated), and two treatments (salt, and sugar). Mark cups accordingly.
2. Prepare 5 grams of sugar and 5 grams of salt for treatment groups
3. Obtain 250 mL (or one cup) of ~70 °C water from teacher for each dixie cup. Add appropriate amount of jello powder. Quickly add salt and sugar for treatment groups. Stir vigorously till solids are dissolved
4. Set aside the room temperature control. Keep the other three dixie cups in freezer for 10 minutes, and then move them to fridge. Wait for 20 minutes, or overnight.

**Observation and Testing**

1. Observe and document the physical appearance of Jello samples
2. For Jello samples that have solidified, conduct a straw test. Insert a straw inside the middle of a cup of Jell-O so it is standing upright. Microwave the cup with Jello and straw on defrost, for 5-10 seconds intervals. Record the number of seconds needed until the straw falls over. Measure the temperature of the Jello with an instant-read thermometer.

**HELPFUL HINTS:**

* Defrost time may vary depending on microwave power
* Student can eat the control jello samples. It is not recommended to consuming salted jello.

**EXPECTED RESULTS:**

* Salt prevents Jello from solidifying
* Sugar results in lowered melting point

**EXPERIMENT QUESTIONS**

**Basic Level**

What are the temperatures at which Jello melts?

Teacher’s notes: Depending on Jello brand, water content, and random errors, students may see various results. It’s most likely 35°C or lower.

**Advanced Level**

What is the impact of salt/sugar? Why do they have such effects?

Teacher’s notes: Salt effectively prevents solidification as it lowers the freezing point of gelatin. Sodium and chloride ions diffuse into the matrix of water and gelatin molecules, thereby retarding the formation of hydrogen bond networks during freezing.  
  
Sugar increases the concentration of solutes in gelatin gel, thus reducing the freezing temperature. This phenomenon is also used in the production of ice cream and frozen desserts for prevention of large ice crystal formation.

**REFERENCES**

Adapted from Science for Ohio, available via http://www.cas.miamioh.edu/scienceforohio/Jello/L.html.

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**WORKSHEET QUESTIONS:**

* What is the effect of cooling on Jello-water mixture?
* How does salt affect the solidifying process of Jello?
* What is the melting temperature (a.k.a. melting point) of Jello? Does sugar affect the melting point of Jello?