**STATION 2: “Cream Chemistry” – Temperature and Healing Reactions**

**NGSS Standard: HS-PS1-5**
**Concept:** Investigating how temperature affects the rate of chemical reactions — like those involved in healing creams or medicines.

**Materials:**

 2 clear plastic or glass cups

 Alka-Seltzer tablets **(or baking soda + vinegar)**

 Room-temperature water (~20–22°C)

 Warm water (~35–40°C — body temp range)

 Thermometer

 Stopwatch or timer

 Measuring cup (for equal water amounts)

**Student Directions:**

**Step 1: Measure and Pour Water:**

* + Pour **equal amounts** (e.g., 100 mL) of water into two separate cups.
	+ Use the thermometer to check and label each:
		- One should be room temperature (~20–22°C)
		- One should be warm (~35–40°C, similar to body temp)

**Step 2: Prepare the Reaction:**

* + Get **two tablets** of Alka-Seltzer (or prepare equal scoops of baking soda for vinegar test).
	+ Have your stopwatch ready.

**Step 3: Start the Experiment:**

* + Drop one tablet into each cup **at the same time**.
	+ Immediately start your stopwatch.
	+ Observe and **record the time** it takes for each tablet to fully dissolve.

**Step 4: Record Observations:**

* + Note how quickly bubbles appear and disappear.
	+ Write down how long it takes for bubbling to mostly stop.

**Step 5: Repeat if Needed:**

* + Try again using slightly different water temps (cool, warm, hot) if time allows.
	+ Compare results to confirm your findings.

**Data Table:**

| **Water Temperature** |  **Time to Dissolve (sec)** |  **Bubbling Intensity (low/med/high)** |
| --- | --- | --- |
|  |  |  |
| Room Temp (°C) |  |  |
| Warm (Body Temp) |  |  |

**Analyze & Reflect:**

1. **What does a faster reaction (more bubbles, less time) tell you about how temperature affects chemical reactions?**
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. **Which cup showed the fastest and most intense reaction? Why do you think that happened?**
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. **If a healing cream needed body heat to activate its ingredients, which water temp represents the best condition for fast healing?**
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. **How is this experiment similar to what happens inside your body during healing?**
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**🧪 STATION 2: “Cream Chemistry” – Temperature and Healing Reactions**

**Focus:** How temperature affects the rate of chemical reactions
**NGSS Standard:** **HS-PS1-5** – Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature on the rate of a chemical reaction.

**✅ ITEEA STEL Standards – High School**

**STEL 1H** – *Technological systems include input, processes, output, and feedback.*
→ This experiment models a system where input (heat) affects a process (chemical reaction rate) and output (reaction intensity/speed).

**STEL 2H** – *Core concepts of technology include energy and matter.*
→ Students explore how thermal energy influences reaction rates, connecting matter transformation with energy transfer.

**STEL 4H** – *The properties of materials influence their applications.*
→ Learners relate chemical reactions to real-world material design, like healing creams that activate at body temperature.

**STEL 8H** – *Design is a creative process that leads to useful ideas and solutions.*
→ Students interpret experimental outcomes to inform product design decisions (e.g., optimal temperature for medical formulations).

**STEL 9J** – *Research, development, and experimentation are used to problem-solve and invent.*
→ This activity builds experimentation and data collection skills to answer a real-world challenge (how fast medicine works at different temps).

**✅ Common Core Math Standards – High School**

**CCSS.MATH.CONTENT.HSS.ID.B.6** – *Summarize, represent, and interpret data on two categorical and quantitative variables.*
→ Students compare two temperature categories with quantitative results (dissolving time, intensity).

**CCSS.MATH.CONTENT.HSF.IF.C.7** – *Graph functions expressed symbolically and show key features of the graph.*
→ Optional extension: Plot temperature vs. reaction time or rate to visualize the relationship.

**CCSS.MATH.CONTENT.HSS.ID.C.9** – *Distinguish between correlation and causation.*
→ This activity invites students to explore cause-effect (temperature causes faster/slower reaction), not just observe trends.

**CCSS.MATH.PRACTICE.MP2** – *Reason abstractly and quantitatively.*
→ Students reason quantitatively using time, temperature, and intensity data.

**CCSS.MATH.PRACTICE.MP4** – *Model with mathematics.*
→ Learners model real-world chemical behavior (e.g., heat-activated medicine) using math and science.

**✅ Summary**

This activity strengthens students' understanding of **temperature-dependent chemical reactions**, modeling how real-life treatments like creams or medicines work. It aligns to **NGSS HS-PS1-5** and integrates **ITEEA STEL standards** in experimentation, materials, and design. It also reinforces **data analysis, measurement, and mathematical reasoning** per the **Common Core Math Standards**.