📍 **Station 3: Cool It! – Burn Treatment Engineering**  
**Focus:** Thermal Energy Transfer  
**NGSS Standard:** MS-PS3-3

Apply scientific principles to design, test, and refine a device that minimizes the transfer of thermal energy.

### **Investigation Goal:**

Test how well different first aid materials (like aloe gel, ice, and cloth) **remove heat** from a simulated skin burn.

### **Background:**

When someone gets a minor burn, **cooling the area quickly** helps stop further skin damage. You’ll act like an engineer testing different **cooling materials** to see which one works best.

**Materials:**

 3 small cups (or water balloons or plastic bags with warm water to simulate “skin”)

 Hot water (~40–45°C, safe to handle)

 Aloe vera gel

 Ice pack or frozen sponge in a bag

 Clean cloth (dry or slightly damp)

 Thermometer (or your hand if safe and instructed by your teacher)

 Timer or stopwatch

 Paper towel (to wipe and clean between trials)

**Student Directions:**

1. **Prepare your “burn site”:**  
   Fill 3 cups with warm water to simulate a mild skin burn. Make sure all cups are at about the same starting temperature. Record the **starting temperature** of one cup.

📍 Start Temp: \_\_\_\_\_\_ °C

1. **Apply the treatments (one per cup):**
   * Cup 1: Cover the surface with **aloe vera gel**
   * Cup 2: Place the **ice pack or frozen sponge** on top
   * Cup 3: Drape with a **clean cloth**
2. **Wait for 2 minutes.**  
   Use a stopwatch or timer. Do not stir the water.
3. **After 2 minutes**, measure the **end temperature** of each cup using a thermometer (or carefully use the back of your hand to feel warmth if approved). Wipe the thermometer between uses.

🧊 End Temps:

* + Aloe: \_\_\_\_\_\_ °C
  + Ice Pack: \_\_\_\_\_\_ °C
  + Cloth: \_\_\_\_\_\_ °C

1. **Record your data** and compare the results. Which material cooled the “burn” fastest?

### 📋 Record It:

| **Treatment** | **Start Temp (°C)** | **End Temp (°C)** | **Temperature Drop (°C)** |
| --- | --- | --- | --- |
| Aloe Gel |  |  |  |
| Ice Pack |  |  |  |
| Cloth |  |  |  |

### 💬 Reflection Questions:

1. **Which material helped cool the water the fastest?**  
   → \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. **Which material would you recommend for burn treatment and why?**  
   → \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. **Why is it important to cool a burn quickly in first aid?**  
   → \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. **What are the pros and cons of each material (comfort, availability, effectiveness)?**  
   → \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

🧠 **Wrap-Up Discussion Questions:**

* What kinds of chemical reactions happen during first aid?  
  → \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Why are synthetic materials helpful for treating injuries?  
  → \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* How can we use energy transfer to help heal burns?  
  → \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

## 📍 **Station 3: Cool It! – Burn Treatment Engineering**

**NGSS Standard:**

* **MS-PS3-3** – Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.

### ✅ ITEEA STEL Standards – Middle School

**STEL 1F** – New technologies are developed to solve problems and extend human capabilities.  
→ Students explore first aid materials as cooling technologies that support healing and safety.

**STEL 2E** – The core concepts of technology include systems, resources, requirements, processes, optimization, and trade-offs.  
→ Students evaluate materials based on cooling efficiency and practical trade-offs like comfort and accessibility.

**STEL 4E** – Materials have different properties that make them useful in different situations.  
→ Central to this activity, students compare physical and thermal properties of various materials.

**STEL 7E** – Design is a creative process used to develop technological products and systems to solve problems.  
→ Students act as engineers testing and refining solutions to treat minor burns using real-world constraints.

**STEL 8F** – Testing and evaluating solutions are essential steps in the design process.  
→ The use of temperature data to assess and improve each treatment emphasizes applied testing and analysis.

**STEL 11F** – Medical technologies allow for the prevention, early detection, and treatment of diseases and disorders.  
→ The activity links directly to the design of first aid tools used in healthcare.

### ✅ Common Core Math Standards – Middle School

**CCSS.MATH.CONTENT.6.SP.B.5** – Summarize numerical data sets in relation to the context in which the data were gathered.  
→ Students gather and interpret temperature data for different cooling treatments.

**CCSS.MATH.CONTENT.7.RP.A.2** – Recognize and represent proportional relationships between quantities.  
→ Students can explore relationships between time and temperature drop, or the rate of cooling per material.

**CCSS.MATH.PRACTICE.MP4** – Model with mathematics.  
→ Students organize thermal data into a table, calculate differences, and draw conclusions from the data.

**CCSS.MATH.PRACTICE.MP2** – Reason abstractly and quantitatively.  
→ Learners compare temperature drops to evaluate efficiency of each cooling method.

**CCSS.MATH.PRACTICE.MP6** – Attend to precision.  
→ Students are expected to take accurate temperature readings and use consistent units (°C).

### ✅ Summary

This activity integrates **engineering design** with real-world healthcare applications. It aligns with **ITEEA standards** by emphasizing testing, optimization, and material properties in medical contexts, and supports **Common Core Math** through measurement, data analysis, and modeling. Students not only test devices but reason through their design decisions, making this a powerful example of applied STEM learning.