

# Puzzle #72: It takes sand!



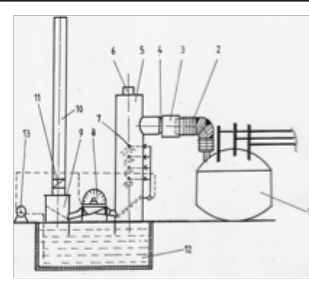
Is sand dirty? I put some sand from the beach into a cup and rinsed it and the water got really cloudy. Can you keep rinsing it until it is only “clean” sand? What’s left?

ELEMENTARY

Send any solutions by June 25 to Moe Benda at mbenda@d.umn.edu.  
Best solutions and next puzzle will appear in HTF on June 30.

# MoeZone

Real challenges for people living in the real world



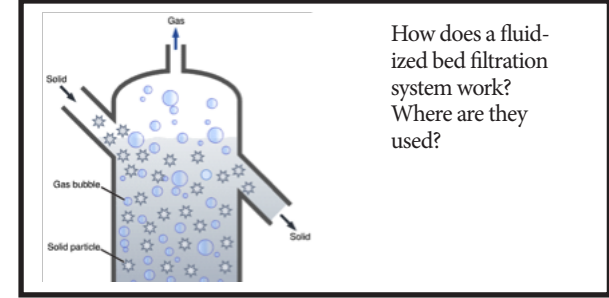
My friend has a cleaning pool filter that she calls a sand filter. What holds the sand in place so that it doesn't flow out into the pool?

ADVANCED



Be safe!

Can you get hurt?  
Can someone else get hurt?



How does a fluidized bed filtration system work?  
Where are they used?

PROFESSIONAL

**Moe's quote:**

May your shadow never grow less.

## MoeZone Puzzle #71 solutions: Can't take the heat?

### ELEMENTARY PUZZLE

*If you have ice cubes in water and heat it up in a pan, why doesn't the temperature increase until all of the ice is melted?*

**MOE'S NOTE:** This is a tough one! No one tried this one (maybe because school is out!). The answer is that water is going through a change from solid to liquid, or a phase change. During this time, all of the heat energy is being used to make that happen. By the way, a calorie is defined as the amount of heat required to heat 1 gram of water, 1 Celsius degree. And 1 gram of water is 1 mL (milliliter).

### ADVANCED PUZZLE

*Which do you think will freeze more quickly: a cup of cold water or a cup of hot water? Test out your theory and let us know.*

**MOE'S NOTE:** While it has never been proven consistently, hot water does freeze more quickly. Weird right? I tried it, but couldn't tell which one froze most quickly. I need more samples and a cleaner freezer! But it is interesting to note that this has been observed—and no one really knows why!

### PROFESSIONAL PUZZLE

*On the side of the box, we see how many calories are in the things we eat. How are calories measured in food?*

So we are talking about calories. Are these the same calories that measure heat as in the Elementary Puzzle? Yup, still with the same definition! It's nice to have a common energy term because everything becomes relative (see Moe's note below). The only small difference is that a "calorie" is really 1,000 calories, or a kilo calorie, but it is still a unit of measure of energy. The Food and Drug Administration requires that all food be labeled with their calorie content in order for us to make smart eating decisions. Instead of getting the 750 calorie breaded chicken sandwich, I might opt for the 450 calorie Tater Tots. Or not. Anyway, calories are determined by getting rid of all the water in food, burning all of it, and measuring the temperature rise in water using an apparatus known as a bomb calorimeter. Well, that's the way we used to do it, and it's the most accurate. But now we can use tables to mathematically determine it. If you are super curious about the law, here is what the FDA has to work with: <https://www.fda.gov/iceci/inspections/inspectionguides/ucm074948.htm#Nutrient>

**MOE'S NOTE:** When I was traveling in Europe, I had no idea how much their money was worth or how much things cost, so I used tomatoes. I would go the market and find out that a tomato cost 1,000 lire, then I could look at a museum entrance fee of 10,000 lire and know it was worth 10 tomatoes to go in. By the way, I was in college, so I spent my time looking at the outside of museums.