Solubility curves

CAL Hey. I'm Cal and this is Mags, my twin sister. We're not identical twins.

MAGS No kidding.

CAL See, I like sweet popcorn – Mags likes salted. Let's look at our solubility curves video. Solubility curves can help determine how soluble different solutes are, like sugar and salt.

MAGS What?

CAL Here's a simple method to work out solubility. A solute is a substance that dissolves. A solvent is the substance it dissolves in.

I'm adding some solute (20 g sugar at a time) to a solvent (100 ml of coffee) to see how much dissolves. 20 g, 40 g, 60 g, 280 g, 300 g, 320 g. Ah, it's stopped dissolving. That small cup took a lot of sugar though.

Mmm. I'm going to do an experiment with this extra coffee to see if salt is as soluble as sugar. Hmm, it's the same volume of coffee – 100 ml – but it won't even dissolve two 20 g spoons of salt.

MAGS Alright, Cal?

CAL Hiya, Mags. Now I know sugar is more soluble than salt, I'm going to look at solubility curves. These show how much solute dissolves at different temperatures in 100 ml of water. This is the solubility curve for sugar.

Each point on the curve is a saturated solution – below the curve is unsaturated and above the curve is supersaturated.

Solubility usually changes when the temperature of the solvent changes. My coffee's about 70°C, and the solubility curve shows that lots of sugar can be dissolved at that temperature. But I also got a tap water.

MAGS Because you're cheap.

CAL 100 ml again and a temperature of 20 degrees and less sugar dissolves. Because the water is colder, it's got less

energy to break apart the sugar.

Here's salt's solubility curve – nowhere near as steep as sugar. Salt is much less affected by increasing temperature.

MAGS Now your coffee's cooled down, loads of sugar crystals have formed again.

CAL This excess solute is key to making solubility curves.

If we did a proper experiment, we'd filter, dry and weigh the crystals that were left. If you repeat the experiment at different temperatures, you can make a solubility curve which you can use to work out solubility at any temperature on the curve.

You can also work out the amount of crystals that will form when you cool the solution down. So, at 70 degrees, 320 g of sugar dissolves. Cool it down to 20 degrees, and only 200 g dissolves. That's 120 g more sugar crystals that will form.

So sugar is more soluble than salt at all these temperatures.

MAGS And nicer in coffee.