Part A: saturated solutions

Sugar dissolved in water is an important component of soft drinks. You are going to investigate just how much sugar can be dissolved in water.

Equipment

chemical balance

250 mL beaker

sugar

water

stirring rod

spatula

Method

- Put 100 mL of water into beaker, and use chemical balance to record mass at start of experiment.
- Add sugar gradually, dissolving it after each addition by stirring solution.
- When no more sugar will dissolve, weigh beaker and solution again.
- Record its mass.

Questions

1. How did you know when no more sugar was dissolving?

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2. What did you notice about mass of the water compared with mass of the solution?

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3. Explain what happened to the sugar as it dissolved?

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4. There is a small amount of undissolved solute in your solution. Explain what you need to do to find out the correct mass of sugar that has dissolved in the solution.

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Scientists use the word ‘solvent’ to describe a substance that dissolves something. The substance that dissolves is called a ‘solute’ and together they make up a ‘solution’.

solvent		solute		solution
water	+	sugar	=	sugar solution

5. Complete this table for some common solutions, then add some of your own.

SOLUTION	SOLVENT	SOLUTE
coffee	hot water	coffee powder
sea		
bubble blower solution		
cordial		

6. Describe some ways that sugar can be taken out of solution.

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7. List some cleaning solvents that are commonly found in the home.

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Part B: supersaturation

Let's look at how much sugar can be added to hot water.

8. Do you think more or less sugar can be dissolved in hot water compared with cold water? Explain your reasons for this prediction.

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Equipment

chemical balance
water
spatula
sugar
250 mL beaker
stirring rod
hot plate

Method

- Put 100 mL of room temperature water into a beaker, weigh beaker and water, and record mass.
- Add sugar gradually, dissolve after each addition by stirring solution.
- When no more sugar dissolves reweigh beaker and solution.
- Record mass.
- Repeat procedure for 100 mL of water at about 70 °C.
- Once no more sugar dissolves in water remove beaker from heat. Observe beaker and solution as it cools.

QUESTIONS

9. Did more sugar dissolve in hot or cold water? Use the particle model to explain why this is the case.

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10. Describe what happened as the beaker of solution cooled.

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As the sugar solution cools it becomes a supersaturated solution. It is unstable and sugar molecules will begin to crystallize if stirred or shaken.

Part C: crystallisation

Equipment

chemical balance
warm water from hot tap or kettle
spatula
popsicle stick
teaspoon
250 mL beaker
stirring rod
piece of thread
about 300 g sugar

Method

- Add spoonfuls of sugar to 100 mL of water in beaker and stir, until no more will dissolve.
- Tie a piece of thread, the length of beaker, on the middle of a popsicle stick.
- Place popsicle stick on top of beaker, with thread dangling in solution.
- Leave on a windowsill for a few days.

Questions

11. Describe what you see after a few days.

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12. Explain what you think has happened.

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Part D: instant crystallisation

Sodium ethanoate is used in commercial hand warmers. The hand warmer pack holds a supersaturated solution of water and sodium ethanoate. When a metal disc in the hand warmer is snapped, a crystal is released that starts a chain reaction where sodium ethanoate solution crystallises out of the solution.

In this experiment, you will have a closer look at sodium ethanoate.

Equipment

2 x conical flasks	2 x 160 g sodium ethanoate
warm water	hot plate
stirring rod	petri dish

Method

NOTE: This experiment is recommended as a teacher demonstration only.
Safety warning: the use of safety glasses is recommended when handling sodium ethanoate.

- Put 160 g sodium ethanoate in one flask, add 30 mL warm water.
- Put flask on hot plate, heat gently, and stir until crystals of sodium ethanoate dissolve.
- Use small amount of water to rinse down inside of flask.
- Remove flask from heat and let cool slowly, without disturbing. You can use this time to prepare another flask of sodium ethanoate, in same way for second trial.
- Feel and watch first flask as you add one or two crystals of sodium ethanoate.
- Watch what happens when you slowly pour solution from second flask onto a petri dish. Crystals of sodium ethanoate can make interesting shapes!

Questions

13. What did you notice about the temperature change of the flask as crystallisation occurred? What do you think is happening?

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14. Describe what crystallisation looked like.

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