B.eing A S.ustainable I.ndividual & C.ommunity!

Changing matter

THINK, TRY, CHALLENGE

1. THINK. The sugar milling process uses a number of techniques to separate substances. Place the name of the separation technique next to each step in the process.

Choose from this list of words: *evaporation, evaporation, centrifusion, crystallisation, gravity separation, settling and decanting, sieving*

1. The mixture of cane and trash is tossed in the air past a stream of air to separate the leaf matter from the billet.

   _____

2. The fibrous bagasse is separated from the sugary juice in the milling train

   _____

3. The mill mud is separated from the juice in the clarifier

   _____

4. The sugary juice goes from 15% to 70% concentration sugar solution by taking the water out of the solution

   _____

5. Sugar is turned from a liquid to a solid by placing a sugary slurry into the sugar solution

   _____

6. The solid sugar is separated from the sugar liquor by spinning it.

   _____

7. The solid sugar is dried in a rotary drier.

   _____

2. TRY. Separate the following mixtures:

(a) Rice and sand (sieve)
(b) Wet lettuce leaves (spinning lettuce dryer as a centrifuge)
(c) Salt from water (evaporation)
(d) Stones from water (decanting)
(e) Dirty water (filtering)

3. CHALLENGE.

(a) *Making crystals*.
Try making copper sulfate crystals with three different methods – which way works best?

MAKING THE CRYSTAL SOLUTION.
Make a saturated solution of copper sulfate by heating 200ml water in a beaker and adding copper sulfate powder or crystals until no more will dissolve. You will need to stir the liquid with a stirring rod. Allow the solution to cool to let the excess solute (copper sulfate that is being dissolved) to settle to the bottom.
(Your teacher may prepare this solution for you)

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METHOD 1.

1. Pour 10mls of the solution into an evaporating dish.
2. Heat. What will have to the water? What will happen to the copper sulfate?
3. Safety: the solution will spit – protective eyewear and coats should be worn. Turn the gas down when it starts to spit.

RESULTS:

Describe the appearance of the copper sulfate.

_____
_____
_____
_____
_____

METHOD 2.

1. Place 50mls of the crystal solution into a shallow dish, such as a Petri dish or saucer.
2. Leave the dish in a dry, preferably dark position for a few days. Check occasionally to see what is happening.

RESULTS:

Describe the appearance of the copper sulfate when the liquid is gone.

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_____
_____
_____
_____

METHOD 3.

1. Pour 200ml of the crystal solution into a clean beaker. Make sure there is no solid in the liquid.
2. Suspend a thread from a pencil into the solution and cover the beaker with cling wrap to keep dust from the solution. Place the beaker in a place where it will not be disturbed.

3. After a few days remove the thread. You will notice that some small crystals have grown. Remove all of the crystals except the most regularly shape one This is called the "seed" crystal. Return the string to the solution.
4. Leave the beaker for two weeks. Every few days remove the smaller crystals growing on the surface of the large one.
5. Do this for about 2 weeks.

RESULTS:

Describe the appearance of the single crystal.

_____
_____
_____
_____
_____
_____

DISCUSSION:

1. What is the difference between the appearance of crystals produced by these three methods?

_____
_____
_____
_____
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_____

2. Which method is better at producing large crystals? Give reasons for your answer.

_____
_____
_____
_____
_____
_____

3. Why do you think method 1 did not produce large crystals?

_____
_____
_____
_____
_____
_____

4. The milling process for sugar uses a sugary slurry to "seed" the crystallisation of sugar from the concentrated sugar solution. Why do you think the sugar solution is not just heated and evaporated like in methods 1 and 2?

_____
_____
_____
_____
_____
_____

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(b) *Distillation*

Distillation allows both the solvent (liquid) and the solute (solid dissolved in the solvent) to be collected from a solution. The process requires heating the solution so that the solvent is evaporated to a gas. Instead of letting the gas float off, we collect the gas by condensing it, and turning it into a liquid again but without the solute.

Try this:

1. Put hot water into a container.
2. Place cling wrap over the top.
3. What do you see forming on the cling wrap?
4. Think of some way to collect this water.
5. Figure A. shows a distiller. This works in the same way. The water is heated and the steam (gas) goes up the tube to a condenser. The condenser is cold, lowers the temperature of the gas, turning it into liquid again. The liquid drips into the beaker at the end to give you clear water.

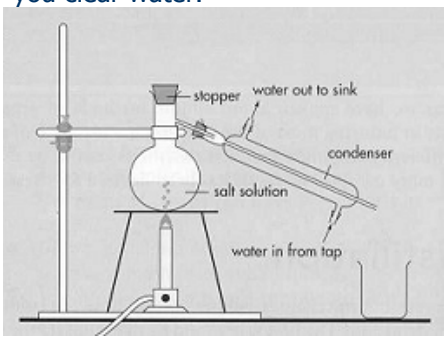


Figure A.

6. Can you think of some other places where you see gas water turn to liquid through condensing?

(c) *ISLAND CHALLENGE*

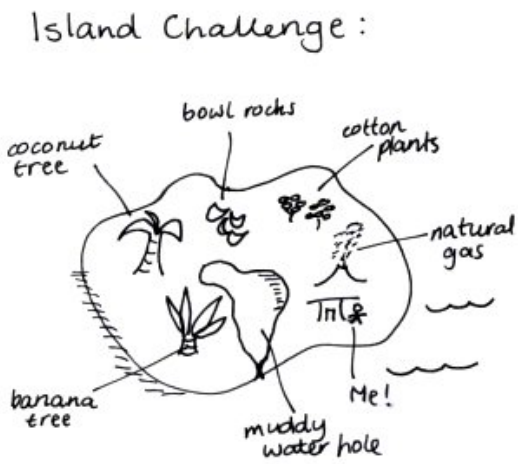
You have been stranded on a desert island. There is no clean water supply, only a muddy, salty water hole. What will you do to get: clean water for washing, and pure water for drinking?

You have found the following materials:

Natural gas, large banana leaves, coconut husks, hollowed out rocks, muddy water, flint that sparks when banged together, twigs and branches, cotton plants.

Write a description of how you would get:

i. clean water for washing.
ii. pure water for drinking.



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