

3.5 Separating Solutions

► Key Question: How can you separate the parts of a solution?

Sometimes a solution looks like a single, pure substance. When you mix sugar particles with water particles, the sugar dissolves. Remember that particles in a solution are evenly mixed. You cannot see the sugar particles once they are mixed, but they are still there.

How can you separate solutions into their parts? There are two ways to separate solutions:

1. evaporation
2. distillation

EVAPORATION

Have you ever been swimming in the ocean? Once you dry off, you may notice that your skin feels strange. Maybe you licked your lips and tasted salt. Where did the salt come from?

Ocean water is a solution. Salt and other solutes are in ocean water.

evaporate

change from a liquid to a gas

After you swim, the water **evaporates** from your skin. This means it changes from a liquid to a gas. Heat from your skin and from the air causes the water to evaporate.

Salt does not evaporate. It stays behind on your skin. This is one way you can separate a solute from a solution.

evaporation

the process by which a sample of matter changes from a liquid to a gas

You can also use **evaporation** to separate sugar from water. You can evaporate the water, leaving the solid sugar behind. You can make maple syrup this way.

DISTILLATION

How do you separate a solution of two liquids? If one liquid evaporates more easily than the other, then you can use **distillation** (Figure 2). Distillation is a way of separating liquids by

- heating the solution
- separating one liquid into a gas using evaporation
- cooling the gas until it becomes liquid again

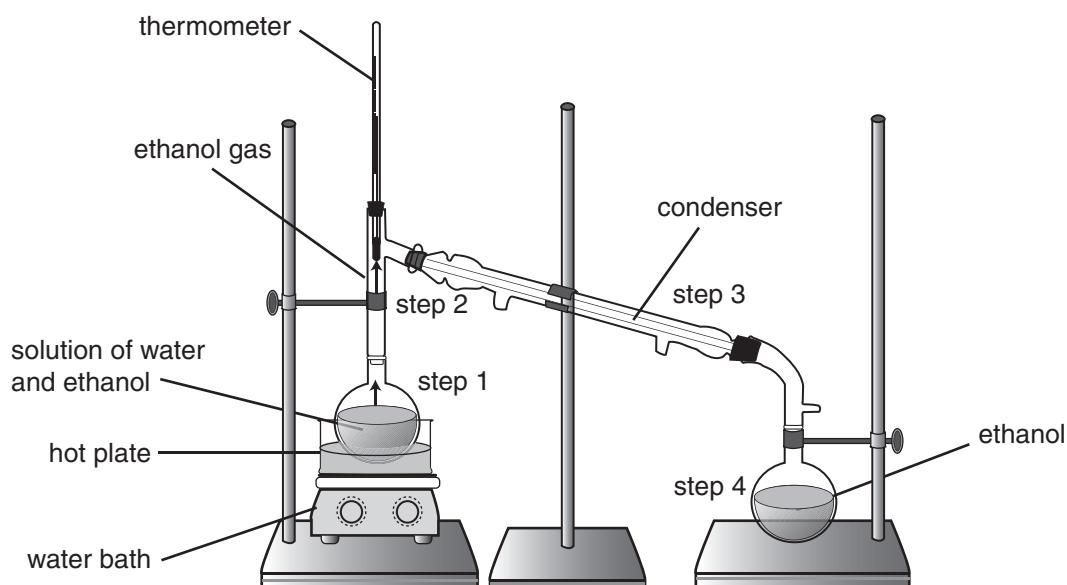


Figure 2 Distillation traps and cools the solution of ethanol and water, returning it to a liquid.

The process of distillation involves four distinct steps:

1. To separate the ethanol and water solution, heat the solution on a hot plate to just below 78 °C.
2. The ethanol will quickly evaporate from the round-bottom flask on the left at this temperature, turning it into a gas. Most of the water stays behind.
3. The ethanol travels through a tube surrounded by cold water, called the condenser. The condenser cools the ethanol gas.
4. Ethanol cools and becomes a liquid. It then drips into the collecting flask on the right.



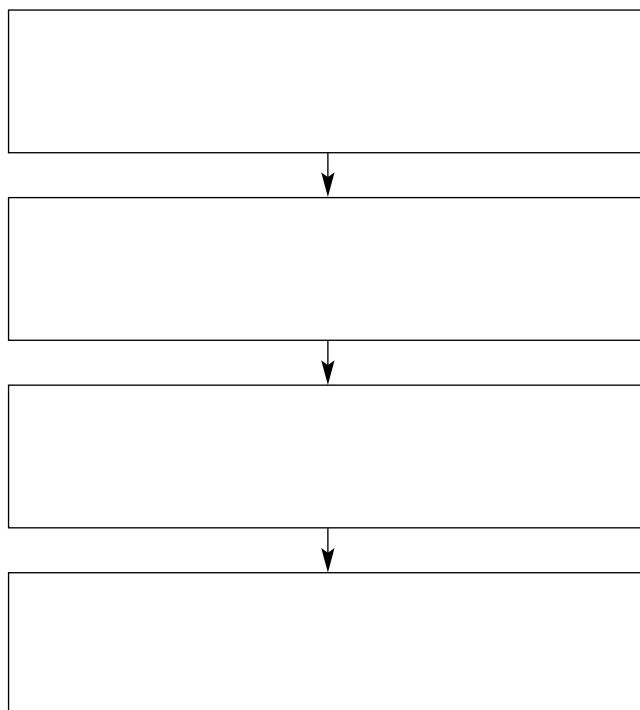
CHECK YOUR UNDERSTANDING

1. Describe one way to separate sugar from a sugar-and-water mixture.

2. You have a solution of salt water. You know that you can separate the salt and water by evaporation. However, you want to collect the evaporated water as well.

- (a) What method would you use to collect the water?

- (b) Complete the flowchart to show how this process works.



3. Think back to the Key Question. What are the two methods of separating solutions and how do they work?
