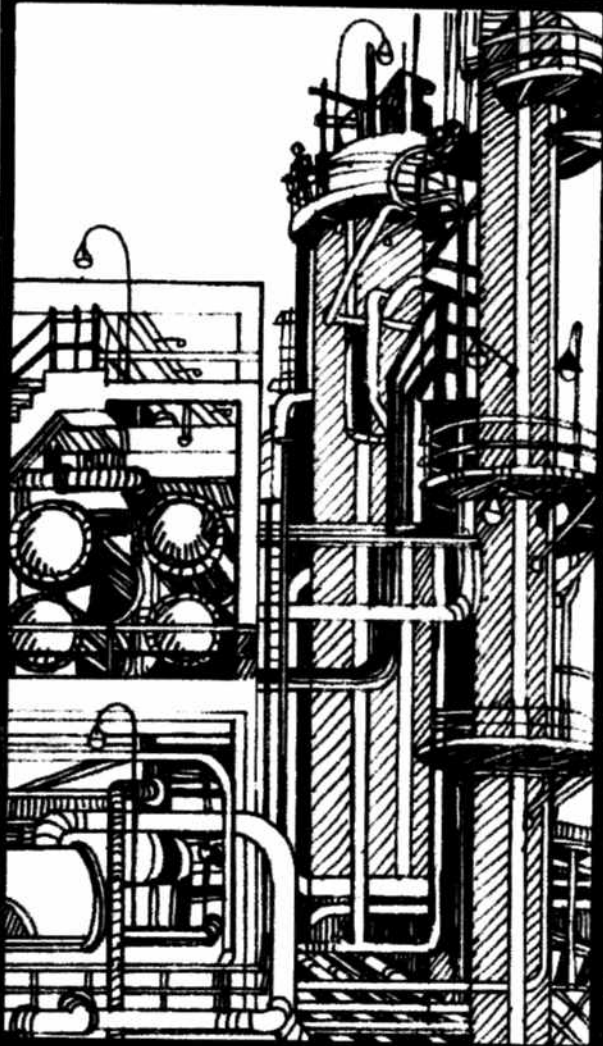


# HOW CAN WE GET THE SOLVENT FROM A LIQUID SOLUTION?

12



**condensation:** the changing of a gas to a liquid

**distillation:** the purifying of a solvent by evaporation followed by condensation

How can we get the solvent  
from a liquid solution?

Have you cooked anything lately? Did you pick up the lid from the pot and find water droplets on the inside?

Where did the water come from? When the hot steam touched the cooler metal cover, the *steam became water*. This process is called *condensation* [kon den SAY shun].

Condensation can help us get the solvent from a liquid solution.

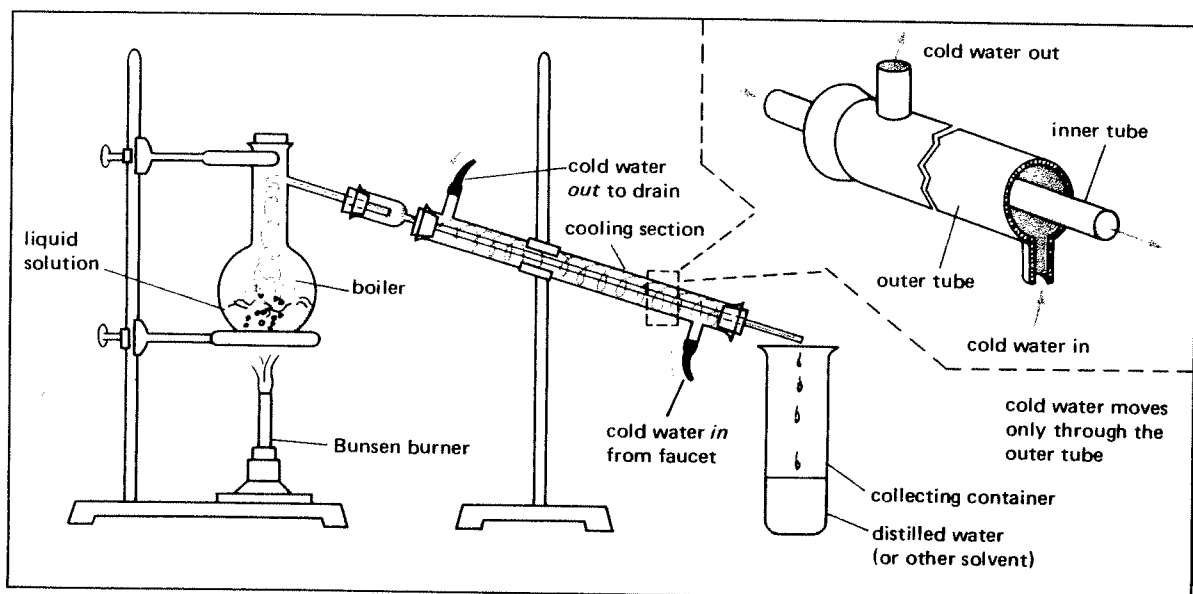
When we boil a solution, the solvent evaporates. We are left with the solute. But, if we trap the evaporated liquid, then we can *condense* it.

This process is called *distillation* [dis tu LAY shun]. There are two steps to distillation.

- The first step is evaporation. The liquid changes to a gas.
- The second step is condensation. The gas changes back to a liquid. We get a pure solvent *without* the solute.

Look at Figure A. It shows a small distillation unit. Follow the steps under Figure A. See what happens to a liquid solution when it is distilled.

## A DISTILLATION UNIT



**Figure A**

### What You Must Know

A distillation unit has two main parts: a *boiler* and a *cooling section*.

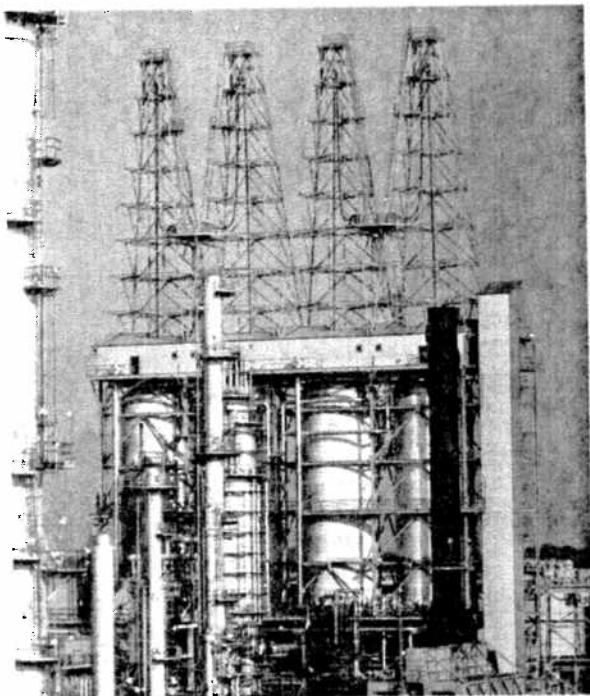
- In the boiler *evaporation* takes place.
- In the cooling section *condensation* takes place.

The cooling section is a “tube within a tube.” Cold water flows in the outer tube. This cools the inner tube.

### WHAT HAPPENS IN DISTILLATION?

Check with Figure A as you read.

1. The liquid solution is boiled in the boiler. The solvent evaporates. The solvent changes from a \_\_\_\_\_ to a gas (water vapor).
2. The vapor moves out of the boiler. It goes into the *inner tube* of the cooling section.
3. The cold water in the outer tube cools the vapor. This makes the vapor *condense*. The vapor changes from a \_\_\_\_\_ back to a liquid.
4. The liquid drips into a container. It is pure. It has been *distilled*. It has no solute in it.
5. What happens to the solute? The solute stays behind in the boiler. It is now dried up. It is in solid form.



**Figure B**

Distillation is important in industry.



**Figure C**

Some places do not have enough good drinking water. It is either salty or polluted. Large distillation units usually make the water good and safe to drink.

**MATCHING** Match the two lists. Write the correct letter on the line next to each number.

---

- |          |                              |                                 |
|----------|------------------------------|---------------------------------|
| 1. _____ | evaporation                  | a) gets back only solute        |
| 2. _____ | distillation                 | b) steps in distillation        |
| 3. _____ | evaporation and condensation | c) speeds condensation          |
| 4. _____ | rise in temperature          | d) gets back solute and solvent |
| 5. _____ | cooling                      | e) speeds evaporation           |

## COMPLETING SENTENCES

Complete the sentences with the choices below. Four of these may be used twice.

liquid  
drop  
condensation

solute  
distilled  
distillation

rise  
evaporation  
gas

1. Evaporation saves only the \_\_\_\_\_ of a liquid solution.
2. \_\_\_\_\_ gets back both the solute and solvent from a liquid solution.
3. The two steps of distillation are \_\_\_\_\_ and \_\_\_\_\_.
4. The first step in distillation is \_\_\_\_\_.
5. The second step in distillation is \_\_\_\_\_.
6. In evaporation a \_\_\_\_\_ changes to a \_\_\_\_\_.
7. In condensation a \_\_\_\_\_ changes to a \_\_\_\_\_.
8. Evaporation is speeded by a \_\_\_\_\_ in temperature.
9. Condensation takes place when there is a \_\_\_\_\_ in temperature.
10. \_\_\_\_\_ water has no solutes in it.

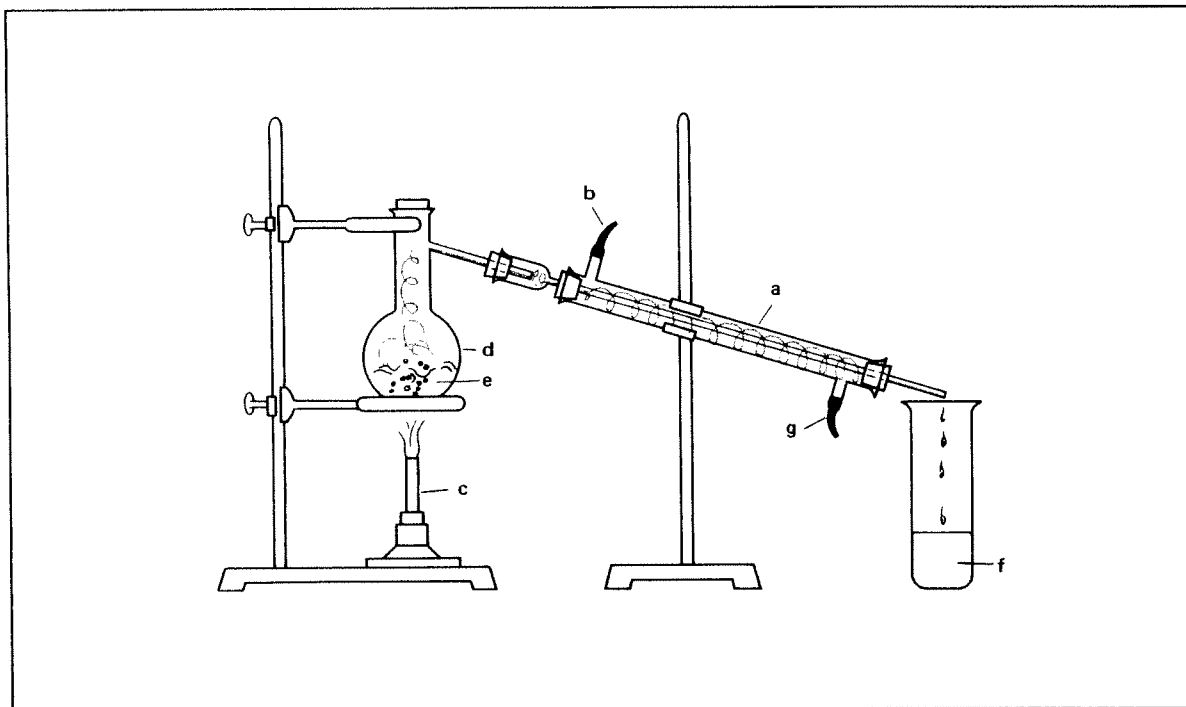
## TRUE OR FALSE

Write T on the line next to the number if the sentence is true.  
Write F if the sentence is false.

1. \_\_\_\_\_ When a liquid solution evaporates, the solvent stays behind.
2. \_\_\_\_\_ Distillation gets back solutes and solvents.
3. \_\_\_\_\_ The first step in distillation is evaporation.
4. \_\_\_\_\_ In evaporation, a gas turns to a liquid.
5. \_\_\_\_\_ The second step in distillation is condensation.
6. \_\_\_\_\_ In condensation, a gas changes to a liquid.
7. \_\_\_\_\_ A rise in temperature speeds evaporation.
8. \_\_\_\_\_ A rise in temperature speeds condensation.
9. \_\_\_\_\_ All water is good to drink.
10. \_\_\_\_\_ Distillation can make salty water good to drink.

**IDENTIFY  
THE PARTS**

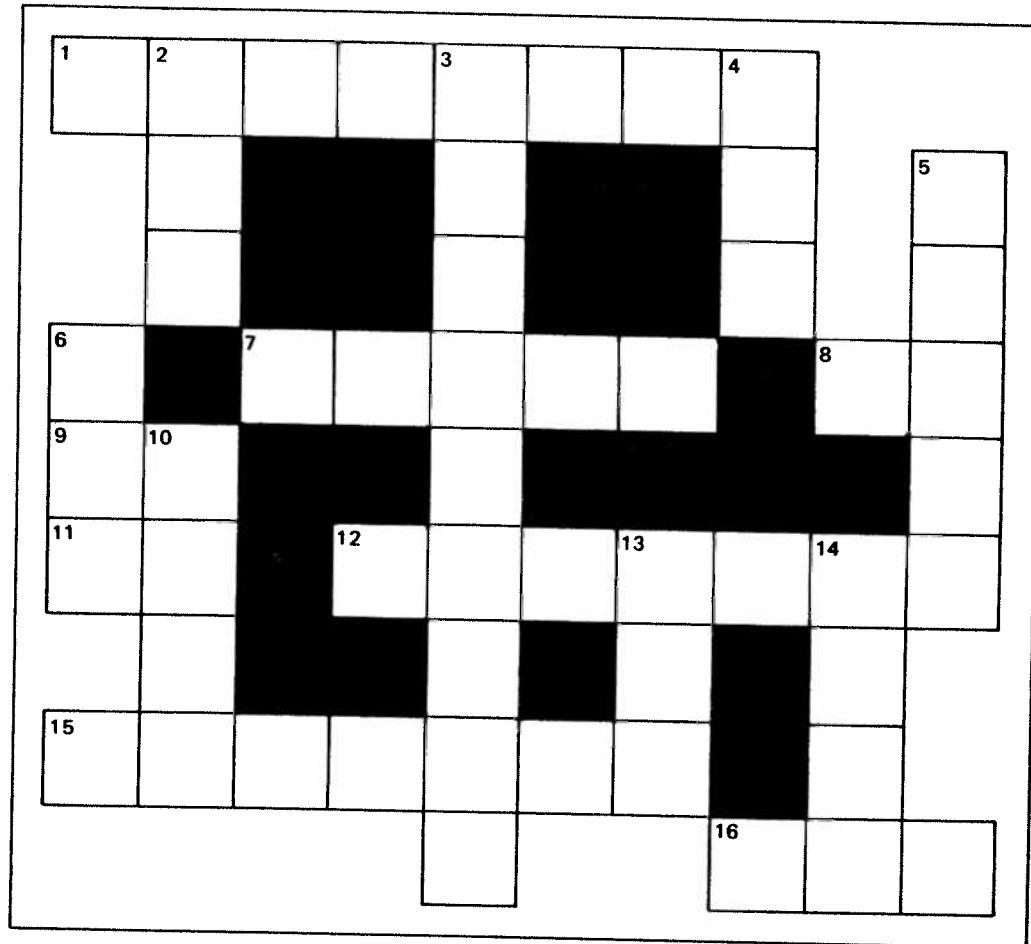
Figure D shows a distillation unit. Identify the following parts by letter. You may use a letter more than once.



**Figure D**

1. Bunsen burner \_\_\_\_\_
2. boiler \_\_\_\_\_
3. cooling section \_\_\_\_\_
4. where cold water enters \_\_\_\_\_
5. where cold water leaves \_\_\_\_\_
6. liquid solution *before* distillation \_\_\_\_\_
7. where evaporation takes place \_\_\_\_\_
8. where condensation takes place \_\_\_\_\_
9. where the solvent changes to a vapor \_\_\_\_\_
10. where the vapor changes to a liquid \_\_\_\_\_
11. distilled solvent \_\_\_\_\_
12. the part where the solute stays behind \_\_\_\_\_

CROSSWORD PUZZLE Fill in the blank spaces by following the clues across and down.



**Across**

1. To change from a gas to a liquid
7. Another name for a gas
8. Short for an American soldier
9. Right \_\_\_\_\_!
11. Self
12. What water does at 0°C
15. Natural shape of some solids
16. Eyelid infection

**Down**

2. Rowboat paddle
3. To change from a liquid to a gas
4. A sense organ
5. What water does at 100°C
6. A boy's name
10. Close by
13. Long snake-like fish
14. Compass direction

# KEEPING UP WITH SCIENCE



Solvents *dissolve*. They change solids into liquids; they *separate* molecules from one another. Solvents can also *join*. They *bond* materials.

Solvent joining can produce very strong bonds. In fact, it is also called *solvent welding* and has many uses. One of the most important uses is in plumbing.

In the past, only metal pipes carried fresh and waste water in homes and factories. Plastic pipes were forbidden. Modern chemistry has now developed very strong and non-toxic plastics. Durable and dependable plumbing pipes and fittings are made from these plastics. Furthermore, plastics do not corrode.

Unfortunately, old ideas are often slow to die. Committees decide local building rules, called codes. The codes state which materials may and may not be used in buildings. For many years, most committees would not accept the idea that plastic plumbing could be as good as metal plumbing. But times change and so do codes. Plumbing restrictions are being eased, especially for homes. This is especially good news for the do-it-yourself

plumber.

Copper pipes and fittings are usually joined by "sweat" soldering. This requires heat—either a flame or a soldering iron. Plastic plumbing requires no heat. It is safer, cheaper, and much easier to work with than metal plumbing.

Plastic-pipe joining (welding) requires only a saw, a knife, a brush, and, of course, a solvent cement. The cement is in a semi-liquid state. It consists of a plastic that is dissolved in one or more solvents. The plastic is of the same kind as the pipe that is to be joined.

To make a solvent-welded joint, you simply brush the solvent cement into the pipe and its fitting. Then you push them together. The solvent softens the walls of the pipe and fitting. Within twenty-four hours, the solvent evaporates. *Only the plastic that was part of the joining cement remains.* It joins to the pipe and its fitting. *The joint is actually welded together.* The parts cemented by solvent welding become one system. And if instructions have been followed carefully, there will be no leaks and no corrosion.