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## LABORATORY WORK No. 22

### DISTILLATION OF DRINKING WATER

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■ **PRINCIPLE:**

Distillation is a separating and cleaning method which is usually used for separating liquids of different boiling point or for removing the solvent from less volatile substances. The liquid mixture is brought to the boiling point and the resulting steam is left to condense in the cooler. The resulting liquid, which doesn't contain any ions, is called distillate.

Successful distillation requires stability of substances in the temperature at which they are converted into steam. If the substance decomposes at these temperatures, it is necessary to use distillation under reduced pressure (vacuum distillation).

■ **TASK NO.1: CARRY OUT THE DISTILLATION OF DRINKING WATER AND VERIFY THE PRESENCE OF  $Cl^-$  AND  $SO_4^{2-}$  IONS**

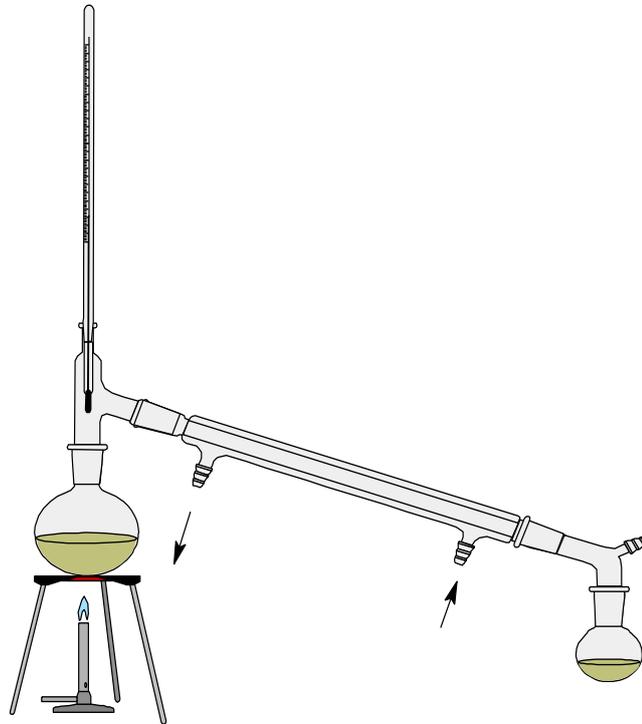
■ **AIDS:**

Side-arm flask, water cooler, burner or thermowell, thermometer, Erlenmeyer or boiling flask, 6 test tubes, stand with holder, beaker, scoop

■ **CHEMICALS :**

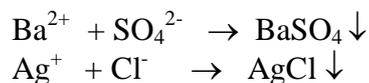
drinking water,  $BaCl_2$  ( $c=0,25$  mol/l),  $AgNO_3$  ( $c=0,1$  mol/l),  $NaCl$ ,  $Na_2SO_4$

**Distillation apparatus:**



■ **PROCEDURE:**

1. We put 100 ml of drinking water into the beaker and we enrich it by  $\text{Cl}^-$  and  $\text{SO}_4^{2-}$  ions (by adding  $\text{NaCl}$  and  $\text{Na}_2\text{SO}_4$  on the tip of the scoop).
2. We carry out tests in the test tube to prove the presence of these ions both in clean drinking water and in drinking water enriched by means of  $\text{BaCl}_2$  solution ( $c = 0,25$  mol/l) and  $\text{AgNO}_3$  solution ( $c = 0.1$  mol/l).  
White precipitates of  $\text{BaSO}_4$  and  $\text{AgCl}$  will create which prove the presence of  $\text{Cl}^-$  and  $\text{SO}_4^{2-}$  ions.



3. We pour the solution of drinking water with ions from the beaker into the side-arm flask, we add boiling stones to remove secret boil and we close the flask by a stopper with the thermometer. We attach the intake of the cooling water and begin to heat the flask up.
4. We let the distillation running for approximately 30 min.
5. We finish the distillation after distilling off about 50 ml of water (distillate).
6. We carry out the tests again with colourless distillate to prove the presence of ions and we write down the results into the table.



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Sample before distillation:	Equation – observations:
Test for $\text{Cl}^-$	
Test for $\text{SO}_4^{2-}$	
<b>Sample after distillation:</b>	
Test for $\text{Cl}^-$	
Test for $\text{SO}_4^{2-}$	

- **CONCLUSION:** Evaluate the result of the distillation and the presence of monitored ions.

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## STUDENT'S SHEET No. 22

### DISTILLATION OF DRINKING WATER

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#### 1. Vocabulary:

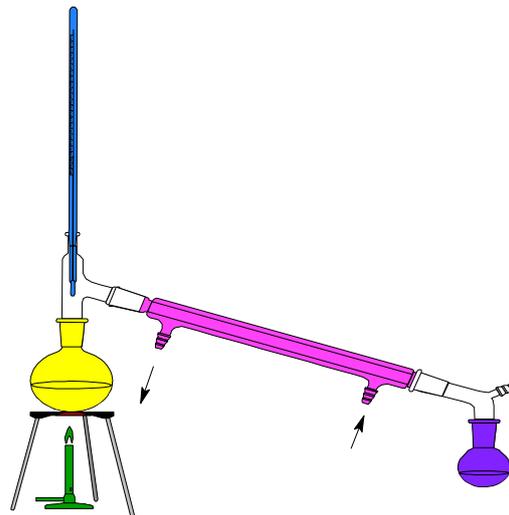
Translate the vocabulary and learn it:

- beaker
- cooler
- side-arm flask
- test tube
- stand with holder
- evaluate
- equation
- enrich
- precipitate, -s
- steam
- stopper
- sample

#### 2. Apparatus description:

Name coloured parts of the apparatus. What do we do with them? What do we need them for?

- 1.
- 2.
- 3.
- 4.
- 5.



#### 3. Matching activity:

- |   |                                      |
|---|--------------------------------------|
| 1. thermometer                          | a) is used for heating the apparatus |
| 2. burner                               | b) doesn't occur in distillate       |
| 3. drinking water                       | c) contains ions                     |
| 4. Cl <sup>-</sup> ion                  | d) in the upper part                 |
| 5. cooling water is entering the cooler | e) is calibrated in degrees Celsius  |
| 6. cooling water is leaving the cooler  | f) in the lower part                 |



**4. Give the right answer:**

1. It is a cleaning method based on boiling point of agent. ....
2. An equipment used for heating liquids. ....
3. We get a very clean liquid after distillation. ....
4. Where can we find ions – in water before or after distillation? .....
5. Which agents did we use for testing ions in this laboratory work? .....
6. Which agents did we use for enriching water in this laboratory work? .....

**5. True / False exercise:**

1. We need a gas burner for this method. **T / F**
2. Drinking water is the result of this method. **T / F**
3. If we add  $\text{AgNO}_3$  solution to the product, we get a white precipitate. **T / F**
4. If we add  $\text{AgNO}_3$  solution to drinking water, we get a white precipitate. **T / F**
5. Can we use a thermowell for distilling water, too? **T / F**