



## Attention

**Important! To be read carefully!**

**To be kept for later reference.**

Attention! Suitable only for children from 8 years on.

To be used by children only when supervised by adults, who have carefully studied the precautions explained in the experiment-box.

- ▶ Read the instructions before use, follow them, and keep them handy for further reference.
- ▶ Do not let the activated carbon get into any contact with your body, especially not with the mouth or the eyes. In case this should nonetheless happen, immediately wash mouth and eyes with lots of water, and go to see a doctor.
- ▶ When experimenting, keep small children and animals at a safe distance!
- ▶ Do store the experiment-box out of range of small children!
- ▶ Do not drink the purified water after the experiment. It might contain particles of dirt, even when seemingly clean.

When doing the experiment, you might get wet. So do not ever carry it out in places, that could get damaged by water.

Do dry the individual pieces carefully after having used them, and store the equipment in a secure place! ( Hier ist im Original ein falscher Bezug!)

Keep the product away from high temperatures, humidity, and direct sunlight.

## Contents

<input type="checkbox"/> 1 Evaporating dish × 1	<input type="checkbox"/> 6 Non-perforated cup × 1	
<input type="checkbox"/> 2 Evaporating dish cover × 1	<input type="checkbox"/> 7 Activated carbon × 1 pack	
<input type="checkbox"/> 3 Cup with 2 holes × 2	<input type="checkbox"/> 8 Gravel × 1 pack...Large particles	
<input type="checkbox"/> 4 Cup with 4 holes × 2	<input type="checkbox"/> 9 Sand × 1 pack...Small particles	
<input type="checkbox"/> 5 Cup holder × 1	<input type="checkbox"/> 10 Filter paper × 10	

## What you need from home

- |   |                                |  |
|---|--------------------------------|--|
| <input type="checkbox"/> Cooking oil  | <input type="checkbox"/> Soil  | <input type="checkbox"/> Opaque liquid...Hot drinks such as coffee               |
| <input type="checkbox"/> Water  | <input type="checkbox"/> Spoon | <input type="checkbox"/> (Ice)...Use ice when you can't do an experiment outside |
| <input type="checkbox"/> Clear plastic cup × 4                                |                                | <input type="checkbox"/> (Packing tape) ...Use it when it is windy               |
| <input type="checkbox"/> Things around you, such as cotton, cloth, and stones |                                |  |

Filtration experiment

Distillation experiment

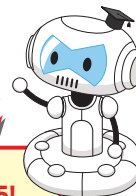
Caution!

**DO NOT drink the filtered or distilled water!**

This kit is not for making drinking water, so DO NOT drink it even if it looks clean!

**Please do the filtration experiment after you have made the "dirty water" on page 5!**

There are many germs in sewage water. To prevent the kit from getting dirty, please make dirty water using drinking water and not sewage water!



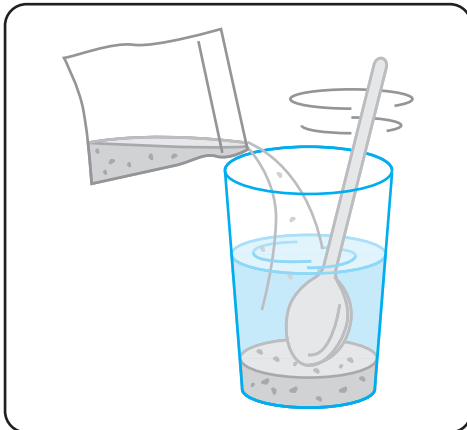
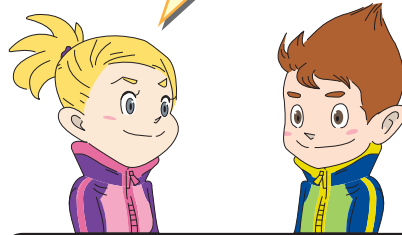


# Wash gravel, sand and activated carbon!

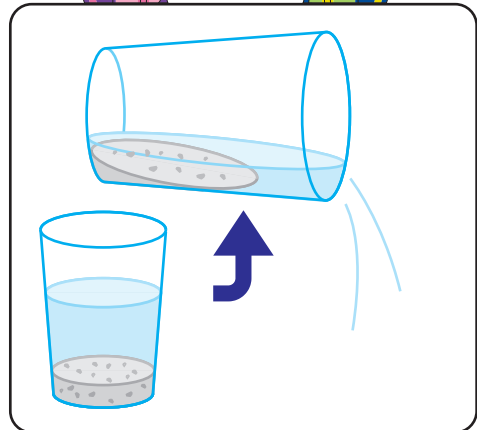
## What you need

- 7 Activated carbon × 1 pack
- 8 Gravel × 1 pack...Large particles
- 9 Sand × 1 pack...Small particles
- Water
- Spoon
- Clear plastic cup × 3

Gravel, sand and activated carbon from the package might be a little dirty, so wash them well before you do the experiment. After doing the experiment wash them well again.

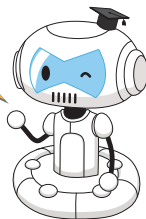


(1) Put the gravel in the clear plastic cup with water, then stir it well.



(2) Pour off the water slowly without letting gravel fall out.

The gravel will become clean after repeating this a couple of times! Let's wash the sand and the activated carbon too!



**Finished**



Washed activated carbon



Washed gravel



Washed sand



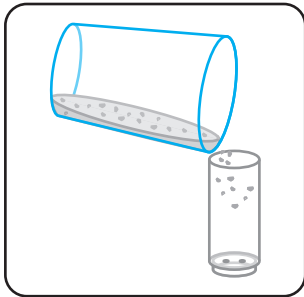


# Let's set up the apparatus!

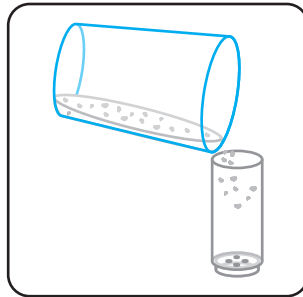
## What you need

- |   |  |
|---|--|
| <input type="checkbox"/> 3 Cup with 2 holes × 2   | <input type="checkbox"/> 7 Washed activated carbon |
| <input type="checkbox"/> 4 Cup with 4 holes × 2   | <input type="checkbox"/> 8 Washed gravel           |
| <input type="checkbox"/> 5 Cup holder × 1         | <input type="checkbox"/> 9 Washed sand             |
| <input type="checkbox"/> 6 Non-perforated cup × 1 | <input type="checkbox"/> 10 Filter paper × 10      |

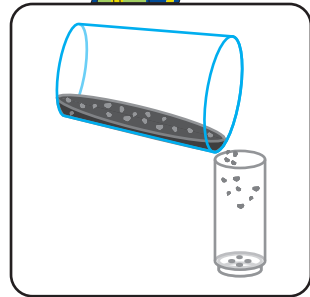
Put the leftover activated carbon, gravel, and sand in their bags. Seal them with tape and set them aside.



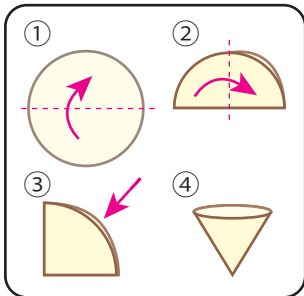
(1) Fill the cup with 2 holes half-full with washed gravel.



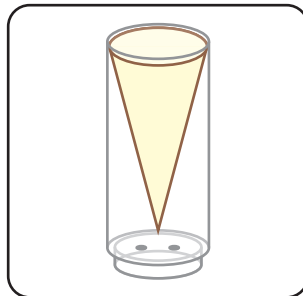
(2) Fill the cup with 4 holes half-full with washed sand.



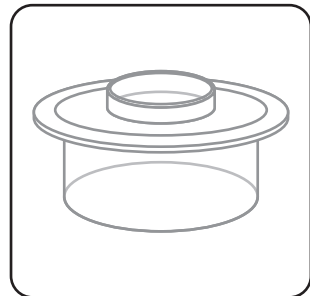
(3) Fill the other cup with 4 holes half-full with washed activated carbon.



(4) Fold the filter paper in half, then half again. Then, open it into a cone shape as shown.



(5) Put the folded filter paper into a cup with 2 holes.



(6) Put the cup holder on the non-perforated cup and it's finished. Use the 2 hole cup or the 4 hole cup on the cup holder.



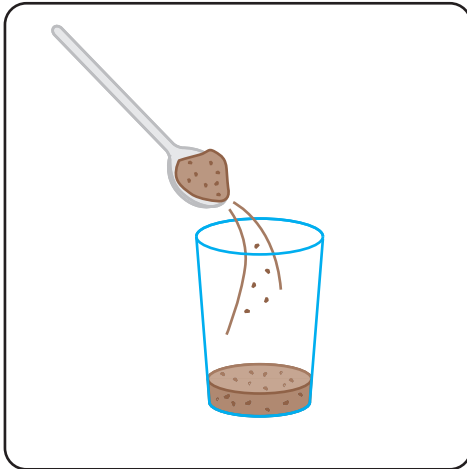
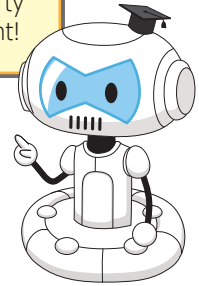


# Make "dirty water"!

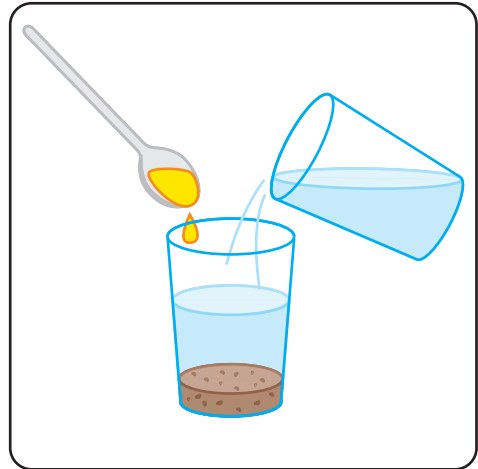
## What you need

- Cooking oil
- Spoon
- Soil
- Clear plastic cup × 1
- Water

Because the water from a river or pond may contain germs, let's make safe "dirty water" for your experiment!



(1) Put some soil in the clear plastic cup.

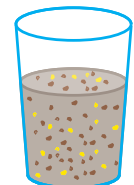


(2) Add a spoonful of cooking oil and some water to the cup and then stir well.

It's ready!  
Let's do some  
experiments!



**Finished**



Dirty water

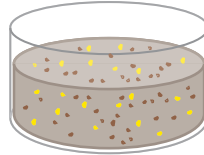
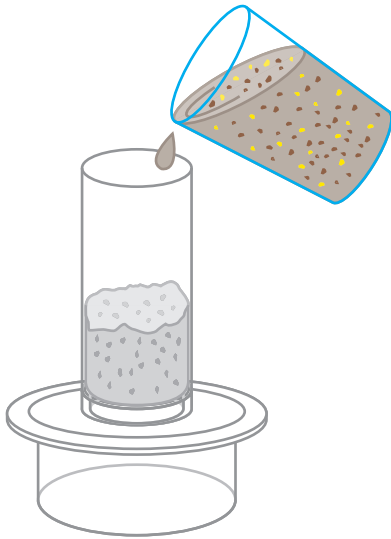




# Let's clean the dirty water!

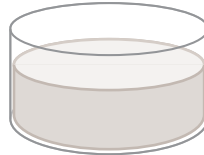
## Question

What will happen to the dirty water after it passes through the gravel?  
Check the box you think is correct!



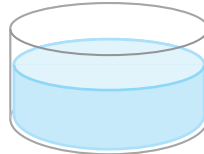
**Prediction 1**

Stay dirty



**Prediction 2**

Become a little bit cleaner



**Prediction 3**

Become very clear with no dirt

Comment on your experiment (Record your observations. Write down anything you found interesting!)





**Answer**



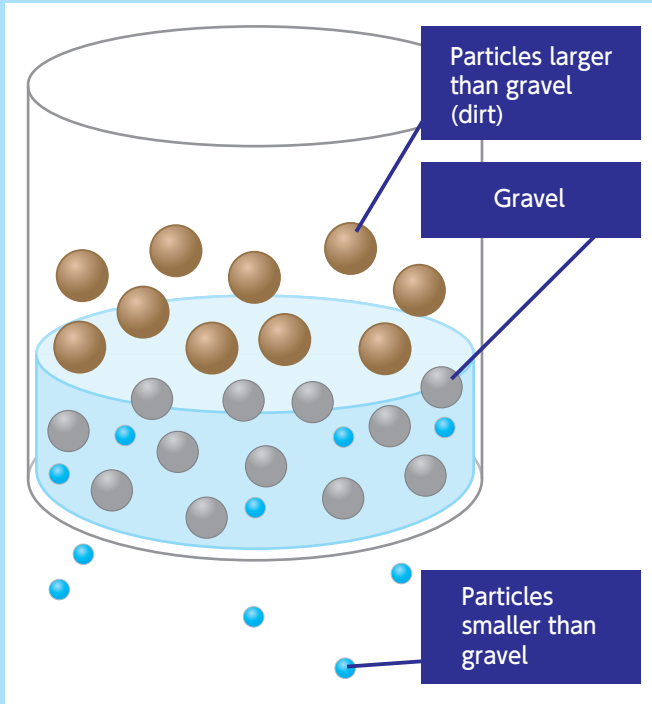
**Prediction 2**

Become a little bit cleaner

Why does it happen?  
Read the explanation below to discover the reason.



## What happens when the dirty water passes through gravel?



Large particles which cannot pass through the gravel are trapped there and can't go down.

However, small particles which are able to pass through the gravel move down with the water.

When the water becomes "a little bit cleaner", the larger dirt particles in the dirty water have been removed by gravel.

This process is called  
**"filtration."**

It makes the water clear, by passing it through several layers and removing the dirt.

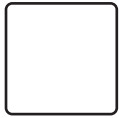




# Let's compare the colors of filtered water!

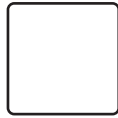
**Question**

Which is the best at cleaning dirty water; sand, activated carbon or filter paper? Color in each cup with whatever shade you expect the result will be!



**Prediction 1**

Sand



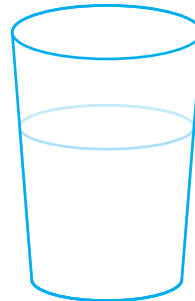
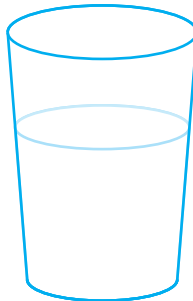
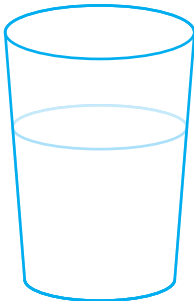
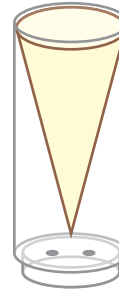
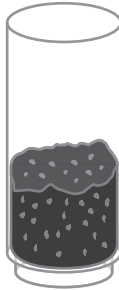
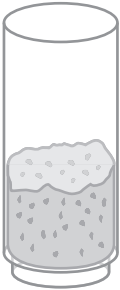
**Prediction 2**

Activated carbon

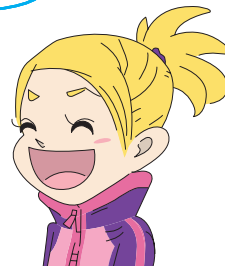


**Prediction 3**

Filter paper

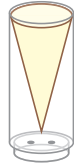


Let's check your prediction for the experiment!





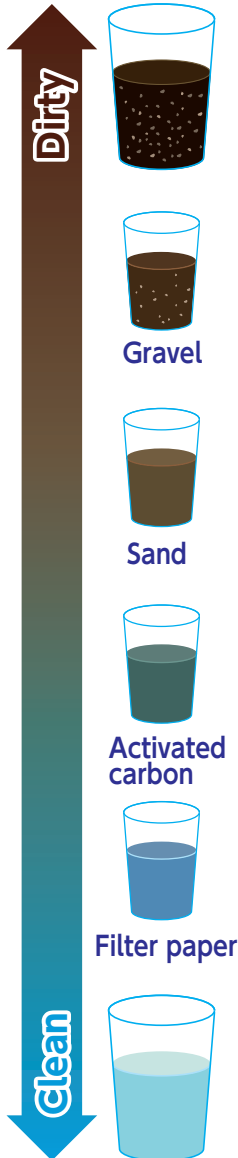
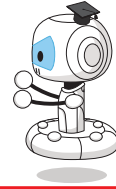
Answer



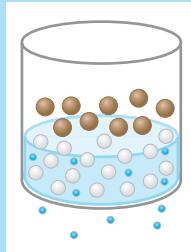
Prediction 3

Filter paper

Why does it happen?  
Read the explanation  
below to discover the  
reason.

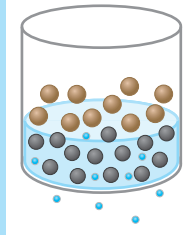


### Filtration by sand



Sand particles are smaller than gravel, so the spaces between them are smaller too. Even though some dirt can pass through the gravel, it can't go through if it's bigger than the spaces between the sand particles. Sand can trap more dirt than gravel; therefore it makes the water clearer than gravel.

### Filtration by activated carbon



The particles of activated carbon are the same size as sand, but they make the water clearer than sand. Because activated carbon has lots of small pores on its surface, it can catch the small dirt particles that would normally pass over the sand particles. Also, the surface of activated carbon is rough and has a special property which can trap even tiny substances such as odor.

### Filtration by filter paper



Filter paper is used to separate water and impure substances (ex. dirt mixed with water). Compared to gravel, sand and activated carbon, the spaces between the particles of filter paper are much smaller and only allow water sized particles to pass through. It can capture almost all of the dirt, and so can produce the cleanest water when compared to sand, activated carbon and filter paper.







# Let's combine the filter cups!

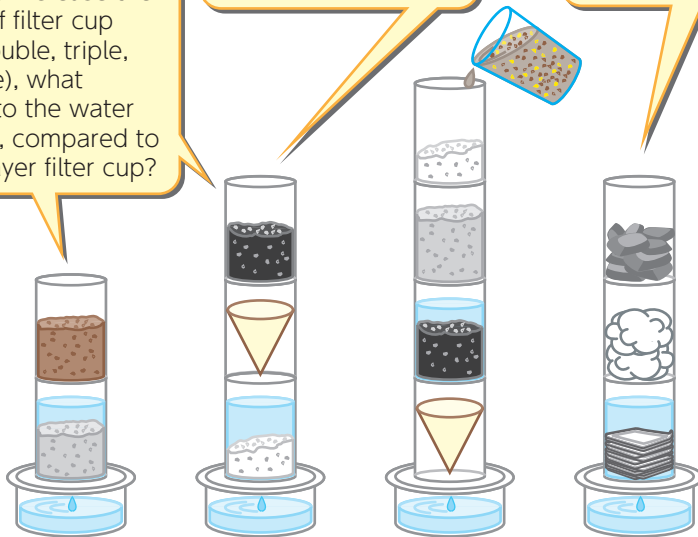
## Study

Let's find the best way to make clean water using gravel, sand, activated carbon and filter paper.

When you increase the number of filter cup layers (double, triple, quadruple), what happens to the water produced, compared to a single-layer filter cup?

Try changing the number of filter cups and also change their order!

Can you make a filter using cotton, cloth, stones, or other things around you?



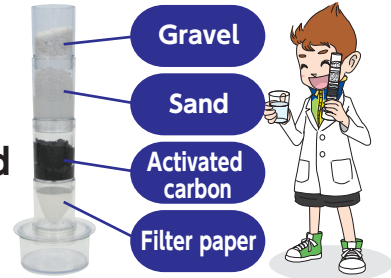
Comment on your experiment (Record your observations. Write down anything you found interesting!)





## Conclusion

Generally, water is filtered through a quadruple layer, usually in the order of gravel → sand → activated carbon → filter paper, from top to bottom.



## Let's check out the micro world!

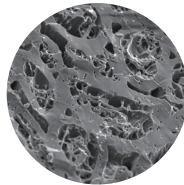
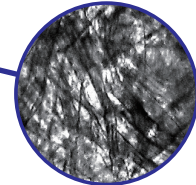
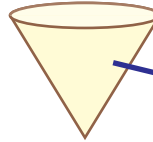
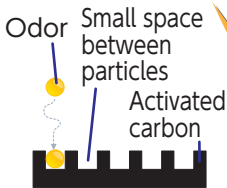


Image courtesy of Dr. Toshifumi Takeuchi, Graduate School of Engineering, Kobe University.



Akroti Coffeefilterar.jpg



Activated carbon is used to remove odor in refrigerators!



Filter paper is used as a filter to make coffee!

## The reason for using a combination of filter cups.

At the top, gravel and sand remove the larger particles. Next, the activated carbon absorbs chemical substances. The filter paper at the bottom removes oil and the smallest particles.

As described above, each material has different properties and roles in filtration. Therefore, combining different filters results in cleaner water.

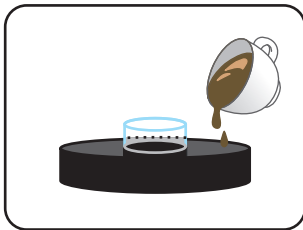




# Let's make clean water using a method other than filtration!

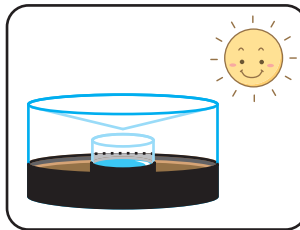
## What you need

- 1 Evaporating dish × 1
- Opaque liquid...Hot drink such as coffee
- 2 Evaporating dish cover × 1
- (Ice)...Use ice when you can't do the experiment outside
- 6 Non-perforated cup × 1
- (Packing tape)...Use it when it is windy

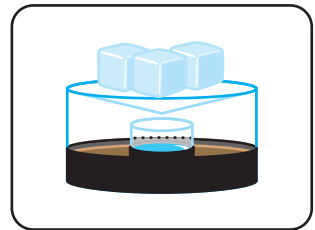


(1) Put the non-perforated cup inside the evaporating dish. Then pour the opaque liquid around the non-perforated cup.

\* In this experiment, coffee is used as an example.



(2) Put the evaporating dish cover on it, and conduct the experiment on a clear day in a place that gets plenty of sunshine.



When it is a rainy or cold day, do the experiment indoors and put ice on the evaporating dish cover while doing the experiment.

## Study

### Let's see what happened when you did the experiment in a sunny place on a clear day!

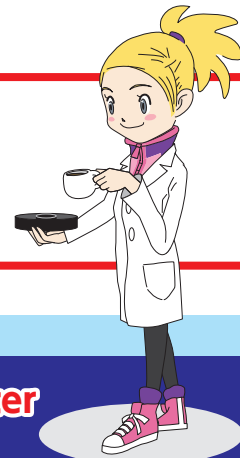
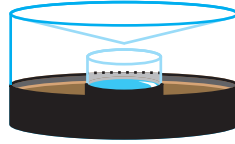
Comment on your experiment (Record your observations. Write down anything you found interesting!)





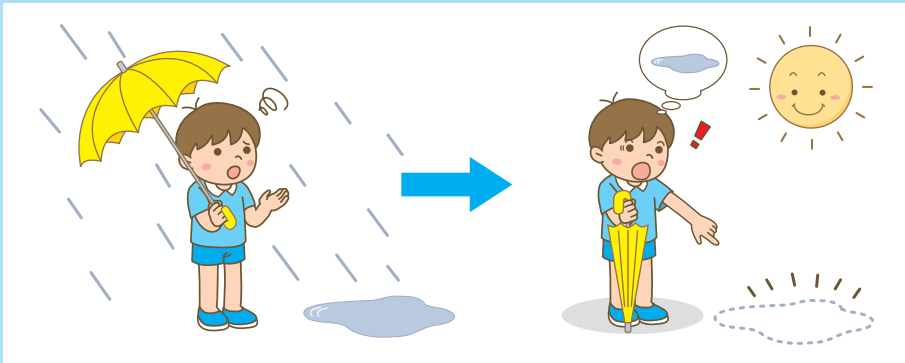
## Result

Collect the water  
in the non-  
perforated cup.



**This is visible proof that water  
"evaporates."**

Have you ever found it strange that while it is raining there are puddles on the ground. Then after a while the rain stops and the puddles disappear?



Does the water soak into the ground?

No, it does not. The water "evaporates" and then disappears into thin air.

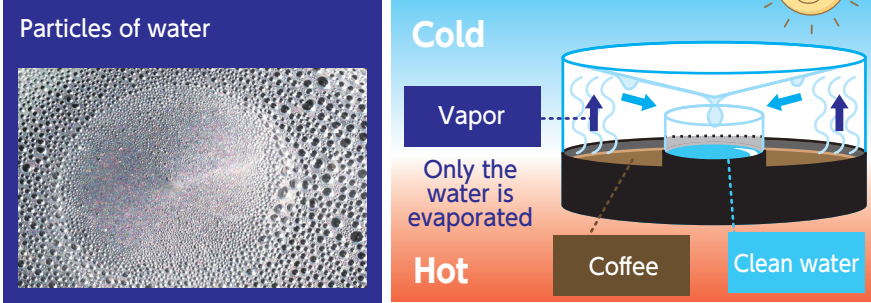
**During evaporation, clean water is produced in the  
form of vapor while any dirt gets left behind on the  
floor. Another name for this process is**

**"distillation."**

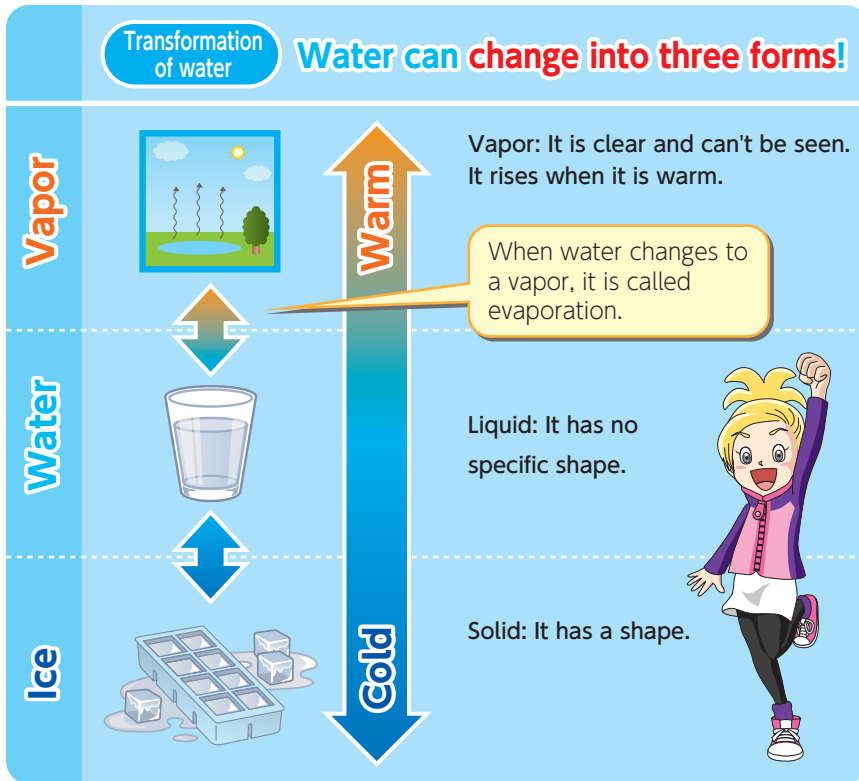




## The process of making clean water through "evaporation."

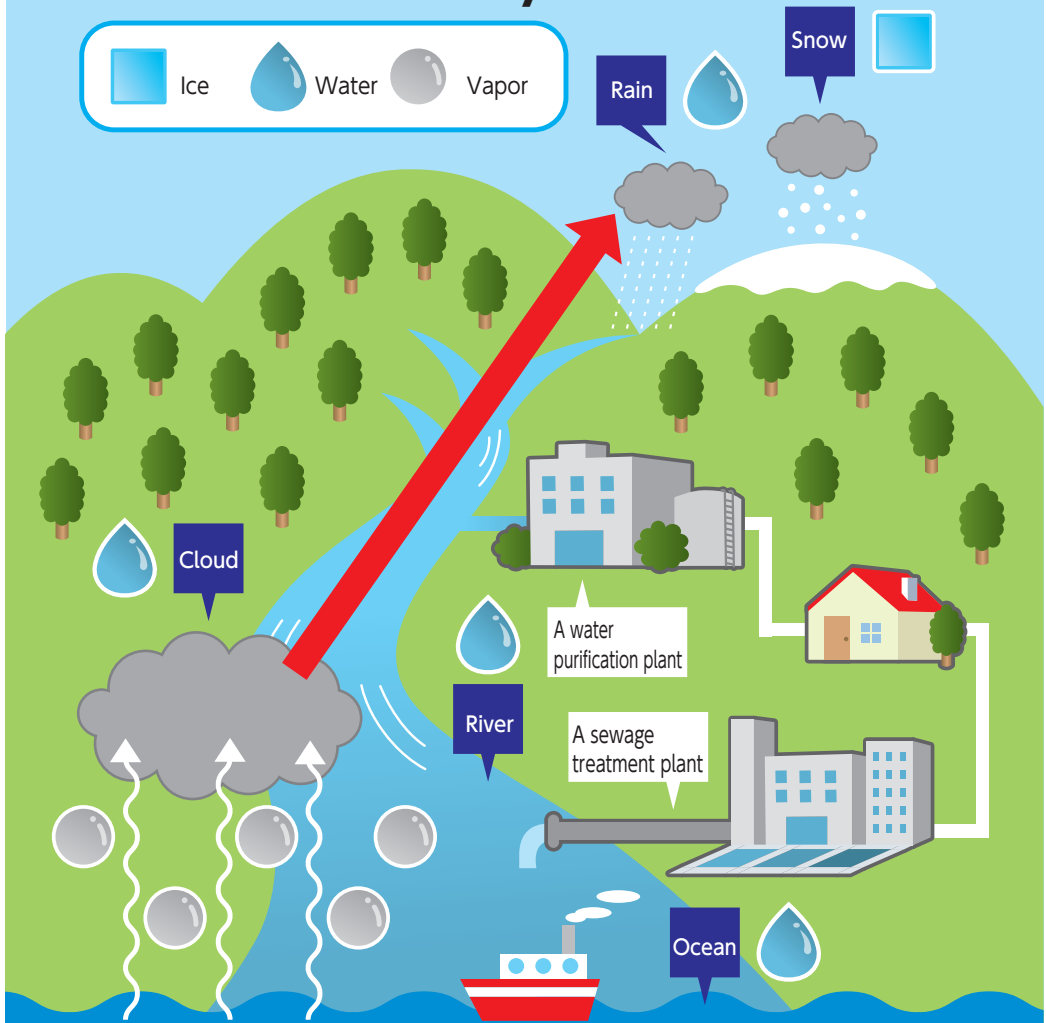


## Solid • liquid • vapor... Three forms of water!





# The earth's water cycle



When it is warm, the temperature of the oceans rises. This leads to the "water" at the surface to evaporate and change to "vapor". After changing to a vapor, the water gets lighter and rises into the air. Clouds that look soft and fluffy from the ground are in fact vapor floating in the sky. The temperature is very cold in the upper sky, so vapor is chilled drastically and changes to "ice". After changing to ice, the water gets heavier and then falls from the sky. If the ground temperature is warm, the ice melts and falls as rain, and if the ground temperature is cold, it does not melt and falls as snow. In this way, "water" changes to "vapor" or "ice", and then moves through the earth's eco-system.

196788 K0513

