



# Amoeba & Water



# Foreword

Drinking water quality affects the health of a family. This book is developed for children to be aware of water and its relation to health, so that they will take necessary precautions to prevent themselves and their family from water borne diseases. It is advised that adults read this book with children at home or in school to ensure that they are informed about safe drinking water.

## What is in this Book

- We need water to survive • Not all water is the same
- The water you drink can make you ill • Sources of drinking water
- Pollution at sources • Ways of making drinking water safe





Look! Here is a tap.  
Lets drink water.

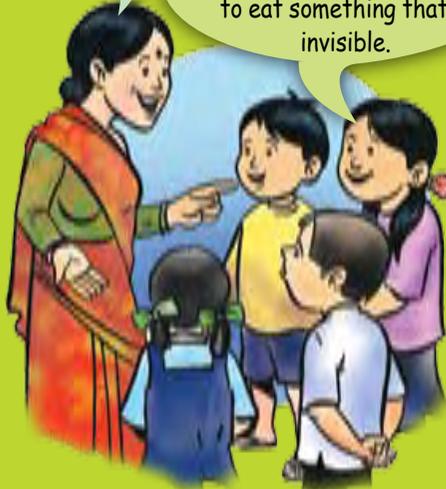
Wait, my friend.  
You should know about the water  
you are about to drink. Read this  
book.



My name is Drop.  
I am a drop of clean water.  
Read this book with me. I  
will teach you to stay  
healthy.

Have anyone of you  
swallowed a frog  
while drinking water?

No one could swallow a frog  
with water? But it is possible  
to eat something that is  
invisible.



## We drink water to survive

Because we need water to survive, we often live near sources of water. Like us, other living creatures also need water to survive. We share the water on this earth with all other creatures. Some of the creatures live in the water. We can not see some of the creatures because they are very small. These small creatures are called microbes. We sometimes swallow them alive as we drink water.

## What is microbe ?

Microbe is a living creature smaller than your naked eyes can see. Thousands of these creatures fit onto a dot like this one:  Bacteria, viruses and yeast are types of microbes. Amoeba is one kind of microbe that lives in water.

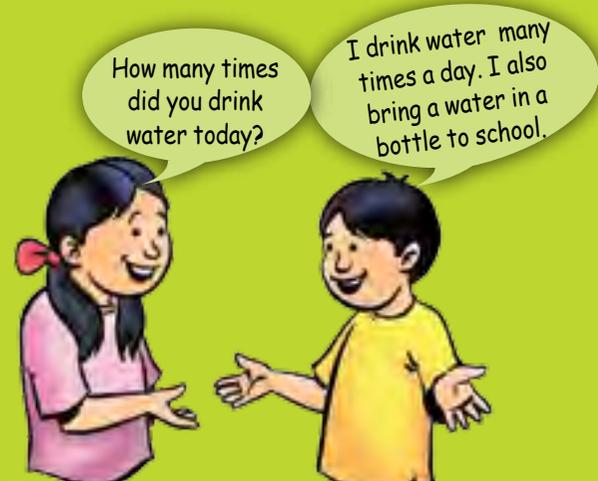
Harmful microbes are  
called germs. Germs are  
the cause of diseases.

I am Amoeba. I am microbe  
who lives in water. I want to  
get into your stomach and  
make thousands more like me.

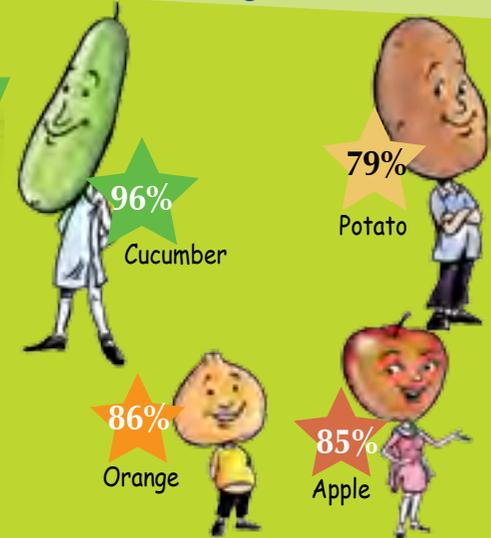


More than seventy percent of our body is made of water. We feel thirsty when our body needs more water. We drink water when we are thirsty. We also get water from milk, juice and other liquids but we must drink water many times a day.

We get our drinking water from various sources depending on where we live. In cities we get water from taps in our houses. In villages we get water from wells, springs, rivers or streams. Where do you get your drinking water in your house ?



### How much water do these fruits & vegetables have ?



### If we don't drink water

When amount of water in the body drops below healthy levels, we feel weak and may even faint. This condition is known as dehydration.



1. Water from oceans, rivers, lakes or from the ground evaporates and form clouds.

# Not all water is the same

Depending on its location, water may have different substances mixed into it. That is why water from different source is different from each other.

2. Water falls from clouds as rain, snow or hailstones.

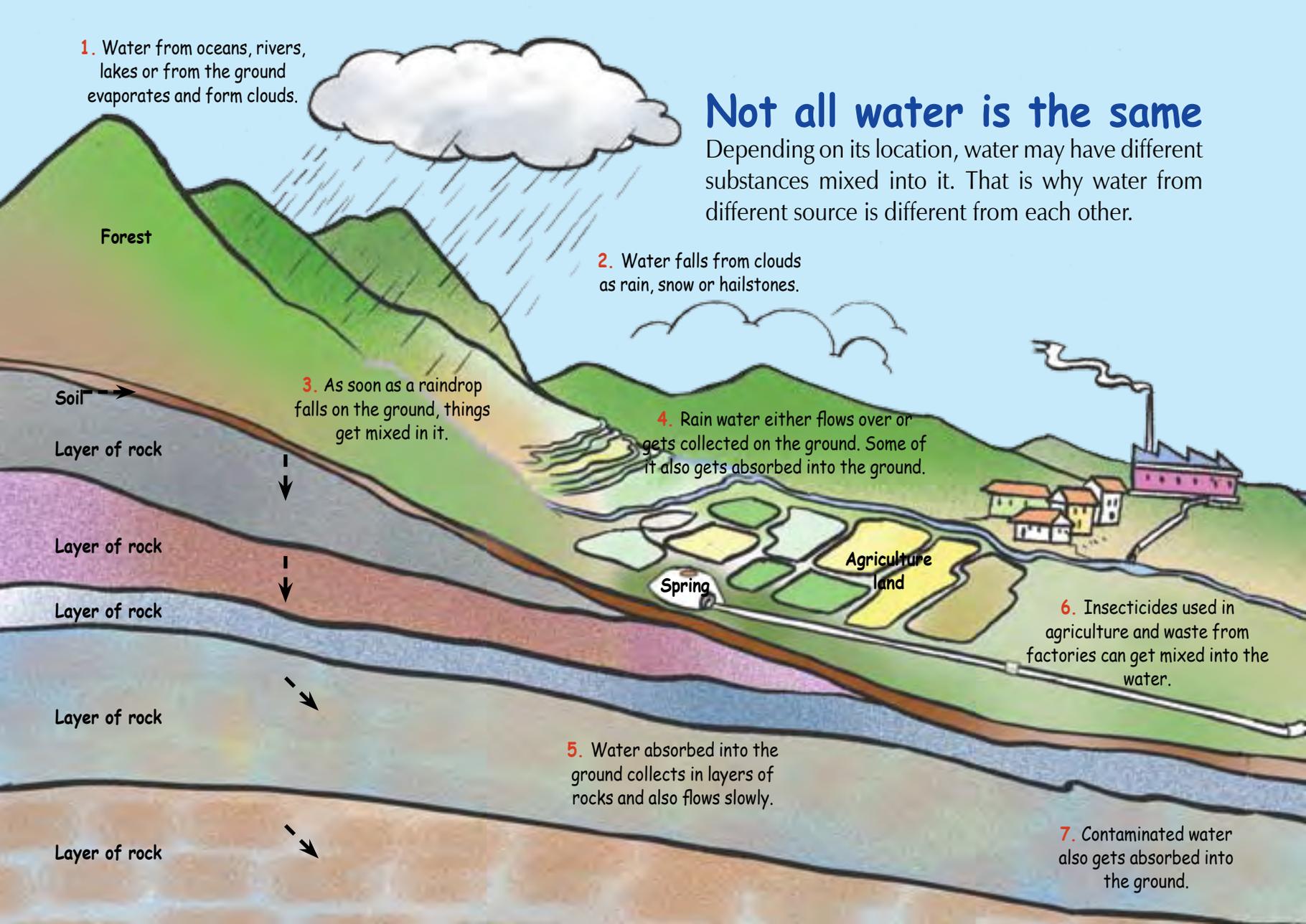
3. As soon as a raindrop falls on the ground, things get mixed in it.

4. Rain water either flows over or gets collected on the ground. Some of it also gets absorbed into the ground.

5. Water absorbed into the ground collects in layers of rocks and also flows slowly.

6. Insecticides used in agriculture and waste from factories can get mixed into the water.

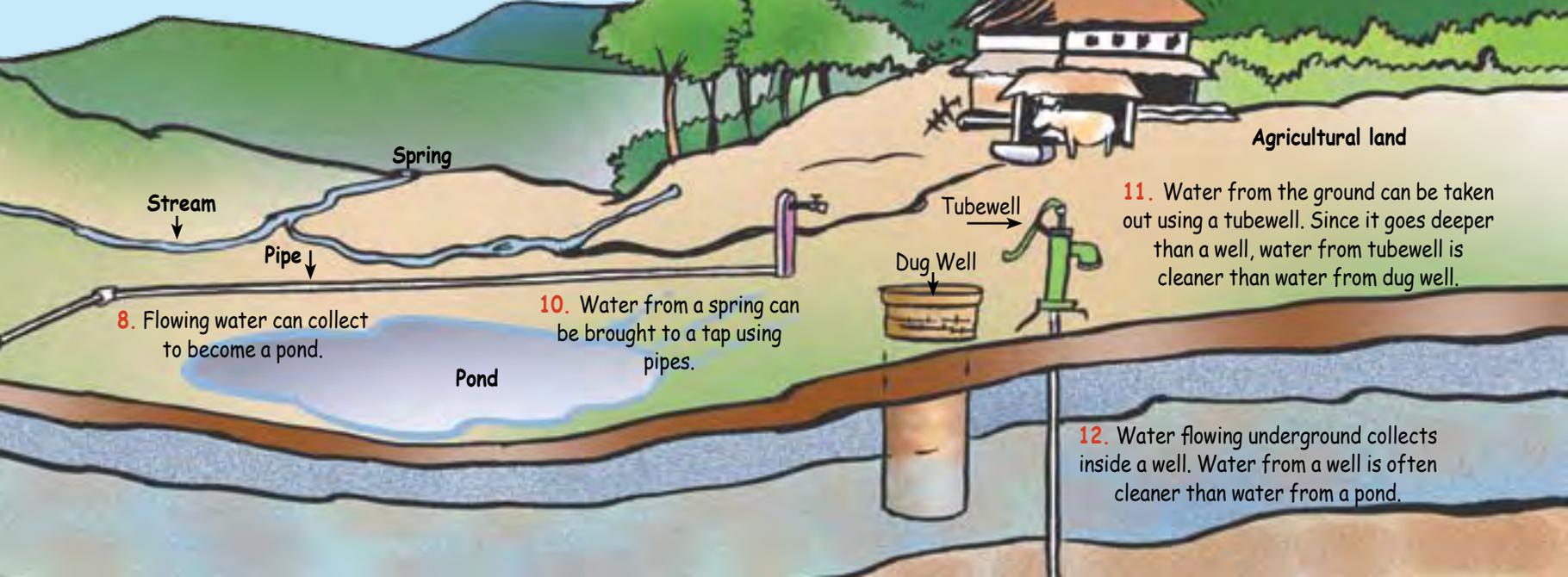
7. Contaminated water also gets absorbed into the ground.



Do you know where I come from to your house? Look at my life cycle.



9. Water flowing underground can flow to the surface in some places. These outlets of water are called springs.



Forest

Agricultural land

8. Flowing water can collect to become a pond.

10. Water from a spring can be brought to a tap using pipes.

11. Water from the ground can be taken out using a tubewell. Since it goes deeper than a well, water from tubewell is cleaner than water from dug well.

12. Water flowing underground collects inside a well. Water from a well is often cleaner than water from a pond.

# Which water is the dirtiest ?

Water can be clean or dirty depending on its source. Water from fresh snow melt will certainly be cleaner than water from a pond. There will be no chemicals mixed in rain water collected from a clean roof. Water from a deep tubewell may not have microbes. Arrange the sources below from the cleanest to the dirtiest.



1 A spring under a forest hill



5 A clean dug well



2 A stream passing through human settlement



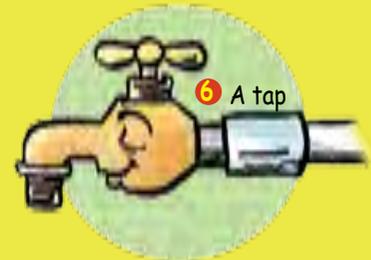
4 Tubewell



3 A village pond



I like to live in dirty, warm and shallow water.



6 A tap

Answer : Cleanest 1, 4, 6, 5, 2, 3 Most polluted

# Dirty and Clean water: which is which?

Water from different sources has different properties. Let us test the properties of water using our five senses organs.

- Eyes
- Nose
- Skin
- Ears
- Tongue



Eyes

## Look at a glass of water

- Is there anything floating on the water ?
- Is the water dirty ?
- Is the water colored ?
- Do you see germs ?



Nose

## Smell it

- Does it smell ?
- Do you smell germs ?



Skin

## Touch and feel water

- Take a bath. What is the water like ?
- Wash your hands. Are they clean now ?
- Can you feel or hold germs ?



Ear

## Listen to it with your ears

- Is there a sound ?
- Are the germs making noises ?



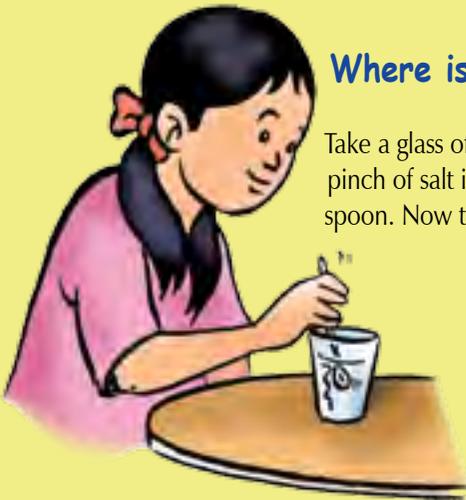
Tongue

## Taste some water

- What does it taste like?
- Can you taste germs ?

## Where is the salt ?

Take a glass of water and put a pinch of salt in it. Stir it with a spoon. Now try to see the salt.



Like salt no one can see me in the water.

Wait a minute. There is a way to see you.



# Dirty drinking water is the major cause of illness in Nepal

A person can get ill by drinking water with germs. In every 15 seconds a child dies in the world because of unsafe drinking water. In Nepal, 13,000 children die every year due to diarrhoea. Diarrhoea is caused by unsafe water and un-hygenic practices.

I am winning.



## Five die of diarrhea in camp for flood displaced

Aug. 16, 2008, Sunsari. Five persons displaced by the floods caused by breach in the Saptakoshi embankment...

## Diarrhea claims 6 lives in remote Jumla

June 28, 2008. Six persons have died due to an outbreak of diarrhea in a remote village in Jumla district over the past two weeks.

The epidemic has badly hit ward no. 1 and 2 of Gadhichaur

Why are you happy about this sad news? You bad Amoeba.



We are going to learn how to punish you.

Take this, Amoeba! Washing hands with soap thoroughly (at least 3 times). I will get rid of you.

I win!



## Five Killed as Bajhang under Diarrhoea Grip

Shiva Raj Bhatta  
Dhangadhi, August 27

An outbreak of diarrhoea killed five persons, including a boy, in Deulikit village development committee-4 of Bajhang district. Diarrhoea has been raging in Deulikit for a week. Deulikit has a health post, but it is of no use to the patients because it does not even have basic medicines.

People have begun moving to safer places to save themselves from the epidemic of diarrhoea. Even common medicines are not available in the Deulikit health post. Jayalal Bohara, a local said. In the name of staff er, the health post has been closed. People have begun moving to safer places to save themselves from the epidemic of diarrhoea. Even common medicines are not available in the Deulikit health post. Jayalal Bohara, a local said. In the name of staff er, the health post has been closed. People have begun moving to safer places to save themselves from the epidemic of diarrhoea. Even common medicines are not available in the Deulikit health post. Jayalal Bohara, a local said. In the name of staff er, the health post has been closed.

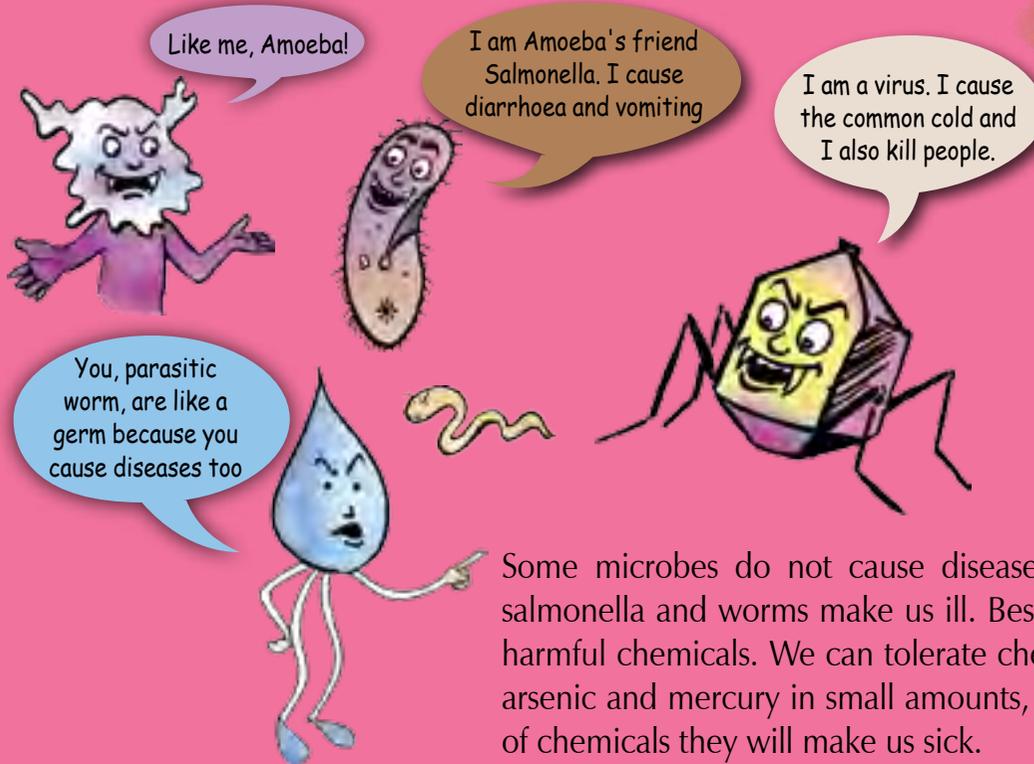
# What causes diseases?

Nothing happens to a buffalo if it drinks from a pond, but if we drink from a pond we would fall ill. Water from lakes, rivers or streams has many microbes in it.



## What are chemicals ?

Acids in batteries, medicines, like iodine, salts like copper sulfate, and substances like washing soda are known as chemicals. Many of them dissolve in water.



Some microbes do not cause diseases, but those like amoeba, salmonella and worms make us ill. Besides germs, water can have harmful chemicals. We can tolerate chemicals like iron, ammonia, arsenic and mercury in small amounts, but when there's too much of chemicals they will make us sick.

## How do germs enter our body?



Different germs enter our body in different ways:

- through the air we breathe (like the virus of the common cold)
- through food and water (like the bacteria that cause cholera)
- through the skin and injuries (like tetanus and scabies)

Once germs enter our body they multiply and we see their effects as a disease. Although germs constantly surround us, our skin protects us. Often they get in through our mouth and reach our stomach, where they cause stomachache. We will be healthier if we can prevent germs moving from places to places.

Although germs constantly attack us, if we stay clean and healthy, we can prevent them from entering our body.

## Three main ways germs get to our stomach



Flies sit on faeces



Come on Fly, full speed to food!

### Eating with dirty hands

- Dirty hands carry germs
- Germs are passed to our food from our dirty hands
- Dirty nails store germs



### Drinking dirty water

- Water kept in a dirty vessel
- Things fallen into water
- Fingers dipped into water



Look what has happened !



### Eating dirty food

- Food touched by dirty hands
- Food that has fallen off the plate
- Food touched by flies and stale food
- Uncooked and poorly washed fruits and vegetables

We have to find out if there are germs in the water, but we can't see, smell or feel them. What shall we do?



This is a way to see germs.



We can use a microscope to see microbes and germs like bacteria, amoeba or eggs of stomach worms. Looking through a microscope we can tell whether there are germs in the drinking water or not.



Why doesn't the buffalo get sick when it drinks from the pond?



Because it has immunity.

Germs look like this



### What is immunity?

When germs enter our body, our body develops ways to kill them or make them inactive. This ability to kill germs is called immunity. Most of the time our immunity takes care of germs, but certain diseases like dysentery trouble us time and again.

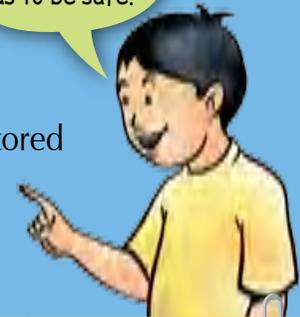
If germs and chemicals cause diseases, then what should drinking water be like?



# Diseases and drinking water

Water with no germs or harmful chemicals and that is stored properly is considered safe drinking water.

Drinking water has to be safe.



## Taste and smell

Safe water normally has no taste or smell. If there is a taste or smell, it is because some of substances or chemicals mixed in the water.



## Look

- Drinking water should be clean.
- It should be clear.
- It should not have any color.
- Even after it stands for several hours there should be no color or turbidity.
- Nothing should be floating or settled at the bottom.



## Think

- Water should be kept covered in a clean vessel.
- Vessel for drinking water should be stainless and odorless and should not break or help germs reproduce.

They are about to drink water. Get ready to attack.

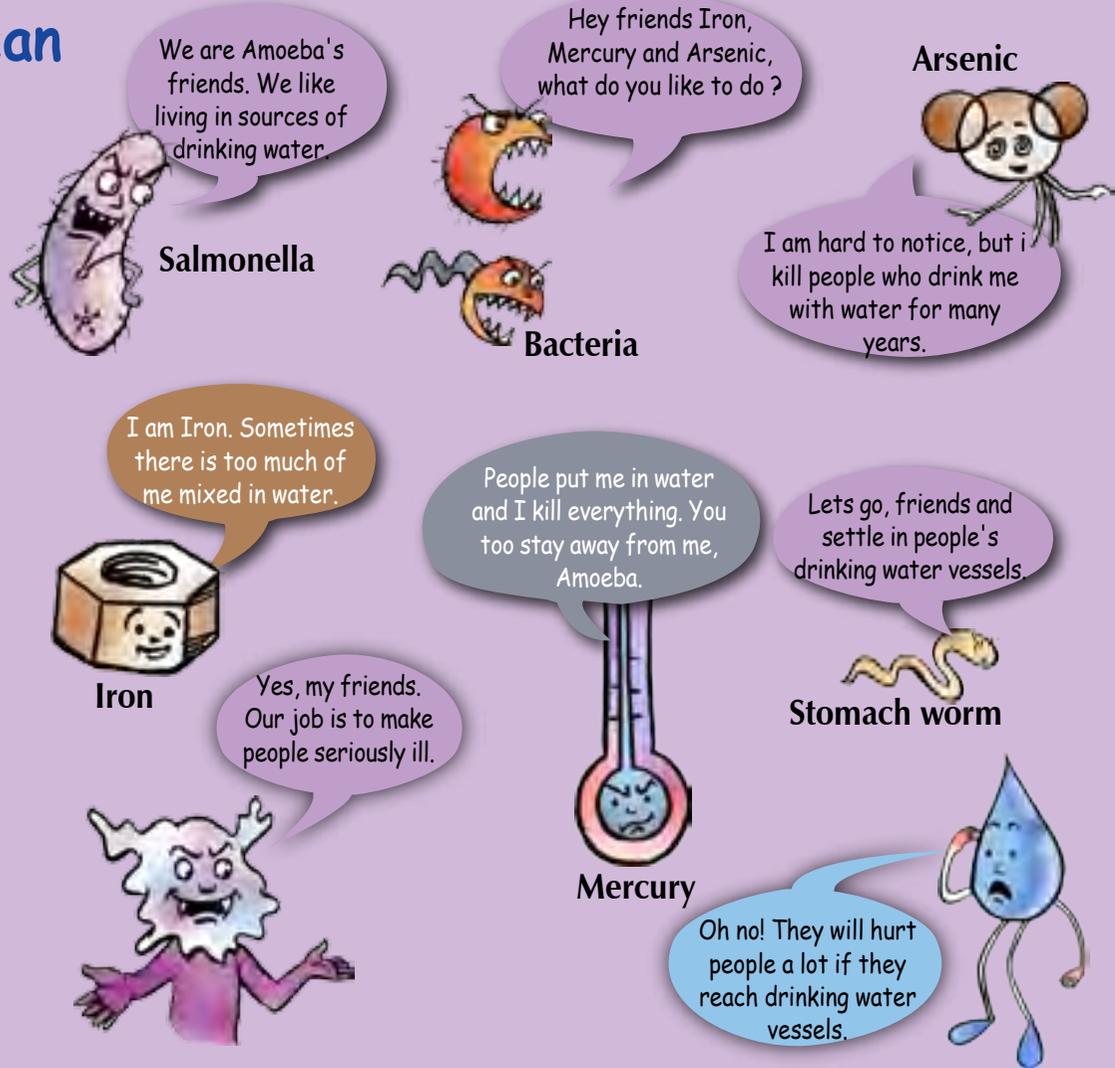


# Pollution of water can start at the source

## Story

The sun melted the snow and the flowing water picked up a dried piece of cow dung. There was an egg of a stomach worm in it. This creature flowed down with the water to some warmer place where it met a crowd of bacteria living on a rock.

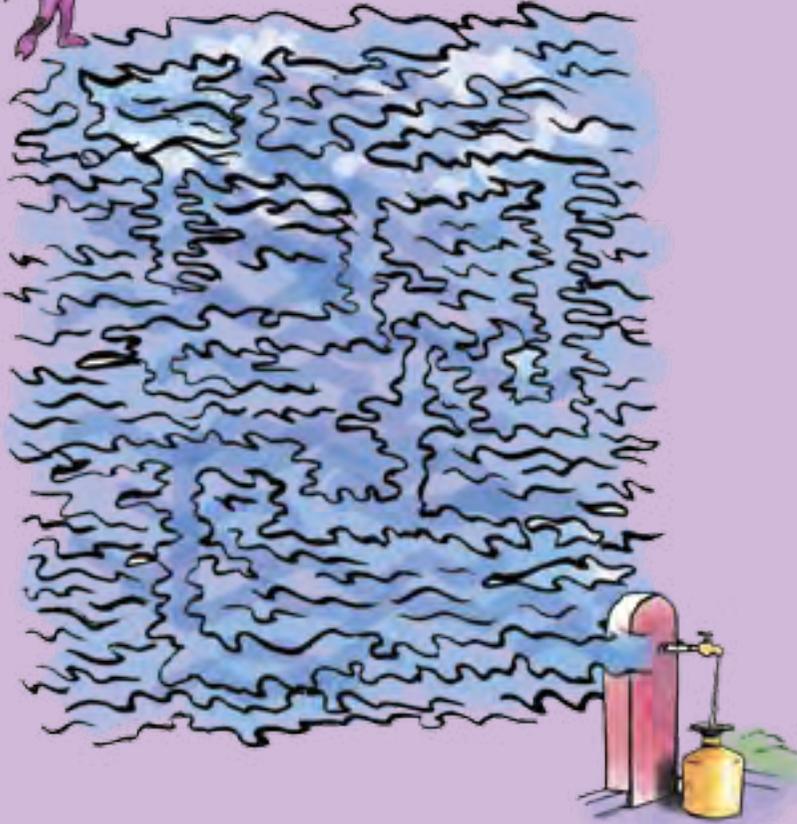
Further on this group of germs came across an amoeba who lived in a drain coming from a village. As the stream flowed down it was channelled into a tank. In the tank the germs met mercury from a battery and iron from rust. A salmonella from somebody's toilet was also there. When they all met, this is what they said.



## Which way, Amoeba?



Help Amoeba to get to the water pot by drawing a line through the maze.



## Pollution of surface water

Waste and dirty water which drains from kitchens, toilets and cowsheds often get mixed into streams as they flow past people's houses.



### Pollution of ground water

- Animals may step or swim in a spring from which water is used and make it dirty.
- Things may fall into a well.
- Harmful substances can seep into layers of underground rocks and pollute underground water.

### Pollution of water on the way from the source to our mouths

- Underground pipes may break letting harmful substances to mix into drinking water.
- Things may fall into storage tanks.
- Storing vessel may be dirty.
- Drinking glasses may be dirty.



WOW! I got, a free ride to a storage pot through a pipe.



Oh, no! The water pipe is broken.



Oh, no! Amoeba has reached the water vessel. What to do now?

# Sources of safe drinking water



Children, from where do you get drinking water at home?

My Father brings it from the river and puts it in a drum

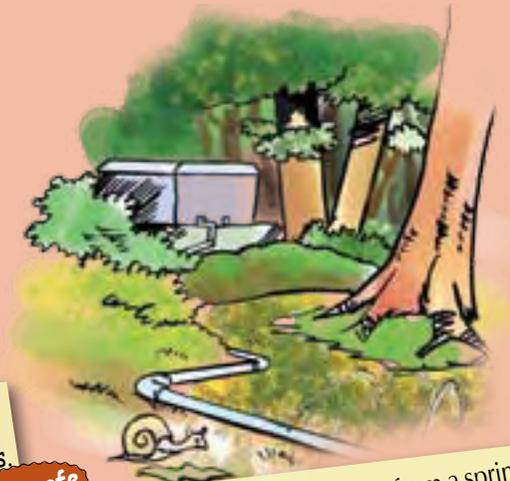


Make it safe



We bring it from a stone tap in a vessel and drink it in a glass.

Make it safe



Water is brought from a spring in the forest above the village, but the pipe is broken in places.

Make it safe

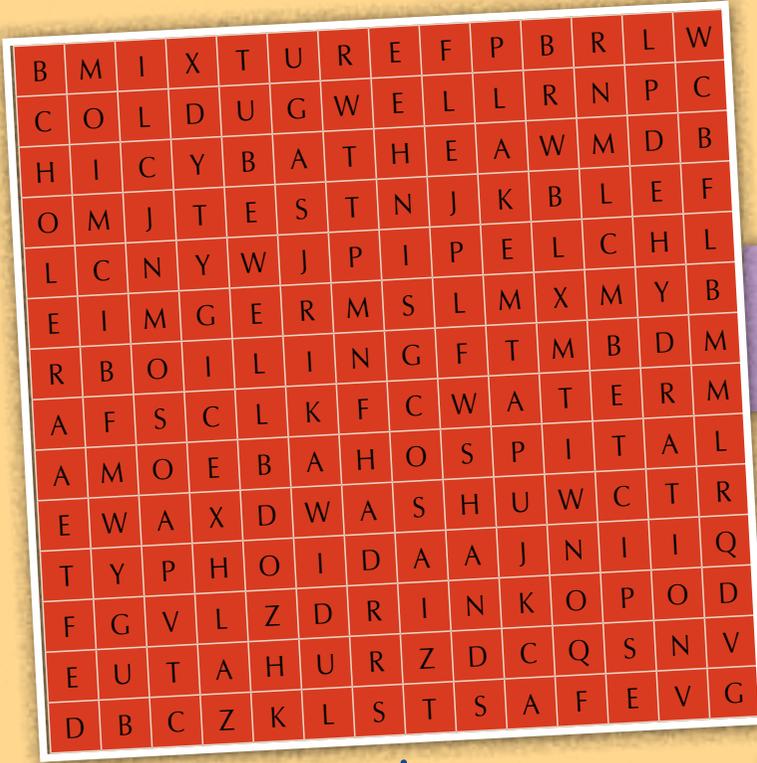
## How can we protect different sources of water:

|        |   |
|--------|---|
| Spring | <ul style="list-style-type: none"> <li>• Remove dry leaves and dirt from time to time.</li> <li>• Stop animals from reaching it by fencing it.</li> <li>• Cover it</li> </ul> |
| Well   | <ul style="list-style-type: none"> <li>• Remove dirt which falls onto a well.</li> <li>• Cover it.</li> </ul>   |
| Pipe   | <ul style="list-style-type: none"> <li>• Repair broken pipes.</li> <li>• Cover pipes so that they do not break.</li> </ul>  |
| Tap    | <ul style="list-style-type: none"> <li>• Keep the surroundings clean.</li> <li>• Maintain it.</li> </ul>  |

Ha! Ha! I rule from their source to their mouths



Look at the word puzzle below. Search for the words related to health and water. Words are arranged horizontally and vertically.



I am happy. Everybody knows about me but nobody knows where I hide.



Look! I have many babies.



### Water quality test

A simple test can be done to check the quality of water. Collect three transparent glass bottles with tight caps. Thoroughly clean each bottle and dry it. Now, fill them with water samples from three different sources and label each of them. Observe the water carefully and note what you see in your note book. Put the bottle in a bright place but away from direct sunlight and examine them after a week.

- What happened to the water from each source?
- What must be the reason for the changes?
- Do you think changes could be invisible to the naked eyes?

### Word Puzzle

Words hidden above  
 Mixture, Tubewell, Dehydration, Amoeba, Boiling, Lake, Pipe, Tap, Dugwell, Wash, Hands, Cold, Germs, Hospital, Soap, Cholera, Ice, Safe, Test, Water, Bath, Typhoid, Drink



Healthy habits game

# Ask yourself

What kind of water did you drink this morning? Could there have been germs in it?



Mother brought water from the spring this morning. I put it in a jug and drank. I don't know if there were germs.

Don't know

I drank from a drain on the side of a road.



Yes, there is.

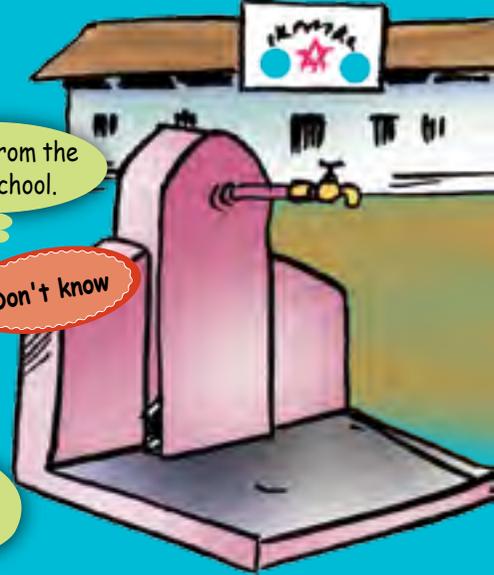
I drank from a water filter which was cleaned thoroughly.



Maybe not

I drank from the tap in school.

Don't know



# Discuss with friends

Where do they get their drinking water from ? Is it likely or unlikely that there are germs in that water ?

I drank water that was boiled and cooled.



Well done!



No germs.

On my way to school there is a river. I fill my bottle in the middle of the river with clear water.



There are germs.

I took water from the pond in a clean bucket and then I drank it in a clean glass.

There are germs.



I have a stomach ache today.

I like losers like this one.



On the way to school there is a waterfall in the forest. I fill my bottle there.

There may be germs.



The other day my brother had diarrhoea. The water my mother fills in the drinking vessel is probably not safe. What should I do?



## Make drinking water safe

Before drinking, you have to be able to say for sure that there are no germs in the water. Some sources like deep wells, tubewells and well managed water supply systems give us safe water.

### But

Most sources are not safe and, we need to get rid of excess chemical and germs to make drinking water safe.

What does making safe mean?



Making water safe means getting rid of you, dumb Amoeba.

What do you get



If I don't get rid of you, you give me diarrhoea.

I am not the only one. Worms and salmonella also give you diarrhoea.



I'll get rid of them too.

But the taste and smell are there.



Fine or not fine, I will get rid of you all. Just wait and see.

What will you do? Pick each of us out with tweezers.



Not with tweezers! We will boil or filter or sodis or chlorinate you.

Oh no! I've no where to run to....

Serves you right!



# Boiling water

Most germs are killed when water is boiled. Water that has no color, odor or turbidity can be used for boiling. Boiling water in a well washed pot with a good lid keeps its taste. If there are things floating on the water after boiling it then they should be blown away. If there are particles after boiling, then we should let them settle at the bottom.

It is easy to get into the habit of drinking boiled water.

Ooh! Ouch!  
Today we are going to be boiled alive.

## Where to cool water after boiling it?

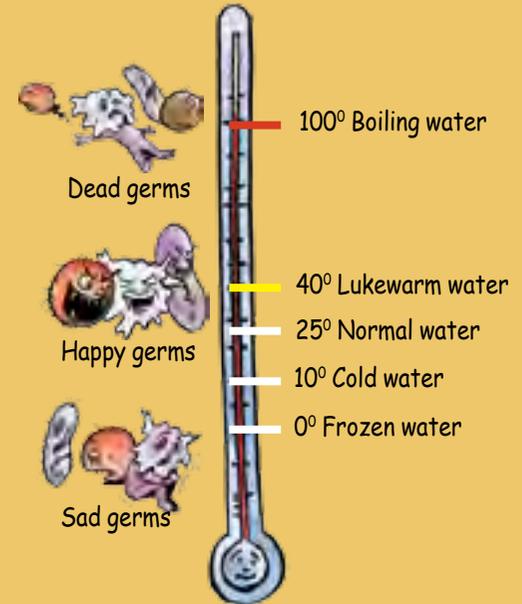
Boiled water should be cooled in the same pot. Cover the pot with a lid to keep it safe. Hot water burns, so be careful.

## How long to boil water?

As the water begins to boil, you will see little bubbles. Keep boiling until you see large bubbles.



A dead amoeba is better than a living amoeba.

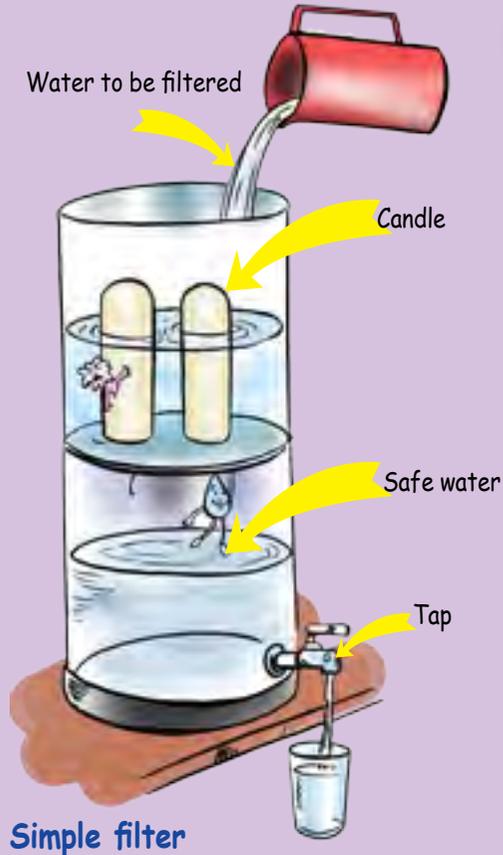


Do not insert another container into boiled water. Pour it into a clean jug and drink it from a clean glass or a cup.



# Filtering water

Rain water gets absorbed into the ground. The layers of soil, sand and rocks filter out the germs that were in the water. As the water goes deeper into the ground, it gets cleaner. A similar method of cleaning water at home is called a filter.



Simple filter

## Simple filter

There are two vessels made of copper, clay, stainless steel or aluminium in a filter. The upper vessel into which fresh water is poured, has one or two candles that are made of a special kind of ceramic material. Water filtered through the candle collects in the lower vessel. This kind of filter

- removes particles.
- is cheap, easy to use and readily available.

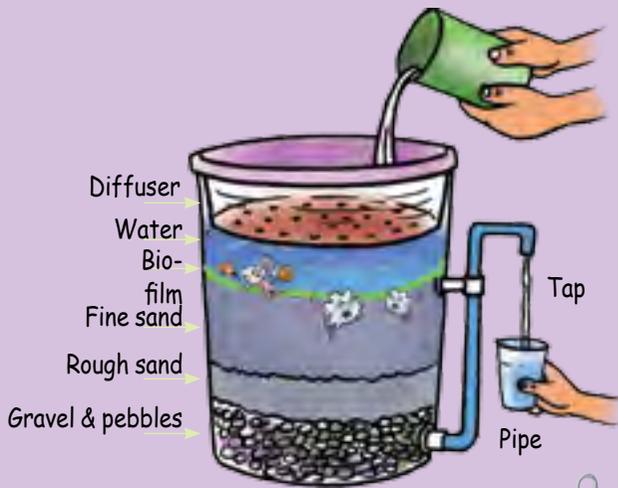
## Colloidal silver filter

This filter is similar to the simple filter in design but its candle or filter disc has a special coating of a substance made from silver which kills germs. This method

- is easy to use.
- kills germs.
- removes particles.

Colloidal silver filter





### Bio-sand filter

The bio-sand filter removes germs through physical and biological processes. This filter uses fine sand and gravel. Various microbes live in the upper layers of sand. This layer is called biofilm. In this biofilm the larger microbes eat germs found in the water. Iron and other chemicals also get stuck in the sand layer and are filtered out. This filter is easy to make using simple materials. It

- removes particles.
- removes germs and chemicals.



### Kanchan arsenic filter

This filter can remove arsenic from water. It is like a bio-sand filter but in its upper part there is a tub full of rusty nails. Arsenic is attracted to the rust and gets attached in it. This filter should be used in places where arsenic is found in water. This filter

- removes germs and particles.
- removes arsenic and iron also.



# Solar water disinfection (SODIS)

Look, Amoeba,  
another method of  
killing you



Sunlight contains ultraviolet rays called UV-A. These ultraviolet rays are harmful to living organisms. Microbes are killed by this UV ray and sun's temperature. The method of killing germs with sunlight is called Solar Disinfection. For this method we need a transparent clean plastic bottle, like a mineral water bottle, with a cap that can be tightly closed.

Ouch! What  
poked me?

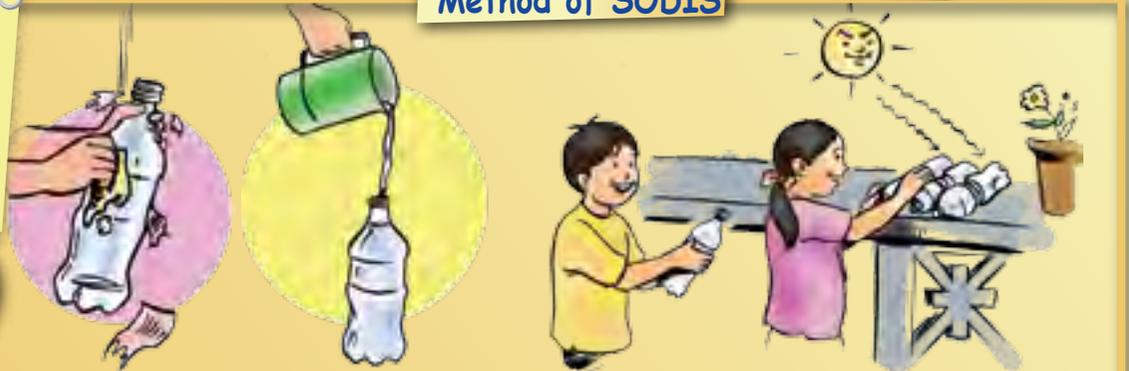


## Why plastic bottles

- Does not break
- UV rays easily go through it
- Shape and size is good
- Easily available

Take a bottle of water  
to school. Leave it in the  
sun to drink the next  
day.

## Method of SODIS



1. Remove the label & clean the bottle including its lid.
2. Fill the bottle all the way to the top and close it.
3. Leave it in a very sunny place for a whole day. If it is cloudy, then leave it in the same place for two days.

## Chlorination

The easiest method of making drinking water safe is to add chlorine drops. You can do this easily at home. Chlorine is a highly reactive chemical that kills harmful organisms. After adding the required amount of chlorine in drinking water all micro-organisms die in half an hour and the water will be made safe to drink.



When travelling or going out far from home, it is best not to drink unsafe water from unknown sources. Use the water that local residents use but you should use chlorine to make it safe.

Piyush and Waterguard are some easily available brands of chlorine. When using, read the instruction on the label carefully and follow it.



Ohh! Ouch!  
Chlorine burns! My  
skin is falling off



See how we can  
kick you out!

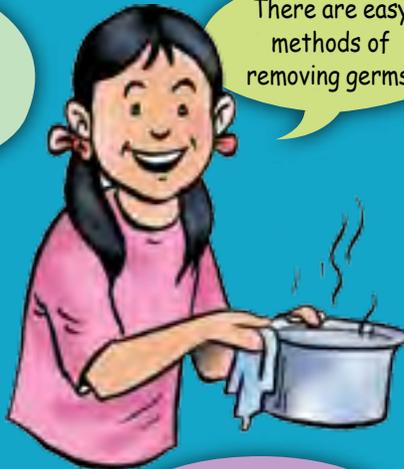
# What did you learn ?

All water is not safe to drink. Just because mother brought the water, does not mean that it is safe to drink.



Although water looks clean. It can have harmful germs and substance in it.

There are easy methods of removing germs.



Remove germs and excess chemicals from water before drinking.

Boiling, Filtration, Sodis and Chlorination use to remove germs.



Forgive me, please. I can't leave water and live elsewhere.



Stick  
your  
Photo  
here

Sorry Amoeba. Now, I know you more. I'll save myself from you.

## Additional information about water



Our brain contains large amount of water. To be alert and productive the brain needs to be supplied with plenty of water and oxygen. Once we drink water our mouth, our brain receives the amount of water it needs. When you want to learn something new in class, drink some water. It helps you to learn things better. Safe drinking water is a basic need in schools.



Don't drink the water straight from me. Make it safe first.



There is a test today. Take a sip of water if you want to do well on it.

Sure, but boil it first.

Ma'am, I don't have water. Can I have ice instead?



## "SAVE YOUR LOVED ONES" game (on the NEXT PAGE)

### RULES

1. This is a game which two players play by rolling a dice
2. One takes germs and the other takes people.
3. Germs move clockwise, following the arrows in boxes of their own colour only. People move across from 1 to 10.
4. Roll dice in turns to move any of the six germs or any of the six people.
5. Only the boxes with healthy habits are safe spots for people.
6. If a germ gets a person in an unsafe spot, the person loses and has to be removed.
7. Moving backward is not allowed and one has to make a move when it is possible to do so.
8. Get all your persons across to win the game.

# "Save Your Loved Ones"



The rules for this game are on the back of this page.

|         | Amoeba                       |               | Worm               |                              | Bacteria           |                              | Virus              |                              | Salmonella        |                               |       |
|---------|------------------------------|---------------|--------------------|------------------------------|--------------------|------------------------------|--------------------|------------------------------|-------------------|-------------------------------|-------|
| Sister  | Filter<br>1                  | 2             | Use of toilet<br>3 | 4                            | SODIS<br>5         | Washing hands with soap<br>6 | 7                  | 8                            | Boiled water<br>9 | 10                            | Saved |
| Brother | Washing hands with soap<br>1 | 2             | 3                  | Filter<br>4                  | 5                  | Chlorine<br>6                | Boiled water<br>7  | 8                            | 9                 | Use of toilet<br>10           | Saved |
| Sister  | 1                            | SODIS<br>2    | Boiled water<br>3  | Washing hands with soap<br>4 | 5                  | 6                            | Use of toilet<br>7 | 8                            | 9                 | Filter<br>10                  | Saved |
| Brother | Boiled water<br>1            | 2             | 3                  | 4                            | Use of toilet<br>5 | Boiled water<br>6            | 7                  | Filter<br>8                  | 9                 | Chlorine<br>10                | Saved |
| Friend  | Use of toilet<br>1           | Chlorine<br>2 | 3                  | 4                            | 5                  | Filter<br>6                  | Chlorine<br>7      | Washing hands with soap<br>8 | 9                 | 10                            | Saved |
| Mother  | 1                            | 2             | Boiled water<br>3  | Filter<br>4                  | 5                  | 6                            | SODIS<br>7         | 8                            | Chlorine<br>9     | Washing hands with soap<br>10 | Saved |

