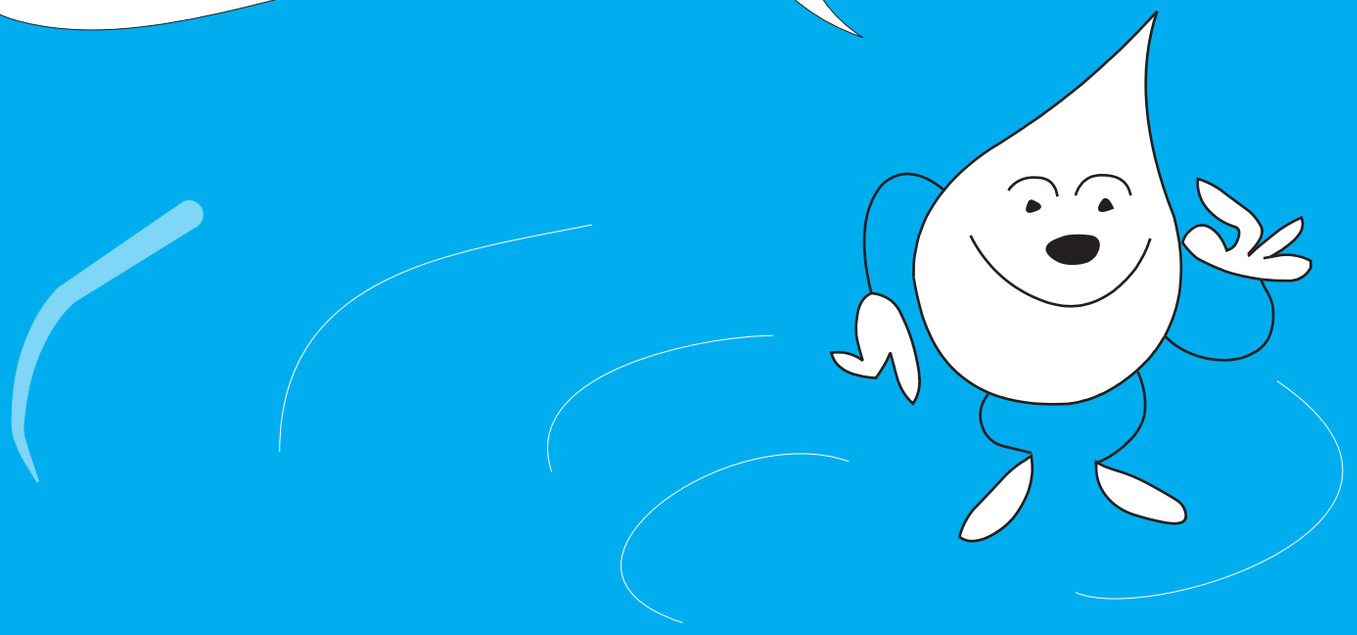
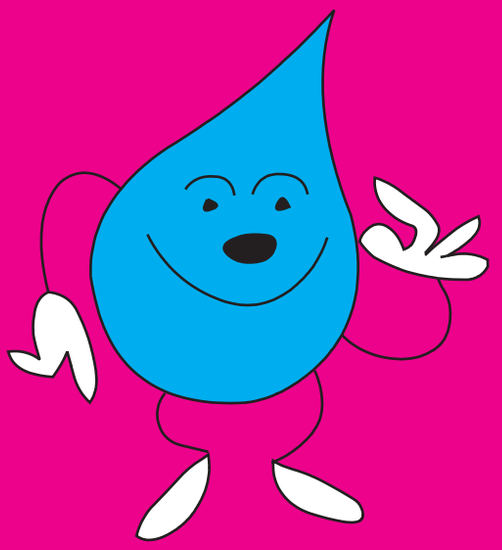
A Trip With Drip
The Water Drop

Greetings to you. My name is Drip, and I invite you to come with me on a trip. On this trip we will see and read and find out more about me, and what I mean…



Let's start our trip from far out in space. Down there is Planet Earthhome to millions and billions of living things. But tell me, what do you see? What colour makes up most of this planet? Yes it is blue. And what does blue stand for? Water, of course. You can see that there is more water than land. Almost three-fourths of the surface of our planet is covered with water.

In fact, people often say that our home should be called Planet Water instead of Planet Earth!



Where can you find water on Earth?

Fill in the blanks to find out

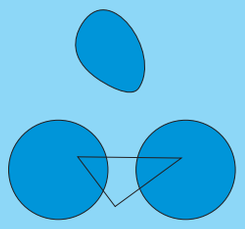
_ C _ A N _
R I _ _ R S
_ A _ E _
_ C E C _ P _
U _ D E _ G _ _
U _ D

Did You Know?

Water exists in three states:
Liquid: as water
Solid: as ice
Gaseous: as vapour

So much water? Have you ever wondered where all the water comes from?
To find out we need to know about the water cycle. No no, the water does not ride a bicycle!

Let me explain.



Water from oceans, rivers, lakes, soil and plants evaporates when it gets heated by the sun. It changes from being liquid, to being vapour. We call this process evaporation.

The water vapour rises into the atmosphere. As it rises it cools, and a process of condensation begins. That is when the vapour turns into drops, and millions of tiny drops form clouds. When the droplets of condensed water become heavy, they fall back to the earth as rain, or snow.

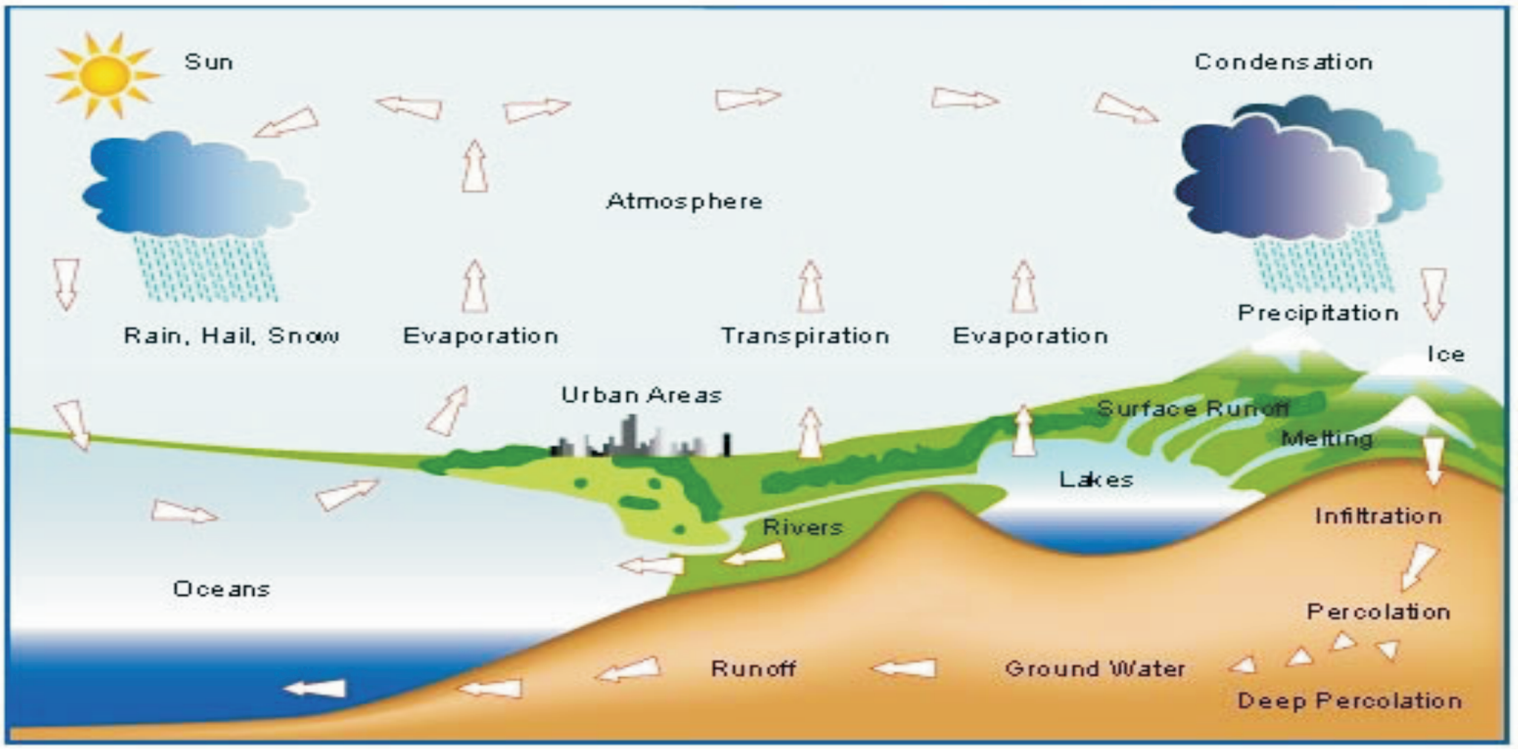
As the rain falls, three things happen. Some of the water evaporates immediately. Some of it seeps into the soil and moves underground where it is stored. The remaining part flows along the surface of the ground to fill rivers, and streams, and lakes and oceans. The water in rivers and streams also flows into the oceans.

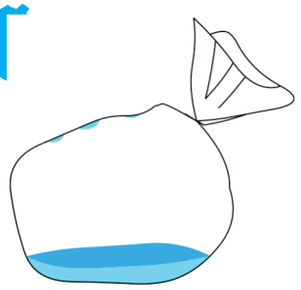
And some more water gets heated, and evaporates, and condenses, and falls back to Earth in a continuous cycle… That is why it is called Water Cycle.

Given below is a picture. Put in the arrows to show how I would move through the Water Cycle.

Illustration

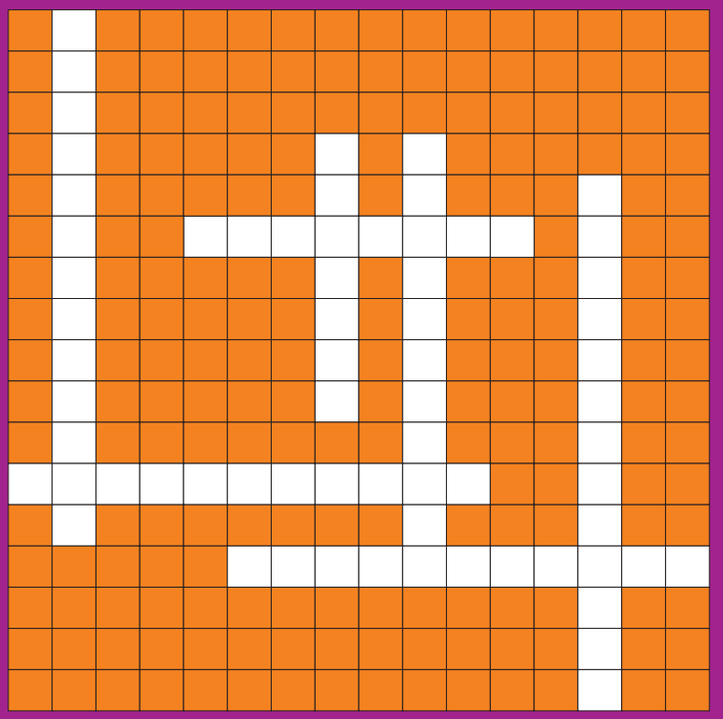
Water cycle





Pour a tablespoon of water in a small transparent plastic bag. Tie the mouth of the bag. Place the bag in direct sunlight. Wait a while. Then observe what happens in the bag. Do you see any drops of water on the top and sides of the bag? Where did they come from? Now place the bag in a cool place. Observe again what happens to the water drops.

FILL IN THE CLUES TO COMPLETE THE WATER CYCLE CROSSWORD



Down

1. Water vapour that condenses into clouds and falls on the land and water in the form of rain, snow, hail or sleet
2. Fresh water from precipitation and melting ice that falls on a body of land that runs off into nearby streams, lakes and wetlands, rather than soaking into the land
3. Process by which liquid form of water is turned into a gas and returns to the atmosphere
4. The process by which water absorbed in root systems of plants moves up through the plant, passes through pores in the leaves, and evaporates into the atmosphere as water vapour

Across

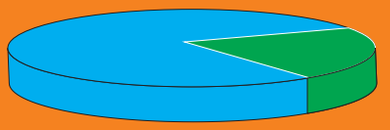
5. The fall of condensed moisture of the atmosphere and visible drops
6. Process of turning from gas or vapour to a liquid
7. Water that has been absorbed into the soil and is contained in cracks and crevices in rocks, sand and other porous materials

Think About This

Water constantly moves and changes form, but the amount on Earth does not increase or decrease. The water on Earth today is the same water that has been there since the planet formed. The glass of water you just had, could have been drinking water for a dinosaur!

If there is so much water on Earth, and if the water cycle is a continuous process, why do people worry about water?

Well, let's look again at all the water we have.



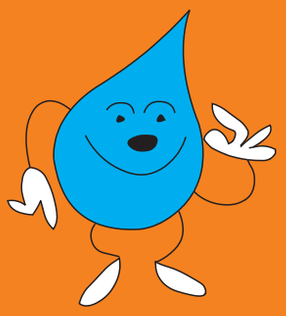
Do you remember where water is stored?

Take oceans: Ninety seven per cent of the Earth's water is in oceans.
Can the ocean water be directly used for daily needs? No. Why?
Because it is salty.

Do you remember what the solid state of water is called? It is ice.
Two per cent of the Earth's water is frozen as ice-caps and glaciers.
This cannot be easily used.

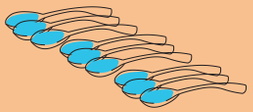
That leaves less than one per cent of water. Where is this water?
Yes, in lakes, ponds, rivers, and under the ground.
This is what we call freshwater.

And that is the water the entire earth has for its use.



Does this sound very confusing?

Let's make it easier by imagining that this 2200 ml of water represents the total water on earth. If we were to take 12 spoons of water out of this, the water that remains is equal to the salty water in the oceans and seas. Now look how the 12 spoons of fresh water are divided.



Nine Spoons Icecaps

Two Spoons Groundwater

½ Spoon Freshwater Lakes

One Drop Rivers

As I go around, I travel across different parts of the world. I see many different people and their way of living. No matter where I go, I know that everyone loves stories.

Let me tell you a story that I heard in South Asia.

Who is Greater?

Once upon a time there was perfect harmony in the forest. There dwelt together, in harmony, animals, birds and trees. Occasionally the Neem and the Banyan trees quarrelled. One morning as the forest awoke to a bright new day, two angry voices pierced the air. It was the Neem tree and the Banyan tree.

The baby squirrel who lived in the Banyan tree was the unintentional cause of this quarrel. In a playful mood it ran up the Neem tree. Seizing this opportunity, the Neem tree teased the Banyan tree. Calling aloud, it said: "Who wants to stay with someone with such entangled branches?" The Banyan tree retorted: "I am considered to be the best among trees, with good reasons. My vines and branches are home to hundreds of birds and animals. They provide shade to tired travellers. Animals and birds feed on my leaves and fruits. When you were born I was already 170 years old. What do you know about the world at 50 years of age?

The Neem tree said, "With due respect to you as an elder. But you should not take pride in your remarkable age. I have accomplished in 50 years what you took 170 years to do. Animals and birds live in my branches too, and they provide shade to man and beast alike. Most important, I serve the sick. My leaves and twigs are used for making herbal medicines. Although you are my senior, I am more useful than you". And so the trees went on. Each trying to make a longer list of how useful it was, for so many.

A frog from the nearby river was listening to their argument. Hopping out he bowed to both the trees. "What are you both quarrelling about? In your own capacities, both of you are useful. The question who is most important does not arise. I am sure you are aware that without water neither you nor I, nor any other living thing would have existed. If there is one thing everyone of us needs, it is water. And yet, the wise water never boasts about its manifold uses."

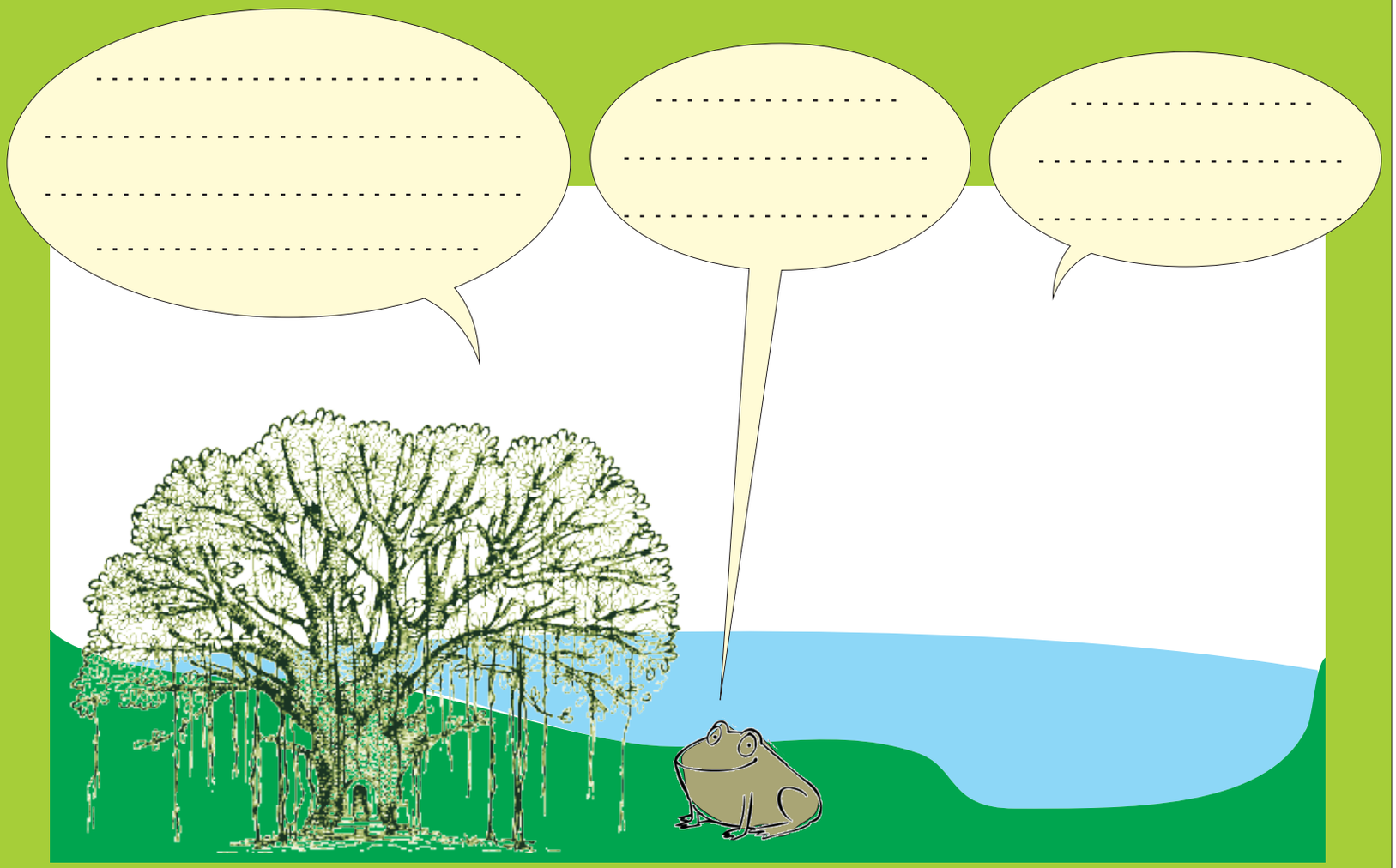
Both trees understood what the frog meantthat without water no life was possible. They felt deeply ashamed and resolved not to get into petty fights again.

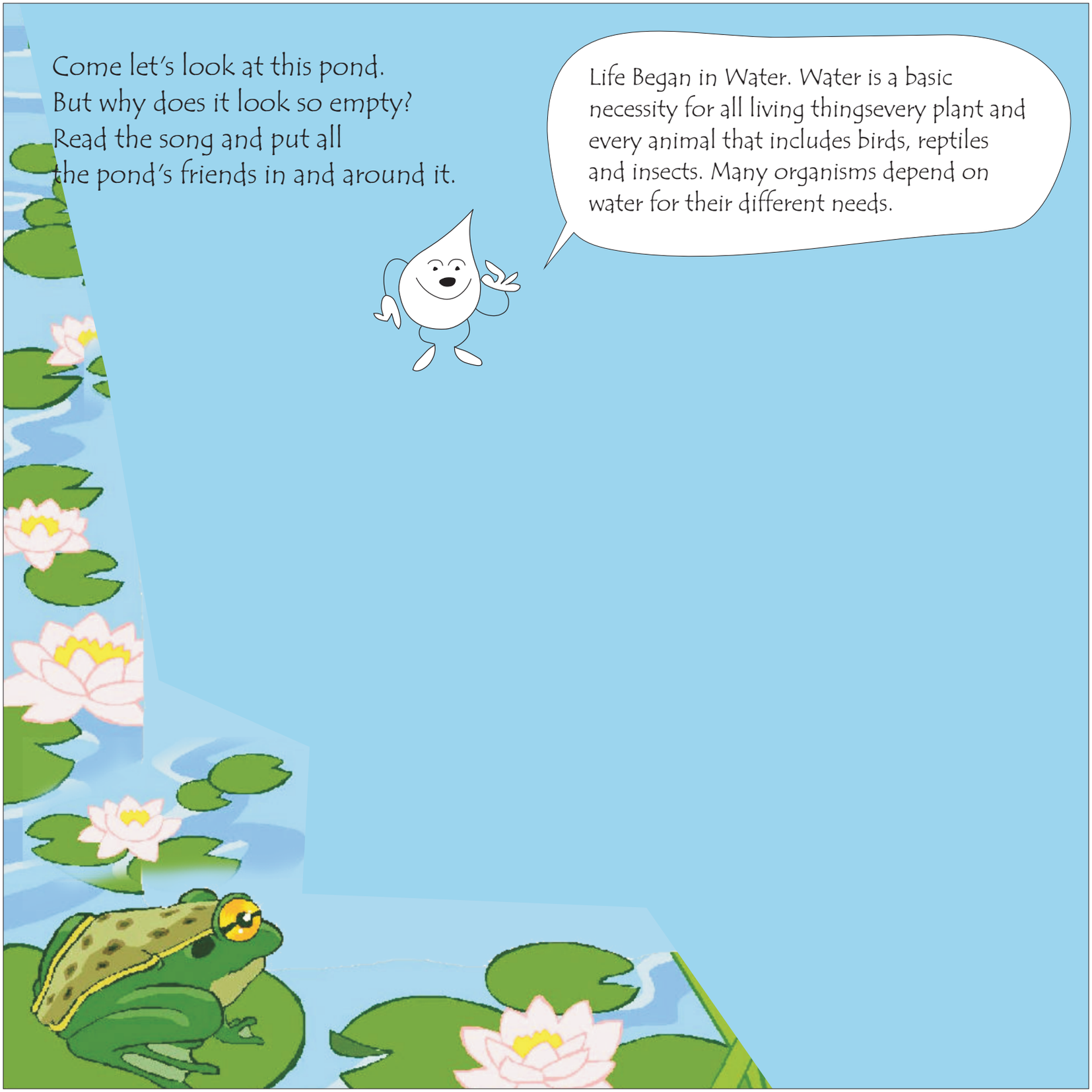
Here is what the scene may have looked like. What are all of them saying?

Here is what the scene may have looked like. What are they saying?

Think About This

Water is essential for all living thingsplants and animals. All organisms need to take in freshwater to maintain life processes. Apart from this, some organisms need water for living in, still other cannot breed except in water. Though the amounts of water required are different for different organisms none can do entirely without it.




Come let's look at this pond.
But why does it look so empty?
Read the song and put all
the pond's friends in and around it.
Life Began in Water. Water is a basic necessity for all living thingsevery plant and every animal that includes birds, reptiles and insects. Many organisms depend on water for their different needs.

The Pond Song

Old Mother Earth she had a pond
Filled drop by drop by drop

And in that pond there lived a fish, fishy, fishy, fish.
With a swim, swim here and a swim, swim there
Here a swim, there a swim, everywhere a swim, swim.

And in that pond there was a turtle, a soft-shelled one was he
With a spalsh, splash here and a snap, snap there
Here a splash, there a snap, everywhere a splash, snap.

And in that pond there lived a frog, croak, croak, croak
With a hop, hop here, and a leap, leap there
Here a hop there a leap, everywhere a hop, leap.

And by that pond there lived a snake, hiss, hiss, hiss.
With a slither, slither here, and a slide, slide there
Here a slither, there a slide, everywhere a slither, slide.

And by that pond there lived a snail, slow, slow snail
With a crawl, crawl here and a creep, creep there
Here a crawl, there creep, everywhere a crawl, creep.

And on that pond there was a skater, long, long legs
With a skate, skate here, and a stride, stride there
Here a skate, there a stride, everywhere a skate - stride.

Near that pond was a mosquito, a pesty pest was he
With a zzzzz here and a zzzzz there,
Here a zzzzz, there a zzzzz, everywhere a zzzzz, zzzzz .

Near that pond there lived a bird, nesting on the tree
With a flap, flap here, and a wade, dive there
Here a flap, there a wade, everywhere a flap, flap .

To that pond came a buffalo, big n'fat n' black
With a plonk, wallow here and a plonk, wallow there
Here a wallow, there a wallow, everywhere a wallow, wallow.

Also to the pond came a washerman, with lots of dirty clothes.
With a soap, soap here and a wash, wash there
Here a soap, there a wash, everywhere a wash, wash.

Old Mother Earth she had a pond, filled drop by drop by drop
And that pond had many friends, who had a lot of fun
With a swim, swim here, and a splash, snap there
With a hop, hop here and hop, leap there
With a slither, slide here and a crawl, creep there
With a skate, stride here and flap, dive there
With a zzzzz here and a wallow, wallow there
Old Mother Earth she had a pond
Filled drop by drop by drop...

Now think about yourself. You know how you feel when you are thirsty. Imagine how it would be if you had nothing to drink for one full day? Did you know that you could live without water only for about a week? The human body cannot keep working without water.

You think that it is the bones and muscles that make your body feel solid and firm. In fact, about 65 per cent of your body is made up of water!

You also lose water from your body when you go to the toilet, when you sweat, when you breathe out. That is why it is important to take in a lot of liquids every day whether it is as water, or as milk, juices, soft drinks, tea or coffee. You need to take in between two or three litres of water each day.

Do you know why the doctor asks you to have a lot of liquids when you have a fever? Because you lose a lot of water when you sweat.

FIND OUT

Measure how much water you drink in a day. To do this, use a measuring jug or container to measure every drink you have. (Don't forget to include milk, juice and other liquids)

Did You Know?

You also take in water when you eat solid foods. Look at these.

Egg

Bread

Tomato

Orange

Potato

Think About This

Water makes up a large part not only of humans. Can you guess how much of these is water?

10% 70% 80% 95%

Now think, what do we use water for?
Start with yourself. Think of all your activities
From morning till night, and
list the ones for which you need water.
I will start the list to get you going.

Brushing teeth

Do you have some more to add?

These are called domestic uses of water.

Water is equally essential for every aspect of your lives: the food you eat cannot be grown or cooked without water. The clothes you wear, the houses you live in cannot be made without water. The paper this book is printed on cannot be made without water.
So water is needed also for:

Agriculture: Food cannot be produced without water. Crops, livestock, all need water.
Vegetables are 80-90 per cent water and milk about 87 per cent water.

Industry: Almost all industrial process need water. It is needed for the manufacturing or processing of ores, textiles, chemicals, paper, food, etc. Water is needed as a solvent, as a medium, as a cooling agent, as a cleaning agent, to name just a few of the industrial uses.

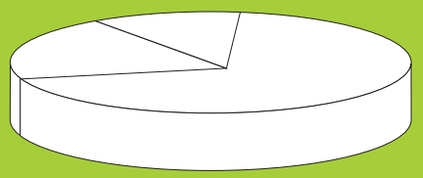
Power: Almost all modes of power generation require waterfrom hydel power, where falling water turns turbines to produce power, to nuclear reactors, where water often acts as a coolant.

Waste disposal: Whether it is domestic sewage or industrial effluents, water provides the medium through which this waste is carried away.

Transportation: Most of the world's traded goods that have to move from one continent to another, are transported by ships and boats over water (oceans, rivers and canals).

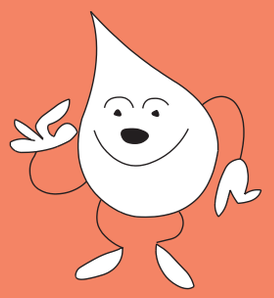
Recreation: A lot of fun activities need waterswimming, surfing, water skiing, fishing, or boating. Even sitting beside a sea or a lake can be a wonderful way to relax.

Did you Know? It is estimated that 70 per cent of water consumed worldwide is used for agriculture, 20 per cent is used for industry, 10 per cent for domestic use.



Mark and colour the sections to show use of water

So many uses of water. But we have already seen, that the water available for this long list is so little.
And everyone yet seems to be using more than they should.
Have you ever wondered how much water you and your family use in one day?
Fill up this table for one day to find out.
Start with yourself.



Date	Time	Use	How much	
	6.00 am	Cleaning teeth	2 mugs	1 mug = 425ml Water used = 2 x 425 = 850 ml
	6.15 am	Bath	1 bucket	1 bucket = 11.8 lit. Water used = 11.8 lit.
	11.00 am	Washing hand	1 mug	425 ml
	Other activities throughout the day			

Now add up for your family.
But wait before you can do this, you will need to have some standard way of measuring.

Try This

Decide upon a standard/common measure that you can use, for example, a measuring cylinder. If you do not have one, you could use a soda or milk bottle which indicates the quantity e.g. 300 ml or 500 ml) or a litre container. In case you use a mug or bucket, find out the capacity of each: e.g. 1 mug = 500 ml, 1 bucket = 20 litres.

So if you use 3 buckets of water for all your needs in one day you would be using 60 litres of water.

My family's water use chart

Activity	How much water is used?					Total
	Mother	Father	Brother/Sister	Self	Others	
Cleaning teeth						
Bathing						
Drinking						
Watering plants						
Cleaning vessels						
Cooking						
Washing Clothes/car						
Total						

Illustrations

You now know how much water you and your family use in one day. So can you calculate how much would be used in:

One week _____

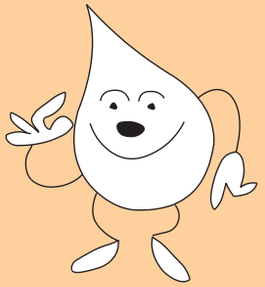
One month _____

One Year _____

Try to imagine how much water would be used by all the world's people… that is 6 billion (60,00,00,000 people) in one day, if everyone used the same amount of water that you do!

And that is only the water for daily domestic use… not the water that is used for agriculture, industry, power, and all the other uses we read about.

It would not be correct to think that people everywhere have, and use, the same amount of water.



In Kenya the average daily water use per person is 13.6 litres of water per day.

In Europe and North American the average water use per person per day is about 135 litres. How is the water used in these places?

Maybe somewhat like this in one single day:

Toilet flush	40 litres
Shower/Bath	40 litres
Washing cloths	15 litres
Washing dishes	8 litres
Washing hands/brushing	8 litres
Cleaning House	8 litres
Drinking, cooking	5 litres
Washing cars, gardens, etc.	11 litres

How does your chart compare with this?

Did You Know?

In Asia and Africa, sometimes a family of 8 persons has to live on 20 litres per day.

Think About This

If water consumption continues at the present rate, by 2025 two out of three people will not have enough water for their basic needs.

We have seen how little usable or drinking water we really have. We also know that so many millions of people need to share this water. The human population is increasing very rapidly. Increasing population also means increasing demand for water, and use of water for many different activities.

But this is not the only reason. A lot of water is also misused and wasted.

Sometimes this happens because people are careless about its use. For example when they keep the tap running while they brush their teeth.

Sometimes it is because they don't know that there is a better way of using water. For example, it is better to water the garden early in the morning or late in the evening, rather than in the middle of a sunny day, because this water is lost due to evaporation.

Sometimes it is because they do not realize how even a small wastage adds up to big losses. For example: How much water is lost through a single dripping tap.

There is a simple way for you to find out.

Did You Know?

It has been estimated that one person's daily requirement of water for bathing, cleaning, drinking, washing and cooking may be about 90-120 litres. A dripping tap may waste upto 50 litres a day.

Try This

You will need a measuring cylinder, a stop watch or other watch, and some good maths!
Find a tap from which a little bit of water is leaking or dripping. Place the measuring cylinder under the tap. Ask your friend to keep time with the watch, and tell you when one minute is up. Take the measuring cylinder from the tap and note how much water is collected in it. This is the amount of water that would have otherwise gone unused, but now is wasted.
Now calculate, how much water would drip away like this in one hour.
For example if 50 ml was wasted in one minute, in one hour 3000 ml or 3 litres (50 ml x 60 minutes) would be wasted.

Now calculate how much water would be wasted in one day. That is 3000 ml x 24 hours = 72,000 ml 72 litres.

And all this from one single dripping tap!

FIND OUT

How many leaking taps are there in your house? Calculate how much water is being wasted in one day, one month, one year.

"Water, water everywhere, but not a drop to drink".
This is an old saying, but never before as true as it is today. Water is getting to be more and more precious, as it is under threat both in terms of quantity and quality. As I travel across the earth, I see how much people have to do, just to get enough water for their daily needs.

Water is not easily available in many parts of the world. In some places even if there are water pipes and taps, water is supplied only for a few hours every day, because the common water supply is scarce.
In some other places in Asia and Africa people have to fill and store their water supply from the village well or a community tap or hand pump. In still other places, women have to walk for many kilometers, every day, to collect a few pots of water for their family.
How do you get water at home?

Most of you will say "From the tap, of course!"
You may not realize how lucky you are.

FIND OUT

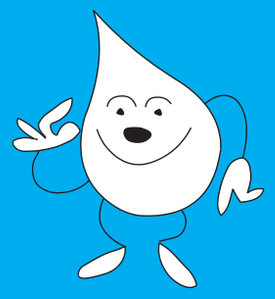
Where does the water in your home come from?
From a natural water source… a nearby river or lake?
How is it transported from there?
Is there a common plant for treatment of the water?
If your water comes from the underground where is the well? How is it pumped from the well, and how does it reach your house?

Try This

Find out just how much water is in the news. Look through your daily newspaper. Mark out articles, news items, and photographs related to water. By now you know that this covers many many areas right from sources of water, the uses of water, the problems with getting water.

Do this for a month. You can look at more than one newspaper, and even magazines. Try and sort out all the items under some common heads. Paste these into a scrap book. You will discover how much water is in the news, and why.

You may wonder why there is so much difference in the availability of water. Some of the reasons are natural. For example different parts of the Earth get different amounts of rainfall.
You do remember, don't you, that it is the rain which brings the fresh water to the Earth?



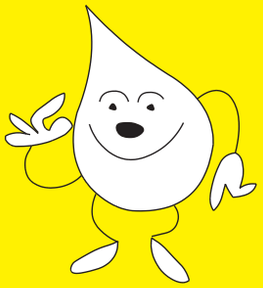
Some parts of the earth get very little rainfall, or irregular rainfall (sometimes the rains do not come at all for 2 or 3 years). This means that there is no water to fill up the rivers, and lakes, and no water to go underground to be stored there. This can become very serious as no rain means no water for domestic use, and for agriculture, and hence no food. This situation is called drought.

In some places, the rain comes for a short period. It rains heavily, and often all the rain water flows away, before it can be stored and used. This can happen especially where there is not enough vegetation covering the soil. It is the roots of plantsgrass and treesthat make the soil softer, and this helps the rainwater to soak underground.

In other places, even though water is stored in ponds and lakes, and under the ground, this is all used up, faster than it is filled. This is like taking more money out of the bank than you put in.

Human beings are now using up the water from its natural stocks, too fast… Faster than it takes for nature to replenish the stock. Humans keep digging deeper and deeper to extract the underground water. Sometimes they dig so deep, they pull up the water that has been collecting under the ground over thousands of years. This is like using up the fixed deposit money in a bank, that has been saved for times of real need.

How much rainfall does your city/town get? Using a Rain gauge is one way to measure the Rainfall where you live.



Try This

What will you need?

A cylindrical tin can or a bottle of any size, with a narrow neck; a funnel, its diameter equaling the base of the container; a wooden scale or a stick.

What will you do?

Find an open area such as playground or other area near your home or school. The area should be more or less level.

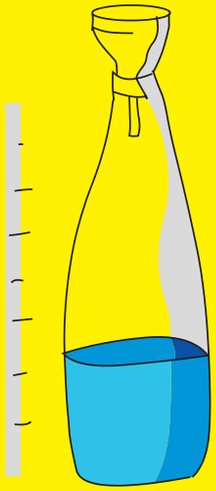
Keep your tin or bottle on the area and place the funnel in it before it begins to rain. Ensure that the container is not disturbed during the period of the rain and is not toppled over by the wind. It would be a good idea to sink the container a few centimeters into the ground.

After the rain let them collect your container carefully without spilling the water in it. Now keep the container on a level surface and, using a metre scale, measure the depth of the water that has collected.

If the mouth of the bottle is too narrow for a scale to be put in, use a stick. The wet part of the stick can be measured, and this can be related to the volume of rainfall.

FIND OUT

Look through the newspapers during the rainy season, and keep a note of the rainfall recorded. How does this figure compare with your rain gauge reading? Find out what the average annual rainfall of your town or city.



Did you Know?

Meteorologists study weather conditions, with the help of accurate instruments and techniques. Their records help in analyzing the patterns of rainfall.

Whatever the amount of rainfall in a place, once the rain falls on to earth, it flows over the land to join a stream, or river, or lake or pond, or seeps into the ground. The land or region over which water flows, to drain into a waterbody, is called a watershed. You can compare a watershed with a funnel, that collects all the water within the drainage area, and channels it into a stream, river or lake.

Homes, farms, villages, forests, small towns, big cities, and more, are all part of some watershed. Water sheds are found in all shapes and sizes. They can cover thousands of hectaresin the case of watersheds of big rivers like the Ganges in India, or a few hectares of land that drain into a local pond.

Within the watershed, humans carry out a different activities that use water. Their activities both affect, and are affected by water quality. We will find out more about this soon.

How limited is the quantity of water available for the many many uses. It is not something to worry about? Our worries do not end there. Often, even the quality of the available water is such that it cannot be safely used. What does this mean?

Water around the globe is being polluted. Water in a pond, lake, river, stream or ocean can get polluted. So can the water which is under the ground, in wells and reservoirs.

How does water get polluted?

When something is added to water, that should not be there, it may cause pollution.

We use water for so many of our activities. Many of our activities such as washing dishes and clothes, cooking, irrigation for agriculture, industrial production, generating electricity. The water that is released as an outcome of these activities, and many more, may carry pollutants. This water flows into the water bodies–lakes, rivers and oceans.

Pollutants reach water in many ways. A pipe from an industrial plant or sewage treatment plant may drain directly into a waterbody. These sources of pollution which can be easily identified and managed are described as **Point sources**.

Water pollution can also be caused indirectly. For instance water that drains from fields, gardens, or city streets, located quite far from the water body may carry sewage, chemical pesticides or fertilizers, and these can pollute the water.These sources which are spread out and which may not directly lead into the water body, are described as **Non-point sources**.

Try This

Pollution Patrol

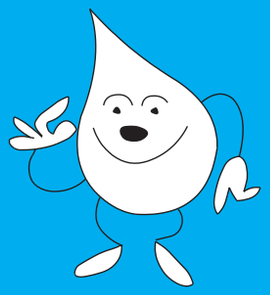
Is there a body of water near your home or your school? It could be a small pond, or stream, lake, a river, or even the ocean. Take a closer look at it.

Is there anything unwanted floating on the surface?
How dirty are the banks?
Are there any pipes leading into the water?
Do people dump garbage around the water? Do they bathe or wash clothes there?
Or maybe bathe their livestock?
Or wash trucks or tractors?
Are there fields or factories around the water?
Where does the sewage from the nearby houses go?

FIND OUT

- ☐ • An open garbage dump.
- ☐ • Water run off from streets.
- ☐ • Leaks from underground septic tanks.
- ☐ • Leaks from underground storage facilities like petrol pumps.
- ☐ • An oil spill from a tanker at sea.
- ☐ • Soil erosion from agriculture fields.
- ☐ • Erosion from construction sites.
- ☐ • Industrial wastes dumped into river.
- ☐ • Garbage dumping in lake.
- ☐ • Clothes being washed at edge of pond.
- ☐ • Water from agricultural fields.

So now you know where the pollutants in the water come from. But what do they do to the water? And what are the other effects of their presence in the water? Come, let's dive into the water and try to find out. "Oh, oh, here come some dangerous looking characters! They're not fish. What are they?"



Microvillis: "We are a deadly army. You can't see us but we can play havoc with your health. We are the bacteria and viruses that spread dysentery, hepatitis, typhoid and other diseases that you can get when we get into you with the water you drink. And we get into the water with all the sewage (that's human and animal waste) which is not treated in a treatment plant.

"We need lots of oxygen and try to grab as much of it as we can from the water, so we don't let too many other things thrive in the water with us."

Oxyhogs: "Ha, look who's talking about oxygen grabbing. Well you can't beat us at that. We're the team of Nitra and Phospa. That's short for nitrates and phosphates. We come in with all the water from fields which have been fertilized, specially with chemical fertilizers. And from all the water used to wash clothes with phosphate-containing detergents. We help lots of algae to thrive. And when these algae die and decompose, they draw more and more oxygen. So when you see that green film on the water, you can be sure we're hard at work."

The Slimes: "Who's that talking about film on water? If you really want to see film, try us. We're the oil that won't mix with the water. People only remember us when we make the headlines in the news: you know, like when there's been an accident with an oil tanker and there's an oil spill. But no one realizes that we are always at work, sliming our way into the seas and oceans from the tankers when they clean out their tanks, from oil refineries, and even washed away from city streets.

"And then just imagine the state of all those creatures that live in the water.They can't help take us in, but they sure can't digest us. And boy, does it kill them! That's the inside story. We can ruin birds' feathers and the fur of animals."

The Acidos: "What's so great about being

slimy? We are even more sneaky. We fly in with the air and mingle with the rain to join the waters of lakes and streams. Then we work to make the water acidic. We call ourselves acid rain. When we arrive with the rain and mix with the water, the plants and animals living in it could get pretty sick.

Sometimes we are joined by other sneaks that also use the air to travel many kilometres to reach the water. These poisonous substances too can kill animals and sometimes even humans who may eat these affected creatures."

The Creeps: "If the Slimes and the Sneaks think they're nasty, they can't beat us for sheer variety and numbers. We are chemicals.

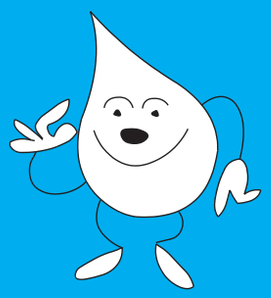
There are thousands of types amongst us; and hundreds of ways by which we creep into the watersome direct, some indirect, and some not even intended. We flow in with the water that runs off fields sprayed with pesticides, from factories, from drains. Once in the water, we can outright kill fish, birds and animals. We can also be more sneaky by gradually collecting, in the bodies of the fish or bird or animals, for many years and showing our nasty effects much later."

Dirty Dozen: "We don't slime or sneak or creep. We just choke. We are the silt and dirt, disturbed by bulldozers, trucks and heavy machinery, that flows into the water from construction sites and other land areas. We can block sunlight from entering water, and that can kill water plants. We can clog gills of fish, and we can smother small creatures that live at the bottom of the water body."

Water Villains: "Aren't we a dangerous gang? Once we're around, there is no escape! Why, most of us can even seep through the ground to infiltrate the water that's underground. That's the water you get from your wells and through the water pipes. So look out."

Match the villains with their source

Microvillis	Oil Spill
Oxyhogs	Air
Slimes	Fields Sprayed With Pesticides
Acidos	Silt From Construction Sites
Creeps	Detergents
Dirty Dozen	Sewage



Phew! I am lucky and glad to get away from that gang of water villains. Aren't you?

In many cases pollution in water can cause direct health problems. The source can be easily traced, and if caught in time, measures can be taken to remedy the problem.

But some kinds of pollution are even more sneaky. They don't show their effects immediately, but they can create problems that show up after many years. Sometimes it is difficult to even find out what is causing the problem.

Here is a real case from Japan.

Fishy Story

In 1953 people living around the Minamata Bay in Japan began to suffer from a mysterious disease that affected their eyesight and physical co-ordination. Plants and animals also were affected. It was clear that it was some kind of epidemic. Investigations to trace the cause began. Nearly 50 people died before investigators realized that these were symptoms of mercury poisoning. But where was the mercury coming from, and how was it affecting people?

Further investigation traced the source to a plastic factory located on a stream which was flowing into the Minamata Bay. The factory was discharging its waste product, high in mercury content, into the stream. The mercury entered the food chain and became concentrated in the fish. People who ate the fish were in turn affected by these high mercury levels. This was recognized as a disease which came to be known as the Minamata disease.

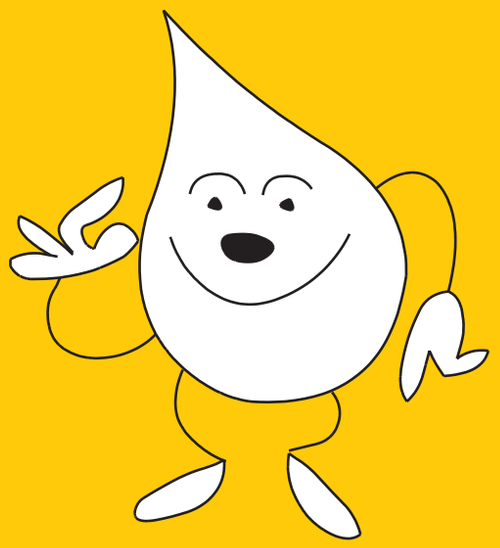
Just as human beings are affected by pollution, so are animals, birds and even plants. Sometimes when there is a major accident, like an oil spill, plant and animal life may be seriously disrupted. Plastic bags and garbage that are thrown into water may choke them.

Plants are also affected by the pollutants they take in from the soil, the water, and even the air. For example, the gases that come out of car exhaust pipes and factory chimneys rise into the air and combine with moisture in the atmosphere. So when the rain falls, it is acidic. This acid rain soaks into the soil and is taken up by the trees and plants, ultimately destroying them.

Here is a real story of what happened to forests in Europe and North America.

Dying Forests

In the 1970s, scientists discovered that some forests in Europe and North America were dying, especially those with large tracts of coniferous trees. Atmospheric testing revealed that pollution from power plants, cars and trucks was to blame. Tall smokestacks and chimneys from industries were releasing chemicals called sulphur dioxide and nitrogen oxides. These were rising with the smoke into the atmosphere, combining with other molecules and falling to the ground as precipitation which was ten times more acidic than normal, sometimes as strong as vinegar. This came to be known as acid rain. The acid rain was dissolving out important nutrients from the soil and allowing in other substances, like aluminium and manganese, which harmed the roots. Weakened trees lost their needles and were attacked by insects and disease. It was like an epidemic in which whole forests died due to this kind of pollution.



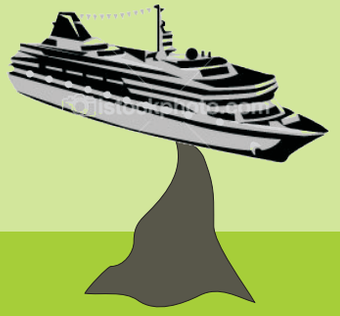
Pollution slowly creeps into the water, day after day, and over a period of time reaches dangerous levels. But sometimes, when there is an accident or disaster, large quantities of pollutants suddenly enter the water in a particular place. The effects of such accidents can be tragic and often reach far beyond the immediate surroundings. Here is another real story.

Oil on the Ocean

On March 16, 1978, an oil tanker 'Amoco Cadiz' was blown ashore by strong winds near the coast of Brittany in France. The ship was badly damaged and broke apart, spilling approximately 1.6 million barrels (220 thousands tonnes) of crude oil into the water and along the shores.

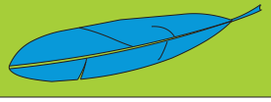
The crude oil ruined the beaches. It clogged the feathers and respiratory tracts of sea birds. Millions of them died in just a few days following the disaster. Not only birds but fish, shellfish and other sea animals, including the plankton in the area died due to the oily waters.

The film of oil on the surface reduced the amount of light and oxygen, passing into the water causing underwater marine life to suffocate to death.



Try This

What can oil in the water do to a bird? Find out.
Take the feather of a bird. Feel it. Look at it. Examine it with a hand lens or magnifying glass. Sketch what you see.
Now dip the feather into water for a couple of minutes. Take it out. Feel it, look at it and examine it with a hand lens. Note down your observations.
Then add some cooking oil to the water. Dip the feather again in the oily water. Take it out and once again feel and examine it. Does it feel and look different? How would a bird with oily feathers be affected?



Did You Know?

Oil spills from oil tanker accidents are often in the news. But almost 90 percent of the oil in the oceans comes not from these oil spills, it is from smaller, almost daily discharges from oil tankers–especially when the oil tanks are cleaned out. It is estimated that over one million tonnes of oil are spilled into the ocean each year from ships and oil rigs.

FIND OUT

Take a close look at the four wheels of pollution. Write down on the line below the wheel, which pollutant is responsible for each:
Pesticides, Garbage, Acid ain, Oil spill.

_____

_____

_____

_____

We have seen how pollution affects the quality of water. And how the quality of water affects all living things that depend on that water - directly or indirectly.
The quality of drinking water is even more of a concern. Do you remember how much water you should drink every day? The water you drink needs to have minerals such as magnesium, calcium, iron and some dissolved gases, in proper proportions. But it should not have contaminant or pollutant.
Water which is contaminated or polluted can lead to serious diseases such as cholera, typhoid, jaundice, diarrhea, dysentery and malaria. These 'water-borne' diseases account for nearly one-third of all deaths in the world.

Try This

Find the names of these waterborne diseases.

1.Cholera 2.Typhoid 3.Jaundice 4.Diarrhoea.
5.Dysentery 6.Malaria 7.Hepatitis 8.Fluorosis

E	K	C	O	Y	R	E	T	N	E	S	Y	D	V	W
A	Q	I	H	Z	O	B	K	C	B	I	B	E	L	Y
T	J	O	H	O	G	W	S	O	D	H	C	K	S	B
J	A	M	J	V	L	L	P	L	M	I	N	S	P	F
B	V	I	G	L	F	E	P	G	D	R	U	A	K	L
S	Y	R	R	S	S	E	R	N	D	Q	Y	P	P	U
M	S	R	D	A	S	V	U	A	I	Z	V	U	O	O
K	I	D	H	S	L	A	T	W	A	J	K	T	J	R
Z	T	H	D	S	J	A	B	J	R	K	Z	P	H	O
N	I	F	I	X	A	P	M	D	R	G	A	J	Z	S
F	T	K	O	N	R	O	L	K	H	O	K	S	P	I
X	A	G	H	S	H	F	N	V	O	I	A	V	O	S
V	P	M	P	O	A	R	L	Y	E	Y	S	J	B	I
H	E	A	Y	E	P	R	K	T	A	W	L	L	I	X
C	H	P	T	R	D	P	R	K	L	T	M	S	B	U

Did You Know?

Underground rocks in some places have high levels of certain metals or compounds. Sometimes, these mix with drinking water especially when water is drawn from deep down in the earth. One such contaminant is fluoride. Fluoride is necessary for humans in small amounts, but when it exceeds this it can be harmful, especially for bones and teeth.

Water that flows through arsenic rich rocks contains arsenic. Such water can lead to serious health problems, affecting skin, lungs, kidneys and bladder.

FIND OUT

Find out from your classmates, neighbours and family whether anyone has been sick with any of these diseases? Do they know what may have caused this?

Do you remember all the kinds of waste that contributes to the pollution of water? Soaps and detergents, food particles, grease and oil, industrial and construction wastes, fertilizers and pesticides.

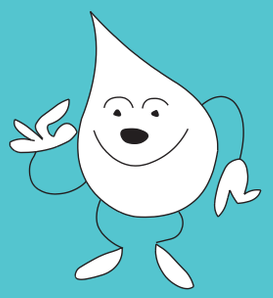
Sometimes this polluted water flows straight into rivers and seas, or seeps underground. We have seen how water which is contaminated or polluted can harm human health, as well as plants and animals.

In many places networks of sewers carry the waste water to sewage treatment plants. Here the sewage, which is partly liquid and partly solid flows into sedimentation tanks full of water. The solids sink to the bottom, and water from the surface can be taken. In some treatment plants the water is trickled slowly through filtration tanks where bacteria feed on the rotting material. In more modern plants the liquid goes into an activated sludge tank where air is bubbled through. This helps the bacteria in the tank to feed quickly on the harmful substances.

The water is now clean enough to be pumped into rivers and seas. And it joins up with the water cycle again.

New techniques and technologies are being developed to treat water, or to make it suitable for use.

But that is not the best solution for pollution. Would it not be better to prevent the water from being polluted in the first place?



Try This

What will you will need? A large transparent plastic bottle, a glass on which the upturned plastic bottle can rest, cotton wool, small pebbles, gravel, sand, a small jug for pouring, some muddy water with bits of leaves, paper, plastic, etc.

What will you do?

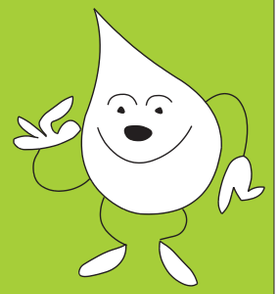
1. Cut off the bottom of the bottle.
2. Push some cotton wool into the neck. Turn the bottle upside down and put it into the glass.
3. Fill the bottle with layers of small pebbles, then gravel, then sand. These must be clean.
4. Pour some water in the jug. Put in two teaspoons of soil and stir it well.
5. Pour some of the soil and water mixture on to the sand in the bottle.
6. Watch the water drip into the glass.

Is there any difference between the water you poured in and the water that came out? What happened to this?

Do not drink the filtered water. It may not be clean enough.

Did You Know?

You have seen that a lot of water is used in your homes for showers and baths, washing machines, and bathroom sinks. This water is called gray water. Gray water usually flows down the drain as waste water, can be reused especially for watering gardens. Gray water is however not potable that is, it is not suitable for drinking.



That was about the quality of water. But let's go back to where we started our trip. Let's worry about how little water there really is, for all the many uses.
And think about how to conserve it.
You can conserve water by wasting less, by collecting more, by storing more efficiently, by not polluting, and by recycling waste water.
Here are some ideas for how every person can help to conserve this precious resource.
These may seen like small actions. You may ask: can they really help conserve water?
Do you remember, how much the water waste from a single dripping tap added up to?

Tips for Water Watchers

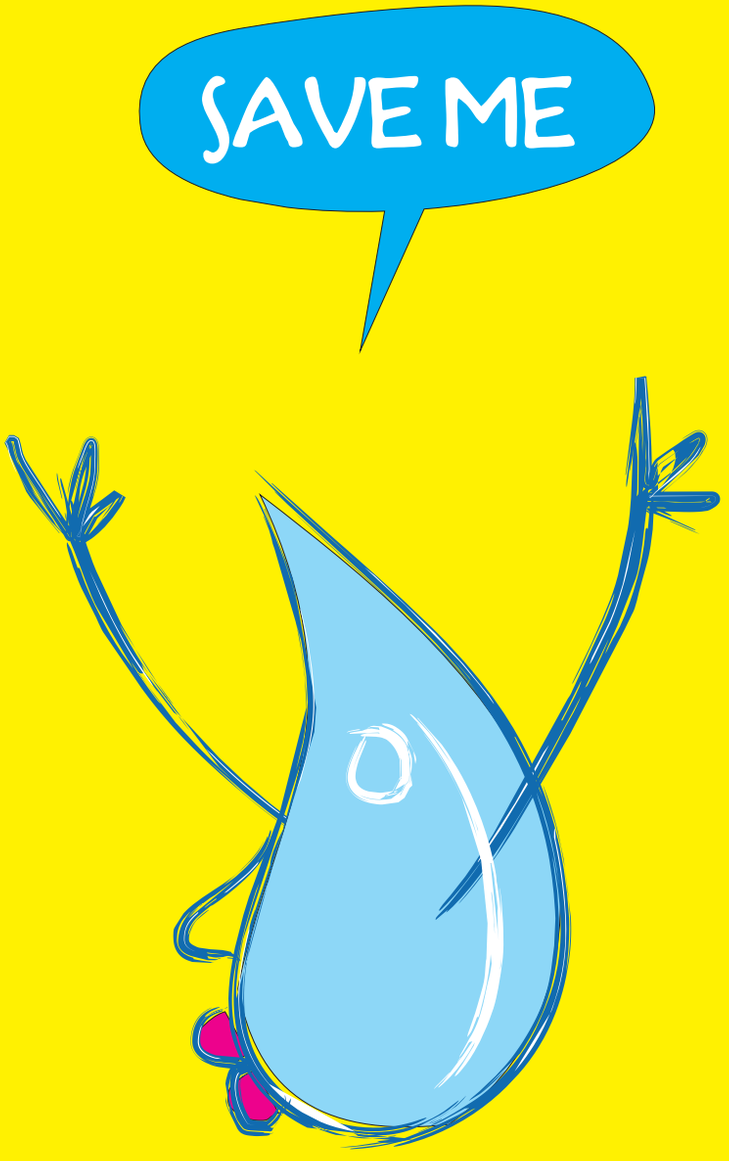
- When you turn on the tap, don't turn it the whole way maintain a slow flow.
- Turn the tap off while you brush your teeth or wash your face.
- Ensure that the tap is closed when clothes are being washed or dishes cleaned.
- Fix leaking taps as a priority.
- When you fill a glass of drinking water, take only as much as you will drink.
- For a cool bath during summer, don't let the water run until the flow is cold; fill a bucket of water and let it stand for a few hours.
- Don't let the water go from the tap, as you wait for it to warm-up. Catch it in a bucket, and use it to water plants.
- Find ways to direct the flow of gray water (from the shower, bath and washing machine) to the garden.
- If you store water in the house, utilize the unused stored water for soaking clothes, watering the garden, mopping the floors, etc.
- Wash vegetables, fruits, etc. in a pan of water, rather than under running water.
- Keep a large bucket in the kitchen and pour water used for washing food items or rinsing dishes into this. This could be used for watering plants.
- Collect and store as much rain-water as possible during the rainy season. Rain-water is pure, and apart from washing and bathing, you could use it for watering delicate plants.
- Water the garden early in the morning or late in the evening. This reduces water loss due to evaporation. Avoid the temptation to over-water the garden and water only until the soil becomes moist, not soggy.
- Use defrost water from the refrigerator for watering delicate plants, after it has warmed to room temperature.

Think About This

These may seen like small actions. You may ask: can they really help conserve water?
Do you remember, how much the water waste from a single dripping tap added up to?

If there were to be an award for the best water conserver who do you think would get it? Mother Nature!

Try This



Nature provides one of the best ways of conserving rainwaterwhich is the source of all fresh water. Any vegetative cover, whether mere blades of grass or a big forest, helps to slow the water running off the land. This helps check soil erosion. The canopy of vegetation, by absorbing the impact of raindrops, minimizes the destructive effects of the beating action of rain on soil. Roots of plants hold the soil together and prevent it from being washed away. They also keep the soil porous thus helping rainwater percolate into the ground. The roots and stems filter the silt out of the run-off water, slow it down and take the erosive power out of it. Vegetative cover also provides decaying organic matter or humus which forms an additional protective layer over the soil. This layer reduces the impact of raindrops. It also absorbs water and allows it to seep through the soil to be stored as groundwater.

Try This

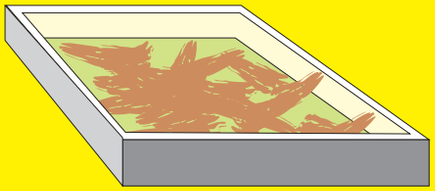
You will need:
Two trays or cardboard or wooden boxes (approximately 90 cm x 50 cm x 15 cm), plastic sheet, piece of tin for spout, one tin can with a perforated base, brick pieces, pebbles, ordinary soil, manured soil, any fast growing seeds, two glass jars (one litre capacity), water.

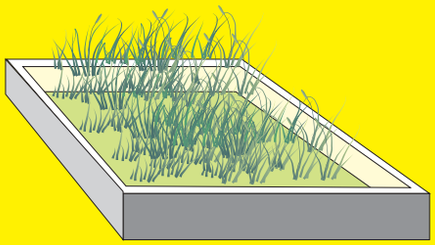
What You Need to Do
Take the two cardboard or wooden boxes or trays. Line them with a plastic sheet to make them leakproof. At one end of each box cut a 'V notch 10 cm deep and fit it with a tin spout to draw the run-off water into a glass jar (as shown in the illustration.)

Fill each box with 3 - 4 cm layer of brick pieces and pebbles, followed by 3 - 4 cm layer of ordinary soil, followed by 3 - 4 cm layer of manured soil. Sow seeds of any quick growing plant seeds in one box. Leave the other box bare. Sprinkle water on Box 1 regularly till the plants are 8 -10 cm high.

Now set the boxes on a table so that the spouts extend over the edge. Place a brick or a stick under the other end to give them slope. Place empty glass jars on stools beneath the spouts (as shown in the illustration.)

Now gently pour equal amounts of water over the two boxes. Check the rate of water flow and collect the water that flows out from the two boxes in the glass jars. Is there a difference in the quantity and quality of water collected in the two jars? What made the difference?





We often forget that no technology or wonderful magic can replace Nature's cycle which has gone on, long before humans even stepped on this Earth.

In recent years, this protective cover is being destroyed at a tremendous rate. Forests are cut down for timber and agriculture. Cities and towns cover with concrete, the fields where crops once grew. Land without vegetation becomes hard. Rain water can no longer percolate into the ground and so most of the water runs off into ponds, streams and rivers, carrying with it fertile topsoil. The silt in water bodies reduces their ability to hold the increased volume of water. This water overflows the banks, and causes floods. And all the precious rainwater rushes away toward the sea, before it can be used.

To protect the vegetative cover where it exists, and to revegetate lands that have lost it, is one way to prevent this wastage of rainwater.

So we have come back to Mother Nature after our long and adventurous trip.

Let us learn to respect her resources, and take a pledge to Act Now to keep her waters flowing and clean, and healthy.

Your small actions, can make a big difference.

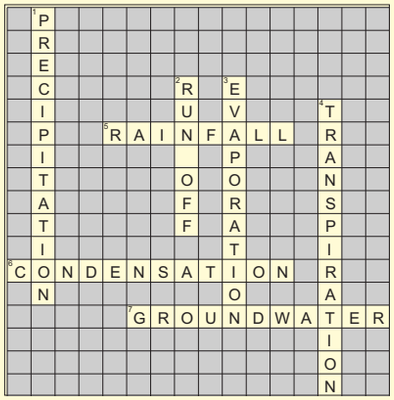
After all "tiny drops do an ocean make" . . .
And I, Drip the Drop is one of these.

Check Your Answers

Page 1:

OCEANS, RIVERS, LAKES, ICECAPS, UNDERGROUND

Page 3:



You have just filled in the many words that include the different aspects of the water cycle. For example: Evaporation, condensation, transpiration, run off, are all different processes. Groundwater, oceans, rivers, lakes are where rain water is collected and stored.

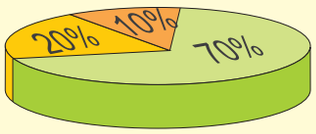
Page 6a:

ELEPHANT 70%
JELLYFISH 95%
WOOD 10%
PINEAPPLE 80%

Page 6

ELEPHANT 70%
JELLYFISH 95%
WOOD 10%
PINEAPPLE 80%

Page 7



Page 14:

- An open garbage dump — P
- Water runoff from streets — NP
- Leaks from underground septic tank — NP
- Leaks from underground storage facilities like petrol pumps — NP
- An oil spill from a tanker at sea — P
- Soil erosion from agriculture fields — NP
- Erosion from construction sites — NP
- Industrial wastes dumped into river — P
- Garbage dumping in lake — P
- Clothes being washed at edge of pond — P
- Water from agricultural fields — NP
- Sewage pipes leading into ocean — P

Page 16:

Villains	Source
Microvillis	Sewage
Oxyhogs	Detergents
Slimes	Oil spill
Acidos	Air
Creeps	Fields sprayed with pesticides
Dirty Dozen	Silt from construction sites