Vision Empower & XRCVC Teacher Instruction KIT Water Pollution

Syllabus: Karnataka State Board Subject: Environmental Science Grade: 4 Textbook Name: Karnataka State Board Chapter Number & Name: 7.Water Pollution

1. OVERVIEW

1.1 OBJECTIVE

Objective

- Know the reasons for water pollution and its evil effects.
- Make a list of diseases that spread through water.
- Know the reasons for dehydration and preparation of Oral Rehydration Solution.

Prerequisite Concept

• Water - EVS, Grade 4, Chapter 6: Each Drop

Content Index

Kindly Note: Activities marked with * are mandatory

LEARN

KEY POINTS LEARN MORE

ENGAGE

INTEREST GENERATION ACTIVITY

Activity 1: Story

CONCEPT INTRODUCTION ACTIVITIES

Activity 2: Pollution detection experiment (Introduction to water pollution) Activity 3: Acid rain (Effects of water pollution) Activity 4: Oil spill simulation (Effects of water pollution)

Activity 5: Rainwater harvesting (water conservation)

LET'S DISCUSS: RELATE TO DAILY LIFE*

EXERCISES & REINFORCEMENT

Activity 6: Ways to reduce water pollution IMPORTANT GUIDELINES* Exercise Reading Perform Textbook Activity Provide Homework

2. LEARN

2.1 KEY POINTS

Water pollution: Water pollution occurs when substances like soil particles, dirt, chemicals, etc contaminate a stream, river, lake, ocean, or other bodies of water, degrading water quality and rendering it toxic to humans or the environment. Polluted water is unfit for drinking.

Water pollution occurs when pollutants (particles, chemicals or substances that make water contaminated) are discharged directly or indirectly into water bodies without enough treatment to get rid of harmful compounds. Pollutants get into water mainly by human causes or human factors.

(Adapted from:

http://eschooltoday.com/pollution/water-pollution/what-is-water-pollution.html)

Causes of water pollution:

- Sewage: Even today sewage is flushed directly into streams and rivers in many areas around the world. Sewage can introduce harmful bacteria that can make people and animals very sick.
- Farm animal waste: Waste from large herds of farm animals such as pigs and cows can get into the water supply from the runoff of rain and large storms.
- Pesticides and herbicides: Pesticides are often sprayed on crops to kill bugs and herbicides are sprayed to kill weeds. These strong chemicals can get into the water through runoff of rain storms. They can also contaminate rivers and lakes through accidental spills.
- Construction, floods, and storms: Silt from construction, earthquakes, floods, and storms can lower the oxygen content in the water and suffocate fish.
- Factories: Factories often use a lot of water to process chemicals, keep engines cool, and for washing things away. The used waste water is sometimes dumped into rivers or the ocean. It can be full of pollutants.
- Oil Spills: Some of the most famous incidents of water pollution have been oil spills. Oil spill is the discharge of oil into the sea by the ship due to accidents caused by human error or natural calamity.
- Acid Rain: Air pollution can also have a direct effect on water pollution. When particles like sulfur dioxide get high into the air they can combine with rain to produce acid rain. Acid rain can turn lakes acidic, killing fish and other animals.

Effects on the Environment

- Pollution in the water can reach a point where there isn't enough oxygen in the water for the fish to breathe. The fish can actually suffocate!
- Sometimes pollution affects the entire food chain. Small fishes absorb pollutants, such as chemicals, into their bodies. Then bigger fishes eat the smaller fishes and get the pollutants too. Birds or other animals may eat the bigger fishes and be harmed by the pollutants. One example of this was the use of the insecticide (bug killer) DDT. When birds of prey ate fishes that were infected with it, they would lay eggs with thin shells. The population of birds of prey began to drop until DDT was banished.
- Sewage can also cause major problems in rivers. Bacteria in the water will use oxygen to break down the sewage. If there is too much sewage, the bacteria could use up so much oxygen that there won't be enough left for the fish.
- Water pollution from major events like acid rain or oil spills can completely destroy marine habitats.

Effects on Health

One of the most precious and important commodities for life on planet Earth is clean water. For over 1 billion people on the planet, clean water is nearly impossible to get. Dirty, polluted water can make them sick and is especially tough on young children. Some bacteria and pathogens in water can make people so sick they can die.

(Adapted from: https://www.ducksters.com/science/environment/water_pollution.php)

Ways of Preventing Water Pollution

- Conserve water by turning off the tap when running water is not necessary. This helps prevent water shortages and reduces the amount of contaminated water that needs treatment.
- Be careful about what you throw down your sink or toilet. Don't throw paints, oils or other forms of litter down the drain. Use environmentally friendly household products, such as washing powder, household cleaning agents and toiletries.
- Take great care not to overuse pesticides and fertilisers. This will prevent runoffs of the material into nearby water sources.
- By having more plants in your garden you are preventing fertiliser, pesticides and contaminated water from running off into nearby water sources.
- Don't throw litter into rivers, lakes or oceans. Help clean up any litter you see on beaches or in rivers and lakes, make sure it is safe to collect the litter and put it in a nearby dustbin.
- Harvest rainwater. Rain Water Harvesting is essentially the capture of rainwater where it falls.

2.2 LEARN MORE None

3. ENGAGE

3.1 INTEREST GENERATION ACTIVITY

Story

Activity 1: Story Materials required: None

Prerequisites: None

Activity Flow Read the story in the class.

One day two friends Ram and Sham went to the forest to collect firewoods. In between while coming back from the forest they had the following conversation. Sham: I am tired and thirsty. Ram: Oh..all our bottles are empty. Even, I am feeling thirsty. Ok, let's walk further and see if we can find a pond or a house. "They walked for quite a distance and found a pond." Ram: Hey!...we found a pond. Come let's drink this water. As soon they went near the pond, Sham: No, no...I am getting a bad smell and also see the colour is dark. My mother used to tell me not to drink if the water smells bad. Ram: Yes...I can also see and I am getting that. But that is ok...we can drink for this time. Don't you see that even the cattles are drinking the same water? "At last Ram drank the water and Sham refused to drink. Next day, Ram fell sick and could not come to school. When the teacher enquired about Ram, Sham told the whole story. Teacher: Oh..is it so. Can any one guess the reason behind his sickness? (All students started thinking) Ok then. Let's try to find out the reason through our new topic "water pollution".

The following activities will explain the water pollution and its effects and prevention.

3.2 CONCEPT INTRODUCTION ACTIVITIES

Water pollution

Activity 2: Pollution detection experiment (Introduction to water pollution)

Materials required: 1 big bottle of water (1 liter), 4 cups or glasses (preferably not ones made of glass), vinegar, food colouring, salt, soil/sand, and 4 spoons. Prerequisites: None Activity Flow

1. Ask students if they have ever heard the word, "pollution." If they have, ask them what it means.

2. Build upon their definitions to come to a definition that pollution is something that hurts the environment (everything that surrounds us – the earth, water, air, etc.) or makes it dirty. Pollution is usually caused by people.

3. Ask how they can tell if something is polluted. Based on their answers, discuss how sometimes we can tell if something is polluted by using our senses (looks dirty, smells funny), but not always. Often, we can't see or smell pollution. A good analogy is that a lot of pollution is like germs. Ask what they know about germs (they get on our hands, they can make us sick, we wash our hands to get rid of germs on them) Can we see germs? No. (That's why we wash our hands even when they look clean.) A lot of pollution is like this—it can make us sick or hurt the environment, but we can't see it. Pollution often "hides"; we are going to see if we can find it. We will play "hide and seek" with pollution.

4. Tell the children that you have with you a bottle of water taken from the school's filter. Ask them if they think this water is polluted. The answer should be "no." Ask how they can tell: looks good, smells good, the school filter always has clean water, etc.

5. Divide the children into 4 groups. If possible, make sure that 1 group consists of students with low vision who can see colours.

6. Give each group a cup or a glass and pour a little water from the pitcher (around half cup) in each. Give each group a spoon for stirring.

7. Ask what would happen if something accidentally spilled in the water. Would it then be polluted? (Yes, it would.) How could you tell? Maybe by sight, maybe by smell, but maybe you couldn't tell at all.

8. Put 2 drops of food coloring in the cups of 1group and have them stir the water. Then have them look at it and show it to their classmates. Can they tell it is polluted? Yes. How can they tell? They can see it is polluted.

9. Put a small amount (e.g., 1 teaspoon) of vinegar in the cups of another group and have them stir. Then have them look and show their classmates. Does it look polluted? No. Can they tell it is polluted even though it looks clean? Yes. Smells bad.

Note: Don't specifically tell them to smell. Smelling something strange is not always good (sniffing some chemicals can be dangerous). Emphasize that we can often smell pollution (e.g. air pollution; use a local example if possible), but that we don't want to just stick our nose in something that we don't know and take a whiff.

10. Put some mud/sand into the cups of the 3rd group. Can they tell it is polluted? Yes. They can feel the mud.

11. Put a small amount (e.g., 1/2 - 3/4 teaspoon) of salt in the cups of the final group and have them stir. Then have them look and show their classmates. Can they tell it is polluted? Should they taste it? NO. Never taste/eat/drink something that you don't know for sure is clean. Even if it looks fine, it may be polluted.

(Adapted from: <u>https://www.deq.idaho.gov/media/570161-pollution lp.pdf</u>)

Acid rain

Activity 3: Acid rain (Effects of water pollution)

Materials required: Three small potted plants, 3 big plastic containers with lids, a bottle of vinegar or lemon juice, measuring cups, 6 small pieces of paper to use as labels, tape/glue. Prerequisites: water pollution

Activity Flow

1. Make two labels that say "a little acid." Put a label on one container.

2. Pour 1/4 cup of vinegar or lemon juice into the container then fill the rest of the container with tap water.

3. Label one plant "a little acid."

4. Make two labels that say "a lot of acid." Put a label on the second container.

5. Pour 1 cup of vinegar or lemon juice into the second container then fill the rest of the container with tap water.

6. Label the second plant with the other label that says, "a lot of acid."

7. Make two labels that say, "tap water." Put a label on the third container.

8. Fill the last container with tap water.

9. Label the last plant with the other label that says, "tap water."

10. Set the plants next to each other, so they get the same amount of sunlight.

11. Every 2 to 4 days, water the plants with solution from the container that has the label that matches the plant's label. (example – water the "a little acid" plant with the "a little acid" container)

12. Observe what happens.

(Adapted from: https://www.kidsecologycorps.org/kid-power/activities/create-acid-rain-in-your-own-kitche n)

Effects of water pollution

Activity 4: Oil spill simulation (Effects of water pollution)

Materials required: Vegetable oil, food dye, pitcher / bowl, water, newspaper, cotton balls, paper towels, dish sponges, twine or rope (0.5 m), dish detergent, paper cups. Prerequisites: None

Activity Flow

Objective: Students will simulate an oil spill and test a variety of materials to see which is best for cleaning the spill.

1. Warm-up activity: Show students a bird feather. Drop the feather in a cup of water. remove it and show students that the water rolls right off and the feather quickly returns to its previous dry state. Now drop the feather into a small bowl of oil. Ask students if they think that the oil will come off as easily as the water. Show them that even if you wipe the feather off with a paper towel, it remains oily. Ask the students how they think an oil spill would affect animals like birds. Would birds be able to fly if they were covered in oil? They should be able to see from this simple activity that even a small oil spill could cause a lot of problems for wildlife.

2. Before class, make the dyed oil that students will use to simulate their oil spills. Add several drops of food dye to a bottle of vegetable oil, then shake the bottle vigorously until it is uniformly colored. This activity has the potential to be messy, so newspapers should be laid down on the desks where students will work. Students should wear smocks if they are available to prevent oil from getting on their clothes. Encourage students to be careful when handling the vegetable oil so that it does not spill on the floor.

3. Explain to students that oils are liquids that do not mix with water, but do mix with each other. Discuss the fact that there are many types of oil. Ask them to identify types of oil that they are familiar with. If they do not suggest it, mention that there is a substance called crude oil that is used to make gasoline and heating oil. Tell them that companies ship crude oil around the world in large ships, which occasionally have accidents and spill oil into the ocean. Tell them that in this lab they will use vegetable oil to model crude oil. Crude oil is toxic, while vegetable oil is safe to use as a model.

4. Pour a small amount of the dyed vegetable oil into the bowl of water from the warm-up activity and have the students come and observe what happens when oil is poured into water. Some students may not have seen oil on water, so allow them to examine it closely. Encourage them to push it around or stir it up with a pencil. once the students are done, have them return to their seats. Ask them to suggest ways that they might remove the oil without removing the water. They might suggest many types of devices, including rags, sponges, or even soap. They should record their answers on the handout.

5. Distribute the oil Spill Cleanup handout and materials to each group of 2–4 students. 6. Explain to students that, in this activity, they will try to find the best method for cleaning up an oil spill. Their goal will be to remove as much oil from an oil/water mixture as they can.

7. Distribute approximately 5 mL (one teaspoon) of dyed vegetable oil to each group in a paper cup. The colored oil will represent crude oil in this model. STEPS FOR OIL SPILL CLEANUP <u>www.siemensstemday.com4</u>

8. Lay out the possible materials that groups can use to clean up their oil spills (such as cotton balls, sponges, gauze, rope, detergent, and paper cups). Allow students to study the different materials. Then, give the groups 15 minutes to brainstorm ways that they can use the materials to clean up the oil. Have them use the handout to record the steps of their planned procedure.

9. When students are done brainstorming their ideas, pour water from a jug or pitcher into one bowl for each group until the bowl is about two-thirds full, and then have the students slowly pour in the vegetable oil so that it settles on top of the water.

10. Next, students should test their cleanup plans. Give students 10 minutes to extract as much oil as they can. Students can use their empty bowls to collect any oil they extract from the water and to put any oily materials that they might use in the activity. Warn students to be careful in transferring oil and water from bowl to bowl, as liquids that end up on the floor are slippery and may be a potential hazard. Instruct the students to record any changes that they make to their procedures. One person should record the changes, and also make notes regarding what parts of the procedure were successful and what parts were not.

11. Before moving on to the remainder of the activity, make sure students clean up any oil that may have spilled onto the floor or desks. Use soapy water to clean up any spills.

12.Wrap-up activity: Lead a discussion of the results of the activity. Have groups describe their procedures, identifying which processes worked well and which did not. Ask the students which materials were best for cleaning up the oil slick. There is no one correct answer to this question. If two groups say they both found the same material to be useful, ask them to explain how exactly they used that material. Each group may have used the material in a different way. Finally, lead a discussion of how the materials they used might be similar to those used to clean up a real-life oil spill. For example, scientists sometimes use floating ropes to contain the oil slick if the water is relatively calm. Then they skim the oil off of the top of the water into boats. If any groups used a similar technique to clean up their oil, have them discuss the effectiveness of the method. Explain that scientists have tried many methods for cleaning up oil spills, including skimming the oil off the water, using detergents to disperse the oil, and using a vacuum to suck up the oil. They have even experimented with using bacteria that can eat oil.

(Adapted from:

<u>https://www.siemensstemday.com/downloads?path=activity/Oil%20Spill%20Cleanup.pdf&fi</u> <u>d=391§ion=educators</u>)

Water conservation

Activity 5: Rainwater harvesting (water conservation)

Materials required: Big drum / bucket with a lid, strainer, chlorine or iodine. Prerequisites: None

Activity Flow

1. Collection of rainwater: Rainwater can be collected for individual homes as well as for the larger community. Take the help of your child to install a rain barrel at your home. You can do so by placing a large drum outside your house and connect it with pipes to the roof or to the verandah of your house. To prevent the breeding of mosquitoes in the barrel, fasten a lid tightly on top of it. Another way of collecting rainwater is to simply place big buckets or a child's swimming pool in the garden, verandah or the roof of your house. However, make sure you treat and use the water immediately, so it doesn't become a breeding ground for mosquitoes.

2. Treatment and storage of rainwater: While rainwater is one of the most important sources of freshwater, it can't be used for consumption directly. The water that you collect may contain debris, metals and even chemical or microbiological contamination. So, it's essential that the water is treated before it is used for domestic consumption. You can store the treated rainwater in barrels or sumps. Before you teach your children how to treat rainwater, make sure they observe it and are not involved in filtering or treating the water. There are a couple of recommended ways to treat rainwater. They are as follows:

• Boiling: This is the best way to kill pathogens. Filter the water using a strainer or a porous cloth and then bring the water to a boil. Let it cool down completely before you use it for washing vessels, watering the plants or washing any equipment.

• Treating it with chlorine or iodine: Another way of disinfecting rainwater is to add chlorine or iodine to it. But, these chemicals don't necessarily eliminate all pathogens. While iodine is considered to be a better disinfectant than chlorine, the use of iodine-treated water is not recommended for more than a few months at a time. Also, pregnant women and those suffering from conditions like thyroid should refrain from using water that has been treated using iodine. Make sure this water is not used for personal consumption like drinking or bathing.

• Using commercial water filters: Water filters that have RO (Reverse Osmosis) or UV (Ultraviolet) systems installed in them are very effective for treating rainwater. Carbon filtration is also a recommended method of filtration as it removes chlorine and other volatile organic substances.

3. Reusing of rainwater: Now that the rainwater has been collected and treated, you can use it for various purposes. Teach your child the importance of conservation of water by using rainwater for the following in school:

• Watering plants

- Flushing toilets
- Washing vessels
- Washing cars and equipment
- Composting

(Adapted from:

https://www.parentcircle.com/article/how-to-teach-your-child-about-rainwater-harvesting/

3.3 LET'S DISCUSS: RELATE TO DAILY LIFE*

• Industrialization, discharge of domestic waste, radioactive waste, population growth, excessive use of pesticides, fertilizers and leakage from water tanks are major sources of water pollution. These wastes have negative effects on human health.

The most common types of water pollution include:

- 1. Agriculture. Agriculture plays a major role in water pollution around the world. ...
- 2. Wastewater and Sewage. Wastewater is any type of water that is used for industrial, agricultural, or commercial activities.
- **3**. Oil Pollution.
- 4. Radioactive Waste.
- 5. Urban Development.
- 6. Plastics.
- Effects of water pollution: Diseases: In humans, drinking or consuming polluted water in any way has many disastrous effects on our health. It causes typhoid, cholera, hepatitis and various other diseases. Destruction of Ecosystems: Ecosystems are extremely dynamic and respond to even small changes in the environment.

4. EXERCISES & REINFORCEMENT

4.1 EXERCISES & REINFORCEMENT

Ways to reduce water pollution

Activity 6: Ways to reduce water pollution Materials Required: None Prerequisites: None

Activity Flow

Teachers can explain the ways to reduce water pollution in the class and make sure that they follow in their daily activities.

1. Use Less Plastic

It is very difficult to break down plastic after it is produced. Much of the plastic we consume ends up in the world's water supply, where it is even harder to fish out and safely throw away.

If you can use as few plastic items as possible, you are helping the environment.

2. Reuse Items

Whenever you buy something that is not recyclable, such as plastic, it is better to reuse this item as many times as possible. This habit limits your consumption and means less of those products will end up in the world's rivers, lakes, and oceans.

3. Recyclable Options

If there are two options for a particular item, try to pick the one that is easily recyclable. Glass bottles are much better for the environment than plastic, for example.

4. Cleaning Chemicals

Similar to oils, cleaning chemicals are hazardous when they enter the water supply. If you are emptying containers of household cleaning supplies, do it in the trash can, not in the sink.

5. Do Not Throw Away Medicines

Never throw away medicines in the water supply, either. Even if you do not need them, it is a bad idea to flush pills, liquid or powder medications or drugs down the toilet or crush them in your kitchen sink disposal.

Hormones and other compounds end up causing adverse effects on fish and other aquatic wildlife, on septic systems and contaminate drinking water.

6. Use Environmentally Friendly Detergents

Whenever possible, get environmentally friendly detergents, soaps, and dishwashing liquids. While these are sometimes more expensive, you are doing the environment a great service by using less harmful substances.

7. Gardening

While everyone wants a nice garden in their home, it is incredible how much water we waste during that process. Install a rainwater harvesting pit in your home because it can catch rainfall throughout the year and allow you to use that to water your grass and plants.

8. Just Do Not Litter!

If you are visiting an area where there is a nearby lake, river, or ocean, do not throw any type of litter or trash into or near the water. Even if you throw away a wrapper on the beach, the tide will eventually pick it up and take it into the water supply.

9. Use Water Sparingly

Turn off the tap while you are brushing your teeth.

10. Plant Fauna at Lakes or Rivers

If you live in an area where a lake or river is present, you might want to think about planting some local fauna near the water.

Trees are also helpful. Not only do they look beautiful when they grow, but these natural items reduce erosion that washes pollution into the water and help protect the nearby water supply from pollutants. Fauna also limits the Carbon Dioxide in the water,

11. Clean Up Litter

If you see someone littering near water, ask them to keep their items and throw them somewhere else. If you see litter on the floor, pick it up and put it in a bag and throw it away when you get home. It is easy to think that someone else will do the job, but we can all help each other and our environment by being proactive.

4.2 IMPORTANT GUIDELINES*

Exercise Reading

It is very important that the children practice their learnings as well as their reading. Hence have the children read out the newly learned concepts from their textbooks or other available resources.

Perform Textbook Activity

It is good practice to have the children perform the textbook activities. Your textbook activities might not be accessible hence go through this resource to learn how to make textbook content accessible

Provide Homework

To evaluate their understanding and to help the student revise and implement the new learnt concept ensure to provide them with homework. Students should perform one or two of the questions mentioned above or from the textbook exercises with the teacher in Class and the remaining may be given for homework. Also, ensure that the student knows their special skills linked to independently using their accessible books as it will be critical to doing homework independently

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