Vision Empower & XRCVC

Teacher Instruction KIT

Wastewater Story

Syllabus: NCERT
Subject: Science
Grade: 7
Textbook Name: NCERT- Science Textbook for class VII
Chapter Number & Name: 18. Wastewater Story

1. OVERVIEW

1.1 OBJECTIVES AND PREREQUISITES

Objective:

- To learn about wastewater(sewage)and its sources
- To understand the process of wastewater treatment and its significance.
- To understand the role of an active citizen

Prerequisite Concept

- Water -a lifeline
  Grade7, chapter 16, Water- a precious resource
- Water scarcity
  Grade 7, chapter 16, Water- a precious resource
- Filtration process
  Grade 6, chapter 5, Separation of substances

Content Index

*Kindly Note: Activities marked with * are mandatory*

1. OVERVIEW

1.1 OBJECTIVES AND PREREQUISITES

2. LEARN

2.1 KEY POINTS

2.2 LEARN MORE

3. ENGAGE

3.1 INTEREST GENERATION ACTIVITY*

Interest generation activity

Activity 1: Waste water from our houses

3.2 CONCEPT INTRODUCTION ACTIVITIES

Sewage

Activity 2: Sewage

Treatment of polluted water

Activity 3: Treatment of polluted water (Activity 18.4, Textbook)

Waste water treatment processes

Activity 4: Waste water treatment processes

Best housekeeping practices

Activity 5: Best housekeeping practices

Sanitation and diseases

Activity 6: Sanitation and diseases

3.3 LET'S DISCUSS: RELATE TO DAILY LIFE*

4. EXERCISES & REINFORCEMENT

4.1 EXERCISES & REINFORCEMENT

Reinforcement

Activity 7: Let's save our environment

4.2 IMPORTANT GUIDELINES*

Exercise Reading

Perform Textbook Activity

Provide Homework

2. LEARN

2.1 KEY POINTS

Water is an elixir of life. 22nd March is celebrated as World Water Day to bring awareness amongst people for safe water, fit for human consumption. Increasing scarcity of fresh water is due to population growth, industrial development, pollution and other factors.

Sewage is the wastewater released by homes, industries, agricultural fields and other human activities. Composition of sewage includes organic impurities, inorganic impurities, nutrients, bacteria and other microbes which can pollute water and soil. It depends on the source.

Sewerage System is an underground network of interconnected pipes called sewers that carries the sewage from the place where it is produced to the sewage treatment plants, where it is processed. Manholes are provided to clean the sewers.

Wastewater treatment plant (WWTP) -Treatment of wastewater involves Physical Process, Biological Process and Chemical Process to remove contaminants from the waste water. **Biogas** and **sludge** are the two useful by-products obtained.

Better Housekeeping processes should be adopted. Cooking oil, fats, paints, chemicals, insecticide sand solid wastes like tea leaves should not be thrown in the drain as they may choke it and hamper the degradation process.
Poor **sanitation** and **contaminated** water may allow flies, mosquitoes and microbes to breed. It can cause many water borne diseases like cholera, typhoid, dysentery, hepatitis.
Low cost onsite sanitation like **septic tanks, chemical toilets, composting pits**, can be adopted where the sewerage system is not possible. **Vermicompost** toilets maintaining proper sanitation at public places like airports, railway stations is very essential to prevent epidemics.

One has to become an enlightened citizen and minimize the pollutants or waste produced and adopts good sanitation methods. We have a great role in keeping our environment clean and healthy.

2.2 LEARN MORE

None

3. ENGAGE

3.1 INTEREST GENERATION ACTIVITY*

Interest generation activity

Activity 1: Waste water from our houses

Materials Required: None

Prerequisites: None

Activity Flow

Discuss with the students any of the following questions to prepare them for the day's lesson.

- Ask the students if they use water to brush their teeth and have a bath?
- Have they made the water dirty?
- Do factories produce waste water too?

Tell the students that our houses, hospitals and factories generate a large quantity of waste water and this chapter would deal with the different sources of wastewater and its treatment.

OR

- Ask the students if there is enough clean and safe water to use?
- When and why is world water day celebrated?

Help them recall the facts from chapter 16 about the factors leading to water scarcity like increase in population, construction agriculture etc. Explain the importance of reducing and reusing wastewater.

3.2 CONCEPT INTRODUCTION ACTIVITIES

Sewage

Activity 2: Sewage

Materials Required: None

Prerequisites: None

Activity Flow

Ask the students

- What is the waste water called? Does it have bad odour? Is it clear? (low vision children can share)
- Does the wastewater from houses, hospitals and industries contain the same impurities? What do they contain?

Lead the discussion to bring out the following points.

The liquid waste called **sewage,** contains different impurities depending on the source.

It may contain suspended solids, **organic impurities** like Human faeces, animal waste, oil etc., **inorganic impurities** like Nitrates, Phosphates, metals, **Nutrients** like Nitrates and Phosphates, **Disease causing bacteria** like Vibrio cholera, Salmonella para typhi and **microbes** like dysentery causing protozoans.

Ask the students

- How is the waste water removed from your house?
- Are there pipes to carry the waste water out of your house?
- Where does the wastewater go?

Lead the conversation to bring out the fact that sewage is the waste water released by homes, industries, hospitals etc. It is carried by a set of pipes called **sewers** which constitute the network called **sewerage.** While explaining that sewers carry the waste water to the sewage treatment plant, give the importance of **manholes** in sewers.

Treatment of polluted water

Activity 3: Treatment of polluted water (Activity 18.4, Textbook)

Materials Required: Large glass jar, grass, orange peels, detergent powder, ink/or any colour, 4 test tubes, funnel, stand, filter paper, aerator/ stirrer, beakers.

Prerequisites: None

The teacher can demonstrate this experiment. Engage the students by asking them what outcome they expect at the end of each step and why?

Activity Flow

- Fill a large glass jar 3/4 full of water. Add some dirty organic matter such as bits of grass or orange peels, a small amount of detergent, and a few drops of an ink or any colour.
- Cap the jar, shake it well and let the mixture stand in the sun for two days.
- After two days, pour a sample of that water into a test tube and label it as "**Before treatment; Sample 1".** How does it smell?
- Use a mechanical stirrer or an aerator from an aquarium to bubble air through the sample in the glass jar. Allow several hours for aeration; leave the aerator attached overnight.
- The next day when aeration is complete, pour another sample into a second test tube. Label it as **"After aeration; Sample 2".**
- Pour the remaining aerated liquid through the filter into the beakers. Filter till you get clear liquid. And label it as "**Filtered; Sample 3".**
- Add a small piece of a chlorine tablet to a small portion of filtered water. Mix well until the water is clear. Label the test tube **"Chlorinated; Sample 4"**.

Discuss the processes taking place in each step and emphasize that the odour, colour, solid and suspended particles are removed. A sample of clean water is obtained in this activity which is disinfected too.

Waste water treatment processes

Activity 4: Waste water treatment processes

Materials Required: Tactile diagram/model of a wastewater treatment plant
Prerequisites: None

Activity Flow

- Tell them to feel the model of the wastewater treatment plant with different stages.

The processes involve
1) Removal of big solid wastes through **bar screens**
2) Removal of sand, grit and pebbles through **sedimentation**
3) Removal of oil and grease by **skimmers** and **sludge** by scrapers. The sludge is decomposed by **anaerobic bacteria** to produce biogas, which is a fuel and can be used for producing electricity.
4) **Aerator** helps to pump air to help aerobic bacteria to decompose unwanted matter present in clarified water. The suspended microbes settle as activated sludge, which is dried to get manure.
5) This water can be cleaned by nature. Some chemicals like **chlorine** or **ozone** may be added to disinfect the water before use.

- While explaining the process in each step give the meaning of the words clarified water, activated sludge, biogas, bar screens, etc.
- Read out the steps in the wastewater treatment process in a random order. Now ask the students to arrange them in the correct order.

1. Air is mixed vigorously into tanks with wastewater.
2. Chlorine or bleach is added to the wastewater.
3. Sand and grit are removed from the wastewater
4. Bacteria are settled out of wastewater.
5. Oils and greases float to the surface of wastewater.

Best housekeeping practices

Activity 5: Best housekeeping practices

Materials required: 3 Funnels connected with thin tubes, a tub, water, solidified coconut oil/ghee, paint, cotton, used tea leaves/solid food particles.
Prerequisites: None

Activity Flow

- Ask the student to take one funnel at a time and hold the funnel above the tub.
- Ask the students to pour water and observe. Ask them whether the water will flow easily to the tub?

- Next pour little ghee. Ask them to hold their palm near the end of the tube. Will it flow easily?
- Repeat the steps with paint, cotton and solid food particles.
- Ask the students which of the items clogged the tubes.
- Tell the students these things should be thrown into a dustbin and not in the drain.
- Lead the discussion to bring out the best housekeeping practices which can prevent the drains from getting clogged.

Sanitation and diseases

Activity 6: Sanitation and diseases

Materials required: None

Prerequisite: None

Activity Flow

- Ask the students whether they have heard about people defecating in the open?
- Tell them it is a health hazard which causes water and soil pollution. This may lead to water borne diseases like cholera, dysentery, polio, typhoid, meningitis, etc.
- Explain that a low cost onsite sewage system like septic tanks, chemical toilets and composting pits can be used where proper sewerage is not possible. In certain toilets, the excreta is directly connected to a biogas plant which is a source of energy. Biogas and sludge are two important byproducts. Also, Earthworms in Vermicomposting toilets help to convert the human excreta into vermicakes, which is a nutrient for soil.
- Ask the students whether all the people follow standards of sanitation in public places like fairs, railway stations, bus depots.
- Do we find people throwing garbage and littering around? What will happen if the garbage is not disposed properly?
- Lead the discussion to emphasize that each one of us should contribute in maintaining sanitation in public places to prevent epidemics.

3.3 LET'S DISCUSS: RELATE TO DAILY LIFE*

- Ask the students to analyze the amount of waste generated in their classrooms and houses in one day.
- Discuss the impact of all this trash on the environment.
- Students are asked to brainstorm on how to reduce their waste production (by using less, recycling more, and so on) and then to put this knowledge to further use by taking action in their community.

- Lead the discussion to highlight Swatch Bharath mission and the role of the student in keeping the environment clean and healthy, both at school and home.

4. EXERCISES & REINFORCEMENT

4.1 EXERCISES & REINFORCEMENT

Reinforcement

Activity 7: Let's save our environment

(Try this with the help of an adult)

Materials Required: None

Prerequisites: None

Activity Flow

Process of Vermicomposting.

Take a large wooden box or dig a pit 30 cm deep. Put the wooden box in a shady area. Spread a net or a fine chicken mesh at the bottom of the box. Spread some vegetable wastes, fruit peels, dried animal dung, husk, old newspapers, etc. on it. The layer of waste should be loose for sufficient air and moisture. Now, spread a layer of soil on it. Sprinkle some water to make the layer moist. Make sure that excess water is not used. Place some redworms in the vermicomposting pit. The redworms need food like fruit and vegetable peels, coffee powder, tea powder, weeds, etc. After 30 days. If proper care is taken, the number of redworms will become double. Cover the pit with grass or gunny bags. Once in a few days, it is important to mix and move the top layer. After 4 weeks. The compost is now ready. Put some food wastes in one corner so that all the worms move towards it. When redworms move to one corner. remove the remaining part of compost. Dry the compost in the sun. After a few days, vermicompost is ready. Part of the compost containing worms can be reused in vermicomposting. This method of making compost with the help of redworms is called vermicomposting.

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.

References:

Vermicomposting: https://youtu.be/SUCVPkvRdRw

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