Teacher's Guide

Garbage In, Garbage Out

Period 2

Based on the NCERT curriculum for Standard VI

JANAAGRAHA CENTRE FOR CITIZENSHIP & DEMOCRACY

Janaagraha's initiative to improve citizen engagement in India's democracy through their civic learning program

Developed in collaboration with Young Leaders for Active Citizenship (YLAC)

© Janaagraha

Garbage In, Garbage Out | Teacher's Guide (1/3)
Period 2

Class VI
Board – CBSE
Subject – Science
Textbook – Science Textbook for Class VI (NCERT)
Chapter 16 – Garbage In, Garbage Out
Number of periods – 03
Length – 75- 80 minutes

Section I: What are we going to learn and why is it important

Learning objectives

- Studying the methods used to decompose organic waste.
- Observing how redworms break down organic waste into compost.
- Understanding the benefits of segregation and the role played by the government in segregating waste.
- Appreciating the need for citizens to do their part in the effective management of waste.

Learning outcomes

- Being conscious of their own behaviour with respect to waste disposal.

Key terms

Compost	Vermicomposting	Redworms	Biogas
Waste segregation	Dry waste	Wet waste	Hazardous waste

Section II: How are we going to learn

Introduction
Time: 5 minutes

Facilitation notes:

- In the last class we discussed how different kinds of garbage decompose or break down at different speeds. Organic matter breaks down very fast while inorganic matter takes a very, very long time to break down.
- We also discussed that dumping all waste together into the landfill creates problems and prevents speedy decomposition. When water mixes with garbage it becomes poisonous and can affect groundwater. If you recall our experiment, we saw that putting organic waste in plastic bags slows down its decomposition. It also smells a lot due to the generation of methane.
- This is very harmful for the environment and our health. Can we do something about it? *[Take a couple of responses]*
- One way is to separate waste into organic and inorganic and treat them separately. We are going to learn about this today! But first, can anyone tell me, how much of the waste we produce is organic? *[Take a couple of responses]*

How much of our waste is organic?

Facilitation notes:

- Studies show that almost 60-80% of the waste generated in our homes is organic. This is a very large number! [Source: Daily Dump]
- If we can find a way to decompose this properly, it can create a huge positive impact on the environment. Some parts of organic waste like paper and cardboard can also be reused. This is called re-cycling and can save us a lot of resources as well.
- Let's first understand how we can help decompose organic waste such as leftover food. The process is called vermicomposting.

Vermicomposting – Activity
Time: 30 minutes

Note to the teacher:

This activity is based on the experiment given in the NCERT textbook. The idea is to demonstrate how organic waste can be broken down into compost by redworms. The activity can be conducted either during class hours or during the laboratory hour, and observations will have to be made over several days. The vermicompost bin created through the exercise can be placed in the laboratory to allow students to observe and record progress.

In case it is not possible to do this activity, the following video can be played in class:

Video: Vermicomposting: How worms can reduce our waste

Link: Youtube

Food waste can be converted into fertilizer through a process called vermicomposting that utilizes redworms to break down waste.

Play from 0:00 - 2:33 (the video gets a bit complicated after)

Materials needed:

- A plastic bin 18 inches high with a lid that has holes drilled in it to let oxygen through.
- Bedding — use a mixture of coconut coir, shredded newspaper, fallen leaves, and sand that is mixed thoroughly in water.
- A few hundred red worms (redworms are a specific type of earthworms).

- Waste to be composted — fruit and vegetable trimmings, bread without anything on it, coffee and tea remains, and egg shells (washed and ground up). Do **not** include any meat, fish, dairy products, citrus fruits, or oily foods.

Approach:

- Place the bedding in the plastic bin and add some soil on top.
- Create a hole in the bedding and place the worms in the hole.
- Add the waste in the bin and distribute it evenly across the bin. Add a thin layer of soil on top of the waste.
- Close the lid and place the bin away from sunlight and in a place that is neither too hot nor too cold. Sprinkle some water everyday to keep the compost heap moist enough.
- Students must observe the contents of the bin every week to identify how much of the waste has been decomposed. As and when the compost is ready, students must remove the compost and add more waste to the bin.
- The compost must be dried in the sun for a few hours, after which it can be used for plants within the school premises.

Facilitation notes:

- Composting which means the rotting of material is one of the best ways of decomposing organic waste. Composting creates compost (manure) which is rich in nutrients and can be used as fertilizer.
- Vermicomposting is the method of preparing compost with the help of redworms. Redworms are specific types of earthworms (that you often see in the soil during rains).
- Redworms don't have teeth to break up the waste. Instead, they have a structure known as **gizzard**, which helps them grind and break down the waste.
- A gizzard is like a pipe in a sink. Inside it are powerful muscles and small particles like soil or sand. The waste enters the gizzard and the muscles and small particles break it down, making it small enough to pass into the worms' intestines.
- Redworms are known as farmer's friends because the compost they help create is very rich in nutrients! Farmers can thus save a lot of money that they spend on buying expensive chemical fertilizers and manure from the market. Let's watch a video on vermicomposting!

Video: Worms at work - 20 days time-lapse of vermicomposting

Link: Youtube

Biogas Plants

Time: 5 minutes

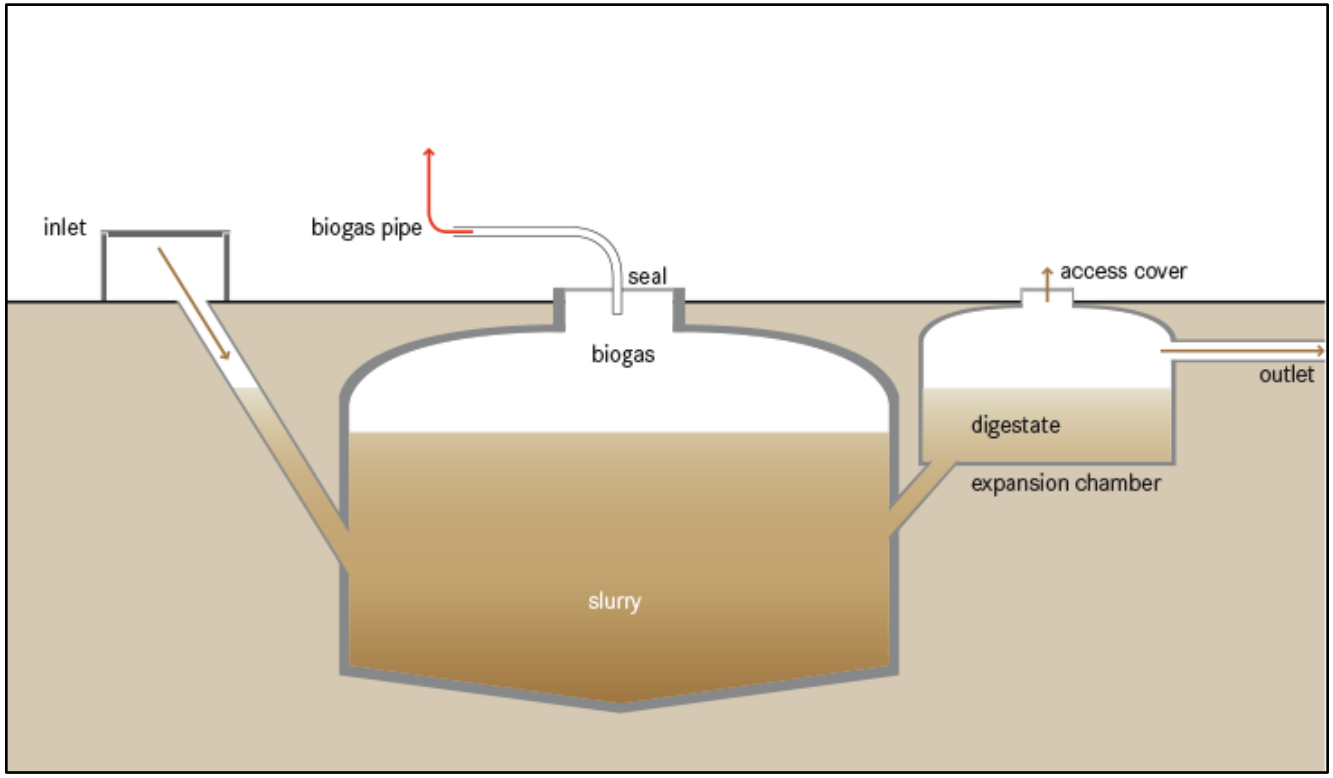
Note to the teacher: This section talks about the other way to make use of organic waste - generating biogas.

Facilitation notes:

- Recall the experiment in our last class. We saw that organic waste put into plastic bags was not decomposing as rapidly as the one put into the soil. It was also generating a bad smell. This was because organisms found in the soil, like redworms, need to be exposed to the air in order to decompose organic matter.
- Organic waste that decomposes without air generates methane gas, also known as biogas, and causes a lot of smell.
- Methane is a greenhouse gas; that is, it traps the planet's heat inside the atmosphere. Thus, it adds to global warming. However, methane can also be used for cooking or to generate electricity. It can even be compressed and used as fuel for vehicles!

- Biogas plants convert organic waste into manure and methane. Like vermicompost, this manure can be used in gardens and fields instead of chemical fertilizers and the methane gas can be collected separately and put to use.

- This is what a simple biogas plant looks like. The 'digestate' is the manure like output that is rich in nutrients and can be used as a fertilizer. We will learn more when we visit a biogas plant! *[Image source: http://sisengconsulting.com.ng/biogas/]*



Waste Segregation

Time: 10 minutes

Facilitation notes:

- Now, for us to undertake vermicomposting or biogas treatment on organic waste, we must collect it separately. If it is mixed, then there is very limited we'll be able to do after. And separating waste after it has already been mixed is much harder and also harmful for the people who will be tasked to do these jobs. Can you imagine yourself in a landfill separating the whole city's waste? *[Take a couple of responses]*

- So, let's understand what we can do at home and in our daily lives to separate waste.

Video: Alag karo - Short film

This is a fun video that draws attention to segregation by highlighting the different instances when people naturally choose to segregate things, but somehow ignore to do so when it comes to garbage.

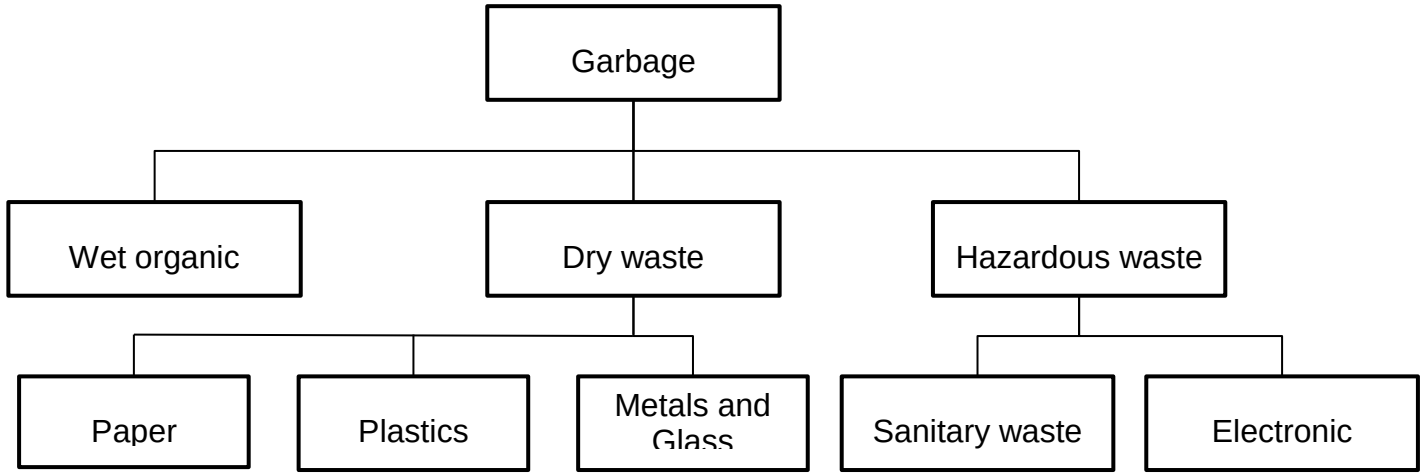
Link: Youtube

De-brief:

- The process of separating different kinds of garbage for disposal is known as **waste segregation**.

- This involves separating our garbage into wet waste, which is organic waste produced in the kitchen such as leftover food etc., and dry waste, which includes inorganic waste such as paper, plastic, glass, etc. A third category is hazardous waste which includes things like diapers, sanitary pads, bandages, etc. which can cause diseases if not disposed off properly.

- Electronics such as batteries, fused bulbs, mobile phones, TVs and computers are also hazardous and collected separately in many places because they contain poisonous chemicals and have to be disposed of carefully. *[Please show/ draw the chart below to reinforce the point]*



- By segregating garbage, it becomes easier to for us to apply appropriate methods to decompose the different kinds of garbage, or reuse them - for instance, paper or glass bottles. We'll talk about this in more detail in the next class.

- By a show of hands, how many of your families already segregate waste at home? *[Do a count, and ask 2-3 volunteers to share how the process works at their home]*

- If you don't already do it, let's get you started! The process is very easy. Just set up different garbage bins—one for all the wet organic waste, the other for dry inorganic waste and a third for hazardous waste and get everyone in your family to start using them from tomorrow!

The role of the government in segregation
Time: 10 minutes

Facilitation notes:

- It is not enough to segregate at home, since the garbage collector may still throw the segregated garbage in the same landfill!
- Therefore, the government must ensure that different kinds of garbage are disposed off differently.
- In India, the municipal government is responsible for garbage collection and disposal. The municipal government makes rules so that everybody segregates their waste at home. For example, Bengaluru has strict rules about waste segregation, and can impose fines on those who do not segregate their waste.
- Municipal governments also install garbage bins of different colours for different kinds of garbage, like this:

Picture 1: Dry and wet waste segregation
Source: Hindustan Times

Highlight that in India all cities do not have such facilities and in most cases, there are only two categories of bins available - green for wet waste and blue for dry waste. But in some places, more bins are being introduced *[Show the next picture]*

Picture 2: Different kinds of bins
Source: Hindustan Times

- In addition to setting up bins, the government also segregates the garbage that we throw, and different kinds of garbage are sent to various places for recycling.
- The government has even set up biogas plants to decompose all the organic waste that is produced in the city.

Section III: Assessment

Time: 10 minutes

True/False Quiz

Materials needed:
Blackboard and chalk

Divide the class into two teams and divide the blackboard into two columns for Team A and Team B. Teams must identify if the following statements are true or false. Whichever team answers first will get 10 points for every correct answer.

1. A landfill is an open area where the garbage collected from a city or town is dumped. [True]
2. When waste is burned, it produces smoke and gases that are very harmful to our health. [True]
3. If you bury kitchen waste in a pit, it will remain forever in its dried form. [False]
4. The process where redworms are used to break down organic waste is known as decomposing. [False]
5. Vermicomposting requires the presence of sunlight for the waste to decompose. [False]
6. The compost produced through vermicomposting is very rich in nutrients and can be used as manure instead of chemical fertilizers. [True]
7. When organic waste decomposes without access to air, it produces a gas called carbon dioxide. [False]
8. Waste segregation is the process of separating different kinds of garbage for disposal. [True]
9. In India, the Central government is responsible for garbage collection and disposal. [False]
10. Sanitary waste may cause contamination and may lead to the spread of diseases if they are not properly disposed. [True]

Homework

1) Ask students to visit ten families in their neighbourhood and find out whether they are segregating their waste. If they are, then students must note down how the garbage is segregated and disposed, and who collects it. Ask students to analyze if people are aware of the importance of waste segregation, and if not, what actions would they take to create awareness on the same.

2) Students whose families do not segregate waste, should try to institute segregation at home. They can be asked to maintain a reference list for their family to help in segregation. This can be pasted in the format below, near the dustbin to encourage family members to separate waste before it is disposed.

   Suggested format:

Items	Color of the dustbin to be put into
Eggs	Green
….	….

Section IV: Closure

Summary by students

Note to the teacher: Select a student at random to summarize the key points of the session and why this particular session is important.

Recap by the teacher
Time: 5 minutes

Dumping both organic and inorganic waste in a landfill can cause environmental as well as health problems. Therefore, it is important to dispose organic and inorganic waste differently.

Organic waste can be decomposed either through vermicomposting or in biogas plants. Vermicomposting is a process where we use a type of earthworm known as redworm to break down organic waste into nutrient-rich compost. The compost can then be used in gardens and fields instead of chemical fertilizers.

Biogas plants convert organic waste into manure and methane. Like vermicompost, the manure can be used in gardens and fields instead of chemical fertilizers. The methane gas is collected separately and used for cooking or to generate electricity or even as fuel for vehicles.

It is important to segregate our waste in separate garbage bins so that they can be disposed off separately. Garbage can be segregated into wet waste, dry waste, and hazardous waste. We must do our part at homes to make sure our garbage is properly segregated before being thrown out.

In India, the municipal government is responsible for the collection, segregation, and disposal of garbage.

Section V: Field Visit

Students can be taken to the following units as field visits in **Bengaluru**:

- Government-run Dry Waste Collection Center (through SWMRT)

  Location: Vidyaranyapura
  Permissions: No permission is required. Organizers to be informed 2-3 days in advance for the visit.
  The staff at the facility briefly explains the process.
  Time: 45 minutes

- Government-run Mechanized Dry Waste Collection Center (through SWMRT)

  Location: Yeshwanthpur
  Permissions: No permission is required. Organizers to be informed 2-3 days in advance for the visit.
  The staff at the facility briefly explains the process.
  Time: 30 minutes

- Government-run Biogas Plant (through SWMRT)

  Location: Vidyaranyapura
  Permissions: No permission is required. Organizers to be informed 2-3 days in advance for the visit.
  The staff at the facility briefly explains the process of how the food waste gets converted into biogas.
  Time: 30 minutes

- Vermicomposting Plant

  Location: University of Agricultural Sciences, GKVK Campus
  Permissions: Permission is required from the Dean of the University for the visit.
  The staff at the University briefly explains the process of using earthworms to convert waste/plant material into compost.
  Time: 1 hour

Students can be taken to the following units as field visits in **New Delhi**:

- MCD Compost Plant (in partnership with IL&FS)
  Location: Haji Colony, Jasola Vihar

- Biomass Utilization Unit (Biogas and Vermicomposting plants)
  Location: Indian Agricultural Research Institute, Pusa

Students can be taken to the following units as field visits in **Mumbai**:

- BMC Compost Plant (in partnership with NGO Come-Post)
  Location: Shivaji Nagar, Govandi

- BMC Vermicompost Plant (through Swachh Mumbai Prabodhan Abhiyan)
  Location: Byculla Zoo

Section VI: Additional resources

Resources for students:

1. Video: Saahas -Zero Waste

This video captures the narrative from a child's perspective. It recaps the lessons from period 1 about landfills and living/ working conditions near them to urge people to segregate.

Link: Youtube

Resources for teachers:

1. Video: Vermi-composting
This video talks about how worms can reduce our waste.
Source: Youtube

2. Reading: Waste Segregation

This video gives an example of a community where waste segregation was made mandatory.
Source: Article

3. Reading: Divide and Conquer: waste segregation is the key
Waste segregation at source improves collection efficiency and leads to better processing of waste.
Source: Article

4. Reading: Know your waste- Sahaas
Understanding waste is an essential part of personal waste management.
Source: Article

ichangemycity

JANAAGRAHA CENTRE FOR CITIZENSHIP & DEMOCRACY

Disclaimer: *This document contains pictures, icons, and content hyperlinks ("copyrighted material") the use of which has not always been specifically authorized by the copyright owner ("third parties"). The copyright for such copyrighted material used in the document vests with/ are owned and operated by appropriate third parties, and are provided here for user information and convenience only. Janaagraha does not intend the usage of such copyrighted material for appropriation of intellectual property of third parties, and does not bear any responsibility for their accuracy or legality of content or their continued availability. All efforts have been taken by Janaagraha to ensure that all copyrighted material is accurately reproduced and prominently acknowledged to third parties, and not used in a derogatory manner or in a misleading context. If any content in this document violates rights of third parties or is in breach of copyright law, Janaagraha is willing to remove it immediately upon request. Contact information available at http://www.janaagraha.org/*