SCIENCE

CHAPTER 18: WASTEWATER STORY

Wastewater Story

Water – Our Lifeline

- Water is used for a variety of purposes in our everyday life. When used, this water becomes adulterated and is called **waste water**.
- Polluted water leads to people suffering from **water-related diseases**.
- Water gets polluted due to several factors such as increase in population, industrial development and mismanagement.
- Waste water is subjected to a cleaning process often referred to as **sewage treatment**.

Sewage

- **Sewage** is liquid waste; most of it is water which has dissolved and suspended impurities.
- Water which washes off the roads and roofs carries harmful substances and impurities called **contaminants**.

Types of Impurities	Examples
Organic impurities	Human faeces, animal wastes, oil, urea, pesticides, herbicides, fruit and vegetable wastes
Inorganic impurities	Nitrates, phosphates, metals
Nutrients	Phosphorus and nitrogen
Bacteria	Those which cause diseases such as cholera, dysentery and typhoid

- A **sewer** is an underground passage for carrying off drainage water and waste matter.
- The provision of drainage at a place by laying sewers under the ground is called **sewerage**. It takes the waste water to the point of disposal, i.e. a treatment plant.
- A **manhole** is a covered vertical hole in the ground, pavement or road. Manholes are located every 50-60 m in a sewerage system, at the junction of two or more sewers and at points where there is a change in direction of the sewer line.

Sources of wastewater:

- Sewage water contains detergents, toxic chemicals food wastes, paper, human faeces, plastics, metal objects, microorganisms, blood, human/animal tissues, etc. These kinds of materials present in wastewater are called contaminants.

- In agricultural practices, pesticides and fertilizers are used, which gets mixed with fresh water during rains or flood, thereby contaminated the river and ponds.

- The wastewater from the industries may contain lubricant oil, paint, dye, chemicals and metals. These are also called Industrial effluents.

- Construction of buildings, mining leads to the generation of wastewater containing cement, paints, metals and chemicals.
- Abattoirs (slaughterhouses), animal farms and veterinary hospitals too contaminate water and contribute to sewage.
- One of the major sources of wastewater is domestic sewage from homes.

Treatment of sewage in cities and towns:

If sewage water is allowed to directly flow into the water bodies, it would pollute water. Such polluted water is not suitable for human consumption or for growing crops. It will also harm all kinds of plants and animals living in this water.

Thus, Wastewater must be cleaned before it is released into the water bodies. This is done in Sewage treatment plant or wastewater treatment plant. Treated wastewater can be used for various purposes.

Effects of improper sewage management:

- Many places in our country have open drains in the streets. These serve as breeding places for mosquitoes, which cause diseases like malaria and Chikungunya.
- Untreated wastewater or sewage contains nutrients which are beneficial for the growth of algae. If this untreated wastewater is let off into the water bodies then it leads to an increase in algal growth called algal blooms. This causes depletion of oxygen in the water bodies making them unable to support aquatic life such a condition is called eutrophication.
- The overflowing drains can contaminate wells and streams too.
- The contamination can cause water- borne diseases such as Cholera, typhoid, Hepatitis and dysentery.

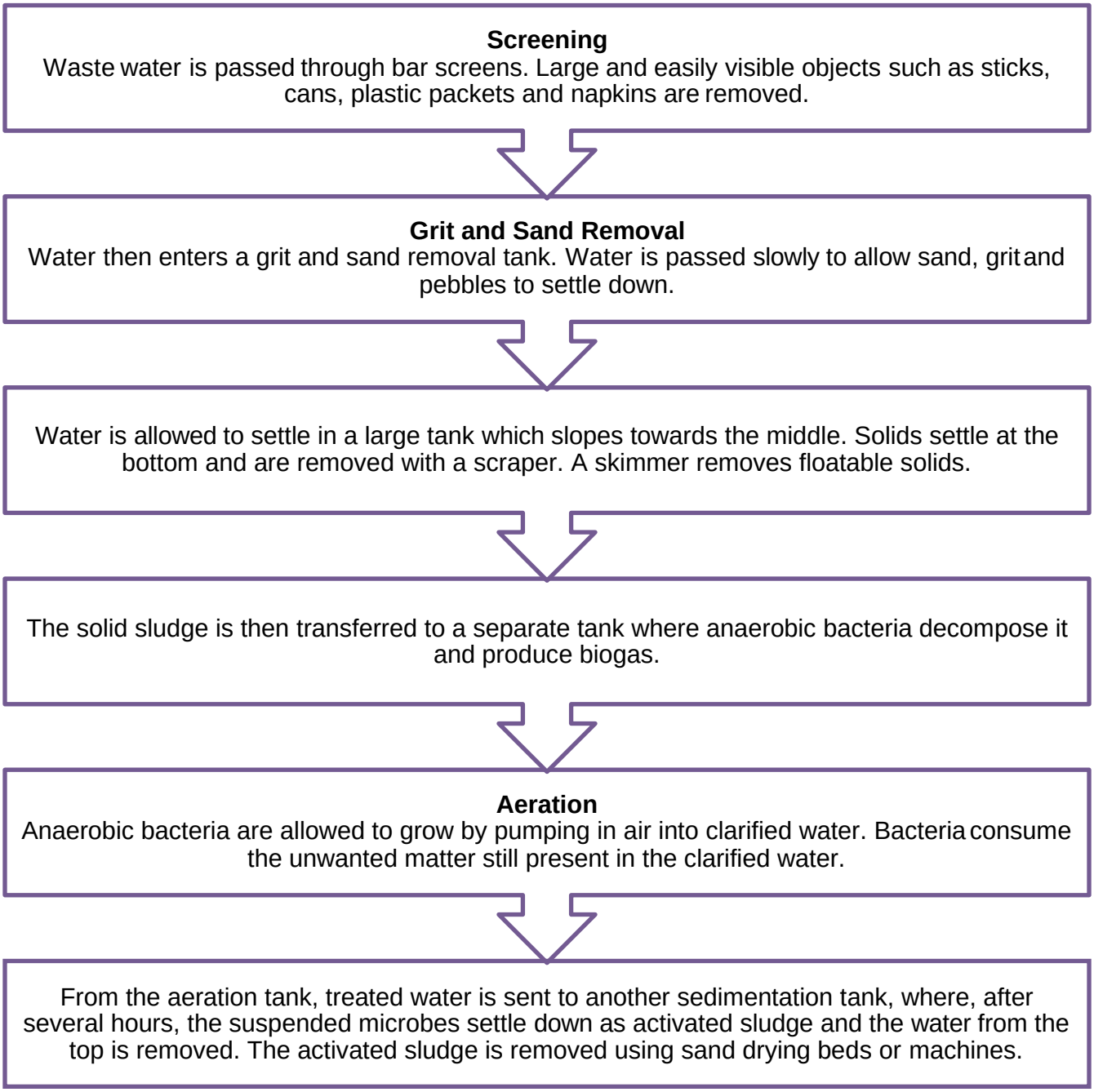
Methods of sludge management:

- Sludge can be incinerated in sludge incinerators to convert it into ashes, which can be used in construction purposes or to supplement the nutrients in the soil.
- Dewatering of the sludge can be done by sludge- drying machines. The leftover solid waste is used in the manufacture of fertilizers.
- The gas produced by aerobic bacteria acting on the sludge in the aeration tank is used as biogas, which is a source of energy for cooking and electricity.

Wastewater Treatment Plant (WWTP)

- Physical, chemical, biological processes are employed to remove physical, chemical and

biological matter from the water.



- The dried sludge is now used as **manure**, thereby returning the organic matter and nutrients to the soil.
- The treated water has a very low level of organic and suspended matter and is hence discharged into seas, rivers or into the ground.
- Sometimes, chemicals such as **chlorine** and **ozone** are used to disinfect water before releasing it into the distribution system.

Primary treatment process:

In this process, the sewage flows through the grit chamber very slowly so that the sand,

pebbles and soil settle down at the bottom.

It is a mechanical process; the sewage flows into the settling tank of sedimentation tank where the solid wastes like faeces are allowed to settle down.

The waste material that settle down at the bottom is called the sludge and the floatable material is called the scum.

The sludge at the bottom is removed with a scrapper every few days and treated further. The water then is left out is called the clarified water.

Fig. 18.4 *Grit and sand removal tank*

Fig. 18.5 *Water clarifer*

Secondary treatment process:

It is a biological process. This is done by transferring the clarified water into an aeration tank where air blowers bubble air, which helps the aerobic bacteria to grow and feed on the organic contaminants.

Microorganisms decompose most of the organic matter still present in the sewage.

The leftover liquid waste is allowed to remain in time so that microscopic organisms settle

down at the bottom. This is called the activated sludge. This activated sludge is then left in sand dry beds.

Fig. 18.6 Aerator

Tertiary treatment process:

The leftover liquid waste is transferred to another large tank where the decomposed waste settles at the bottom. These tanks too are called sedimentation tanks.

At this stage, most of the solid substance from the water are removed.

The water is then shifted to a tank where it is treated with chlorine to kill all the microorganisms present in the wastewater and to remove the Phosphorus compounds and nitrogen compounds. Addition of chlorine to wastewater to kill germs is called chlorination. It is a chemical process.

The dirty water that was brought to the sewage treatment plant is now clean and can be used to cultivate crops, maintain large gardens, and manufacture goods in industries.

The water can also be discharged into oceans, rivers and lakes or used to recharge groundwater.

Alternative Arrangement for Sewage Disposal

Septic tanks	• Anaerobic bacteria break down the solid-liquid waste, thereby reducing its volume.
Composting toilets	• A composting toilet breaks down and dehydrates human waste to compost which can be added to soil to make it fertile.
Chemical toilets	• These toilets have a chemically treated reservoir directly below the toilet seat. • The chemicals help reduce the odour and carry out partial disinfection of human waste.
Vermicomposting toilets	• Earthworms eventually eat up all the organic matter present in the excreta, decompose it and pass it out of their body as worm castings which act as a very good manure for soil.

Sanitation and Disease

- A large number of diseases are caused by **poor sanitation** and **contaminated drinking water**.
- Water contaminated with untreated human excreta causes diseases such as cholera, typhoid and dysentery.

The wastes generated at public places such as railways, bus depots, hospitals and airports must be disposed off properly or else an epidemic could break out.

We must take care that water does not stagnate in the surroundings or that open heaps of garbage do not lie unattended.

Low-cost onsite human waste disposal systems are being used to improve sanitation. In this system, excreta from toilets flow through covered drains into a biogas plant. The biogas produced is used as a source of energy.

Good Practices of Waste Disposal

Citizens can approach the municipality or gram panchayat and insist that drains be covered and a proper method for waste disposal be used.

We must not litter public places such as roads and parks. Paper, food waste, packets or empty plastic water bottles must be thrown in dustbins.

We must not spit or urinate in public places.

Authorities should look to it that there are public toilets and dustbins.

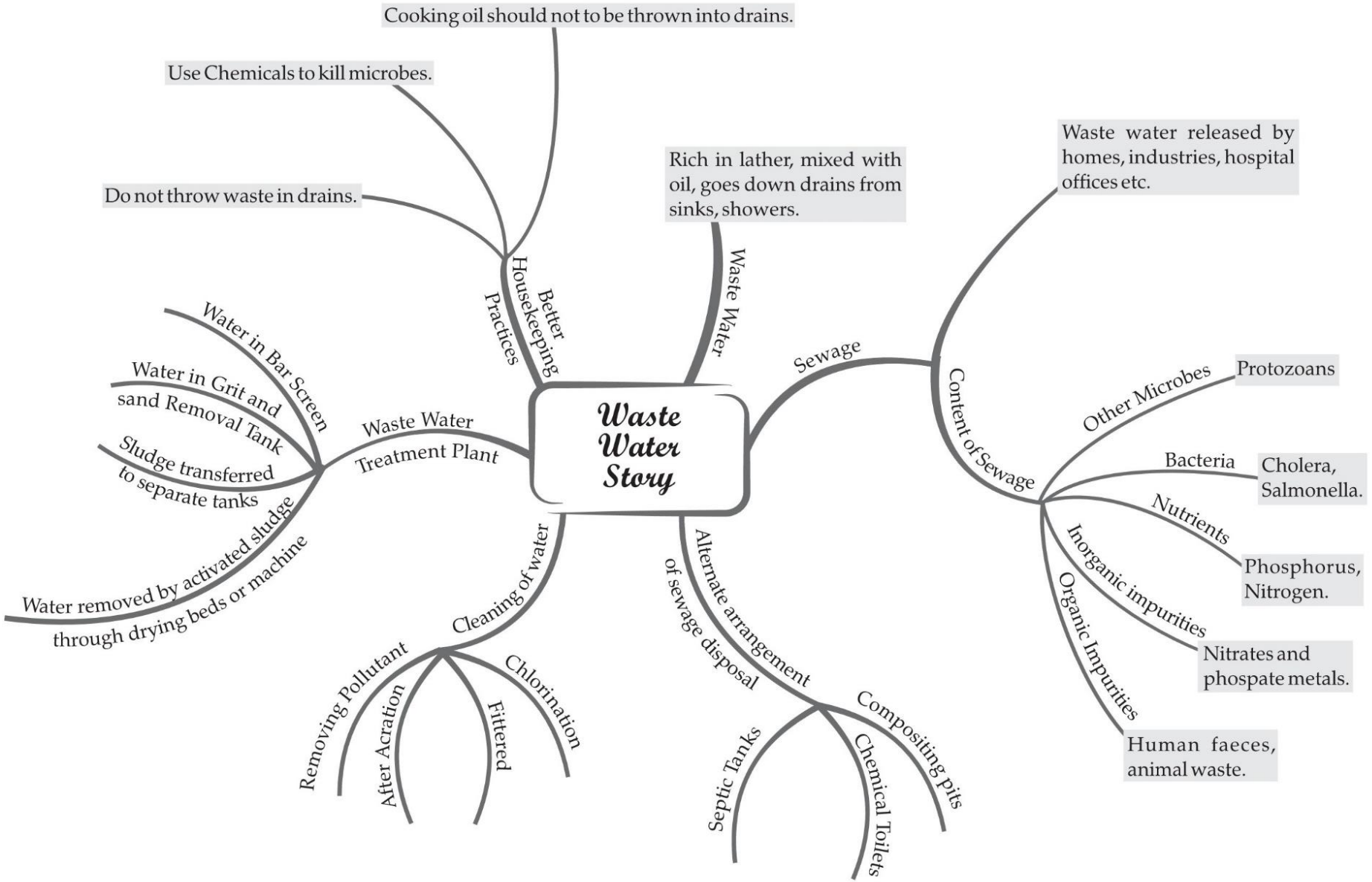
Awareness must be spread among the citizens about the ill-effects of an unclean environment.

Control of sewage at homes:

- Do not drain off cooking oil, paints and automobile oils. it leads to blockage.
- Chemical like paints, insecticides, medicines may kill decomposer microbes that help purify water, so, these must never be thrown down the drain.
- Do not drain the tea leaves, vegetable and animal food waste and egg shell. Solid waste clogs drains and make surrounding dirty.

MIND MAP : LEARNING MADE SIMPLE

CHAPTER-18



Important Questions

➢ Multiple Choice Questions:

Question 1. Water that is not fit for use is called

(a) clean water

(b) wastewater

(c) both (a) and (b)

(d) none of these

Question 2. Which of the following is not a source of wastewater?

(a) Sewers

(b) Homes

(c) Industries

(d) Hospitals

Question 3. The period of International Decade for action on 'Water for Life' is

(a) 2000 – 2010

(b) 2005 – 2015

(c) 2010 – 2020

(d) 2003 – 2013

Question 4. The process of removing pollutants in water before it enter a water body is called

(a) cleaning of water

(b) refining

(c) filtering of water

(d) none of these

Question 5. Which of the following is a part of inorganic impurities of the sewage?

(a) Pesticides

(b) Urea

(c) Phosphates

(d) Vegetable waste

Question 6. Wastewater released by homes, factories, industries and other users is known as

(a) polluted water

(b) sewage

(c) both (a) and (b)

(d) none of these

Question 7. Suspended impurities contained by sewage are called

(a) contaminants

(b) sludge

(c) grey water

(d) none of these

Question 8. A network of big and small pipes under the ground for wastewater management is known as

(a) sewage

(b) sewerage

(c) manhole

(d) channel

Question 9. Solid waste extracted during sewage treatment is known as

(a) sewage

(b) sludge

(c) biogas

(d) contaminants

Question 10. Which portion of WWTP retains large objects like rags, sticks, etc.?

(a) Bar screen

(b) Sludge

(c) Sedimentation tank

(d) Sewerage

➢ Fill In the Blanks:

1. Wastewater should be cleaned up by removing ……
2. Some factors responsible for the increasing scarcity of freshwater are …… , …… and ……
3. The General Assembly of the …… proclaimed the period 2005-2015 as the International Decade for action on ‘Water for Life’.
4. Sewage is a …… waste.
5. Sewage contains some organic impurities like oil, …… , …… and ……
6. Air is pumped into the clarified water to help …… bacteria to grow.

➢ True or False:

1. Wastewater is suitable for drinking purpose.
2. Wastewater can be revised.
3. Clean water is available for every person.
4. Pollution is one of the factors of the increasing scarcity of freshwater.
5. World Water Day is celebrated on 22 March every year.
6. Cleaning of water is also known as sewage treatment.

➢ Very Short Question:

1. What is sewage?
2. What per cent of earth's water is fresh?
3. What constitutes waste water?
4. State one of the reasons for increasing scarcity of fresh water.
5. Which day is celebrated as World Water Day?
6. What is cleaning of water?
7. What are the adverse effects of drinking contaminated water?
8. What is sewage treatment?
9. What is the purpose of filtering waste water?
10. What is a clarifier?

➢ Short Questions:

1. What do you mean by waste water?
2. Enlist the various causes of water pollution.
3. What is sludge and how is it treated?
4. What is sewage and sewage treatment?
5. Explain why is it harmful to discharge untreated sewage into Water bodies?
6. Untreated human excreta are a health hazard. Justify the statement.
7. What do you understand by the term "sewerage"?
8. List few ways to control sewage generation.

➢ Long Questions:

1. What is sewage? Explain why it is harmful to discharge untreated sewage into rivers or seas?
2. Oils and fats should not release in the drain. Explain why?
3. Explain the various steps involved in water treatment plant.

✓ Answer Key-

➢ Multiple Choice Answers:

1. (b) wastewater
2. (a) Sewers
3. (b) 2005 – 2015
4. (a) cleaning of water
5. (c) Phosphates
6. (b) sewage
7. (a) contaminants
8. (b) sewerage
9. (b) sludge
10. (a) Bar screen

➢ Fill In the Blanks:

1. pollutants
2. population growth; pollution; mismanagement
3. United Nation
4. liquid
5. urea; human faeces; animal waste
6. aerobic

➢ True or False:

1. False
2. True
3. False
4. True
5. True
6. True

➢ Very Short Answers:

1. Answer: Waste water released by houses is called sewage.
2. Answer: 3 per cent.
3. Answer: It can include human waste, food scraps and chemicals.

4. Answer: Population growth.
5. Answer: 22 March
6. Answer: Cleaning of water is the process of removing pollutants before it enters a water body or is reused.
7. Answer: Drinking contaminated water results in diseases such as cholera, typhoid and diarrhoea. Polluted water can also prove fatal.
8. Answer: Pollutants in waste water can be removed in several stages, and this process is called “sewage treatment.
9. Answer: To remove large impurities.
10. Answer: A clarifier is a tank with its central part inclined downwards so as to allow faeces to settle down. The inclined waste is then removed using a scraper.

➢ Short Answers:

1. Answer: The dirty water which contains various impurities like dust, polythene bags, Vegetable peels, kitchen waste, oil & water that goes down the drains from sinks, showers, toilets, laundries etc. is waste water. Waste water cannot be used further.
2. Answer: Water is polluted by various factors like:
   - Bathing of cattle in river bodies.
   - Washing of clothes & utensils by people in rivers.
   - Discharging wastes from factories, industries in nearby river bodies & ponds.
3. Answer: Solid Faecal matter which is generated after the water treatment plant is known as sludge. The sludge is transferred to a separate tank where it is decomposed by anaerobic bacteria. The biogas produced can be used as a fuel & the dried sludge is used as manure for replenishing the nutrients of the soil.
4. Answer: The waste water that is being generated at homes, industries, agricultural activities, human activities etc. is called sewage. And sewage treatment is a process of removing pollutants before it enters a water body or is refused.
5. Answer: It is harmful to discharge the untreated sewage into the water bodies as it contains harmful substances. Most of it is water which has dissolved & suspended impurities which may pollute the water bodies & also harm the aquatic plants & animals.
6. Answer: An untreated human excreta is a health hazard as it may cause water pollution. It pollutes both Surface water as well as ground water. Since ground water is a source of water for wells, tube wells etc. therefore it leads to waterborne diseases like cholera, jaundice, typhoid etc.
7. Answer: Sewerage is like a transport system that carries sewage from the point where it is being generated to the point of disposal i.e. treatment plant.

8. Answer: Following are the ways to control sewage generation are:
    - Leakage in sewer lines should be checked & repaired regularly.
    - Do not defecate, spit or scatter litter in public places.
    - Used tea leaves, solid food remains, toys, towels etc. should not be thrown in water pipe because these materials may choke the pipe.

➢ Long Answers:

1. Answer: Sewage is waste water released by homes, industries, hospitals, offices and other users. It also includes rainwater that has run down the street during a storm or heavy rain. The water that washes off roads and rooftops carries harmful substances with it. Sewage is a liquid waste which has dissolved and suspended impurities as contaminants or pollutants. If this untreated sewage is discharged into rivers or seas, It may cause water pollution and soil pollution in which both the surface water and groundwater get polluted. Groundwater is a source of water for wells, tube wells, springs and many rivers. Therefore if it gets polluted, it becomes the most common route for water borne diseases. They include cholera, typhoid, polio, meningitis, hepatitis and dysentery.
2. Answer: Cooking oil and fats should not be thrown down the drain. They can harden and block the pipes. In an open drain the fats clog the soil pores reducing its effectiveness in filtering water. Also they may kill microbes that help purify water. Therefor oil and fats should be always discharged after taking due care in the dustbin or if possible in some suitable dumping place.
3. Answer: There are various steps involved in the water treatment plant which involves physical, chemical & biological processes:
    - Waste water is passed through bar screens to remove big objects like cans, sticks, rags etc.
    - The liquid material is then passed through sedimentation tank where solid waste like faecal matter, sand, grit settles down.
    - This solid matter is then removed with the help of a scrapper. This is the sludge.
    - A skimmer removes the floatable solids like oil, grease etc.
    - The clear water so obtained is called clarified water.
    - Air is pumped into clarified water to help aerobic bacteria to grow. The bacteria then consume the unwanted matter still present in clarified water.
    - The suspended microbes settle at the bottom & the water is removed from the top