MSBTEs Study Material

<Program Code: **CE**>: <Course Code:**22447**>: <Course Name: **Environmental Studies**>: <Unit-4: Environmental pollution>: <Sub topic **4.1: Land Pollution**>: <**UO: 4a, 4b and 4c**>: <Study Material>		
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Key words **Pollution, Sources of Pollution, Effects of Pollution.**	**Learning Objective:** Students will able to understand causes and effects of Land pollution CO; Apply techniques to reduce environmental pollution.	**Diagram/ Picture** **Fig. 2: Types of Pollution**
Key Questions: Define land pollution. State causes and effects of land pollution. describe preventive measures of land pollution.	**Concept Map:** **Fig. 1: Pollution**	
Solved word Problem: Answers of above questions are covered in study material.	**Pollution** is the introduction of harmful materials into the environment. These harmful materials are called pollutants. **Pollutions are two types**. **The natural**: The natural pollution is caused and produced naturally and will not affect our environment because of its regeneration ability. **Man Made**: The Man made pollution is being made by humans and have huge affect on our environment and definitely ourselves. **Land Pollution:** ► Land pollution is the demolition of Earth's land surfaces often caused by human activities and their misuse of land resources. ► It occurs when waste is not disposed properly. **Causes of Land Pollution** **1. Industrialization** ► Plastics factories, chemical plants, oil refineries, large animal farms, coal-fired power plants, metals production factories and other industries all contribute to land pollution. **2. Mining Activities** ► The mining process can lead to the creation of large open spaces beneath the surface of the earth ► Heavy minerals, sulfuric acid and other toxic material leak from mining waste into soil **3. Agricultural Activities** ➢ Due to population rise, food is in higher demand and so forests are chopped down and	**Key Definitions/ Formulas:** **Fig. 3: Land Pollution** **Fig. 4: Industrialization** **Fig. 5:Mining**

turned into farmland
- ➢ In addition, herbicides, pesticides, artificial fertilizers, synthetic manure are washed into the soil and pollute it.

4. Sewage treatment:
- ➢ Large amount of solid waste is leftover once the sewage has been treated.
- ➢ The leftover material is sent to landfill site which end up in polluting the environment.

5. Overcrowded landfills:
- ► Household waste produces tones of garbage each year.
- ► Items that can not be recycled become a part of the landfills that destroy soil quality and cause land pollution.

6. Construction activities:
- ➢ Due to urbanization, large amount of construction activities are taking place which has resulted in large waste articles like wood, metal, bricks, plastic

7. Deforestation
- ► In search of more land for industries, agriculture, residence Deforestation is carried out.
- ► Land that is once converted into dry or barren land can never be made fertile again.

8. Urbanization
- ➢ Urbanization refers to the population shift from rural to urban areas
- ➢ It imparts additional pressure on **land** resources for Residence and food production.

The Negative Impact Of Land Pollution

1. Ground water poisoning
- ► The Agricultural run off waste water from industrial sites, and landfills percolates through soil and pollute the ground water.

2. Water nutrient enrichment
- ► Chemicals, such as nitrogen, are used frequently on farms. Only a small portion of the nutrients end up benefitting the crops. The remainder usually ends up in water bodies populated by fish, algae, and other life forms. The nutrient-heavy water saps up most of the oxygen in the water, which leaves little for fish and other life.

3. Soil erosion
- ► Deforestation leads to exposer of soil to atmospheric conditions like wind, rain which wash out top soil layer resulting in soil erosion. It severely affects the fertility of land.

4. Shifting habitat
- ► As deforestation and soil erosion progress, animals are forced to move to find shelter and food. For some animals, the change is lethal. As a result, some species are at a greater risk of extinction.

5. Increased risk of forest fires/ wildfires
- ► The dry conditions created by pollutants in the soil help to create the perfect environment for forest fires/ wildfires.

Effects of Land Pollution on Humans
- ► Humans can also experience negative consequences that can influence quality of life

Fig. 6:Agricultural activities

Fig. 7:Sewage Stagnation

Fig. 8:Landfill

Fig. 9:Construction Activities

Fig. 10:Deforestration

Fig. 11:Urbanization

and health.

► The potential consequences include birth defects, the development of breathing disorders, skin diseases, and cancer.

► Land pollution has also been linked to development of children. The e waste Chemicals that are commonly found in contaminated soil and water, such as lead can impact a child's cognitive development even if the exposure is very low.

Prevention For Land Pollution

1. Proper waste disposal

► Focuses on treating waste and disposing it in the safest possible manner.

2. Reduce, Recycle and Reuse.

► Reduce the usage of non-biodegradable materials, such as plastic shopping bags.

► Recycle the waste that can be recycled and

► Reuse the materials that can still be used to reduce the need for harvesting of resources.

3. Buy Biodegradable Product

► Biodegradable products can be easily decomposed and not harmful.

4. Create Dumping Ground Away

► Dumping Ground or Landfills should be away from residential area so that waste product will not be seen all over the places.

5. Do Organic Garden

► Organic gardening can reduce the usage of pesticides and insecticides. Non-gardeners can help by buying organic food.

The negative consequences of land pollution can be greatly reduced with the cooperation of everyone.

The health and well-being of all can be protected by making a continuous effort for a safer environment.

Fig. 12:Soil Erosion

Fig. 13:Foest fire

Fig.14: Effects of Land Pollution on Humans

Application of Concept/ Examples in real life:	**Link to YouTube/ OER/ video:**
The concept is useful in understanding the environmental pollutions and the knowledge shall apply in our day to day life to safeguard the environment.	**https://youtu.be/Xdve8SQhrBc** **Environmental Pollution**

Key Take away from this UO:
Understanding the pollution, its causes, effects and Prevention of land pollution.

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Key words **Water treatment, Aeration, sedimentation, Coagulation, Filtration**	**Learning Objective:** Students will able to understand water treatment process. CO; Apply techniques to reduce environmental pollution.	**Diagram/ Picture** **Fig. 2: Water**
Key Questions: State the need of water treatment. State types of impurities in water. Describe the units of water treatment with their functions .	**Concept Map:** Water Treatment Process Standard For Safe Drinking Water **Fig. 1: Concept map of water treatment**	

| **Solved word Problem:**

Answers of above questions are covered in study material. | .
Water: A Precious Gift by Nature
► Water carries nutrients to all cells in our body and oxygen to our brain.
► Water allows the body to absorb minerals, vitamins etc.
► Water flushes out toxins and waste. Water helps to regulate body temperature.
► Drinking water, also known as potable water. It must be free from all types of impurities.
Types of Impurities in water
1. Suspended Impurities
2. Dissolved Impurities
3. Colloidal Impurities
4. Biological Impurities
Need of water treatment:
► To kill all pathogenic germs, which are harmful to human health.
► To remove the unpleasant and objectionable taste and odors from the water.
► To remove dissolved gases and color of water
► To make water fit for domestic, industrial, and commercial uses.
► To remove all types of impurities present in water.
Water treatment process:
Raw water collection:
► Raw water is collected from different water sources like rainwater, ground water and water from bodies like lakes and rivers.
Screening:
► The removal of any floating objects like leaves, branches, fishes , weeds, etc. from the water.
► It is carried out by Bar Screening or Mechanical | **Key Definitions/ Formulas:**
1. Suspended Impurities- The visible floating impurities.
2. Dissolved Impurities- The soluble salts of Ca and Mg.
3. Colloidal Impurities - The impurities of very fine sizes of silt and clay.
4. Biological Impurities - The invisible disease causing germs / bacteria.

Fig. 3: Flow diagram of water treatment

Fig. 4: Raw water collection

Fig. 5: Screening |

Screening.

Aeration:
► It dissolve oxygen into the water to remove smell and taste.
► It precipitate unwanted metals like iron and manganese.
► It is carried out by Cascade and spray aerator.

Sedimentation:
► Removal of Suspended matters having higher specific gravity than water and also fine suspended matter by keeping water in stand by position for several days.

Coagulation:
► This step removes the colloidal impurities from water.
► It is carried out by addition of a coagulating agent (usually aluminum sulfate and/or iron sulfate) to the raw water to help form a flock.

Flocculation
► Flocculation is the gathering of colloidal particles into a large size particles known as flocks which can be effectively removed by sedimentation or flotation

Filtration
► Theprocess of passing the water through the bed of granular materials is known as filtration.
► Gravity sand filters are used in water purification for treating raw water to produce a potable product.

Water Softening-
► The dissolved impurities of Calcium and Magnesium ate removed by various water softening methods like Lime soda Process, Permutite process, Ion exchange process.
► It makes the water fit for domestic as well as industrial use.

Disinfection:
► It is carried out by treating water either with Chlorine gas or Bleaching Powder or Chloramines called as chlorination.
► Chlorination is carried out to kill algae that would otherwise grow and clog the water filters.
► It also kills the disease causing germs to obtain sterilized water.

Distribution of water:
► Water distribution systems provide an uninterrupted supply of safe drinking water to all consumers.

Standard For Safe Drinking Water:
► The Bureau of Indian Standards (BIS) has specified drinking water quality standards in India to provide safe drinking water to the people

BIS Standards Set for drinking water quality
► This standard has two limits, acceptable limits and permissible limits in the absence of an alternate source.
► If any parameter exceeds the limit, the water is considered unfit for human consumption.

Fig. 6: Aeration

Fig. 7: Sedimentation
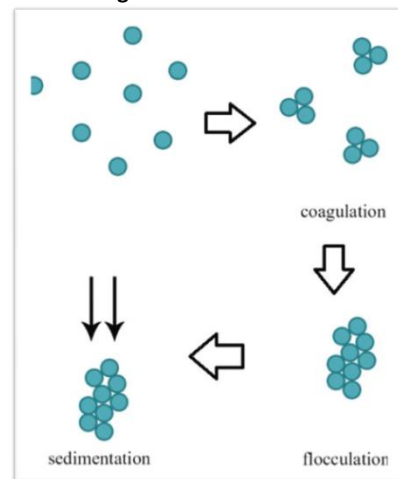
Fig. 8: Coagulation and Flocculation
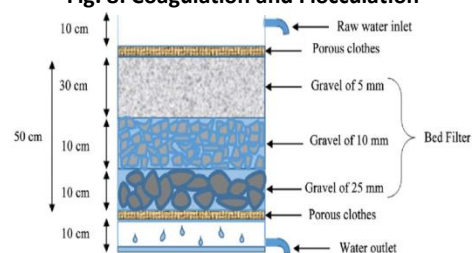
Fig. 9: Filtration
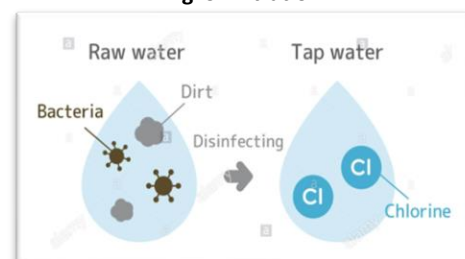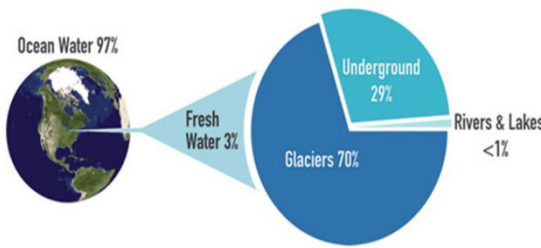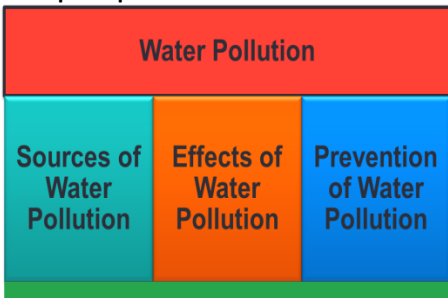
Fig. 10: Disinfection

Test parameter	Acceptable limit	Permissible limit (In the absence of alternate source of water)
pH value	6.5-8.5	No relaxation
Turbidity	1	5
Total hardness as CaCo3, mg/l, Max	200	600
E.coli presence/absence	Shall not be detectable in any 100ml sample	Shall not be detectable in any 100ml sample
Total iron as Fe, mg/l, Max	0.3	No relaxation
Taste	Agreeable	Agreeable
Odour	Agreeable	Agreeable

Fig. 10: Treated water Distribution

Application of Concept/ Examples in real life: The concept is useful in understanding the process of water treatment.	**Link to YouTube/ OER/ video:** **https://youtu.be/6u9L0nVUYPY** **Water treatment**

Key Take away from this UO:
Understanding the processes of water treatment..

MSBTEs Study Material

<Program Code: **CE**>: <Course Code:**22447**>: <Course Name: **Environmental Studies**>: <Unit-IV:ENVIRONMENTAL POLLUTION>: <UO: 4e>: <Study Material>		
< Swati Ingale>	<26 July 2020>	<Dr. D. K. Parbat>

Key words Pollution	**Learning Objective:** UO 4e: State the needs of water conservation.	**Diagram/ Picture**

Water is a vital natural resource which forms the basis of all life.
Earth is known as the "Blue Planet" because 71 % of the Earth's surface is covered with water.
About 97% of the earth's water is strong saline.
The rest 3% is freshwater.

Key Questions:

What is Pollution?
What is water Pollution?
What are the effects of water Pollution?
Why conservation of water is necessary?

Concept Map:

Explanation of Concept:

Water Pollution
Water pollution occurs when harmful substance like chemicals or microorganisms contaminates a stream, river, lake, ocean, or water bodies, degrading water quality and rendering toxic effects to humans or the environment.

Sources of Water Pollution
Domestic waste :-
  ► Residential **waste** containing disposable materials generated by households containing waste food, detergent, soap water, flushes from sink, bathrooms. As it contains pathogens, disease producing microbes it is very harmful.

  ► **Industrial waste:-**
  ► Industrial waste is the waste produced by industrial activity which includes any material that is rendered useless during a manufacturing process. This waste contains toxic chemicals and pollutants.

Key Definitions/ Formulas:

Sources Of Water
  ► **Surface water:** Water on the surface of the planet such as in a river, lake, wetland, or ocean.
  ► **Ground water**: Water present beneath Earth's surface in soil pore spaces and in the fractures of rocks
Eg. Open well, tube well bore well etc

Sources of Water Pollution
  ► Domestic waste :-
  ► Industrial waste:-
  ► Accidental Oil leakage:-
  ► Marine dumping:-
  ► RADIOACTIVE WASTE

► **Accidental Oil leakage:-**
► Oil spill from ships in sea causes adverse effects on local marine wildlife such as fish, birds because oil do not get dissolve with water.

► **Marine dumping:-**
► Garbage such as plastic, paper, aluminum, food, glass, or rubber are deposited into the sea. These items take weeks to hundreds of years to decompose, and thus they are a major cause for water pollution.

► **AGRICULTURE**
► Agriculture has an impact on water pollution. The chemicals such as fertilizers, pesticides, fungicides, herbicides or insecticides used in farming run off with water and pollute nearby water bodies.

► **RADIOACTIVE WASTE**
► Waste generated by power plants and uranium mining can pollute the water and environment for thousands of years

Solved word Problem:

Answers of above questions are covered in study material.

Effects of Water Pollution
► **On The Environment**
► Water pollution truly harms biodiversity and aquatic ecosystems.
► Thermal pollution, defined by a rise in the temperature of water bodies, contributes to global warming
► The main problem caused by water pollution is that it kills fish, crabs, birds, sea gulls, dolphins, and many other animals that depends on these water bodies.

Effects of Water Pollution
► **On Human Health**
► Water pollution has very negative effects on public health.
► A lot of diseases result from drinking or being in contact with contaminated water, such as diarrhea, cholera, typhoid, dysentery or skin infections.
► In zones where there is no availability of drinking water is subjected to the high risk of dehydration.

Prevention of Water Pollution
. Wastewater treatment
► Wastewater treatment consists of removing pollutants from wastewater through a physical,

3. Air pollution prevention

► **It has a direct impact on water** contamination as human induced CO2 emissions are absorbed by oceans. This pollution causes a rapid acidification of our oceans, and threatens marine life and corals.

4. Plastic waste reduction

► 80% of plastic in our oceans is from land sources. In order to reduce the amount of plastic entering our ocean, we need to reduce our use of plastic globally and to improve plastic waste management.

Water Conservation

chemical or biological process.

2. Green agriculture

► Globally, agriculture depends on water resources, so it is essential to have climate-friendly crops, efficient irrigation that reduces the need for water and energy-efficient food production.

Water Conservation

Rapid population growth and increasing water consumption for agriculture, industry and domestic purposes have strained the world's fresh water resources. Hence, there is immediate need of Water conservation.

1. Domestic conservation

► Verify taps at your home is leak free.
► Use waste water in flush.
► Keep overflow valve in the overhead tank.
► Use sprinkle irrigation in your garden.

2. Industrial conservation

► Install waste water treatment plant in the factory.
► Reuse cooling water for gardening or irrigation.
► Develop new techniques which require less water.

3. Agricultural conservation

► Improved methods of irrigation like drip irrigation and sprinkler irrigation must be used.
► Reducing losses from canals.
► By constructing structures like: check dames,khettalawadi, pala, gully plugging etc

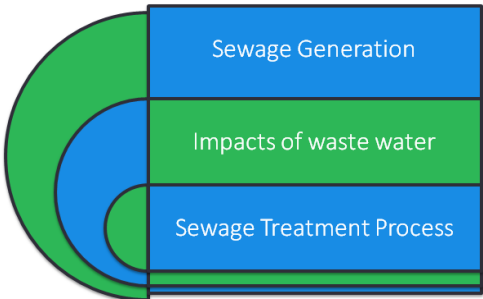| **Application of Concept/ Examples in real life:** students should understand about environmental pollution. The concept is important for lifelong learning.	**https://youtu.be/Xdve8SQhrBc** **Environmental Pollution**

Key Take away from this UO:

- **Students will able to understand sources and effects of environmental pollution.**
- **Students will know water treatment process**

Study Material : UO 4f and 4g

<Program Code: **CE**>: <Course Code:**22447**>: <Course Name: **Environmental Studies**>: <Unit-4: **Environmental pollution**>: <Sub topic **4.4: Waste water** >: <**UO: 4f and 4g**>: <**Study Material**>		
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Key words **Wastewater, Impacts, Sewage treatment.**	**Learning Objective:** Students will able to understand Sewage Treatment Process CO; Apply techniques to reduce environmental pollution.	**Diagram/ Picture** **Fig. 2: Wastewater (Sewage)**
Key Questions: State Define sewage. Types of sewage, Impacts of sewage. Describe various process of sewage treatment.	**Concept Map:** **Fig. 1: Concept map of water treatment**	
Solved word Problem: Answers of above questions are covered in study material.	Water bodies can be polluted by a wide variety of substances, including pathogenic microorganisms, organic waste, toxic chemicals, sediments, heat, petroleum (oil). Such polluted water is called as waste water or sewage. **Types of Sewage:** 1. Domestic sewage 2. Industrial sewage **Domestic sewage** ► It carries used water from houses and apartments; it is also called sanitary sewage. ► It is the primary source of pathogens (disease causing microorganisms) ► A lot of diseases result from being in contact with sewage water, such as diarrhea, cholera, typhoid, dysentery or skin infections. ► Domestic sewage contains excess of nitrates and phosphates which promote the growth of algae. **Industrial sewage** ► It is used water from manufacturing or chemical processes ► Industrial waste include dirt and gravel, masonry and concrete, scrap metal, oil, solvents, chemicals, scrap lumber, even vegetable matter from restaurants ► The biomedical waste and e waste when enters in waste water its effects becomes more prominent. **Impacts of waste water** **Impacts of waste water on the environment** ➢ The most immediate effect of wastewater on the environment is destruction of natural habitats of aquatic wildlife like fishes, crabs,	 **Domestic sewage** **Industrial sewage**

birds, tortoise etc. due to exposure to harmful chemicals.

Impacts of waste water on Human Health
► Pathogens in waste water spreads water-borne diseases like Typhoid, Cholera, Paratyphoid **Fever**, Dysentery, **Jaundice**, Amoebioasis and Malaria.
► Chemicals in the water also have negative effects on our health. Pesticides can damage the nervous system and cause **cancer**

Sewage Treatment Process
► Sewage treatment is the process of removing pollutants from both domestic and industrial waste water.
► The objective of sewage treatment is to produce a safe disposable effluent without polluting the surrounding environment.

Steps in Sewage Treatment
1. Primary Treatment
2. Secondary Treatment
3. Tertiary Treatment

Primary Treatment
Primary treatment removes materials that can be easily collected from the raw sewage
1. Suspended debris removal by Bar Screening
► The influent sewage water passes through a bar screen to remove all large objects lik cans, sticks, plastic packets etc. carried in the sewage stream.
2. Grit Removal in sand and grit channel
► The velocity of the incoming sewage is adjusted to allow the settlement of sand, grit, stones and broken glass
3. Sludge removal by Primary Clarification in sedimentation tank
► The effluent is kept undisturbed Primary sedimentation tank. The settled and floating materials are removed and the remaining liquid may be discharged or subjected to secondary treatment.

Secondary Treatment

► Secondary treatment removes dissolved and suspended biological matter.
► Secondary treatment is typically performed by a membrane bioreactor with water-borne micro-organisms in a managed habitat.
► This Biological films of bacteria, protozoa and fungi form on the membrane eat or reduce the harmful organic content from waste water.

Tertiary Treatment
► The purpose of tertiary treatment is to raise the effluent quality before it is discharged to the water bodies.
1. Filtration
► Sand filtration removes much of the residual suspended matter. Filtration over activated carbon, also called carbon adsorption, removes residual toxins.
2. Sludge removal by secondary Clarification in

Impacts on Environment

Impacts on Human Health
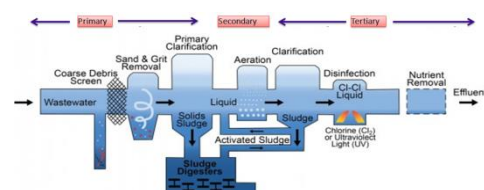
Flow chart of Sewage Treatment Process
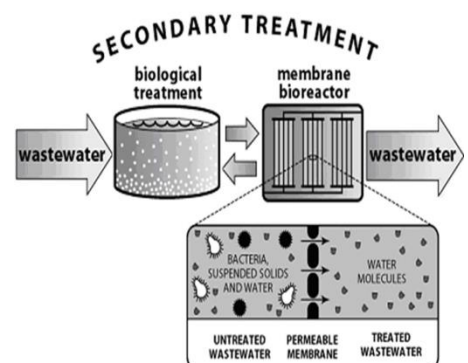
Secondary Treatment
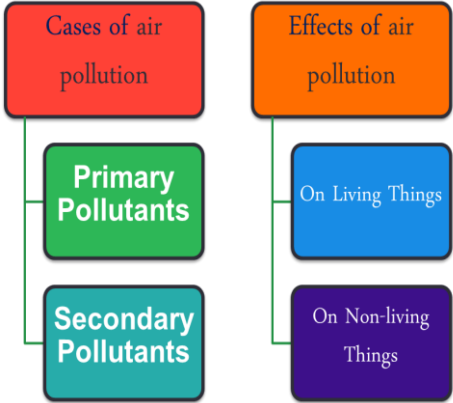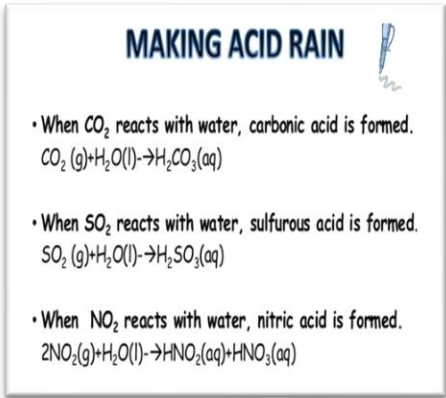
Disinfection

CPCB Norms of sewage discharge

SR. No.	Parameters	Parameters Limit
1	pH	6.5-9.0
2	Biochemical Oxygen Demand (3 days at 27 degree Celsius) (mg/lit)	Not more than 10
3	Chemical Oxygen Demand (mg/lit)	Not more than 50
4	Total Suspended Solids (mg/lit)	Not more than 20
5	Ammonical-Nitrogen(mg/lit)	Not more than 5
6	Total Nitrogen(mg/lit)	Not more than 10
7	Fecal Coliform (MPN/100 ml)	Less than 100

sedimentation tank ► Liquid sludge is separated and subjected for further treatment to make it suitable for final disposal . Typically, sludge's are thickened (dewatered) to reduce the volumes for disposal. 3. **Chlorination** ► —Chlorination is a water treatment that destroys disease-causing bacteria, parasites and other organisms. Chlorination also oxidizes iron, manganese and hydrogen sulfide so they can be filtered out. 4. **Chlorination** ► —Chlorination is a water treatment that destroys disease-causing bacteria, parasites and other organisms. Chlorination also oxidizes iron, manganese and hydrogen sulfide so they can be filtered out. 5. **Removal of plant nutrients** ► The phosphates and Nitrates promote the growth of algae and the eutrophication of lakes, can be removed by chemical precipitation. A method called nitrification-denitrification can be used to remove the nitrates.	

	Application of Concept/ Examples in real life: The concept is useful in understanding the concepts of impacts of sewage and process of Sewage treatment.	**Link to YouTube/ OER/ video:** **https://youtu.be/OrD892RVsZo** Waste water treatment

Key Take away from this UO:
Understanding the processes of sewage treatment.

MSBTEs Study Material

<Program Code:**CE**>: <Course Code:**22447**>: <Course Name: **Environmental Studies**>: <Unit-IV:**ENVIRONMENTAL POLLUTION**>: <**UO: 4h**>: <**Study Material**>		
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Key words **Pollution** **Primary Pollutants** **Secondary Pollutants**	**Learning Objective:** **UO 4h: State sources and effects of air pollution.**	**Diagram/ Picture**
Key Questions: What is Pollution? What is Air Pollution? What are the effects of Air Pollution? Describe the methods to reduce air pollution.	**Concept Map:** Cases of air pollution Effects of air pollution **Primary Pollutants** **Secondary Pollutants** On Living Things On Non-living Things	

Explanation of Concept:

Primary Pollutants (Released directly in air)
Natural Sources
- **Pollens**
- **Volcanoes**
- **Dust**
- **Bacteria & Viruses**
- **Fire**

Primary Pollutants (Released directly in air)
Man made Sources
- **Combustion Processes**
- **Chemical Processes**
- **Nuclear or Atomic Processes**
- **Mining Processes**
- **Oil Refinery Processes**
- **Farming Activities**

Secondary Pollutants
2) Photochemical Smog:
The primary pollutants like NO and Hydrocarbons released from automobiles or on burning fossil fuels reacts with each other in presence of Sunlight and ozone Forming a toxic brown haze called as photochemical smog.

Among the photochemical products the most potent pollutants are:
1. Benzpyrene
2. peroxyacetyl nitrate **(PAN)**
3. peroxybenzoil nitrate (**PB2N**)mos

Key Definitions/ Formulas:

Air Pollution
Definition:
Presence or addition of harmful substances to the air which causes negative impacts to the health of living organisms is called as Air Pollution
Causes of Air Pollution:
The harmful substances which causes Air Pollution are called as Air Pollutants.
Types of Air Pollutants:
1. Primary Pollutants (Released directly in air)
Ex: ash, salts, pollen, spores, smoke, dust etc
2. Secondary Pollutants (Formed by chemical reaction between air and primary pollutants)
Ex: smog, acid rain, ozone etc

1) Acid Rain: The primary pollutants released from chemical industries like CO_2, SO_2, NO_2, Cl_2 reacts with atmospheric moisture to form acids resulting in acid rain.

MAKING ACID RAIN

- When CO_2 reacts with water, carbonic acid is formed. $CO_2 (g) + H_2O(l) \rightarrow H_2CO_3(aq)$

- When SO_2 reacts with water, sulfurous acid is formed. $SO_2 (g) + H_2O(l) \rightarrow H_2SO_3(aq)$

- When NO_2 reacts with water, nitric acid is formed. $2NO_2(g) + H_2O(l) \rightarrow HNO_2(aq) + HNO_3(aq)$

Effects of air pollution

- Air pollution occurs when harmful or excessive quantities of substances are introduced into Earth's atmosphere
- Air pollution not only causes hazardous health effects on in humans, plants and animals but also contributes to climate change.

Effects of Air Pollution on living things

- **On Human Health**
- ► Our physical and psychological wellbeing is affected differently by the kind of air pollution we are exposed to. There are many organs and bodily functions that can be harmed, the consequences including:
- ► Respiratory diseases
- ► Cardiovascular damage
- ► Fatigue, headaches and anxiety
- ► Irritation of the eyes, nose and throat
- ► Damage to reproductive organs
- ► Harm to the liver, spleen and blood
- ► Nervous system damage.

Effects of Air Pollution on living things

- **On Vegetation**
- ► **Air pollution have negative effect on** the plants; they can have direct toxic effects, or indirectly by changing soil pH
- ► They cover the leaf blade reducing light penetration which strongly influences the process of photosynthesis
- ► Effects of some specific pollutants are:

2. Abscission: The premature fall of leaves de to rise in NO2

Effects of Air Pollution on living things

- **On Animals**
- ► Air pollutants can poison wildlife through the disruption of endocrine function, organ injury, increased vulnerability to stresses and diseases, lower reproductive success, and possible death.
- ► When pet animals are fed with fodder having remains of insecticides and pesticides it will severely affects their digestive system.

Effects of Air Pollution on non-living things

- ► **On Materials**
- ► The main pollutants affecting materials are sulphur dioxide and sulphates,
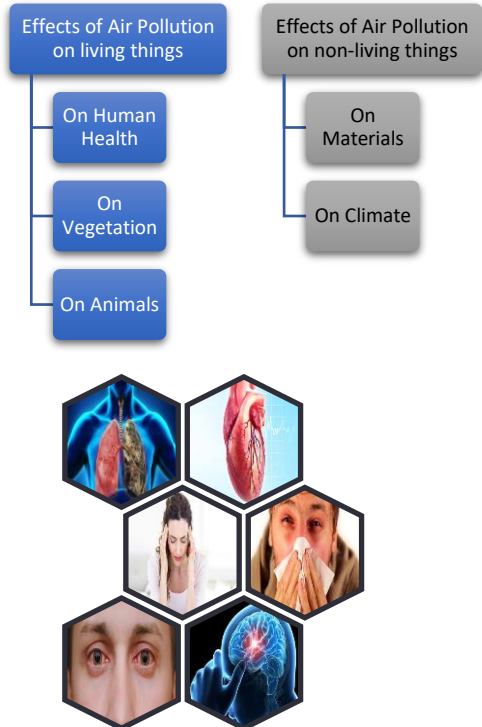
1. **Necrosis:** The damaging of leaves due to rise in Ozone

3.**Chlorisis: Yellowing of leaves due to rise in SO2**
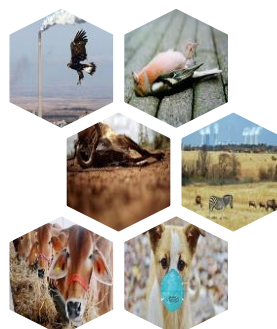
nitrogen oxides and nitrates, chlorides, carbon dioxide and ozone
► The materials most sensitive to air pollutants are calcareous building stones and metallic structures.
► The damage include losses of mass, changes in porosity, discoloration, corrosion of metallic structures.

- **On Climate**
► Air pollutants have a complex relationship with climate change.
► Some pollutants such as Carbon dioxide increase warming by trapping heat in the atmosphere casing Global warming due to green house effect.
➢ The release of CFC gases damages the protective Ozone layer allowing Harmful UV radiations to reach to earths surface. It is called as Ozone depletion.
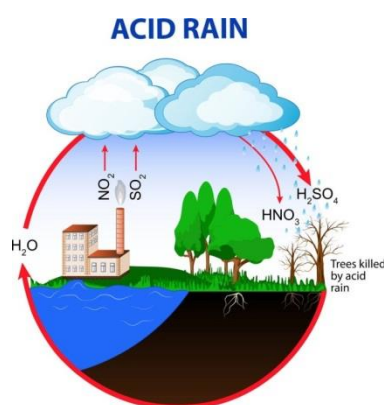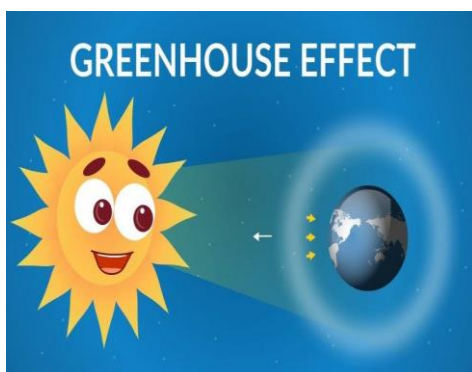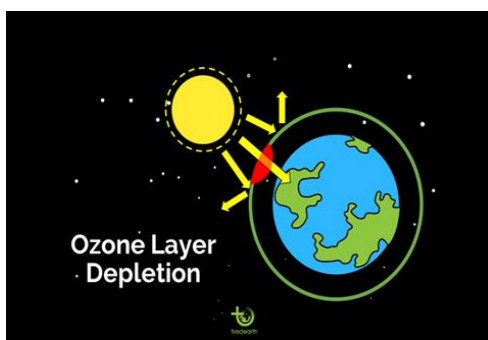
Application of Concept/ Examples in real life: Student should understand about air pollution, its causes and effects.	**Link to YouTube/ OER/ video:** **https://youtu.be/W_jvqlFnQeQ** Air poolution

Key Take away from this UO:
Students will able to understand causes and effects of Air pollution.

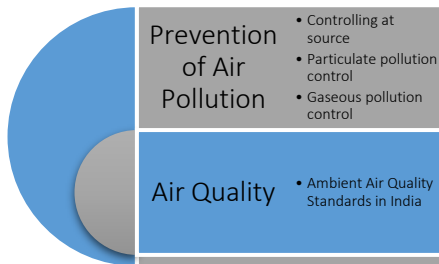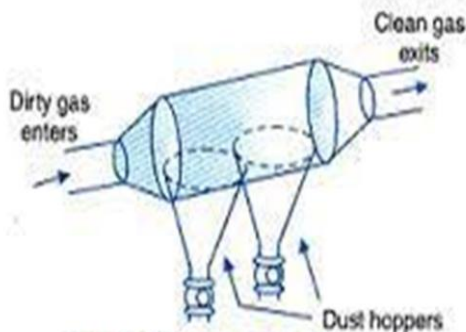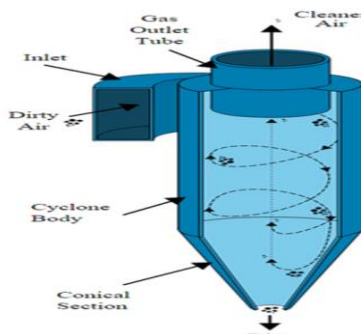| <Program Code: **CE**>: <Course Code:**22447**>: <Course Name: **Environmental Studies**>: <Unit-IV:**ENVIRONMENTAL POLLUTION**>: <UO: 4i and 4o>: <Study Material>		
<Dr.B. R Ambade, Swati Ingaleand Dr.Raman>	**<26 July 2020>**	**<Dr. D. K. Parbat>**
Key words **Pollution** **Particulate pollution control** **Gaseous pollution control**	**Learning Objective:** UO 4i: Describe various methods to prevent air pollution. UO 4o: State the standards limiting/controlling values of various types of pollution	**Diagram/ Picture** **Prevention of Air Pollution** Since the Industrial Revolution, people have been polluting the Earth like never before. There is rarely a place today that has not been subjected to pollutants in one form or another. The key to have a healthier life is to adopt measures that do not pollute air so much because we all have a role to play when it comes to creating healthy environment for living. How to Control Air Pollution??? 1. Controlling at source 2. Particulate pollution control 3. Gaseous pollution control
Key Questions: What is Pollution? What is Air Pollution? State the particulate matters. What are the control measures of Air Pollution?	**Concept Map:** Prevention of Air Pollution • Controlling at source • Particulate pollution control • Gaseous pollution control Air Quality • Ambient Air Quality Standards in India	
	Explanation of Concept: 1. Controlling at source • Source relocation: Keeping the Industrial area away from residential area. • Source shut down: Pollutant Casing hazardous effect should be immediately banned • Fuel or Energy substitution: Using environment friendly fuels like CNG, Biofuels, Biogas etc • Good operating practices: Good Maintenance, Controlled Driving speed can reduce the pollutant emission • Vehicular emission control: Regular PUC checking, Good quality fuel with oil additives can control Vehicular emission **2. Particulate pollution control** **Settling chambers** • A simplest device, collecting dust of size >10µm. • Settling chambers use the force of gravity to remove solid particles. The gas stream enters a chamber where the velocity of the gas is reduced. Large particles drop out of the gas and are recollected in hoppers. **Inertial separator or Cyclone** • This process is achieved by a sudden change in the direction of gas flow. • The dust particle is spinning in a circular path, As a result the particles collide on the wall and fall to the bottom of the vessel. **Electrostatic precipitator**	**Key Definitions/ Formulas:** **Particulate pollution control** ► Particulate matter is the sum of all solid and liquid particles suspended in air, many of which are hazardous. This complex mixture contains for instance dust, pollen, soot, smoke, and liquid droplets. ► There Five major groups of processes. ► Settling chambers ► Inertial separator or Cyclone ► Electrostatic precipitator ► Bag houses and filters ► Wet scrubbers Fig. 5.3. Gravity settling chamber

- Passing the particle laden gases between high voltage discharge electrodes.
- Majority of particles get charged and collected on ground electrodes.
- At intervals electrodes are rapped to dislodge collected particles from the electrodes, which then fall into hoppers at the bottom of the precipitator.

Bag houses filters
- This method is most often used type of device

The Fabric filters, or bag houses , remove dust from a gas stream by passing the stream through a porous fabric

Wet scrubbers
- Objective of scrubber is to trap the particulate matter in liquid droplets.
- Water subsequently flows from the bottom of the scrubber, the particulate is allowed to settle and clarified water is re- circulated

3. Gaseous pollution control
► Gaseous pollutants are controlled by means of three basic techniques:
- Absorption: concentrate the pollutants in a liquid
- Adsorption: concentrate the pollutants in on solid
- Combustion: direct incineration of pollutants
► These techniques can be employed singly or in combination.
► They are effective against the major greenhouse gases as well.

Adsorption
► Adsorption is a process where gases,vapours or liquids are concentrated on a solid surface
► The most important adsorbents in industrial use to-days are Bauxite, activated carbon, activated alumina, silica gel
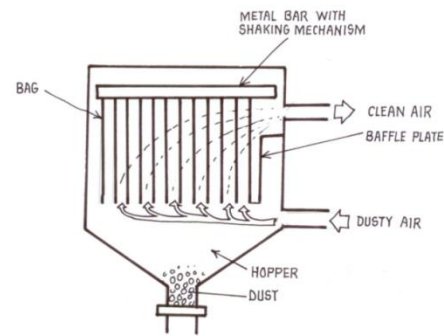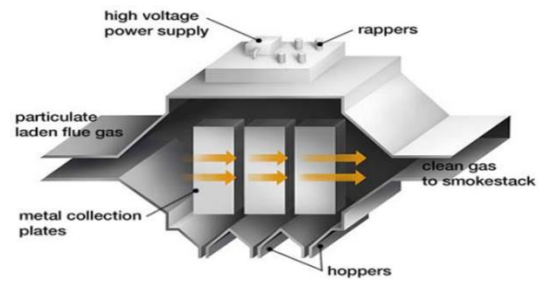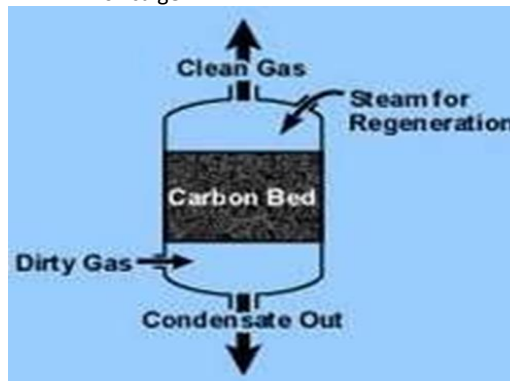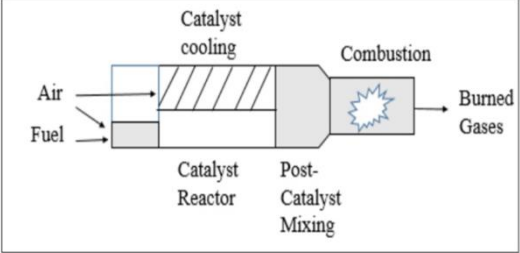
WET SCRUBBER
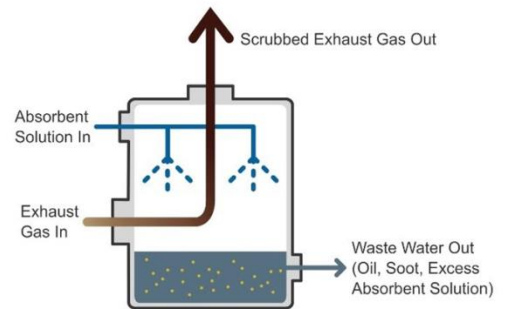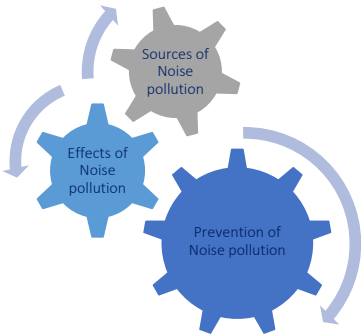
Absorption
This processes is selected to remove gaseous pollutants by dissolution into a liquid solvent such as water

Solved word Problem: Answers of above questions are covered in study material.	**Combustion** • **This method for the removal of Volatile Organic Compounds (VOC) since they can be decompose to CO_2 and H_2O.** • To provide technical assistance and guidance to the State Pollution Control Board. • To carry out and sponsor investigations and research related to prevention, control and abatement of air pollution. • To collect, compile and publish technical and statistical data related to air pollution; and • To lay down and annul standards for the quality of air	 **Ambient Air Quality Standards** ► The Air (Prevention and Control of Pollution) Act 1981 was enacted by the Central Government with the objective of arresting the deterioration of air quality. ► It describes the main functions of the Central Pollution Control Board (CPCB) as follows: • To advise the Central Government on any matter concerning the improvement of the quality the air and the prevention, control and abatement of air pollution. • To plan and cause to be executed a nation-wide program for the prevention, control and abatement of air pollution.
	Application of Concept/ Examples in real life: **Students should know the impacts of air pollution. Air quality standards. Methods to prevent air pollution.**	**Link to YouTube/ OER/ video:** *** Source: National Ambient Air Quality Standards, Central Pollution Control Board Notification in the Gazette of India, Extraordinary, New Delhi, 18th November, 2009** **http://www.arthapedia.in/index.php?title=Ambient_Air _Quality_Standards_in_India#:~:text=National%20Ambie nt%20Air%20Quality%20Standards,of%20Pollution)%20A ct%2C%201981**
Key Take away from this UO: Students will able to understand the methods for Preventing Air Pollution		

<Program Code: **CE**>: <Course Code:**22447**>: <Course Name: **Environmental Studies**>: <**Unit-IV: ENVIRONMENTAL POLLUTION**>: <**UO: 4j and 4k**>: <Study Material>		
< Swati Ingale>	Coordinator: Dr. B R Ambade: <**26 July 2020**>	<**Dr. D. K. Parbat**>

Key words **Noise Pollution** **Industrial noise.** **Man made noise.**	**Learning Objective:** UO 4j:State sources and effects of noise pollution. UO 4k: Describe preventive measures for noise pollution.	Diagram/ Picture
Key Questions: What is Pollution? What is noise Pollution? What are the effects of noise Pollution? What are the control measures to noise pollution?	**Concept Map:** 	

Explanation of Concept:

Noise Pollution
- ► When there is lot of noise in the environment, then it is termed as noise pollution.
- ► It is unwanted or excessive sound that can have deleterious effects on human health and environmental quality.
- ► **Sources of Noise pollution**
- ► Household or Domestic sources.
- ► Social and Cultural Events.
- ► Commercial & Industrial Activities.
- ► Transportation.
- ► Agricultural Activities
- ► Defense Activities
- ► Mining Activities
- ► Natural Sources

Household or Domestic sources
- ► Gadgets like food mixer, grinder, vacuum cleaner, washing machine and dryer, cooler, air conditioners
- ► Others include loud speakers of sound systems and TVs, iPods and ear phones.

Social and Cultural Events
- ► Places of worship, discos, parties, marriage functions and other social events also create a lot of noise for the people living in that area.
- ► In many market areas, people sell with loud speakers, others shout out offers and try to get attention of customers

Commercial & Industrial Activities.
- ► Printing presses, manufacturing industries,
- ► Textiles and steel rolling industries

Key Definitions/ Formulas:

What is Noise ?

Noise is unwanted sound considered unpleasant, loud or disruptive to hearing.
Normal sound becomes undesirable when it disturbs our normal activities such as working , sleeping and during conversation.
World Health Organization stated that "Noise must be recognized as a major threat to human well-being".
Types of Noise:-
Atmospheric noise.
Industrial noise.
Man made noise

Transportation.
► Aero planes flying over houses close to bisy airports.
► Over ground and Under ground trains, vehicles on roads

Agricultural Activities
Noise created by Tractors, Threshers etc.

Mining Activities
Noise created by Blasting in mines Metallurgical processes etc

Defense Activities
Noise created by Tanks, Gunfire, Airplanes, Bombs, Army Exercise, Satellite and missile launching etc

Natural Sources
Noise created by Landslides, Earthquake, Thunder and lightening, storms etc

Solved word Problem:

Answers of above questions are covered in study material.

Effects of Noise pollution
► Noise pollution is more than just an annoyance; it can also lead to adverse health effects.
► In fact, studies have shown that noise pollution may leads to temporary or even permanent damage to :
1. Physiological health
2. Psychological health

Effects of Noise pollution
In Animals:
► Noise pollution damages the nervous system of animal. Animal looses the control of it's mind
► Excessive noise has the ability to raise an animal's heartbeat speed and even harms an animal's metabolism.

Measurement of Intensity of Noise
► The unit of measurement of sound is called as decibel (dB).
► The range of this scale between 1dB and 140 dB
► When it is less then 1dB we can not hear it

Effects On Physiological health
• Temporary or Permanent Deafness
• Pain in Heart
• Loss of Memory
• Headache
• Rise in blood pressure
• Reduction in the Vision

Effects on Psychological health
► Fatigue

and when it is more then 140 dB we cannot stand to it.
► Not all sound is considered noise pollution.
► The World Health Organization (WHO) defines noise above 65 decibels (dB) as noise pollution.
► To be precise, noise becomes harmful when it exceeds 75 decibels (dB) and is painful above 120 dB

HORN NOT OK PLEASE
Representative Image Only

NO HORN SILENT ZONE

Standard limiting noise levels at various zones of city
► Central Pollution Control Board (CPCB) has laid down the permissible noise level in India for different areas.

Zone	Permissible noise level standards in the daytime (dB)	Permissible standards at
Industrial Zone	75	70
Commercial Zone	65	55
Residential Zone	55	45
Silent Zone	50	40

► Emotional Disturbance
► Frustration
► Depression

Effects of Noise pollution
In Plants:
Noise also has detrimental effects on the growth of some plants.
Noise pollution causes poor quality of crops

► The whispering sound level is up to 30 dB
► Our normal talk has the sound intensity of about 40 dB
► Shouting may reach the level above 60 dB
► A traffic busy road with high speed vehicles have sound level up to 70 db.
► The industrial units using big auto machines creates the sound above 90 dB
► The natural sources of noise like thunder storms with lightening cases the noise level up to 120 dB
► Near the airport the noise pollution level is above 150 dB
► The rocket engines creates the noise pollution above 190 Db

Prevention of Noise pollution
► Do not use car horns unnecessarily in areas like hospitals, educational campuses
► Proper and regular maintenance should be carried out for noise free better performance of Motors, machines and vehicles.
► Turn off the engine of your car or motorbike when you are not using it. It stops the annoying hum, and reduces air pollution also!
► The workers exposed to loud noises must wear earplugs, ear muffs, Noise helmets to prevent loss of hearing.
► Don 't blast music on the radio or computer or speakers and Train your dog not to bark so much.
► Protective Green Belt should be developed to separate residential area and industrial area
► The areas like Hospitals, Schools, Courts must be declared as Silence Zones
► Laws regarding Noise pollution must be strictly followed.
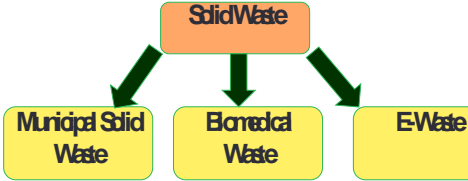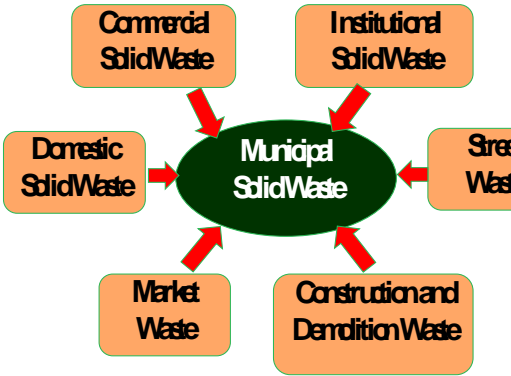
	Application of Concept/ Examples in real life: Lifelong learning to understand the concept of noise pollution.	https://m.economictimes.com/small-biz/productline/power-generation/generator-noise-level-regulations-permissible-limits-and-different-types-of-gensets/articleshow/69094804.cms

Key Take away from this UO:
Students will able to understand causes and effects of Air pollution

<Sub topic **4.7: Solid waste**>: <**UO: 4l, 4m and 4n**>: <**Study Material**>		
< **Dr. B. R. Ambade, Ms. Swati Ingale**, **and Dr. N S Raman**>	<Coordinator: **Dr. B. R. Ambade**>**18 July 2020**	<Mentor: **Dr. D.K.Parbat**>
Key words **Solidwaste, Biomedicalwaste, E-waste, Environmental pollution**	**Learning Objective:** Apply techniques to reduce environmental pollution.	**Diagram/ Picture** **Fig. 2: Solid waste**
Key Questions: State characteristics of solid waste. State the impacts of solid waste. Describe sanitary landfilling, incineration and RDF.	**Concept Map:** **Fig. 1: Types of Solid waste**	

Solved word Problem:

Answers of above questions are covered in study material.

Explanation of Concept:

Solid Waste – The waste which is *solid* in nature and *discarded* by *community* because of it has *no value* and of *no use* is called as solid wast**e.**

Examples- paper, Plastic, Glass, Metal, Rubber, Food waste, Vegetable waste, Cardboard, Leaves, Street waste, Biomedical waste, E-waste, Agriculture waste, Industrial waste, Construction and demolition waste etc.

Municipal Solid Waste (MSW)– The solid waste which is generated within the Municipal limits of the city or town is called as MSW.

Sources of MSW:
- Domestic sources- Paper, Plastic, glass, metal, food and vegetable waste, house swept etc.
- Commercial sources –Paper, Plastic, cardboards etc.
- Institutional sources- Paper, Plastic, cardboards etc.
- Street waste – Leaves, soil, ash, sand etc.
- Market waste – Vegetable and fruit waste, Paper, Plastic etc.
- Construction and demolition waste – sand, broken bricks, waste concrete, old reinforcements etc

Generation of MSW:

Per capita generation of waste varies from 200 gm to 600 gm per capita / day. Average generation rate at 0.4 kg per capita per day.

As per Ministry of Housing and Urban Affairs Annual Report for the year 2016-17, it is estimated that the total generation of solid waste is approximately 1,50,000 T/day. Out of the total, approximately 90% (1,35000 T/day) is collected. Out of the collected waste, 20% (27,000 T/day) is processed and the remaining 80% (10,8000T/day) is going to the dump sites.

Impacts of MSW

Key Definitions/ Formulas:

Fig. 3: Sources and types of MSW

Physical Characteristics of MSW:
* Density   * Moisture Content
* Size Distribution   * Field Capacity
* Permeability   * Porosity

Physical Compositions of MSW:
* Paper   * Plastic
* Glass   * Metal
* Cloth   * Rubber/leather
* Biodegradables (Food, vegetables, fruits waste, leaves)   * Non-biodegradables /Inert (Ash, soil, sand, construction wastes)

Chemical Characteristics of MSW:
* pH   * Carbon   * Nitrogen
* Potassium   * Phosphorous   * C/N Ratio
* Calorific value

Table 1:Physical Compositions of MSW

A) On Public Health -
• Chemical poisoning through chemical inhalation,
• Uncollected waste can obstruct the storm water runoff resulting in flood,
• Low birth weight,
• Cancer,
• Congenital malformations, Respiratory diseases,
• Neurological diseases,
• Nausea and vomiting,
• Mercury toxicity from eating fish with high levels of mercury,
• Plastic found in oceans ingested by birds,
• Resulted in high algal population in rivers and sea,
• Epidemics through stray animals, etc.

B) On Environment –
• Soil pollution due to dumping of MSW on soil,
• Air pollution due to methane (GHG) emission (Global Warming and climate change),
• Water pollution due to leachate generation and its contamination into water bodies,
  • Fires within the waste dumps,
  • Bird menace above dump site affects aircrafts,
  • Create nuisance, etc.

Methods of MSW management:
• Sanitary landfilling,
• Incineration,
• Refuse Derived Fuel (RDF).

a) Sanitary Landfilling: sanitary landfills refer to an engineered facility for the disposal of MSW designed and operated to minimize public health hazards and environmental impacts.

Components of Sanitary Ladfilling: Liner, Leachate Management System, Landfill Gas Management facility, Ground water monitoring wells, Final cover at top.

b) Incineration: Incineration is a process of complete combustion of solid waste under controlled environment.
➤ Incinerators are designed to operate at high temperature @ more than 850⁰ C.
➤ It reduce the volume of waste from 80 to 95 %.
➤ It leads to energy recovery and complete destruction of toxic wastes.
➤ The by-products are Ash, Heat and Gases.
➤ Ash is used as filler material or manufacturing of bricks; Heat is used to generate energy.

Refuse Derived Fuel (RDF):
► The combustible fraction of MSW is shredded into smaller, more uniform size particles for burning this is called as RDF.
► The RDF thus produced may be burned in boilers on-site, or it may be shipped to offsite boilers for energy conversion.
► If the RDF is used off-site, it is usually

Parameter	Low income countries (≤360 $)	Middle income countries (360 – 3500 $)	High income countries (≥3500 $)
Metal (%)	0.2 – 2.5	1 – 5	3 - 13
Glass, ceramics (%)	0.5 – 3.5	1 – 10	4 - 10
Food and garden waste (%)	40 - 65	20 – 60	20 - 50
Paper (%)	1 – 10	15 – 40	15 - 40
Textile (%)	1 – 5	2 – 10	2 - 10
Plastic / rubber (%)	1 – 5	2 – 6	2 - 10
Misc. Combustible (%)	1 – 8	--	--
Inert (%)	20 – 50	1 – 30	1 - 20
Density (kg/cum)	250 – 500	170 – 330	100 - 170
Moisture content (%)	40 – 80	40 – 60	20 - 30
Waste generation (kg/c/d)	0.4 – 0.6	0.5 – 0.9	0.7 – 1.8

Source: CPHEEO, 2000

Table 1:Chemical characteristics of MSW

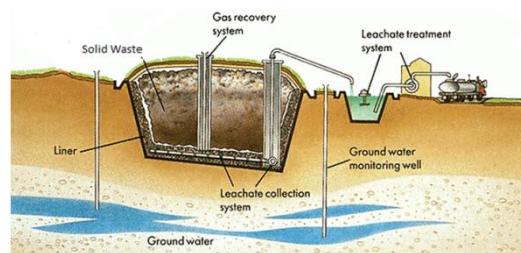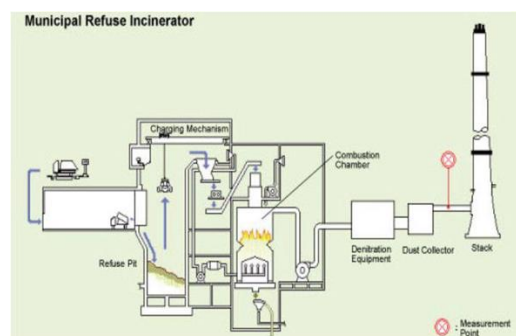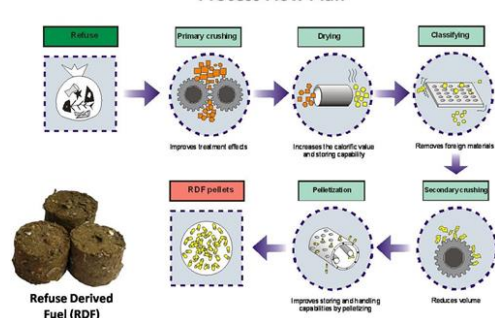| Population Range (Million)	Nitrogen (%)	Phosphorous (%)	Potassium (%)	C / N ratio	Calorific value (Kcal/kg)
0.1 to 0.5	0.71	0.63	0.83	30.94	1009.89
0.5 to 1	0.66	0.56	0.69	21.13	900.61
1 to 2	0.64	0.82	0.72	23.68	980.05
2 to 5	0.56	0.69	0.78	22.45	907.18
5 & above	0.56	0.52	0.52	30.11	800.70

Fig. 4: Sanitary Landfilling

Fig. 5: Municipal Incinerator

Refuse Derived Fuel (RDF) Process Flow Plan

densified into pellets through the process of pelletization.

► The calorific value of RDF pellets can be around 4000 Kcal / Kg.

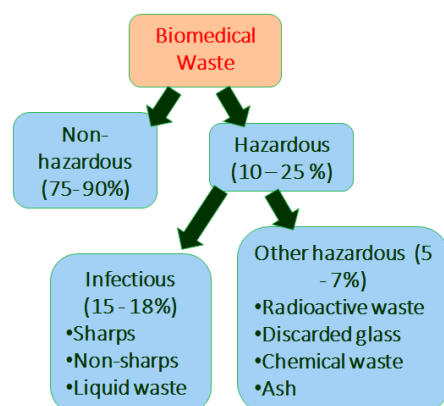► The RDF is used as a substitute of coal in industries.

Biomedical Waste (BMW) – The waste which is generated from *health care facilities* during diagnosis and treatment is called as Biomedical waste.

Sources of BMW:
- Hospitals
- Clinics,
- Path Labs.
- Blood banks,
- Nursing Homes.
- Mortuaries,
- Funeral services,
- Dental clinics,
- Animal research etc.

Generation of BMW:
► The generation of BMW in India is 1 to 2 Kg/bed /day.

► About 484 t of BMW are generated per day in India out of which 447 t are treated.

```
                    Biomedical
                      Waste
                   /          \
        Non-                    Hazardous
     hazardous                  (10 − 25 %)
     (75-90%)                  /          \
              Infectious          Other hazardous (5
              (15 − 18%)          − 7%)
              •Sharps             •Radioactive waste
              •Non-sharps         •Discarded glass
              •Liquid waste       •Chemical waste
                                  •Ash
```

Impacts of BMW:
On Public Health:
- Nausea and vomiting
- Low birth weight
- Airborne diseases
- Chemical poisoning
- Neurological diseases
- Contigineous diseases
- Cancer
- Effects on animals

On Environment:
- Ground water contamination
- Radioactive pollution
- Airborne Pollutants
- Air pollution
- Soil pollution

Methods of BMW management:

➢ Secured landfilling,
➢ Incineration,
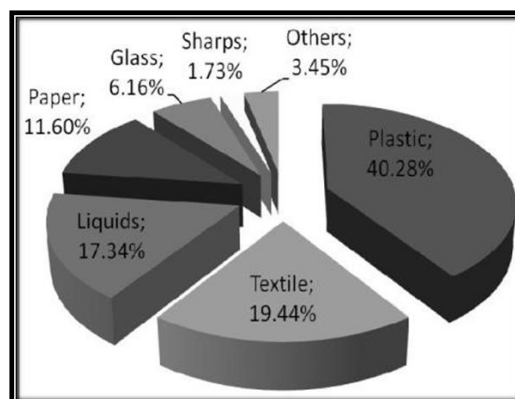➢ Shredding,

Fig. 6: Biomedical waste

Fig. 7: Compositions of Biomedical waste

Secured Landfilling: It is similar to sanitary landfilling with two liners.
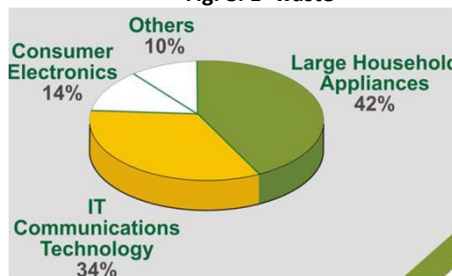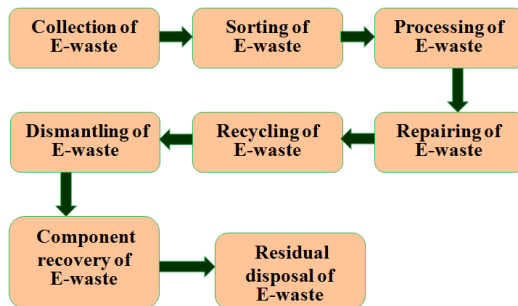
Shredding is define as the process of cutting the waste into small pieces. Only disinfected wastes are used in shredding.

Deep Burial: A pit 2 m deep half filled with BMW and half by lime and covered with soil at top. This method should be adopted away from water sources and residential area.

Autoclaving is a time-tested process of sterilization of BMW at high temperature(121°C) and high pressure(105 kPa) steam for minimum 1 hour.

Microwaving is a process which disinfects the waste by moist heat and steam generated by microwave energy. High-heat systems employ combustion and high temperature plasma to decontaminate and destroy the waste.

Chemical disinfection, primarily through the use of

> - Deep Burial
> - Autoclaving
> - Microwaving
> - Chemical treatment

E- Waste – The waste from electronic and electrical appliances which have reached their end of life period are called as E-waste or Electronic waste.

> - **Examples** – Refrigerator, washing machine, TV, Scanners, Printers, Computers, cables, AC, calculator, audio system, cartridges, mobile phones, oven etc.

Sources of E-waste:
- House holds,
- Shops,
- Industries,
- Electrical / electronics repairing center,
- Institutions,
- Laboratories,
- IT centers,
- Computer institutes, etc.

Generation of E-waste:
> - According to UN's Global Monitor India ranked fifth in the world in generating E-waste.
> - India generating 1.81million tons E-waste.
> - The rate of E-waste generation increases 10 % every year.

Compositions of E-waste
Large household appliances- AC, Washing M/C
Small household appliances - Iron, toaster
IT equipments - PCs, Laptops, fax, copier
Entertainment devices - TV, DVD, Radio, toys
Lighting equipments - lamps, tubes, bulbs
Electrical tools - Drills, saws, cables,
Security equipments - CCTV, medical equipments

Impacts of E-waste:
On Public Health:
- DNA Damage,
- Lung cancer,
- Damage to heart, lungs and spleen,
- Chronic damage to brain,
- Asthmatic bronchitis,
- Vision failure, ulcer,
- Breathing difficulties,
- Birth defects,
- Hormonal changes,
- Damage immune system etc.

On Environment:
- Ground water pollution,
- Acidification of soil, Soil pollution,
- Air pollution,

chlorine compounds, kills microorganisms in medical waste and can often oxidize hazardous chemical constituents. Chlorine bleach has been used for disinfecting processes

Fig. 8: E- waste

Fig. 9: Compositions of E-waste

Fig. 9: Flow chart of E-waste management

Application of Concept/ Examples in real life:
The concept is useful in understanding the environmental pollutions by solid waste and the knowledge shall apply in our day to day life to safeguard the environment.

Link to YouTube/ OER/ video:
https://youtu.be/pGAouXquINI
https://youtu.be/6yG4ihbtals

Solid Waste Management

Key Take away from this UO:
Understanding the environmental pollution by solid waste and methods of solid waste managements.