

TOPICS COVERED

18.1 Air Pollution: Pollutants, Effects, Prevention and Case Study

18.2 Potable Water and Water Pollution Causes, Effects and Prevention

IMPORTANT POINTS TO REMEMBER

- **Pollution:** Contamination of natural resources like air and water by addition of harmful substances due to various human activities is called pollution.
Examples: Air pollution, Water pollution
- **Pollutant:** Any substance that causes pollution is called a pollutant.
Examples: Carbon monoxide gas, smoke, sewage etc.
- **Air** is a mixture of gases. By volume, about 78% of air is composed of nitrogen and 21% is composed of oxygen. The rest 1% is composed of carbon dioxide, argon, methane, ozone, water vapour and many other gases.
- When air is contaminated with unwanted substances which can be harmful for the living and non-living, this is called **air pollution**.
- Causes of air pollution are; smoke and dust from forest fire and volcano, automobile exhaust, factories, construction sites and quarries, CFCs, etc.
- Ozone layer is a protective layer in the atmosphere. It prevents harmful ultraviolet radiations from the sun from entering our atmosphere.
- Carbon dioxide is a potent greenhouse gas. It results in global warming.
- A mixture of smoke and fog is called **smog**. Smog reduces visibility. It can create problems for drivers at highways. It can also create problems for pilots while landing or take off.
- Carbon monoxide is a poisonous gas even at low concentration. It reduces oxygen carrying capacity of blood.
- Oxides of sulphur and nitrogen mix with rainwater to create acid rain. Acid rain can be harmful for living beings and also for non-living things.
- Suspended Particulate Matter in air can cause respiratory problems; like asthma and other respiratory disease.
- Carbon dioxide and methane trap solar radiation and thus increase atmospheric temperature. This is called **greenhouse effect** and results in global warming.
- Overall increase in global temperature is called global warming. Global warming is resulting in melting of icebergs and glaciers.
- **Ways and Means to Check Air Pollution:** Use of CNG, use of public transport, monitoring of air quality, use of alternative sources of energy, etc.
- Addition of unwanted substances in water makes water harmful for living beings and non-living things. This is called **water pollution**.
- According to a recent study by World Wide Fund for Nature (WWF), Ganga is one of the most polluted rivers.

- **Causes of Pollution of Ganga:** Untreated sewage, bathing and washing in river, cremation of dead bodies on river banks, polluting industries in major towns along the river, excess use of weedicides, pesticides and chemical fertilizers.
- Excess quantity of chemicals in a water body provides nutrients to algae. This condition is called **eutrophication**.
- Water which is fit for drinking is called potable water. 25% of the world's population does not have access to safe drinking water.
- Municipal bodies purify water by various physical and chemical methods to supply drinking water to households. Filtration, boiling and chlorination are among common methods of purification of water.
- **Water** is a precious resource. Every step should be taken to conserve water. We should follow the principles of three R's, i.e. Reduce, Reuse and Recycle to conserve water.

18.1 AIR POLLUTION: POLLUTANTS, EFFECTS, PREVENTION AND CASE STUDY

Air-pollution: The contamination of air with harmful unwanted substances like toxic gases, smoke and dust which have harmful effects on both living organisms and non-living objects is called air-pollution.

Air-pollutant: The harmful and unwanted substances which contaminate the air are called air pollutants.

Examples: Automobile exhausts, industrial emission.

S.No.	Air Pollutant	Sources of Pollutants
1.	Sulphur dioxide	Burning of fossil fuels, automobile exhaust, refining of petroleum and its products, volcanic eruption
2.	Oxides of nitrogen	Burning of fossil fuels, automobile exhaust
3.	Excess of carbon dioxide	Burning of fossil fuels
4.	Carbon monoxide	Automobile exhaust, incomplete combustion of fossil fuels
5.	Acid fumes	Fertilisers and chemical industries
6.	Smoke	Combustion of fossil fuels
7.	Dust	Stone crushing, woodwork, volcanic eruptions
8.	Lead compounds	Automobile exhaust on burning petrol
9.	Chlorofluorocarbons	Used in refrigerators, air conditioners and spray cans

Harmful Effects of Air Pollution

1. *Carbon monoxide:* It is a very poisonous gas. When inhaled in excess, it combines with the haemoglobin of blood forming carboxyhaemoglobin which prevent it from carrying oxygen and thus reduced the oxygen capacity of blood which causes nausea, unconsciousness and sometimes even death.
 2. *Oxides of sulphur and nitrogen:* These oxides are released by automobiles, cause various respiratory problems and lung infection.
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3. *Lead oxide*: Particles of lead oxide present in the automobile exhausts can cause mental disorder and brain damage.
4. *Smog*: A conspiracy of smoke and fog is called smog. It causes breathing problems such as asthma, cough and wheezing in children.
5. *Acid Rain*: Rain water containing large amount of dissolved acids is called acid rain.

Burning of fossil fuels like coal, petrol produces gas like CO_2 , oxides of sulphur and nitrogen and unburnt hydrocarbon which escape into the atmosphere. They react with the water vapour present in the atmosphere to form sulphuric acid and nitric acid which finally comes down as acid rain.

Effects of Acid Rain

- (i) It increases the acidity of soil and affects plant and animal life.
 - (ii) The water in lakes and rivers becomes acidic leading to destruction of aquatic plants and animals.
 - (iii) It destroys monuments and buildings. "Marble Cancer" i.e. Marble turns yellow.
6. *Greenhouse effect*: Carbon dioxide released by the burning of fuels increases the concentration of carbon dioxide in the environment which leads to greenhouse effect. The phenomenon whereby the earth's atmosphere traps solar radiations because of presence of gases like carbon dioxide, water vapour, methane and CFC's is called greenhouse effect.
 7. *Global warming*: It is the rise in average temperature of the atmosphere of the Earth due to the increase in greenhouse effect. Its *damaging effects* are melting of ice-caps, glaciers, climate and rainfall pattern would change, it would also affect agriculture thus production of food.
 8. *Depletion of ozone layer*: Ozone forms a layer in the stratosphere. The depletion of ozone layer allows harmful ultraviolet radiations coming from the sun to enter our earth.

Effects of Ozone Layer Depletion

- (i) Harmful ultraviolet radiations reaching the earth cause various diseases in human beings such as cataract, skin cancer.
 - (ii) It can have adverse effect on gene structure leading to mutation.
9. *Chlorofluorocarbons (CFC's)*: These are used in refrigerators, air conditioners and aerosol sprays. When released in air, damage the ozone layer of the atmosphere and creates a hole in the ozone layer. This is called depletion of ozone layer.

Methods to Control Air Pollution

1. Use of eco-friendly clean fuels like CNG.
 2. Use of modern automobile engines which bring about complete combustion.
 3. Use unleaded petrol in automobiles.
 4. Regular pollution check of vehicles.
 5. Planting of trees (Afforestation).
 6. Use of recycled paper to save trees.
 7. Use catalytic convertors in automobiles which convert harmful gases into harmless gases.
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8. Encourage use of alternative sources of clean energy like solar energy, wind energy.
9. Encourage use of public transport.
10. Bring awareness in people to reduce air pollution.

Taj Mahal – A Case Study: India’s most famous tourist attraction is under severe threat due to increasing air pollution.

Cause: Industries located in and around Agra like rubber processing industries, Mathura Oil Refinery releasing gases like sulphur dioxide and nitrogen dioxide. These gases come down with rain as acid rain.

Effect: Acid rain corrodes the marble of the monument. The phenomenon is also called “Marble Cancer”.

Exercise 18.1

I. Very Short Answer Type Questions (1 Mark)

1. Give one word for the following:
 - (a) Excessive of this gas cause greenhouse effect. _____
 - (b) Type of pollution which affects our lungs. _____
 - (c) A household device used for checking air pollution. _____
 - (d) An example of greenhouse gas. _____
 - (e) Incomplete combustion of petrol leads to emit _____
2. Fill in the blanks:
 - (a) The Earth’s temperature is increasing due to _____.
 - (b) _____ used in refrigerators damage the ozone layer of the atmosphere.
 - (c) When inhaled in excess, _____ can even kill a person.
 - (d) _____ of nitrogen, sulphur react with rain and come down as _____.
 - (e) CFC’s damage the _____ layer in the atmosphere and this is called _____ of ozone layer.

II. Short Answer Type Questions-1 (2 Marks)

3. Which gas is released by exhausts of automobiles.
4. What is acid rain? Give one effect of acid rain. (NCERT)
5. What is global warming? Give one effect of global warming.
6. What is air pollutant? Name any two air pollutants.
7. Why is carbon monoxide considered a suffocating gas?
8. Write any two methods to control ‘air pollution’.

III. Short Answer Type Questions-2 (3 Marks)

9. What do you mean by “depletion of ozone layer”?
 10. What is greenhouse effect? Why is it called greenhouse effect? Name any two greenhouse gases. (NCERT)
 11. A lot of dry leaves are collected in a school garden and are burnt everyday. Do you think that it is right to do so? If not, what should be done to dispose off the dry leaves? (NCERT Exemplar)
 12. “CO₂ contributes to global warming”. Explain.
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IV. Long Answer Type Questions (5 Marks)

13. Describe in details the harmful effects of air pollution.
14. What do CFC's stand for? Name some devices where CFC's are used. Why CFC's are considered as pollutant.
15. The level of air pollution is higher at busy traffic intersection. Why?
(NCERT Exemplar)
16. Describe the threat to the beauty of Taj Mahal.
(NCERT)
17. We should plant trees and nurture the ones already present in the neighbourhood. Why?

ANSWERS

1. (a) Carbon dioxide (b) Air pollution (c) Use unleaded petrol in automobiles.
(c) Smokless chulhas (d) Carbon dioxide (d) Regular pollution check of vehicles.
(e) Carbon monoxide gas. (e) Planting of trees (Afforestation).
2. (a) Global warming (f) Use of recycled paper to save trees.
(b) CFC's (c) Carbon monoxide (g) Use catalytic convertors in automobiles
(d) Oxides, acid rain (e) Ozone, depletion which convert harmful gases into
harmless gases.
3. Oxides of sulphur and nitrogen released by automobiles, cause various respiratory problems and lung infection. (h) Encourage use of alternative sources of energy like solar energy, wind energy.
4. *Acid Rain*: Rain water containing large amount of dissolved acids is called acid rain. (i) Encourage use of public transport.
It increases the acidity of soil and effects plant and animal life. (j) Bring awareness in people to reduce air pollution. (*Any two*)
5. *Global warming*: It is the rise in average temperature of the atmosphere of the earth due to the increase in greenhouse effect. It results in melting of ice-caps, glaciers, change in climate and rainfall pattern. 9. Ozone forms a layer in the stratosphere. The ozone layer prevents harmful ultraviolet radiations coming from the sun to enter our earth. Chlorofluorocarbons (CFC's) which are used in refrigerators, air conditioners and aerosol sprays when released in air, damage the ozone layer of the atmosphere and creates a hole in the ozone layer (Antartica). This is called depletion of ozone layer.
6. The harmful and unwanted substances which contaminate the air are called air pollutants.
Examples: Automobile exhausts, industrial emission.
7. Carbon monoxide is a very poisonous gas. When inhaled in excess, it combines with the haemoglobin of blood forming carboxyhaemoglobin which prevent it from carrying oxygen and thus reduced the oxygen capacity of blood which causes nausea, unconsciousness and sometimes even death.
8. (a) Use of eco-friendly clean fuels like CNG.
(b) Use of modern automobile engines which bring about complete combustion. 10. The phenomenon whereby the earth's atmosphere traps solar radiations because of presence of greenhouse gases is called greenhouse effect. In a nursery, there is a greenhouse where Sun's heat is allowed to get in but is not allowed to go out. The trapped heat warms the green house. The trapping of radiations by the Earth's atmosphere is similar thus it is called greenhouse effect.
Examples of greenhouse gases are carbon dioxide, water vapour, methane, etc.

11. No, lot of smoke is produced and causes air pollution. A pit should be dug and all the leaves should be put into it and then covered with mud. It will gradually get converted into compost.
12. Carbon dioxide is responsible for trapping heat from sun and does not allow it to escape due to greenhouse effect. This raises the average temperature of Earth causing global warming
13. *Harmful Effects of Air Pollution*
- (a) *Carbon monoxide*: It is a very poisonous gas. When inhaled in excess, it combines with the haemoglobin of blood forming carboxyhaemoglobin which prevent it from carrying oxygen and thus reduced the oxygen capacity of blood which causes nausea, unconsciousness and sometimes even death.
- (b) Oxides of sulphur and nitrogen released by automobiles, cause various respiratory problems and lung infection.
- (c) Particles of lead-oxide present in the automobile exhausts can cause mental disorder and brain damage.
- (d) *Smog* causes asthma, cough and wheezing in children.
- (e) *Acid Rain* increases the acidity of soil and affects plant and animal life.
14. CFC's stand for Chlorofluorocarbons which are used in refrigerators, air conditioners and aerosol sprays. When they are released in air, they damage the ozone layer of the atmosphere and creates a hole in the ozone layer. Thus, it is considered as pollutant.
15. At busy traffic intersection, the continuous movement of vehicles and their stoppage at red light causes the constant supply of vehicular exhausts in the region. These automobiles releases toxic gases like oxides of nitrogen, sulphur, etc. which are released to the atmosphere of the region. Thus, the level of air pollution is higher for those intersections.
16. Industries located in and around Agra like rubber processing industries, Mathura Oil Refinery releasing gases like sulphur dioxide and nitrogen dioxide. These gases come down with rain as acid rain. Acid rain corrodes the marble of the monument. The phenomenon is also called "Marble Cancer". Also, the suspended particulate matter, such as the soot particles emitted by Mathura oil refinery, has contributed towards the yellowing of the marble.
17. We should plant more trees because more trees will consume more carbon-dioxide and hence will reduce the chances of global warming. This in turn will improve the water cycle leading to adequate rainfall. It also increases the water holding capacity of soil leading to the improvement in the movement of water from soil into the ground. Thereby reducing the chances of flood.

18.2 POTABLE WATER AND WATER POLLUTION: CAUSES, EFFECTS AND PREVENTION

Potable Water: Water that is suitable for drinking is called potable water. The municipal system treats the water before supplying it to households. Water can be made safe for drinking:

- (a) By using filters (candle filter) (b) By chlorination
(c) By reverse osmosis system (RO) (d) By boiling

Water Pollution: The contamination of water with harmful, unwanted substances like domestic sewage, toxic industrial wastes, chemicals like pesticides and fertilizers which cause harmful effect on both living organisms and non-living objects is called water-pollution.

Water Pollutants: The harmful and unwanted substances which contaminate the water are called water pollutants. *Example:* Pesticides, fertilizers, synthetic detergents, chemicals, oil and grease.

The presence of pollutants makes the water foul-smelling and bad in taste.

Causes of Water Pollution

- (a) *Industrial Sewage:* Industries of paper, textile, leather, paint produce wastes containing highly toxic substances like lead, mercury, arsenic or their compounds. The discharge of untreated industrial sewage directly into the water-bodies is one of the main cause of water pollution.
- (b) *Domestic Sewage:* Liquid waste from kitchens, and toilets are discharged into rivers through sewer system causing water pollution.
- (c) *Human activities:* Bathing of human beings, and animals in or near lakes, rivers etc. pollute the water bodies.
- (d) *Agricultural wastes:* In modern agriculture, large quantities of pesticides and fertilizers are used. Excess of these inorganic chemicals find their way to water bodies which result in water pollution.
- (e) *Oil spill:* Oil from huge tankers is one of the major causes of water pollution which affects the marine plant and animals.

Harmful Effects of Water Pollution

1. *Human Health:* Polluted water can cause many diseases like cholera, dysentery, typhoid, diarrhoea, jaundice.
2. *Eutrophication:* Washing away of fertilizers into water bodies causes increased growth of algae and other weeds in water bodies. This is called algae bloom. Due to respiration carried out by algae, a large amount of dissolved oxygen in the water is consumed. The level of dissolved oxygen falls in water, thus fishes and most other aquatic animals also die due to suffocation. The loss of dissolved oxygen from water in water bodies is called eutrophication.

Methods to Prevent and Control Water Pollution

1. Washing clothes, cleaning utensils or taking a bath in lakes, rivers should be restricted.
2. Excessive use of fertilizers and pesticides should be discouraged.
3. Toxic industrial waste should be treated chemically to remove toxic substances before being released into the water bodies.
4. Pollution control rules should be strictly followed.

Reduce: While taking bath or washing utensil, we shall not keep our taps on.

Reuse: Water used for washing vegetables, rice etc. can be used for gardening.

Recycle: Dirty water can be recycled and used after proper purification.

Ganga Action Plan (GAP) was a programme launched by the Government of India in April 1985, in order to reduce the pollution level in the river. However, the increasing pollution, industrialisation and increasing use of chemical fertilizers and detergents have already damaged this mighty river beyond repair. The activities of GAP initiated in 1985 were declared closed on 31st March 2000. However in 2008, the Government has set up the Ganga River Basin Authority to put forward planning, implementing and monitoring of various programme for the River Ganga.

Exercise 18.2

I. Very Short Answer Type Questions (1 Mark)

1. Give one word for the following:

- (a) Substances that cause pollution are called _____
- (b) Purification of water to remove suspended impurities _____
- (c) Water pollution is caused by _____
- (d) The loss of dissolved oxygen from water in water bodies _____
- (e) Water that is fit for drinking. _____

2. Fill in the blanks:

- (a) Polluted water can cause many diseases like _____.
- (b) _____ was a programme launched by the Government of India in April 1985 to reduce the pollution in Ganga.
- (c) The main aim of purification of water is to remove _____.
- (d) _____ is a chemical method of purifying water.
- (e) _____ is a cause of water pollution.

II. Short Answer Type Questions-1 (2 Marks)

- 3. State the characteristics of drinking water.
- 4. State the different methods to purify water?
- 5. Name two diseases caused by drinking polluted water.
- 6. Which one is safe for drinking – river water or well water? Why?
- 7. What are the major contaminants of water?

III. Short Answer Type Questions-2 (3 Marks)

- 8. What is potable water? How can water be made safe for drinking?
- 9. Mention some measures to control water pollution.
- 10. How can we reduce, reuse and recycle water? (NCERT Exemplar)

IV. Long Answer Type Question (5 Marks)

- 11. What are the causes of water pollution?

ANSWERS

- | | |
|---|--|
| <ul style="list-style-type: none">1. (a) Pollutants (b) Filtration(c) Sewage (d) Eutrophication(e) Potable water2. (a) typhoid, cholera(b) Ganga Action Plan(c) suspended impurities(d) Chlorination (e) Sewage3. (a) Free from germs(b) Clear and transparent(c) Free from suspended impurities4. Filtration, Chlorination5. Typhoid, Cholera6. River water which is flowing water, while | <ul style="list-style-type: none">well water is stagnant so impurities are more in the well water.7. Domestic sewage, Industrial waste, Fertilizers and pesticides.8. <i>Potable Water</i>: Water that is suitable for drinking is called potable water.
Water can be made safe for drinking:<ul style="list-style-type: none">(a) By using filters (candle filter)(b) By chlorination(c) By reverse osmosis system (RO)(d) By boiling9. <i>Methods to Prevent and Control Water Pollution</i> |
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- (a) Washing clothes, cleaning utensils or taking a bath in lakes, rivers should be restricted.
- (b) Excessive use of fertilizers and pesticides should be discouraged.
- (c) Toxic industrial waste should be treated chemically to remove toxic substances before being released into the water bodies.
- (d) Pollution control rules should be strictly followed.
10. *Reduce*: While taking bath or washing utensil, we shall not keep our taps on.
Reuse: Water used for washing vegetables, rice etc. can be used for gardening.
Recycle: Dirty water can be recycled and used after proper purification.
11. *Causes of Water Pollution*
- (a) *Industrial Sewage*: Industries of paper, textile, leather, paint produce wastes containing highly toxic substances like lead, mercury, arsenic or their compounds. The discharge of untreated industrial sewage directly into the water-bodies is one of the main cause of water pollution.
- (b) *Domestic Sewage*: Liquid waste from kitchens, and toilets are discharged into rivers through sewer system causing water pollution.
- (c) *Human activities*: Bathing of human beings, and animals in or near lakes, rivers etc. pollute the water bodies.
- (d) *Agricultural wastes*: In modern agriculture, large quantities of pesticides and fertilizers are used. Excess of these inorganic chemicals find their way to water bodies which result in water pollution.
- (e) *Oil spills*: Oil spills from huge tankers is one of the major causes of water pollution which affects the marine plant and animals.

Did You Know?

- **SPM (Suspended Particulate Matter)**: These are minute solid particles emitted during burning of fossil fuels, fine particles of lime and cement. They cannot filter through hair of our nose and this cause irritation in nose, throat, respiratory tract and can even damage lungs.
- There is a massive hole in the ozone layer right above the Antarctica which is gradually expanding and exposing the populated areas of S. America to harmful ultraviolet radiation of the sun.

HOTS & VALUE BASED QUESTION

1. Incomplete combustion of firewood in homes produces a very poisonous gas X. When inhaled, gas X combines with the substance Y present in blood to give substance Z and reduces the oxygen carrying capacity of blood. What are X, Y and Z? **(HOTS)**
2. At many places the waste water containing human excreta from homes is carried in big underground pipes is dumped into a river as such which pollutes the river water. **(HOTS)**
 - (a) What is the common name of such waste water?
 - (b) Name any five diseases which can be caused due to this type of water.
3. What do you mean by 'Eutrophication'? **(HOTS)**
4. Mr. Mehta has a CNG fueled car, while Mr. Singh uses petrol in his car. Mr. Mehta has to stand in long queue. He also uses catalytic converter in his car. Mr. Singh advises Mr. Mehta to shift to petrol instead of CNG, to get rid of queue-problem.
 - (a) Do you think Mr. Mehta should shift to petrol instead of CNG? Why or Why not?
 - (b) Is it right to use catalytic converter in the cars? Why or Why not? **(VBQ)**

ANSWERS

1. X – Carbon monoxide
Y – Haemoglobin
Z – Carboxyhaemoglobin
 2. (a) Sewage
(b) Diarrhoea, Dysentery, Typhoid, Cholera, Jaundice
 3. *Eutrophication*: Washing away of fertilizers into water bodies causes increased growth of algae and other weeds in water bodies. This is called algae bloom. Due to respiration carried out by algae, a large amount of dissolved oxygen in the water is consumed. The level of dissolved oxygen falls, fishes and most other aquatic animals also die due to suffocation. The loss of dissolved oxygen from water in water bodies is called eutrophication.
 4. (a) No, Mr. Mehta should continue with CNG, since it is ecofriendly, non-polluting and cost effective.
(b) Yes, a catalytic converter converts harmful gases into harmless or less harmful gases thus, reduce air pollution.
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