

CBSE OPEN TEXT MATERIAL THEME-1

Clean Air-A Shared Concern

Abstract

*Human activities have put water and air in a bad state
Let's save, freshen and conserve them before it is too late.*

Clean air is vital for the existence and continuance of all living organisms on earth. Naturally existing mixture of gases in the atmosphere, comprising of mainly Nitrogen, Oxygen, Carbon dioxide and water vapours, provides excellent conditions to support and sustain life. However, this natural composition of air is getting disturbed due to variety of human activities. Human activities related to mainly industry, vehicular emissions, burning of fossil fuels, accidental nuclear emissions etc. contaminate the natural air with undesired components resulting in air pollution. These components, called pollutants, are not only harmful for living organisms but also affect non-living things adversely. The situation is quite alarming, particularly in big industrialized cities. With worldwide trend of shifting of human population to cities and their human desire to lead more comfortable life, the issues and concerns related to availability of clean air for survival are becoming a great challenge for everyone.

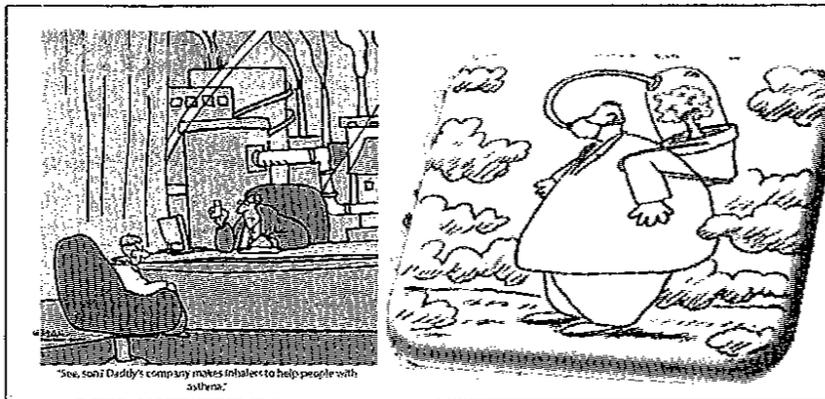
The present text attempts to help the reader comprehend the situation in a holistic manner, identify the causes and effects of air pollution, examine and analyze the existing status, reflect, debate and generate ideas as to what actions need to be taken at individual, collective or governmental level to meet the emerging challenges.

The Context

The atmosphere surrounding the earth is a mixture of many gases which, along with the other conditions, makes

it a unique planet for existence of life. Unprecedented urbanisation and development during the past few centuries and many human activities have disturbed the natural composition of this atmosphere. It is unfortunate that the cost of development is very heavy and is being paid by causing a severe damage to the life support system in the form of clean air.

The contamination of air with undesirable gases and particulate matter is called air pollution. The substances which cause pollution are called pollutants. These are either gaseous pollutants like oxides of carbon, sulphur, nitrogen etc. or particulate matter in the form of dust, smoke, fumes or mist. A person living in a city with polluted air is likely to suffer from one or the other breathing problem.



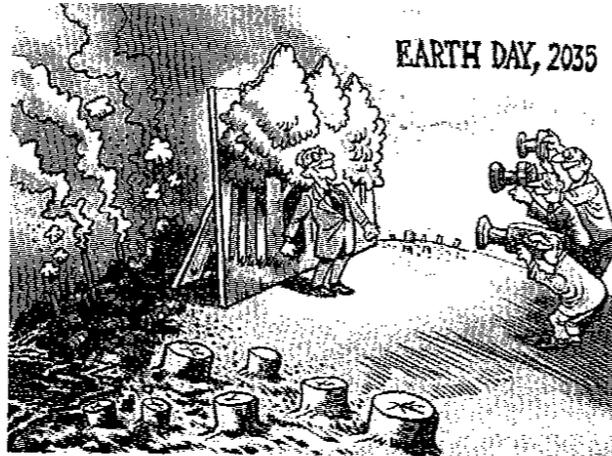
Picture: 1

Picture: 2

To sensitize people towards keeping the planet Earth non polluted, **Earth Day**, an annual event, is celebrated on April 22. On this day, programmes are held worldwide to sensitize people towards environmental protection. People are made aware that if they do not act collectively, the green clean environment will be only for the pictures.

Carbon dioxide is necessary for the survival of life on Earth as it is an essential raw material for the process of photosynthesis and greenhouse effect. This effect is essential

to maintain and keep the earth's atmosphere warm to sustain life. But due to excessive burning of fossil fuels and other carbon containing fuels, there has been an excessive release of CO_2 in the atmosphere. The increasing CO_2 levels in the atmosphere lead to excessive heating of the earth's surface. The heating results into a new phenomenon called **Global Warming**. Besides carbon dioxide, the other greenhouse gases present in the earth's atmosphere in their order of abundance are; water vapour, carbon dioxide, methane, nitrous oxide, ozone and chlorofluorocarbons.



Picture: 3

The gaseous and particulate pollutants together cause further damage to life. Have you ever observed that visibility is very low during winters due to fog? Smog is a mixture of smoke dust particles and fog. This phenomenon increases during heavy traffic hours in cities. The reason is that smoke emitted from the exhaust of the vehicles settles over fog in winter and reduces the visibility.

We all know about the smoke laden fog, called smog, which surrounded the city of London in the year 1952. It resulted in the loss of about 4000 human lives and many others suffering from serious breathing problems according to the available press reports. Even the cattle had been asphyxiated by the smog. The unfortunate accident gave a rude shock to

the Governments of different nations and the problem of air pollution took a central stage.



Picture: 4

The human lifestyle in many developed countries is also causing another serious problem in the form of depletion of ozone layer. The use of refrigerators and air conditioners, fire extinguishers, aerosol sprays like deodorants etc. results in release of CFCs and NO_2 in the atmosphere which is responsible for depletion of ozone layer. This results in ultraviolet radiations entering the atmosphere unobstructed causing damage to all kinds of life on Earth.

Many organizations are coming forward to create awareness among the masses so that we leave a cleaner planet for the coming generations.

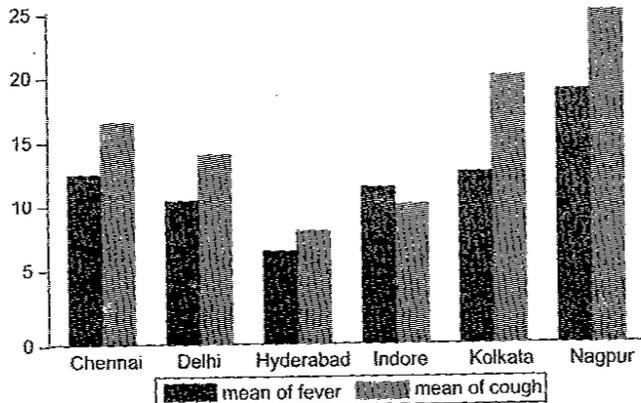
Early childhood is a critical period for the continued development and maturation of several biological systems such as the brain, lungs, and immune system. Air toxics can impair lung function and neurodevelopment, or aggravate existing conditions, such as asthma. Infants who were born premature or growth-retarded may be particularly vulnerable to additional environmental insults.

Stage/ Age:	Newborn 0-2 mos	Infant/Toddler 2 mos-2 yrs	Young Child 2-6 yrs	School Age Child 6-12 yrs	Adolescent 12-18 yrs
Lung development:	Alveolar development				
	High respiratory rate			Increasing lung volume	
Air pollution risks:		Respiratory death		Chronic cough and bronchitis	
				Reduced lung function	
				Wheezing and asthma attacks	
		Respiratory symptoms and illnesses*		Respiratory-related school absences	

*Air pollution exposure has also been more recently linked to respiratory symptoms and illnesses in early life including cough, bronchitis, wheeze and ear infections

Picture: 5

Following bar graph shows results of National Family Health Survey about health of children in various cities of India. What could be the reasons for ill health of the children of Nagpur as compared to Delhi or Hyderabad? Which city do you think would have a cleaner environment for the children to be healthy?



Source: NFHS 3 data

Health Outcomes

Following statistics show the status of air quality in metropolitan cities of India, a survey conducted by Central Pollution Control Board:

Is there any correlation between the health of the children and air pollution of a particular city?

Status of Ambient Air Quality in 12 Metropolitan Cities of India

S.No.	Name of the City	State	2011		
			SO ₂	NO ₂	PM10*
1.	Agra	U.P.	3	23	155
2.	Bangalore	Karnataka	14	28	91
3.	Chennai	Tamilnadu	9	24	92
4.	Delhi	U.T.	6	61	222
5.	Gwalior	M.P.	12	20	311
6.	Hyderabad	A.P.	5	28	74
7.	Indore	M.P.	12	14	132
8.	Kolkata	West Bengal	12	65	113
9.	Malappuram	Kerala	2	5	30
10.	Mumbai	Maharashtra	5	33	116
11.	Nagpur	Maharashtra	8	35	108
12.	Raipur	Chhattisgarh	15	42	310

Note: Source: Data as reported by CPCB/SPCBs/PCCs/NEERI

Data for 2011 is average of data available as on date (08.08.2012). National Ambient Air Quality Standard for Residential, Industrial, Rural and others Areas (Annual average) for SO₂ = 50 microgram per cubic metre, NO₂ = 40 microgram per cubic metre and PM10 = 60 microgram per cubic metre. NA = No Ambient Air Quality Stations operating under NAMP in these cities during the period.

Annual average concentration in µg/m³

*"PM10 is the term used to describe tiny particles in the air, made up of a complex mixture of soot, organic and inorganic materials having a particle size less than or equal to 10 microns diameter (10 microns is equal to one hundredth part of a millimetre)."

Air pollution, the 5th largest killer in India: Study

PTI Feb 13, 2013, 08.35PM IST

NEW DELHI: Air pollution is the fifth largest killer in India taking 6.2 lakh lives per year and Delhi is among one of the five most critically polluted regions in the country, a study by a US-based health institute has claimed.

The other four most critically polluted regions in the country are Ghaziabad, Gwalior, West Singhum district in Jharkhand and Raipur, according to the study.



All this was about the damage caused to the animate world due to air pollution but the damage to the inanimate world is also not less. Much of the tangible heritage is at a danger of surviving for the coming generations to see due to acid rains caused due to air pollution. The oxides of sulphur, carbon and nitrogen released into the atmosphere from chimneys of industries and exhaust of vehicles react with water of the rains and oxygen from air to form acids. Dissolved acids make the rain acidic in nature. Acid rains are very harmful for both, living and non-living things. Acid rains damage crops, pollute soil and water, ruin the harvest, damage aquatic life and erode buildings.

The Taj Mahal is a white - marbled domed monument built between 1632 and 1654. Approximately three billion tourists visit the famed site every year. It is listed amongst

the ten wonders of world but is turning yellow because of air pollution. Glass factories, rubber industries, Mathura oil refinery and other industries of the neighbouring towns which burn fossil fuels are responsible for this. These industries release soot particles and gases into the atmosphere. The soot particles turn the colour of the marble to yellow and the gases react with water to form acid rain which corrodes the marble of the monument. This phenomenon is also called "marble cancer".

In order to prevent further degradation of the building, the government has put a ban on driving near the Taj Mahal. All cars and buses are parked roughly 1 km away. Battery-run buses or horse-drawn carriages have been set up for visitors to reach the monument. Industries in neighbouring towns are being persuaded to use cleaner fuels like CNG and LPG instead of coke in their furnaces.

The challenges and problems are complex and deserve to be addressed urgently. Immediate action points need to be decided and taken by every individual, social groups and governmental level. Can you reflect, debate, discuss and decide these action points with your friends, parents, teachers and others to make a difference?

References:

- <http://cpcbenviis.nic.in/airpollution/air%20data%202011-2007/2011/air2011.html>
- National family health Survey: <http://www.rchiips.org/nfhs/report.shtml>
- <http://www.environment.ucla.edu/reportcard/>
- <http://www.sciencedaily.com/releases/2013/08/130808124501.htm>
- <http://economictimes.indiatimes.com/photo/18486442.cms>
- <http://thinkprogress.org/climate/2013/07/13/2296461/open-thread-plus-cartoon-of-the-week-29/>

CBSE SAMPLE QUESTIONS AND ANSWERS**Question 1**

“Act local, think global”. How is this jargon suited to tackle the increasing problem of air pollution? Relate this to the marble cancer of the Taj and pollution levels in Agra city. Identify various steps that can be taken up at the individual and government level to curb the menace of air pollution.

Answer Option 1

Environmental pollution is a purely human activity which is altering the natural composition of elements at an alarming rate. As the scientific prowess and knowledge of humans have advanced in the recent times, their harmful effects on their surroundings have also increased. As a result the problem of pollution is not limited to a geographic region but it has become a menace for the whole humankind of the planet collectively. Now the pollutants released in air from an industry in China can cause smog in America and Australia. A nuclear disaster in Japan can transfer its harmful radioactive debris to distant countries and continents via the oceans. Geographical boundaries blur in the wake of pollution disasters.

If the problem is our creation, then the solution also lies in the hands of every individual. But the question is how do we achieve it? Simple steps taken by one individual has far reaching effects. It can also develop awareness and motivate millions of other people to join the drive to clean our planet.

One such case is of Taj Mahal monument in Agra. Taj Mahal has been synonymous with India. The beautiful and gleaming white marble monument spell bound the tourists from world over. It is included as one of the ten wonders of the world. Emperor Shah Jahan has taken every possible step to keep the monument safe from the wrath of nature and imagined it to stand as it till time immemorial. But Shah Jahan had never thought that the flowing air will become an enemy

of this monument. He had never foreseen a time when the pollutant in air will pose danger to this monument.

In recent time it was observed that the walls of Taj started to become yellow. This was a matter of great concern for the authorities and Taj lovers. It was discovered that the chemicals released in air from the glass, rubber factories and Mathura oil refinery have added significant amount of oxides of sulphur, carbon and nitrogen in the air. These oxides mix with the water vapours in air and form acids. The burning of fossil fuels in these factories also releases soot and harmful fumes. These acids cause acid rain and along with soot it gets deposited on the walls of Taj. This corrodes the marble of Taj. This phenomenon is called 'marble cancer'.

It is important to note that though the fumes and pollutants were released far away from the Taj but they were affecting the most beautiful monument on the Earth. Therefore some concrete steps had to be taken to protect this monument for the future generations.

The government has banned driving near the monument. Only battery operated or animal driven carts are permitted to carry visitors near the monument. The industries have been either relocated, closed and have been persuaded to use cleaner fuels such as CNG, LPG and coke. The restoration of Taj is being done to restore its original colour.

At individual level also simple steps can be taken which can help to reduce air pollution.

As individuals we can reduce the usage of fossil fuels to drive our vehicles. For smaller distances we can either walk or use a bicycle. We should also use carpool to reduce the number of vehicles on road and usage of fossil fuels. Public transportation systems also help to reduce air pollution in the same way.

Planting more and more trees will help to absorb carbon dioxide which can reduce the problem of global warming. The roots of the plants also hold the soil particles together. This also reduces the problem of soil erosion.

We should try to use alternative sources of fuels such as biogas, solar energy and biofuels which are renewable and also protect us from the harmful effects of air pollution and global warming.

Corporate houses should be made accountable for the industrial emissions. They should devise proper methods to trap the particulate matter before releasing their fumes.

Answer Option 2

This jargon is suited to tackle the increasing problem of air pollution. This is because it is the responsibility of every individual to think about our environment. We must not always depend on government or authorities to make some rules to reduce pollution. We ourselves can take small steps to reduce air pollution. The Taj Mahal of Agra is one of the ten wonders of the world. It is the proud of our country. We must think and take some steps to reduce air pollution to protect the heritages of our country. Due to the glass factories, rubber industries, Mathura oil refinery and other industries in the neighbouring towns, and the fossil fuels burnt here release lot of smoke and gases which mixes with water to form acid rain. This causes the corrosion of marble, called marble cancer.

The steps that can be taken at individual and government level to curb the menace of air pollution are as follows:

1. Plant more trees and conserve the green belts.
2. Fuel tanks should be preferably filled in the evenings and their caps should be tightened severely.
3. Vehicles should not be left idle.
4. Industries, factories and refineries should be constructed in the suburbs of the cities.
5. Whenever possible, use public transport, walk, ride a bike or a carpool.
6. Do away with vehicles which are more than 10 years old.

Answer Option 3

The jargon "Act local and think global" is best suited to curb the menace of air pollution. Act local means to adopt and promote non-polluting activities and pollution control measurements at local level. It also include use of natural resources—exhaustible and inexhaustible judiciously keeping concept of sustainable development in our mind.

Think global means that our efforts for development should not only be for welfare of us but also for all human beings. Nature has enough to feed/need of each individual but not to fulfil its greed specially human. Our natural resources are limited, hence they must be used judiciously and cautiously.

Taj Mahal— a white-marbled domed monument— is India's major tourist attraction. It was built about 500 years ago between 1632 to 1654 by Shah Jahan. About three billion tourists visit it every year. It is listed among ten wonders of the world. Presently Taj Mahal is turning yellow because of air pollution. Agra has many industries such as rubber processing, chemicals, automobiles and nearby Mathura oil refinery. These are responsible for releasing harmful gases like sulphur dioxide (SO_2), nitrogen dioxide (NO_2), and shoot particles into the atmosphere. Shoot particles change colour of white marble yellow. Oxides of sulphur and nitrogen react with rain water to form acid rain which is responsible for corrosion of marble of Taj Mahal. This phenomenon is also known as "*Marble cancer*".

Steps to save Taj Mahal:

1. Automobile movement near the Taj Mahal must be banned.
2. To use battery-run buses or horse-drawn carriages for visitors to reach the monument site.
3. Supreme Court India has instructed that industries either use cleaner fuel like CNG nad LPG instead of coke or shift.

Some measurements to curb the menace of air pollution at individual and government level are as follows:

At Individual Level:

1. To maintain oxygen and carbon dioxide balance in nature plant more trees. By absorbing excess amount of CO_2 from the atmosphere they can save us from hazard of Global Warming.
2. Use smokeless stove, furnace, chulha, etc.
3. Use cleaner fuels like LPG (Liquefied Petroleum Gas), CNG (Compressed Natural Gas) and unleaded petrol.
4. Avoid automobiles to cover nearby distances and use bicycle, riksha, horse-drawn cart, etc.
5. If anyone is violating pollution control laws, inform nearby authority about it.

At Government Level:

1. All automobile must use smokeless fuels—LPG, CNG, unleaded petrol.
2. Use of catalytic converter should be must to prevent vehicular pollution. It can change harmful carbon monoxide and nitrogen dioxide into carbon dioxide, nitrogen and water.
3. In all industries use of electrostatic precipitator, particulate wet scrubber, spray tower, mechanical collector, dust collector must be compulsory.
4. People/industry violating Pollution Control Laws should be punished severely.
5. To prevent ozone depletion use of refrigerators, air conditioners, fire-extinguisher, aerosol spray—sources of CFCs should be limited.

Answer Option 4

Air pollution is a global problem. But it can also be tackled at local level, *i.e.*, individual efforts can play major role to overcome such a problem. It is the responsibility of all of us to keep our environment clean, By reducing the use of fossil fuels and other carbon containing fuels, using public

transport and carpool for travelling, avoiding the use of traditional ovens, and planting trees, etc. at local level we can contribute to tackle this global problem of air pollution.

The pollution level in Agra increased due to glass factories, rubber industries, Mathura oil refinery and other industries of neighbouring towns, and heavy traffics in the city. These industries release shoot particles and gases like CO_2 , SO_2 and NO_2 into atmosphere. The soot particles turn the colour of marble to yellow and the gases like SO_2 react with water to form acid rain which causes corrosion of marble, called 'Marble Cancer'.

It was observed that some steps such as ban of driving near the Taj, prohibiting the parking of cars and buses near the monument, setting up battery-run buses or horse-drawn carriage for visitors, and persuading industries to use cleaner fuels etc. succeeded to reduce the pollution level near Taj Mahal.

Hence, the jargon "Act local, think global" is suited to tackle increasing problem of air pollution.

Following steps can be taken up at government level to curb the menace of air pollution:

1. Government should encourage the use of CNG in vehicles instead of diesel and petrol.
2. Industries should be persuaded to use cleaner fuels like CNG and LPG instead of coke in their furnaces.
3. Public should be provided with the common means of transportation such as metro rail.
4. Forest should be conserved and more trees should be planted.
5. Prevention and Control of Pollution Act should be implemented strictly to restore the air quality.

Following steps can be taken up at individual level:

1. As well as possible use of fossil fuels should be reduced.
2. When possible use public transport, carpool or walk.
3. Get pollution under control certificate for in-use vehicles.

4. Purchase only those vehicles which follow international norm.
5. Plant more and more trees.

Question 2

Identify from the pictures and data given in the text, the diseases which occur in children of age group 6 to 12 and 0 to 5 due to air pollution. Analyse the given data and draw conclusion about health of children and pollution levels of various cities in India. What are the steps which can be taken by the authorities and communities to check the same?

Answer Option 1

The perils of air pollution is not only limited to monuments and environment. The children of this generation have a lot to suffer. The air pollution has been viewed as the silent killer of our children. Due to industrial revolution a major portion of population has voluntarily moved to cities in search of more comfortable and economically better lives, the stress on the resources of cities has increased. To satisfy the human needs and wants, now more and more factories have been developed and they burn fuel and release their poisonous gases in the atmosphere. These gases are carried to far away places with blowing wind.

In 1952 a shocking incident of smog in London city killed more than 4000 people and many others suffered due to breathing problems. Who can forget the fateful winter night of Bhopal when methyl isocyanide which leaked from the factories of Union Carbide killed thousands of people? It didn't spare young children or the growing young ones in their mother's womb. These incidents have shaken the people from their deep slumber who think that exploiting mother nature beyond her limits doesn't pose any imminent danger.

Childhood is a delicate and critical period when the body of children undergoes several changes to prepare them for a healthy adult life ahead. Before 15 years the human brain develops to its fullest. Therefore, any serious damage to

the body of the child can impair his growth forever. Toxic chemicals in the air can impair the growth and development of a child. It can retard the development of brain, nervous system and the respiratory system. No wonder that the cases of asthma and brain damage are on a rise nowadays.

A National Family Health Survey which was carried out in many cities of India shows a strong relation between the quality of air and the health of children. It can be inferred that the cities where the quality of air is poor and is most polluted has the most number of ill children. For example the children of Hyderabad and Indore fell less sick when compared to children of Nagpur and Kolkata. There has been a steady increase in the diseases of chronic cough, bronchitis, reduced lung function, wheezing, asthma attacks and other complications. Due to these diseases children miss their schools, suffer academically and a continuous attack of these diseases can further reduce their chances of leading a healthy life.

Therefore, to protect the future of our generations, we need to make policies which ensure cleaner air for our children to breathe.

Individuals need to be sensitized about the harmful effects of air pollution on our children and human health.

Reduce the usage of fossil fuels wherever possible.

Use cleaner fuels such as CNG and LPG. Use fewer vehicles if possible. Use bicycles, carpools, and public transportation systems.

Vehicles more than 10 years should not be allowed on roads.

The Bharat-IV and Bharat-III emission norms should be strictly enforced and people who break the law should not be spared.

Afforestation should be strictly enforced and trees, green patches and parks should be protected by the government and people.

Government should ban the usage of CFCs and use safer chemicals in place of it.

Answer Option 2

The diseases which occur in children of age group 6 to 12 and 0 to 5 due to air pollution are-

0-5 years 1. Impair lung function and neurodevelopment

2. High respiratory rate

3. Respiratory death

4. Aggravate existing conditions like asthma.

6-12 years 1. Chronic cough and bronchitis

2. Reduced lung function

3. Wheezing and asthma attacks

4. Respiratory-related school absences

The health of children is becoming worst day by day due to the increase in pollution. These days premature birth and growth retardation is increasing due to pollution. The early childhood is a critical period for continued development and maturation of several biological systems such as the brain, lungs and immune system. The air toxics can impair lung function and neurodevelopment, or aggravate existing conditions such as asthma.

In Nagpur, maximum children suffer from cough and fever and in Hyderabad minimum children suffer from cough and fever.

Thus, it is proved that Nagpur is the most polluted city followed by Kolkata, Chennai, Delhi, and Indore, whereas Hyderabad is the least polluted city.

The steps that can be taken by the authorities and communities to check pollution are-

1. By planting more trees and conserving green belts.

2. By more use of public transport or a car pool.

3. State pollution control board should implement the Air Act 1981 (Prevention and Control of pollution) strictly to restore air quality.

4. Sources of industrial pollution must be taken into account in setting air quality standards and awareness

should be generated among producers and consumers about the air pollutants and their hazardous impacts.

5. Introduction of Metro in Delhi followed by other metropolitan cities to promote use of mass transport.

Answer Option 3

The diseases which occur in children of age group 0-5 and 6-12 are—

- 0-5 years – Respiratory symptoms and illness like cough, wheeze, asthma, bronchitis and ear infections.
- 6-12 years – Chronic cough and bronchitis, reduced lung function, respiratory related school absences.

Conclusion about Health of Children and Pollution Level of Various Cities in India

National Family Health Survey bar graph presents mean of cough and mean of fever of six most polluted Indian cities. In increasing order they are—

City	Mean of cough	Mean of fever
1. Nagpur	25	18
2. Kolkata	20	13
3. Chennai	17	13
4. Delhi	15	10
5. Indore	10	8
6. Hyderabad	7	5

It is clear from the above table that Child Health outcomes of Hyderabad is best and Nagpur is worst.

In table Ambient Air Quality in 12 Metropolitan Cities of India is given. The main conclusions of this table are—

1. The highest sulphur dioxide content is in Raipur $15 \mu\text{g m}^{-3}$ and Bangalore with $14 \mu\text{g m}^{-3}$ holds second position.
2. Lowest sulphur dioxide contents are of Malappuram ($2 \mu\text{g m}^{-3}$) and Agra ($3 \mu\text{g m}^{-3}$) respectively.
3. Kolkata ($65 \mu\text{g m}^{-3}$) and Delhi ($61 \mu\text{g m}^{-3}$) hold first and second position in nitrogen dioxide content respectively.

4. Malappuram contains least NO_2 in its atmosphere ($5 \mu\text{g m}^{-3}$).
5. The PM10 (particulate matter) content in Gwalior ($311 \mu\text{g m}^{-3}$) and Raipur ($310 \mu\text{g m}^{-3}$) is highest while Malappuram ($30 \mu\text{g m}^{-3}$) and Hyderabad $74 \mu\text{g m}^{-3}$ is lowest.

The main pollutants in Indian cities are SO_2 , NO_2 and PM 10 (particulate matter). They are responsible for bad health of children in urban areas specially Metropolitan cities.

Some steps that should be taken by government and communities to check pollution level of various cities in India are—

1. The combustion of coal and petroleum produce sulphur dioxide. It is responsible for acid rain. The exhaust gas containing sulphur dioxide should be released in atmosphere after passing through wet scrubbers, dry scrubbers and fuel-gas desulphurization.
2. Petroleum and coal should be replaced by neat and clean fuels like CNG, LPG, etc.
3. Nitrogen dioxide is released by high temperature combustion and also produced naturally during thunderstorms by electric discharge. *Catalytic converter* in automobiles changes it into nitrogen and water. Some other devices to control NO_2 pollution are low NO_x burners, selective catalytic reduction (SCR), selective non-catalytic reduction (SNCR), NO_x scrubbers and exhaust gas recirculation.
4. Particulate matters include tiny particles of solid and liquid suspended in gas. Some sources of particulate matters are dust storms, forest fire, aerosols, burning of fossil fuels in vehicles, power plants and various industries. Vehicular and industrial particulate matter can be controlled by use of particulate wet scrubbers. Proper attention should be given by forest authorities to control forest fire.
5. At community level people should be awoken to raise voice against particulate producing sources like building construction sites, stone cutting sites, etc.

6. Factories should use electrostatic precipitators which remove solid particles like carbon from waste gases.
7. Planting more trees reduce CO_2 content and also particulate matter in the air.
8. Government should enforce strictly Air (Prevention and Control of Pollution) Act, 1981 to factories, industries, vehicles, etc.

Answer Option 4

Diseases which occur in children of age group 6 to 12 due to air pollution are: chronic cough and bronchitis, reduced lung function, wheezing and asthma.

Diseases which occur in children of age group 0-5 due to air pollution are: respiratory death, respiratory symptoms, cough and asthma.

National Family Health Survey tells about the health of children in various cities of India. The health of children is affected by the means of fever and cough present in the air of these cities.

As per National Family Health Survey, means of fever and cough are highest in Nagpur. Hence its environment is most hazardous for the health of children. Nagpur is followed by Kolkata having 20 means of cough and 13 means of fever present in air. Chennai with 17 means of cough and 13 means of fever is also worse for the health of children. With 14 means of cough and 10 means of fever, Delhi too is not safe for health of children, but is comparatively better than Nagpur, Kolkata and Chennai. Atmosphere of Hyderabad has least means of cough and fever (that is 6 and 8 respectively) followed by Indore with 10 means of cough and 9 means of fever. Hence the two cities have comparatively a cleaner environment for the children to be healthy.

According to the table given for status of ambient air quality in 12 metropolitan cities of India, concentration of PM_{10} in air is highest in Gwalior ($311 \mu\text{g}/\text{m}^3$) followed by Raipur with $310 \mu\text{g}/\text{m}^3$. Hence the risks of respiratory diseases are maximum in these cities. In Delhi and Kolkata concentration of NO_2 is also high. Hence, Delhi, Kolkata, Gwalior, Raipur

and Nagpur are most polluted cities of India. In Malappuram (Kerala) air has least concentration of SO_2 , NO_2 and PM 10. So, it is the least polluted among the 12 metropolitan cities of India.

Air pollution is the main reason behind the ill health of children. So it is necessary to take steps to check the increasing level of pollution.

The following steps can be taken by authorities:

1. Use of CNG in vehicles instead of diesel and petrol should be encouraged.
2. Increasing number of vehicles should be controlled.
3. Industries should be persuaded to use cleaner fuels like CNG, LPG instead of coke in their furnaces.
4. Public should be provided with common transport system like Metro rail.
5. Forest should be conserved.
6. Prevention and Control of Pollution Act, 1981 should be implemented strictly.

Following steps can be taken by communities:

1. Use of fossil fuels should be reduced.
2. When possible public transport or carpool should be used.
3. As well as possible use of refrigerator and air-conditioner should be avoided.
4. More and more trees should be planted.
5. People should be made aware about the adverse effects of pollution on health.

**MORE SAMPLE QUESTIONS AND
ANSWERS FOR PRACTICE**

Question 1

Earth is a unique planet for existence of life. How human activities have disturbed the balance in nature? Relate it with urbanization and development.

Answer Option 1

Our earth is indeed a unique planet as it is the only planet in the whole solar system which contains life. Various living animals and plants constantly interact with each other and support for survival. The only planet in the universe with water air, adequate temperature and a rare combination which supports the growth of life is our earth.

But human activities have proved to be a bane for this planet's existence. Clean air, water and soil are the most important prerequisites for life to sustain. All of these are constantly getting polluted due to incessant human development activities.

Atmosphere is the mixture of gases which spreads like a protective layer around the earth. Human activities like industry and vehicular emissions, burning of fossil fuels, nuclear emissions, etc. cause pollution of air. Clean air is important for us to breathe. If the air is polluted then it can cause many diseases. It can also retard the growth of young children.

Due to urbanization, many and many people are leaving their ancestral villages and moving to cities in search of a more comfortable life. This causes a constraint on the resources of the urban areas. Therefore, pollution is more prominent in the urban areas as compared to rural areas. Moreover presence of industries and vehicles release toxic chemicals in the air as fumes and aggravate the problem of pollution.

Answer Option 2

Human have disturbed the balance in nature by cutting down trees, forest, destroying natural resources that leads to environment pollution. We know that pollution is a major problem. Problem of air is increasing day by day and causing harm to the environment. People are cutting down trees, destroying the natural resources like mountains. The air is getting polluted by smoke from factories and industries. Due to deforestation the plants are reduced in number so gaseous exchange cannot happen at a normal rate. Thus, the air remains polluted.

Due to urbanisation and development, humans are cutting down trees, destroying land, etc. to build houses, factories, industries to fulfil their needs. The forest and mountains are getting destroyed that leads to imbalance in nature. Due to this imbalance, natural calamities happen.

Question 2

'The green clean environment will be only for the pictures'. How far is this statement true? Give reasons to support your answer. Explain the effect of air pollution during winter season.

Answer Option 1

Due to indiscriminate release of chemicals in air and polluting environment, it is feared that the next generation will not get a chance to know what does it means to have a clean surrounding and pure air to breathe. They may never know what a tree looked like, what did it meant to enjoy a cool and serene breeze.

To sensitize people on the dangers humans pose to Mother Nature, various organizations such as Green Peace and WWF have been founded. We also celebrate Earth Day and Van Mahotsav to generate awareness and participate in protecting nature. But for the rest part of the year we do not or hardly pay any attention to these details. Nowadays there are lesser open spaces left for our kids to play, there are lesser varieties of plants and lesser living animals. Even non-living things are also affected adversely due to air pollution. Factories near Taj Mahal had to be shut down to protect the marble from getting yellow.

During winters the effect of air pollution magnifies to an unprecedented level. The particulate matter, smoke and the fog mix together and form the smog. The smog is dangerous for living beings. The particles of smog if inhaled with air cause breathing problems and further cause infections. In 1952 in London a case of smog killed thousands of people in their sleep.

Answer Option 2

'The green clean environment will be only for pictures.' This statement is completely true. This is because due to the increase in pollution these days, the natural environment is getting destroyed. Humans are cutting down forest, and trees to fulfil their basic needs of food, and living. They are clearing more and more forests to build up industries, factories, buildings and houses. If deforestation and removal of natural resource will go on like this, then one day there will be no plants, forests and greenery left in the world. As we all know plants keep our environment clean and fresh. Hence, when there will be no plants, then the environment will also not be clean and green.

Effect of Air Pollution during Winter Season

During winter season, due to fog visibility is very low. This is due to formation of smog. Smog is a mixture of smoke, dust particles and fog. This formation of smog increases due to heavy traffic hours in cities. The reason is that smoke emitted from the exhaust of the vehicles settles over fog and reduces the visibility.

Question 3

What steps can be taken to improve the quality of air as a citizen of the nation and the world?

Answer Option 1

Apart from government, citizens can also help to improve the quality of air and reduce their carbon foot print. The steps to be followed are:

- Planting more trees and conserving green belts.
- Fuel tanks should be filled in the evenings and their caps should be replaced immediately. This step saves evaporation of fuel.
- Use more and more public transportation systems for regular commuting.
- Using carpools instead of using individual vehicles can reduce

the usage of fuel and release fewer emissions in air. Fewer cars on road will cause less traffic problems as well.

- Vehicles should be checked for pollution emissions. The vehicles should comply with the norms and their pollution certificated should be strictly enforced.
- People should purchase only those vehicles which follow the regulated emission norms.
- Do not use vehicles which are more than 10 years old.

Answer Option 2

As a citizen, we can take the following steps to improve the quality of air:

- (a) Avoid using chemical products.
- (b) Compost leaves, garden trimmings and other outdoor fireplaces.
- (c) Garden without pesticides.
- (d) Avoid use of chimneys or other outdoor fireplaces.
- (e) Reduce our heating needs by making our house more energy efficient.
- (f) Use non-toxic art supplies.
- (g) Do not idle vehicles. Car exhausts release pollutants that are harmful to health.

Question 4

Regular pollution check aids in reduction of level of pollution. Do you agree with the above statement? Write down some other steps that are taken to save our environment from air pollution.

Answer Option 1

It is interesting to note that most of the pollution of air happened from the vehicles. The burning of petrol and diesel releases harmful gases like nitrogen and sulphur oxides along with carbon and other oxides. These gases can mix with the water vapours in the atmosphere and form acids. This falls back to earth in the form of acid rain. Moreover lead mixed

in petrol forms lead oxides and can cause severe mental retardation in children if it is inhaled by them.

Therefore, it is extremely important to ensure that the pollution from vehicles is kept in check. To achieve this government has enforced Bharat Emission Norms- III and IV.

Public transport is run on cleaner fuels such as CNG or LPG. These fuels cause less harmful emissions.

Vehicles which are older than 10 years are banned as they cause harmful emissions.

Vehicles should be regularly checked for pollution emission. In case the amount of emissions is above the prescribed levels the vehicles should be immediately repaired, checked or changed.

Answer Option 2

Yes, I agree with the statement. The other steps that are taken to save our environment from air pollution are:

1. Supply of improved diesel and gasoline.
2. CNG mode public transport in Delhi.
3. 15 years old commercial vehicles are not allowed to ply in Delhi since Dec. 1998.
4. All the commercial vehicles are required to undertake fitness check and certification.
5. Special drives for prevention and control of pollution in 17 categories of highly polluted industries.

Question 5

How is the pollution of air affecting the plants, wildlife and aquatic life?

Answer Option 1

Air is required by all living beings for breathing. Plants, animals and even tiny bacteria also need air to meet their requirements. The main reason of presence of life in this planet is the availability of atmosphere which provides right temperature and habitable conditions. None of these are

present in any other planet in the solar system. Therefore, our planet is indeed a unique one.

As the human technological prowess progressed, it started exploiting the natural resources. Now in modern times, this exploitation has led to severe pollution of air, water and soil. Air pollutant particles can easily travel from one place to another and can affect a huge population over a vast area.

Smog formation during winter season causes severe visibility and breathing problems. It can cause even death as it happened during the winter night of 1952 in London. In Delhi and China, smog is becoming a serious and a regular feature during winter season. This is a matter of great concern for their governments.

The Bhopal gas tragedy was a real eye opener for Indian government and people all over the world. It was an incident of gas leak which created havoc in the whole city.

The fume of sulphur and nitrogen oxides causes acid rain. This acid rain is highly corrosive. It can kill animals and plants. It can kill humans, make fields barren and kill fishes in aquatic areas.

The situation of Global warming is known to everyone. Excess burning of fossil fuels has led to the deposition of carbon dioxide in the atmosphere. It traps the heat of sunrays and causes heating of the Earth. As a result, the polar ice is melting at an ever faster rate. The melting of ice will raise the water levels of oceans. The coastal areas are in danger of being submerged. The continuous heating of the earth has altered the climate pattern. The rivers are changing its course and agricultural practices are at risk. If we have source of food on earth the mankind's existence on the planet will be under question.

The pollution in air affects all the living beings on this planet.

Answer Option 2

Due to air pollution, acid rains are happened. The oxides of sulphur, carbon and nitrogen released into the atmosphere from chimneys of industries and exhaust of vehicles react with water of the rains and oxygen from air to form acids.

Dissolved acids make the rain acidic in nature. Acid rains are very harmful for both living and non-living things. Acid rains damage crops, pollute soil and water, ruin the harvest, erode buildings, harm animals and damage aquatic life.

Question 6

What is the significance of Earth day? How far is this helpful in preventing pollution?

Answer Option 1

Earth day is celebrated on April 22 every year. The main aim of this event is to generate awareness about the environmental pollution. It aims to sensitize people about the delicate balance of nature which is being lost due to continuous human encroachment. People are being made aware about the important role of plants, clean air, water and soil for our well-being. They are also made aware about the effect of industrial effluents on soil, water and air.

Earth day is celebrated in over 192 countries and it is supported by UNO. People are made aware of the fact that if they do not act collectively and decisively then the green clean environment will be left only for pictures.

Answer Option 2

Earth day is celebrated to sensitize people towards keeping the planet Earth non-polluted and environmental protection. People are made aware that if they do not act collectively, the green clean environment will be only for pictures.

Celebrating Earth day is helpful in making people aware about the environment where they live in. They are made aware about the imbalance in nature and harm that we are causing to our environment. They are motivated to keep their environment clean and pollution free. People know about the ill effects and hazards that the environment is facing.

Nowadays the children from the very beginning in their school are made aware of this so that they would always try to take steps that reduce pollution and do not harm the nature and environment.

